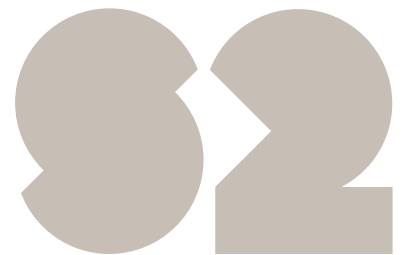


# JUBILEE COMPLEX FORECOURT

CENTENNIAL PARK CEMETERY

5 MAY 2026  
REV A - TENDER ISSUE

# SPECIFICATIONS



**ARCHITECTS**

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**0121 TENDERING****1 CONDITIONS OF TENDERING****1.1 RESPONSIBILITIES****General**

Requirement: Provide a complete genuine tender.

**1.2 GENERAL****Status**

General: These conditions of tendering do not form part of the contract.

**Interpretation**

General: In these conditions of tendering, the word principal has the same meaning as owner and proprietor.

**1.3 PROJECT INFORMATION****Outline description of the works**

Jubilee Complex Forecourt renewal including removal of existing slate paving, installation of non-slip bluestone (or similar) paving, central water feature and canopy, pedestrian flow management and wayfinding improvements.

**Description of the site**

Location: Jubilee Complex forecourt within the Centennial Park Cemetery

**Tender documents**

The tender documents comprise the following:

- Conditions of tendering.
- General conditions of contract.
- Special conditions of contract.
- Schedule or annexure to general conditions of contract, partly pre-completed.
- Specifications.
- Drawings.

**Preferred construction period:** September - November 2026

**1.4 FURTHER INFORMATION****Contact person**

Enquiries: Refer inquiries to the following:

- Name: Amy Smedley
- Telephone: 0412811247
- Email: amy@s2architects.com.au

**Site inspections**

General: A non-mandatory site inspection is scheduled. Refer cover letter.

**Addenda**

General: Written addenda issued by the principal are the only recognised explanations of, or amendments to, the tender documents.

**1.5 PREPARATION OF TENDERS****Tender form**

Form: Submit the tender on the *Tender form* provided.

Addenda: Confirm on the *Tender form* that allowance has been made of each addendum and any extensions of the tender period.

Name and address of tenderer: State the following:

- If an individual, the name in full and address of the individual.
- If an unincorporated body, the registered business name and address of the body and the name in full and address of each member of the body.
- If a company, the name, ABN and registered office address of the company.

Address for service of notices: Include on the *Tender form* an address for service of notices for the purpose of this tender and any subsequent contract arising out of this tender.

Execution: Sign the *Tender form* or, if a company, comply with the relevant provisions of the Corporations Law and regulations.

### **Scope**

**Scope: Tenderers are requested to price the following options**

1. Full project
2. Full project inclusive of canopy footings, but deletion of the steel framing and roofing.

Exclusions: If unable to tender on parts of the works, inform the contact person in writing as soon as possible, defining the relevant parts and giving reasons.

### **Completion**

General: Complete in full the *Tender form* and other required documents.

Alterations: Do not alter or add to tender documents except as may be required by these conditions of tendering.

### **Selected subcontracts**

General: Submit with the tender the identity of subcontractors proposed for selected subcontract work.

### **Alternatives**

General: Alternative proposals may be submitted with the tender for consideration, but the following must also be submitted:

- A conforming tender that complies with the tender documents.
- A detailed description of the alternative stating clearly how it differs from the requirements of the tender documents whilst complying with the principal's commercial and technical objectives.

Alternative time for practical completion: Consideration will be given to alternative tenders which offer different times for practical completion. The prescribed liquidated damages will apply to those different times.

Alternative working hours and working days: If the tender includes an allowance for work at times other than the working hours or working days prescribed in the tender documents, submit the working hours and days proposed.

### **Evidence of contractor's registration or licensing**

General: If it is a statutory requirement of the state or territory in which the works are located that a contractor (as defined by the statutory requirement) be registered or licensed to carry out the work described in the tender documents, submit with the tender evidence of registration or licence.

### **Program**

General: Submit a construction program in the form of a preliminary bar chart and network diagram, showing the following:

- Sequence of work.
- Periods within which various stages or parts of the work are to be executed.
- Critical paths of activities related to the work.
- Allowance for holidays.
- Restraints imposed by the contract documents.
- Significant milestones including separable parts, if any.
- Activity inter-relationships, including those activities to be undertaken by subcontractors and suppliers, both on and off site.
- External dependencies including provision of access, document approvals and work by others.
- The estimated value of work completed for each month.

Time for submission: With tender

**Method statements**

Submit method statements describing proposals for the following: Management of noisy works during chapel open hours.

Time for submission: With tender

**Attestation of probity**

General: Submit a signed statement confirming that the tender has been prepared independently and in good faith, without collusion or improper assistance. Confirm that no gifts, benefits, or inducements have been offered or will be offered to any employee, council officer or representative in connection with this tender.

**Conflict of interest**

General: Declare any actual, potential, or perceived conflicts of interest in relation to the tender. Include details of any relationships with the Principal, its employees, or consultants that could give rise to a conflict. Where a conflict exists, describe the measures proposed to manage or mitigate the conflict.

Tenderers must promptly advise the Principal of any conflict of interest that arises after submission of the tender.

**1.6 SUBMISSION OF TENDERS****Lodgement**

Refer to the cover letter.

**1.7 PROCEDURES AFTER TENDER PERIOD****Tender validity period**

General: Unless withdrawn, tenders must remain valid from the date and time for closing of tenders, for the following period: 90 days

**Evaluation of tenders**

General: In evaluating the tenders, the principal may take into consideration the following:

- Conformity with tender documents.
- Capital cost compared with estimated cost.
- Construction period.
- Proposed use of local subcontractors and suppliers.
- Proposed alternatives.
- Alternative working times proposed by the tenderer, and the cost to the principal of providing contract administration for the work under the contract at those times.
- Maintenance and running costs.
- Design proposals.
- Quality of prototypes.
- Construction program.
- Proposed methods.
- Quality assurance.
- Conflicts of interest.
- Life of proposed equipment.
- Standardisation of proposed equipment.
- Tenderer's CAD format.
- Value for money.
- Tenderer's resources.
- Tenderer's current commitments.
- Tenderer's previous performance.
- Industrial relations and safety records.

Qualifications: Tenders containing unauthorised alterations, additions or qualifications may be rejected.

Unpriced items: Costs relating to items not priced will be assumed to have been included elsewhere in the tender.

**Additional information**

General: If required, submit additional information, by the stipulated date and time, to allow further consideration of the tender before any tender is accepted. Failure to meet this requirement may result in the tender being rejected.

**Confidentiality**

General: Treat as confidential any information provided after the tender period.

**Acceptance of tender**

Non-acceptance: The principal is not bound to accept the lowest or any tender, or to give reasons.

Acceptance: A tender is not accepted until notice in writing of acceptance is delivered by one of the following methods:

- Handed to the tenderer.
- Sent by prepaid post to, or left at, the address for service of notices stated in the Tender form.
- Emailed from the Principal.

Partial acceptance: Tenders may be accepted for the whole of the work or for the following worksections: Demolition, pavement, water feature and canopy footings only. The canopy structure is requested as a separable portion of the construction works.

Formal instrument of agreement: Required.

**Period between acceptance of tender and possession of site**

Anticipated maximum period: 60 days

## 2 TENDER FORM

<b>Name of principal:</b> Centennial Park Cemetery Authority
<b>Name of project:</b> Jubilee Complex Forecourt Renewal
<b>Tender – lump sum FULL PROJECT</b> I/We tender to perform the work for the above project as described in, and in conformance with, the tender documents referenced in the <i>Conditions of tendering</i> and in conformance with the attached <i>Schedule of rates/Contract sum analysis/priced Bills of quantities</i> and for the lump sum (which includes specified provisional sums) of
..... including GST (sum in words and figures)
<b>Tender – lump sum DELETED CANOPY WORKS</b> I/We tender to perform the work for the above project as described in, and in conformance with, the tender documents referenced in the <i>Conditions of tendering</i> and in conformance with the attached <i>Schedule of rates/Contract sum analysis/priced Bills of quantities</i> and for the lump sum (which includes specified provisional sums) of
..... including GST (sum in words and figures)
The contract duration will be ..... weeks from the date of site possession FOR THE FULL PROJECT SCOPE.
The contract duration will be ..... weeks from the date of site possession FOR THE DELETED CANOPY SCOPE.
This tender remains open for consideration for ..... weeks from the date and time of closing of the tender period.
I/We acknowledge the receipt of addenda numbered ..... during the tender period.
<b>Name of tenderer</b>
ABN/ACN
Telephone
Email
<b>Tenderer's address or registered business office address</b>
<b>Address for service of notices</b>
<b>Tenderer's bank and branch address</b>
<b>Execution if tenderer is an individual or unincorporated body</b>
Tenderer's signature
Witness' signature

<b>Execution if tenderer is a company</b> The common seal of the tenderer was affixed in conformance with the Articles of Association
Director's signature
Secretary's signature
<i>OR</i>
Authorised officer's signature
Witness' signature
Date of tender

## 0142 PRELIMINARIES – ABIC SW-2018

**1 GENERAL****1.1 GENERAL****General conditions**

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

**Interpretation**

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

Cross reference: The clause **GENERAL, INTERPRETATION**, in *0171 General requirements*, also applies.

**1.2 THE SITE****Site restrictions**

Site limitations: Comply with the following restrictions on the use of the site: Mandatory check-in upon entry. The construction schedule will be contingent upon the client's approval, restricting activities to days authorised by the client. All personnel engaged in the construction activities have to check-in with the client upon arrival at the construction site. (or admin building)

Access: Access onto and within the site, use of the site for temporary works and constructional plant, including working and storage areas, location of offices, workshops, sheds, roads and parking, is restricted to the following areas: refer to drawings.

**Work hours: Medium and high-noise activities are limited to 7am-12pm during chapel and office occupancy periods. Noise may be defined as construction noise that is audible from within the office or chapels.**

Low noise level activities are permitted within normal work hours subject to the Centennial Park Cemetery bi-laws and authority approvals.

**Occupied premises**

General: For the parts of the site designated as occupied premises, as documented in the **Occupied premises schedule**:

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

**Works plan: Refer to works plan for suggested staging to allow maintenance of occupied premises. Proposals for alternative arrangements are welcome.**

**Occupied premises schedule**

<b>Occupants</b>	<b>Occupied premises</b>	<b>Period of occupancy</b>
Staff of Centennial Park	Offices	8am-6pm, Monday - Friday
Chapel staff and Funeral directors, Funeral attendees	Chapels	9am-7pm, Monday - Saturday
Public	Carpark and grounds	Park opening hours

**Protection of persons and property**

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

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.

**Rectification**

Accessways, services: Rectify immediately any obstruction or damage to roadways and footpaths, drains and watercourses and other existing services in use on or adjacent to the site. Provide temporary services whilst repairs are carried out.

Property: Rectify immediately any interference or damage to trees and property which are to remain on or adjacent to the site, including adjoining property encroaching onto the site.

**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.

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

Proposals: Submit proposals for action to be taken to existing services before starting this work.

- Purpose of submission: For review.

**Adjoining property**

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

Revealed encroachments: If the works reveal unknown encroachments of adjoining 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 owner and occupant of the property, before commencement of work.
- Make detailed records of conditions existing within the property, especially structural defects and other damage or defacement.
- Arrange for at least 2 copies of each 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****Use of existing services**

General: Existing services may be used as temporary services for the performance of the contract.

**Protective clothing**

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

- Safety helmets: To AS/NZS 1801, Type 1.
- Certification provider: Submit product certification from an organisation accredited by the Joint Accreditation System of Australia and New Zealand (JAS-ANZ).

**Temporary fence**

Requirement: Provide to the extent of Construction Site

**Project signboards**

Site signage to the temporary fencing will be provided by the owner. Project team acknowledgment will form part of the fence signage. Other signage should be restricted to regulatory signage only.

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

**1.4 BUILDING THE WORKS****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, cave-ins and fire risk.

Accident reports: Submit reports of accidents.

- Purpose of submission: Information only.

### **Contractor's representative**

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

### **Subcontracting**

General: Submit a complete list of proposed subcontractors and suppliers and fully inform them of relevant obligations.

### **Program of work**

Construction program: Show 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.

- Frequency: at each site meeting

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, the architect, and appropriate consultants.

Frequency: Fortnightly

Minutes: Make a record of site meetings. Within 5 working days after each meeting, distribute a copy of the minutes to each party.

- Purpose of submission: Review.

Contacts: At the first site meeting, submit names and telephone numbers of responsible persons who may be contacted after hours during the course of the contract.

- Purpose of submission: Information only.

## **1.5 COMPLETION OF THE WORKS**

### **Final cleaning**

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

### **Adjoining property**

Evaluation: At practical completion, for each property described in the **Adjoining properties to be recorded schedule**, inspect the property with the architect and owner and occupant of the property, recording any damage that has occurred since the pre-commencement inspection.

### **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**

### **Import costs**

Definition: Import costs include costs attributable to exchange rates, customs and import duty of imported content of items purchased for incorporation in the works.

Adjustment: If there are changes in rates applying to import costs of items listed in the Import cost adjustment schedule, add or deduct the amount of the difference to or from the contract sum, as applicable.

#### Anticipated progress payments

General: At commencement of the works, submit a schedule of anticipated progress claims for the contract period. Submit a revised schedule with each progress claim.

- Purpose of submission: Information only.

#### Progress claims

Break down: With each progress claim, submit a statement of amounts claimed in respect of each worksection or trade heading designated in the specification.

- Purpose of submission: Review.

#### Method of measurement

General: In conformance with the principles of the Australian Standard Measurement of Building Works (ASMM6).

### 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

Prior notices given and applications made	Fees paid	Permits, approvals and authorisations received
Planning approval	Yes	Yes
Building approval	Yes	Pending
Development approval	No	Pending

Authority conditions: Comply with the **Authority conditions schedule**.

#### Authority condition schedule

Authority	Document	Condition
City of Mitcham	Planning consent	<p>Condition 1</p> <p>The development granted Planning Consent shall be undertaken and completed in accordance with the stamped plans and documentation, except where varied by conditions below (if any).</p> <p>Condition 2</p> <p>All materials, surface finishes and colours of the development must be consistent with the description and details on stamped plans hereby granted Planning Consent.</p>

**0171 GENERAL REQUIREMENTS****1 GENERAL****1.1 RESPONSIBILITIES****Noise levels**

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

**Structure**

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

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

**1.2 DESIGN****Design development**

General: The works include development of the design beyond that documented, as required.

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

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

**1.3 PRECEDENCE****General**

Order of precedence:

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

**1.4 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 **BOLD** text.
- Clause titles are indicated by **BOLD** text.
- Subclause titles are indicated by **Bold** text.

**1.5 REFERENCED DOCUMENTS****General**

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

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

## 1.6 INTERPRETATION

### Documentation conventions

Imperative mood and streamlined language: The words shall or shall be are implied where a colon is used following a keyword or within a sentence or sentence fragment.

Subject of sentences and phrases: Specification requirements are to be performed by the contractor, unless stated otherwise.

### Abbreviations

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

- AS: Australian Standard.
- NCC: 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 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 test in the relevant field; or
  - . An organisation outside of 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.
- Attendance: Attendance, provide attendance and similar expressions mean give assistance for examination and testing.
- Contract administrator: Has the same meaning as architect or superintendent 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 which is to be provided unless otherwise documented.
- Design life: The period of time for which it is assumed, in the design, that an asset will be able to perform its intended purpose with only anticipated maintenance but no major repair or replacement being necessary.
- Documented: Documented, as documented and similar terms mean contained in the contract documents.

- 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.
- Fire hazard properties: Terminology to NCC requirements.
- Geotechnical site investigation: The process of evaluating the geotechnical characteristics of the site in the context of existing or proposed construction.
- Give notice: Give notice, submit, advise, inform and similar expressions mean give notice (submit, advise, inform) in writing to the contract administrator.
- High level interface: Systems transfer information in a digital format using an open system interface.
- Hot-dip galvanized: Zinc coated to AS/NZS 4680 after fabrication with coating thickness and mass to AS/NZS 4680 Table 1.
- Ingress protection: IP, IP code, IP rating and similar expression have the same meaning as IP Code in AS 60529.
- Joints:
  - . Construction joint: A joint with continuous reinforcement provided to suit construction sequence.
  - . Contraction joint: An opening control joint with a bond breaking coating separating the joint surfaces to allow independent and controlled contraction of different parts or components, induced by shrinkage, temperature changes or other causes. It may include unbound dowels to assist vertical deflection control.
  - . Control joint: An unreinforced joint between or within discrete elements of construction which allows for relative movement of the elements.
  - . Expansion joint: A closing control joint with the joint surfaces separated by a compressible filler to allow axial movement due to thermal expansion or contraction with changes in temperature or creep. It may include unbound dowels to assist vertical deflection control.
  - . Sealant joint: A joint filled with a flexible synthetic compound which adheres to surfaces within the joint to prevent the passage of dust, moisture and gases.
  - . Structural control joint: A control joint (contraction, expansion and isolation) in structural elements when used with applied material and finishes.
  - . Substrate joint: A joint in the substrate which includes construction joints and joints between different materials.
  - . Weakened plane joint: A contraction joint created by forming a groove, extending at least one quarter the depth of the section, either by using a grooving tool, by sawing, or by inserting a premoulded strip.
- Local (government) authority: A body established for the purposes of local government by or under a law applying in a state or territory.
- Low level interface: Systems transfer information via terminals and voltage free contacts.
- Manufacturer's recommendations: Recommendations, instructions, requirements, specifications (and similar expressions) provided in written or other form by the manufacturer and/or supplier relating to the suitability, use, installation, storage and/or handling of a product.
- Metallic-coated: Steel coated with zinc or aluminium-zinc alloy as follows:
  - . Metallic-coated steel sheet: To AS 1397. Metal thicknesses specified are base metal thicknesses.
  - . Ferrous open sections zinc coated an in-line process: To AS/NZS 4791.
  - . Ferrous hollow sections zinc coated by a continuous or specialised process: To AS/NZS 4792.
- Network utility operator: The entity undertaking the piped distribution of drinking water or natural gas for supply or is the operator of a sewerage system or external stormwater drainage system.
- Obtain: Obtain, seek and similar expressions mean obtain (seek) in writing from the contract administrator.
- Pipe: Includes pipe and tube.

- Practical completion or defects free completion: The requirements for these stages of completion are defined in the relevant building contract for the project.
- Principal: Principal has the same meaning as owner, client and proprietor and is the party to whom the contractor is legally bound to construct the works.
- Professional engineer: As defined by the NCC.
- Proprietary: Identifiable by naming the manufacturer, supplier, installer, trade name, brand name, catalogue or reference number.
- Prototype: A full size mock-up of components, systems or elements to demonstrate or test construction methods, junctions and finishes, and to define the level of quality.
- Provide: Provide and similar expressions mean supply and install and include development of the design beyond that documented.
- Record drawings: Record drawings has the same meaning as as-installed drawings, as-built drawings and work-as-executed drawings.
- Referenced documents: Standards and other documents whose requirements are included in this specification by reference.
- Required: Required by the contract documents, the local council or statutory authorities.
- If required: A conditional specification term for work which may be shown in the documents or is a legislative requirement.
- Sample: A physical example that illustrates workmanship, materials or equipment, and establishes standards by which the work will be judged. It includes samples and sample panels.
- 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 – completion: Tests carried out on completed installations or systems and fully resolved before the date for practical completion, to demonstrate that the installation or system, including components, controls and equipment, operates correctly, safely and efficiently, and meets performance and other requirements. The superintendent may direct that completion tests be carried out after the date for practical completion.
- Tests – pre-completion: Tests carried out before completion tests, including:
  - . Production: Tests carried out on a purchased item, before delivery to the site.
  - . Progressive: Tests carried out during installation to demonstrate performance in conformance with this specification.
  - . Site: Tests carried out on site.
  - . Type: Tests carried out on an item identical with a production item, before delivery to the site.
- Tolerance: The permitted difference between the upper limit and the lower limit of dimension, value or quantity.
- Verification: Provision of evidence or proof that a performance requirement has been met or a default exists.

## 1.7 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.

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

## 1.8 SUBMISSIONS

### Requirement

General: Submit the following:

- Authority approvals: Notes of meetings with authorities whose requirements apply to the work and evidence that notices, fees and permits have been sought and paid, that authority connections are complete and that statutory approvals by the authorities whose requirements apply to the work have been received.
- Building penetrations: Details of the methods to maintain the required structural, fire and other properties to **EXECUTION, BUILDING PENETRATIONS**.
- Certification: Certification of conformance to documented requirements, including certification that the plant and equipment submitted meets all requirements of the contract documents and that each installation is operating correctly.
- Design documentation: Design data and certification of proposed work, if required and as documented.
- Electronic facility and asset management information: For the whole of the work to **EXECUTION, 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 **EXECUTION, MARKING AND LABELLING**.
- Operation and maintenance manuals: For the whole of the work to **EXECUTION, OPERATION AND MAINTENANCE MANUALS**.
- Products: Products and materials data, including manufacturer's technical specifications and drawings, type tests results, evidence of conformance to product certification schemes, performance and rating tables and installation and maintenance recommendations.
- Prototypes: Prototypes of components, systems or elements.
- Records: As-built documents, photographs, system diagrams, schedules and logbooks to **EXECUTION, RECORD DRAWINGS**.
- Samples: Representative of proposed products and materials and including proposals to incorporate samples into the works, if any to **EXECUTION, SAMPLES**.
- Shop drawings: To **EXECUTION, SHOP DRAWINGS**.
- Substitutions: To **PRODUCTS, GENERAL, Substitutions**.
- Tests:
  - . Inspection and testing plan consistent with the construction program including details of test stages and procedures.
  - . Test reports for testing performed under the contract.
- Warranties: To **EXECUTION, WARRANTIES**.

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

### Submission times

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

Proposed products schedules: If major products are not specified as proprietary items, submit a schedule of those proposed for use within 3 weeks of site possession.

### Identification

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

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

### Errors

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

## 1.9 INSPECTION

### Notice

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

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

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

### Light levels

Requirements: To AS/NZS 1680.2.4.

### Attendance

General: Provide attendance for documented inspections and tests.

## 2 PRODUCTS

### 2.1 GENERAL

#### Manufacturers' or suppliers' recommendations

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

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

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

#### Product identification

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

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

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

#### 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).
- Materials that use chlorofluorocarbon (CFC) or hydrochlorofluorocarbon (HCFC) in the manufacturing process.

#### Substitutions

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:

- Evidence that the performance is equal to or greater than that specified.
- Evidence of conformity to a cited standard.
- Samples.

- Essential technical information, in English.
- Reasons for the proposed substitutions.
- Statement of the extent of revisions to the contract documents.
- Statement of the extent of revisions to the construction program.
- Statement of cost implications including costs outside the contract.
- Statement of consequent alterations to other parts of the works.

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

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

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

## 2.2 MATERIALS AND COMPONENTS

### Consistency

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

### Corrosion resistance

General: Conform to the following atmospheric corrosivity category as defined in AS 4312 and the AS/NZS 2312 series.

### Galvanizing

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

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

## 3 EXECUTION ---

### 3.1 SAMPLES

#### General

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

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

Unincorporated samples: Remove on completion.

### 3.2 SHOP DRAWINGS

#### General

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

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

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.

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.

Building work drawings for building services: On dimensioned drawings show all:

- 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.

### 3.3 OFF-SITE DISPOSAL

#### Removal of material

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

### 3.4 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 nominated as fire-resistance or acoustic rated.

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

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

#### Concrete blockwork chasing table

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

### 3.5 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.

### 3.6 SERVICES CONNECTIONS

#### Connections

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

#### Network distributors' requirements

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

### 3.7 SERVICES INSTALLATION

#### General

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

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

Concealment: Unless otherwise documented, conceal all cables, ducts, trays and pipes except where installed in plant spaces, ceiling spaces and riser cupboards. If possible, do not locate on external walls.

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

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

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

**Dissimilar metals**

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

**Temporary capping**

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

**Piping**

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

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

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

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

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

Valve groupings: If possible, locate valves in groups.

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

**Differential movement**

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

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

### 3.8 BUILDING PENETRATIONS

**Penetrations**

Requirement: Maintain the required structural, fire 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.

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

**Sleeves**

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

- Movement: Arrange to permit normal pipe or conduit movement.
- Diameter (for non fire-resisting building elements): Sufficient to provide an annular space around the pipe or pipe insulation of at least 12 mm.
- Prime paint ferrous surfaces.
- Sealing: Seal between pipes or conduits and sleeves to prevent the entry of vermin.
- Terminations:
  - . If cover plates are fitted: Flush with the finished building surface.
  - . In fire-resisting and acoustic rated building elements: 50 mm beyond finished building surface.
  - . In floors draining to floor wastes: 50 mm above finished floor.

- . Elsewhere: 5 mm beyond finished building surface.
- . Termite management: To AS 3660.1.
- Thickness:
  - . Metal: 1 mm or greater.
  - . PVC-U: 3 mm or greater.

Sleeves for cables: For penetrations of cables not enclosed in conduit through ground floor slabs, beams and external walls provide sleeves formed from PVC-U pipe sections.

### 3.9 CONCRETE PLINTHS

#### Construction

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

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

### 3.10 SUPPORT AND STRUCTURE

#### General

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

### 3.11 PIPE SUPPORTS

#### Support systems

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

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

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

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

Uninsulated pipes: Clamp piping supports directly to pipes.

Insulated pipes:

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

#### Support spacing

Cold and heated water pipes: To AS/NZS 3500.1 Table 5.6.4. Provide additional brackets, clips or hangers to prevent pipe movement caused by water pressure effects.

Sanitary plumbing: To AS/NZS 3500.2 Table 10.2.1.

Fuel gas: To AS/NZS 5601.1 Table 5.5.

Other pipes: To AS/NZS 3500.1 Table 5.6.4.

#### Hanger size table

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

### 3.12 PLANT AND EQUIPMENT

#### General

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

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

### 3.13 ACCESS FOR MAINTENANCE

#### General

Requirement: Provide access for maintenance of plant and equipment.

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

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

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

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

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

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

#### Clearances

Minimum clearances for access: Conform to the following:

- $\geq 2100$  mm clear, vertically above horizontal floors, ground and platforms.
- Preferably  $\geq 750$  mm clear, but in no case less than 600 mm horizontally between equipment or between equipment and building features including walls.
- If tools are required to operate, adjust or remove equipment, provide sufficient space so that the tools can be used in their normal manner and without requiring the user to employ undue or awkward force.
- If equipment components are hinged or removable, allow the space recommended by the manufacturer.
- Within plant items: Conform to the preceding requirements, and in no case less than the clearances recommended in BS 8313.

#### Elevated services other than in occupied areas

Access classifications:

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

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 that large and/or heavy items can be moved with the minimum of changes of direction.

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

#### **Facilities for access**

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

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

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

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

#### **Piping**

Requirement: Conform to the following:

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

#### **Electrical and controls**

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

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

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

### **3.14 VIBRATION SUPPRESSION**

#### **General**

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

#### **Standard**

Rotating and reciprocating machinery noise and vibration: Vibration severity in Zone A to ISO 20816-1 and ISO 10816-3.

#### **Speeds**

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

#### **Connections**

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

#### **Inertia bases**

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

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

#### **Vibration isolation mountings**

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

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

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

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

Spring mountings: Provide freestanding laterally stable springs as follows:

- Clearances:  $\geq$  12 mm between springs and other members such as bolts and housing.
- High frequency isolation: 5 mm neoprene acoustic isolation pads between baseplate and support.
- Levelling: Provide bolts and lock nuts.
- Minimum travel to solid:  $\geq$  150% of the designated minimum static deflection.
- Ratio of mean coil diameter to compressed length at the designated minimum static deflection:  $\geq$  0.8:1.
- Snubbing: Snub the springs to prevent bounce at start-up.
- Vertical resilient limit stops: To prevent spring extension when unloaded, to serve as blocking during erection and which remain out of contact during normal operation.

### **3.15 SEISMIC RESTRAINT OF NON-STRUCTURAL COMPONENTS**

#### **3.16 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 Sections 3, 6 and 7 or AS 2312.1 Sections 6, 7 and 8, as applicable.

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

##### **Painting systems**

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

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

##### **Paint application**

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

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

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

##### **Underground metal piping**

Corrosion protection: Provide corrosion protection for the following:

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

Protection methods: Select from the following:

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

Aggressive soils: If metallic piping or components are installed in chemically aggressive soil, provide the following in addition to the corrosion protection above:

- Material: Continuous polyethylene sleeve to ASTM D1248 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.

#### **Low VOC emitting paints**

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

#### **Repairs to finishes**

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

### **3.17 MARKING AND LABELLING**

#### **General**

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

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

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

#### **Label samples and schedules**

Submission timing: Before marking or labelling.

Schedule: For each item or type of item include 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.

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

- Fan coil units and terminal equipment (e.g. VAV terminals).
- Fire and smoke dampers.
- Isolating valves not directly connected to items otherwise labelled.
- Motorised dampers.
- Wall mounted equipment in occupied areas: 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. Store in a pocket on the door of the panel. Lists to include terminal numbers, point addresses, short and long descriptors.

**Pressure vessels**

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

**Valves and pumps**

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

**Underground services**

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

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

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

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

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

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

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

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

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

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.

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

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

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

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

Lettering heights:

- Danger, warning and caution notices: Minimum 10 mm for main heading, minimum 5 mm for remainder.
- Equipment labels within cabinets: Minimum 3.5 mm.
- Equipment nameplates: Minimum 40 mm.
- Identifying labels on outside of cabinets: Minimum 5 mm.
- Isolating switches: Minimum 5 mm.

- Switchboards, main assembly designation: Minimum 25 mm.
- Switchboards, outgoing functional units: Minimum 8 mm.
- Switchboards, sub assembly designations: Minimum 15 mm.
- Valves: Minimum 20 mm.
- Self-adhesive flexible plastic labels:
  - . Labels less than 2000 mm above floor: 3 mm on 6 mm wide tape.
  - . Labels minimum 2000 mm above floor: 8 mm on 12 mm wide tape.
  - . Other locations: Minimum 3 mm.

Label locations: Locate labels so that 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.

### 3.18 SOFTWARE

#### General

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

### 3.19 WARRANTIES

#### General

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

Warranty period: Start warranty periods at acceptance of installation.

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

### 3.20 TACTICAL FIRE DRAWINGS

#### General

Requirement: Supply sets of colour coded tactical fire drawings, showing all items and systems relevant in a fire.

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

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: Show:
  - . Floor plans.
  - . Pressurised and non-pressurised fire isolated stairs and passages.
  - . Smoke and fire compartments.
  - . Special risk areas.
- Fire services: Show:
  - . Automatic fire detection systems.

- . Automatic suppression systems including gas flooding systems.
- . Communications including Warden Intercom 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: Show:
  - . Emergency power supplies.
  - . Essential services switchboards.
  - . Evacuation warning panel.
  - . Standby power plant.
  - . Substations/transformers.
  - . Switchboards, main switch room.
- Mechanical ventilation and air handling equipment: Show:
  - . 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:
  - . Statement of normal condition.
  - . Condition upon fire alarm.
  - . Manual controls available.
- Hydraulic services: Show:
  - . Gas meters.
  - . Gas supply control.
  - . Incoming water supplies and valves for the sprinkler, hydrant and fire hose reel systems.
  - . Water tank.

### **Coordination**

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

### **3.21 RECORD DRAWINGS**

#### **General**

Requirement: Show the following:

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

#### **Recording, format and submission**

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

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

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

Endorsement: Sign and date all record drawings.

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

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

### **Services record drawings**

General: To **General** and **Recording, format and submission** and the following:

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

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

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

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

## **3.22 OPERATION AND MAINTENANCE MANUALS**

### **General**

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

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

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

### **Contents**

Requirement: Include the following:

- Table of contents: For each volume. Title to match cover.
- Directory: Names, addresses, email addresses and telephone and facsimile numbers of principal consultant, subconsultants, contractor, subcontractors and names of responsible parties.
- Record drawings: Complete set of record drawings, full size.
- Drawings and technical data: As necessary for the efficient operation and maintenance of the installation. Include:
  - . Switchgear and controlgear assembly circuit schedules including electrical service characteristics, controls and communications.
  - . Charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

- Installation description: General description of the installation.
- Systems descriptions and performance: Technical description of the systems installed and mode of operation, presented in a clear and concise format readily understandable by the principal's staff. Identify function, normal operating characteristics, and limiting conditions.
- Systems performance: Technical description of the mode of operation of the systems installed.
- Baseline data: To AS 1851, AS 1668.1 and AS 1670.1.
- Documentation to AS 1851 including the schedule of essential functionality and performance requirements.
- Digital photographic records to **Underground services**.
- Equipment descriptions:
  - . Name, address, email address and telephone and facsimile numbers of the manufacturer and supplier of items of equipment installed, together with catalogue list numbers.
  - . Schedules (system by system) of equipment, stating locations, duties, performance figures and dates of manufacture. Provide a unique code number cross-referenced to the record and diagrammatic drawings and schedules, including spare parts schedule, for each item of equipment installed. Equipment schedules in tabular form including the equipment designation used on the drawings, manufacturer's name and contact details, equipment name plate data, function of item, associated system and capacity data.
  - . Manufacturers' technical literature for equipment installed, assembled specifically for the project, excluding irrelevant matter. Mark each product data sheet to clearly identify specific products and component parts used in the installation, and data applicable to the installation.
  - . Supplements to product data to illustrate relations of component parts. Include typed text as necessary.
- Certificates:
  - . Certificates from authorities.
  - . Copies of manufacturers' warranties.
  - . Product certification.
  - . Test certificates for each service installation and all equipment.
  - . Test reports
  - . Test, balancing and commissioning reports.
  - . Control system testing and commissioning results.
- 7 day record of all trends at commissioning.
- Operation procedures:
  - . Manufacturers' technical literature as appropriate.
  - . Safe starting up, running-in, operating and shutting down procedures for systems installed. Include logical step-by-step sequence of instructions for each procedure.
  - . Control sequences and flow diagrams for systems installed.
  - . Legend for colour-codes services.
  - . Schedules of fixed and variable equipment settings established during commissioning and maintenance.
  - . Procedures for seasonal changeovers.
  - . If the installation includes cooling towers, a water efficiency management plan.
- Maintenance procedures:
  - . Detailed recommendations for periodic maintenance and procedures, including schedule of maintenance work including frequency and manufacturers' recommended tests.
  - . Manufacturer's technical literature as appropriate. Register with manufacturer as necessary. Retain copies delivered with equipment.
  - . Safe trouble-shooting, disassembly, repair and reassembly, cleaning, alignment and adjustment, balancing and checking procedures. Provide logical step-by-step sequence of instructions for each procedure.

- . Schedule of spares recommended to be held on site, being those items subject to wear or deterioration and which may involve the principal in extended deliveries when replacements are required. Include complete nomenclature and model numbers, and local sources of supply.
- . Schedule of normal consumable items, local sources of supply, and expected replacement intervals up to a running time of 40 000 hours. Include lubrication schedules for equipment.
- . Schedules for recording recommissioning data so that changes in the system over time can be identified.
- . Instructions for use of tools and testing equipment.
- . Emergency procedures, including telephone numbers for emergency services, and procedures for fault finding.
- . Safety data sheets (SDS).
- . Instructions and schedules conforming to AS 1851, AS/NZS 3666.2, AS/NZS 3666.3 and AS/NZS 3666.4.
- Maintenance records:
  - . Prototype service records conforming to AS 1851 prepared to include project specific details.
  - . Prototype periodic maintenance records and report to AS/NZS 3666.2, AS/NZS 3666.3 and AS/NZS 3666.4 as appropriate, prepared to include project specific details.
  - . For hard copies: In binders which match the manuals, loose leaf log book pages designed for recording completion activities including operational and maintenance procedures, materials used, test results, comments for future maintenance actions and notes covering the condition of the installation. Include completed log book pages recording the operational and maintenance activities performed up to the time of practical completion.
  - . Number of pages: The greater of 100 pages or enough pages for the maintenance period and a further 12 months.
- Emergency information: For each type of emergency, including fire, flood, gas leak, water leak, power failure, water failure, system or sub system failure, chemical release or spill, include the following:
  - . 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.

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

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

### **Format – hard copy**

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

- Cover: Identify each binder with typed or printed title *OPERATION AND MAINTENANCE MANUAL*, to spine. Identify title of project, volume number, volume subject matter, and date of issue.
- Dividers: Durable divider for each separate element, with typed description of system and major equipment components. Clearly print short titles under laminated plastic tabs.

- Drawings: Fold drawings to A4 size with title visible, insert in plastic sleeves (one per drawing) and accommodate them in the binders.
- Pagination: Number pages.
- Ring size: 50 mm maximum, with compressor bars.
- Text: Manufacturers' printed data, including associated diagrams, or typewritten, single-sided on bond paper, in clear concise English.

Number of copies: 3.

#### **Date for submission**

Draft submission: The earlier of the following:

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

Final submission: Within 2 weeks after practical completion.

### **3.23 ELECTRONIC FACILITY AND ASSET MANAGEMENT INFORMATION**

#### **3.24 TOOLS AND SPARE PARTS**

##### **Spare parts**

General: Provide spare parts listed in the appropriate worksections.

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.

Replacement: Replace spare parts used during the maintenance period.

### **3.25 TESTING**

#### **Attendance**

General: Provide attendance on tests.

#### **Testing authorities**

General: Except for site tests, have tests carried out by an Accredited Testing Laboratory.

Test instruments: Use instruments calibrated by an Accredited Testing Laboratory.

#### **Test reports**

General: Indicate observations and results of tests and conformance or non-conformance with requirements.

#### **Notice**

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

#### **Controls**

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

#### **Circuit protection**

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

#### **Completion tests**

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

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

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

Sound pressure level measurements: Conform to the following:

- Correction for background noise: To AS/NZS 2107 Table B1.
- External: To AS 1055.
- Internal: To AS/NZS 2107.
- Measurement positions: If a test position is designated only by reference to a room or space, do not take measurements less than 1 m from the floor, ground or walls.
- Sound pressure level analysis: Measure the sound pressure level and the background sound pressure level over the full range of octave band centre frequencies from 31.5 Hz to 8 kHz at the designated positions.
- Sound pressure levels: Measure the A-weighted sound pressure levels and the A-weighted background sound pressure levels at the designated positions.

### **Certification**

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

## **3.26 TRAINING**

### **General**

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

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

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

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

### **Demonstrators**

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

### **Maintenance**

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

### **Operation**

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

### **Seasonal operation**

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

## **3.27 CLEANING**

### **Final cleaning**

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

Labels: Remove all labels not required for maintenance.

## **3.28 PERIODIC MAINTENANCE OF SERVICES**

### **General**

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

Emergencies: Attend emergency calls promptly.

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

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

**Maintenance program**

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

**Maintenance records**

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

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

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.

**3.29 POST-CONSTRUCTION MANDATORY INSPECTIONS AND MAINTENANCE****General**

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

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

Records: Provide mandatory records.

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

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

**0181P MAPEI IN ADHESIVES, SEALANTS AND FASTENERS****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide Mapei adhesives and sealants, with fasteners specified generically, as documented.

**Performance**

Requirements: Conform to the following:

- Fitness for purpose: 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.
- Fasteners: Suitable for the particular use, capable of transmitting imposed loads and maintaining the rigidity of the assembly.

**1.2 COMPANY CONTACTS****Mapei technical contacts**

Website: [www.mapei.com/AU-EN/contacts.asp](http://www.mapei.com/AU-EN/contacts.asp)

**1.3 CROSS REFERENCES****General**

Requirement: Conform to the following:

- *0171 General requirements.*

**1.4 MANUFACTURER'S DOCUMENTS****Technical manuals**

Data sheets: [www.mapei.com/AU-EN/products.asp](http://www.mapei.com/AU-EN/products.asp)

Systems: [www.mapei.com/AU-EN/systems.asp](http://www.mapei.com/AU-EN/systems.asp)

**1.5 SUBMISSIONS****Products and materials**

Sealants: Submit technical data sheets.

**Samples**

Visible joint sealants: Submit colour samples.

**Tests**

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

**Warranties**

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

Sealants and tile adhesives:

- Warranty period: 10 years.
- Warranty terms: As offered by Mapei.

**1.6 INSPECTION****Notice**

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

- Prepared joints and penetrations for each sealant application included in the **Installed sealant tests schedule**.

## 2 PRODUCTS

### 2.1 GENERAL

#### Product substitution

Other products: Conform to PRODUCTS, **GENERAL, Substitutions** in *0171 General requirements*.

#### Storage and handling

Store and handle to Mapei'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 MAPEI ADHESIVES FOR VINYL, RUBBER AND SPORTS FLOORING

#### Adesilex G19

Description: Two-part polyurethane adhesive for rubber and PVC flooring. Extremely strong, tough, elastic, adhesive for general purpose use, particularly suitable for non-absorbent substrates or moisture-sensitive substrates (wood, metal, ceramic, stone, resin, PVC, rubber, etc.). For use on floor in interior and exterior applications. Specifically developed for the installation of rubber athletic tracks.

- VOC content: 14.6 g/l.

#### Mapecoat TNS Urban

Description: Acrylic resin-based coloured coating in water dispersion with selected fillers for coating new or old cycle tracks, footpaths and urban features on concrete or bitumen surfaces.

#### Mapecoat TNS Protection

Description: Two-component transparent protective finish for products from the Mapecoat TNS line.

#### Mapecoat TNS Color

Description: Fine-grained coloured coating made from acrylic resin in water dispersion and micro-granular quartz sand for indoor and outdoor tennis courts, multi-purpose courts, cycle tracks and footpaths.

#### Mapecoat TNS Finish 1.3.4

Description: Coloured acrylic resin-based coating product in water dispersion with selected fillers for indoor and outdoor tennis courts, multi-purpose courts. Certified by the ITF (International Tennis Federation).

#### Rollcoll

Description: Solvent-free, multi-purpose adhesive in water dispersion for laying vinyl floors and walls and for bonding textile floors and walls with all types of backing. Fast-setting, non-flammable and non-toxic.

- VOC content: 79.3 g/l.

#### Ultrabond ECO 380

Description: Solvent-free adhesive in water dispersion with a strong initial bond, long open time for vinyl flooring.

- VOC content: 17 g/l.

#### Ultrabond ECO Contact

Description: Solvent-free contact adhesive for resilient and textile floor and wallcoverings.

- VOC content: 41.4 g/l.

#### Ultrabond ECO V4 SP

Description: Solvent-free, universal adhesive in water dispersion with extended open time. Interior bonding of sheet or tile vinyl and acoustic matting in dry areas.

- VOC content: 0 g/l.

**Ultrabond ECO V4 SP Fiber**

Description: Solvent-free multi-purpose acrylic adhesive in water dispersion with extended open time and improved by adding fibres.

- VOC content: 0 g/l.

**Ultrabond ECO V4 SP Conductive**

Description: Solvent-free light-coloured adhesive in water dispersion for installing conductive vinyl, rubber and textile flooring.

- VOC content: 0 g/l.

**Ultrabond ECO VS90 Plus**

Description: Solvent-free multi-purpose high temperature adhesive in water dispersion for installing resilient floor coverings.

- VOC content: 0 g/l.

**Ultrabond Turf 2 Stars**

Description: Solvent-free, two-component rapid setting polyurethane adhesive for bonding synthetic turf.

- VOC content: 1.4 g/l.

**2.3 MAPEI ADHESIVES FOR LINOLEUM FLOORING****Mapecontact**

Description: Reinforced adhesive strip for laying profiles, base-boards, covings and resilient and textile coatings on steps.

- VOC content: 0 g/l.

**Mapecryl ECO**

Definitions: Solvent-free acrylic adhesive in water dispersion for installing linoleum, vinyl and textile floor coverings.

- VOC content: 5.9 g/l.

**Rollcoll**

Description: Solvent-free, multi-purpose adhesive in water dispersion for laying vinyl floors and walls and for bonding textile floors and walls with all types of backing. Fast-setting, non-flammable and non-toxic.

- VOC content: 79.3 g/l.

**Ultrabond ECO 170**

Description: Multi-purpose adhesive in water dispersion for laying vinyl floors and walls and for bonding textile floors and walls with all types of backing. Fast-setting, non-flammable and non-toxic.

- VOC content: 79.3 g/l.

**Ultrabond ECO Contact**

Description: Solvent-free contact adhesive for resilient and textile floor and wallcoverings.

- VOC content: 41.4 g/l.

**Ultrabond ECO V4 SP Fiber**

Description: Solvent-free multi-purpose acrylic adhesive in water dispersion with extended open time and improved by adding fibres – particularly suitable for laying rubber and PVC flooring.

- VOC content: 0 g/l.

**Ultrabond ECO V4 SP Conductive**

Description: Solvent-free light-coloured adhesive in water dispersion for installing conductive vinyl, rubber and textile flooring.

- VOC content: 0 g/l.

**Ultrabond ECO VS90 Plus**

Description: Solvent-free multi-purpose high temperature adhesive in water dispersion for installing resilient floor coverings.

- VOC content: 0 g/l.

## 2.4 MAPEI ADHESIVES FOR CARPET AND TEXTILE FLOORING

### **Mapecontact**

Description: Reinforced adhesive strip for laying profiles, base-boards, covings and resilient and textile coatings on steps. Available in 35 mm, 65 mm, 85 mm and 240 mm wide rolls x 50 m length.

- VOC content: 0 g/l.

### **Mapecryl ECO**

Definitions: Solvent-free acrylic adhesive in water dispersion for installing linoleum, vinyl and textile floor coverings.

- VOC content: 5.9 g/l.

### **Rollcoll**

Description: Solvent-free, multi-purpose adhesive in water dispersion for laying vinyl floors and walls and for bonding textile floors and walls with all types of backing. Fast-setting, non-flammable and non-toxic.

- VOC content: 79.3 g/l.

### **Ultrabond ECO 170**

Description: Multi-purpose adhesive in water dispersion for laying vinyl floors and walls and for bonding textile floors and walls with all types of backing. Fast-setting, non-flammable and non-toxic.

- VOC content: 79.3 g/l.

### **Ultrabond ECO Contact**

Description: Solvent-free contact adhesive for resilient and textile floor and wallcoverings.

- VOC content: 41.4 g/l.

### **Ultrabond ECO Fix**

Description: Solvent-free adhesive in water dispersion which remains permanently tacky for laying non-permanent dry-lay carpet and vinyl floor tiles.

- VOC content: 13.6 g/l.

### **Ultrabond ECO Tack**

Description: Solvent-free, non-staining acrylic-based adhesive remains permanently tacky for laying non-permanent dry-lay carpet tiles.

- VOC content: 13.7 g/l.

### **Ultrabond ECO V4 SP**

Description: Solvent-free, universal adhesive in water dispersion with extended open time. Interior bonding of sheet or tile vinyl and acoustic matting in dry areas.

- VOC content: 0 g/l.

### **Ultrabond ECO VS90 Plus**

Description: Solvent-free multi-purpose high temperature adhesive in water dispersion for installing resilient floor coverings.

- VOC content: 0 g/l.

## 2.5 MAPEI ADHESIVES FOR WALLCOVERINGS

### **Mapecontact**

Description: Reinforced adhesive strip for laying profiles, base-boards, covings and resilient and textile coatings on steps.

- VOC content: 0 g/l.

### **Rollcoll**

Description: Solvent-free, multi-purpose adhesive in water dispersion for laying vinyl floors and walls and for bonding textile floors and walls with all types of backing. Fast-setting, non-flammable and non-toxic.

- VOC content: 79.3 g/l.

### **Ultrabond ECO Contact**

Description: Solvent-free contact adhesive for resilient and textile floor and wallcoverings.

- VOC content: 41.4 g/l.

**Ultrabond ECO V4 SP**

Description: Solvent-free, universal adhesive in water dispersion with extended open time. Interior bonding of sheet or tile vinyl and acoustic matting in dry areas.

- VOC content: 0 g/l.

**Ultrabond ECO V4 SP Fiber**

Description: Solvent-free multi-purpose acrylic adhesive in water dispersion with extended open time and improved by adding fibres.

- VOC content: 0 g/l.

**2.6 MAPEI ADHESIVES FOR SYNTHETIC GRASS****Ultrabond TURF PU 1K**

Description: Solvent-free, premium one-component polyurethane resin-based, moisture-curing adhesive for bonding synthetic grass and bonding strips between synthetic grass panels in both indoor and outdoor installations.

- VOC content: 0 g/l.

**Ultrabond Turf PU 1K LC**

Description: Solvent-free, economical one-component polyurethane resin-based, moisture-curing adhesive for bonding synthetic grass and bonding strips between synthetic grass panels in both indoor and outdoor installations.

- VOC content: 0 g/l.

**Ultrabond Turf 2 Stars**

Description: Solvent and water-free, two-component, rapid-setting polyurethane adhesive for bonding strips between synthetic grass sheets in both indoor and outdoor installations. Hardens quickly (24 hours) without shrinkage.

- VOC content: 1.4 g/l.

**2.7 MAPEI PRIMERS FOR TIMBER FLOORING****ECO PRIM T Plus**

Description: Solvent-free acrylic primer in water dispersion for interiors to improve adhesion on levelling compounds on all absorbent and non-absorbent surfaces. To be used over Primer MF moisture vapour barrier before applying Mapei levelling compounds.

- VOC content: 19.6 g/l.

**Mapeprim SP**

Description: Synthetic-resin-based primer which ensures perfect bonding with smoothing and levelling compounds and cementitious mortars on non-absorbent and difficult substrates.

- VOC content: 12.6 g/l.

**ECO PRIM Grip**

Description: Multi-purpose ready to use primer for internal and external floors and walls and may be used to improve the bond of all types of cement, gypsum and time-based plasters on substrates made from concrete, brickwork, vibro-compressed concrete blocks, lightweight blocks and gypsum.

- VOC content: 0 g/l.

**2.8 MAPEI ADHESIVES FOR TIMBER FLOORING****Ultrabond P990 1K**

Description: Solvent-free, one-component, ready-to-use polyurethane one-component elastic adhesive to install with all types of timber flooring including pre-finished, multi-layered and traditional jointed solid timber parquetry. Extended open time and excellent rib stability. 30% higher yield than most conventional two-part adhesives.

- VOC content: 0 g/l.

**Ultrabond ECO S955 1K**

Description: Solvent-free, one-component, ready-to-use sililated polymer-based adhesive without water or solvents suitable for use by installers who are allergic to epoxy or epoxy-polyurethane products. Ideal for bonding pre-finished, slats and all types of parquetry on cementitious screeds and also suitable for heated screeds.

- VOC Content: 8.5 g/l.

## 2.9 MAPEI REPAIR AND SMOOTHING COMPOUNDS FOR TIMBER FLOORING

### Nivorapid

Nivorapid: Ultra-fast setting, thixotropic, internal levelling compound for horizontal and vertical surfaces from 1 to 20 mm thick.

- Application: Nivorapid develops a high compressive and flexural strength and is resistant to impact and abrasion.
- VOC content: 0 g/l.

### Mapecem Quickpatch

Mapecem Quickpatch: High performance, high flow, fast-setting ramping and patching compound for use in interiors and exteriors.

- VOC content: 0.01 g/l.

### Latexplan Trade

Description: Two-part Smoothing and Levelling Compound for interiors in thicknesses from 1 to 10 mm particularly suitable for levelling over FC sheeting and wooden substrates – refer Technical Data Sheet.

- VOC content: < 10 g/l.

### Ultraplan

Description: Fast drying levelling compound in interiors in thicknesses from 1 to 15 mm. Especially suitable for areas subject to wheeled chairs.

- VOC content: 0.01 g/l.

### Ultraplan ECO

Description : Fast hardening levelling compound in interiors in thicknesses from 1 to 10 mm to receive any type of floor covering.

- VOC content: 0.01 g/l.

### Ultranplan Maxi

Description : Fast drying levelling compound in interiors in thicknesses from 3 to 30 mm to receive any type of floor covering.

- VOC content: 0.01 g/l.

### Ultraplan Fast Track

Description: Ultra-fast drying levelling compound for interiors in thicknesses from 1 to 10 mm to receive any type of floor covering in a very short time (2 hours).

- VOC content: 0.01 g/l.

### Nivorapid + Latex Plus

Description: Ultra-fast setting, thixotropic, internal levelling compound for horizontal and vertical surfaces from 1 to 20 mm thick. Mix with Latex Plus to increase bond strength on metal surfaces, old rubber floors, PVC, chipboard, timber, linoleum or similar. Refer to TDS.

- VOC content: 0 g/l.

## 2.10 MAPEI MOISTURE VAPOUR BARRIERS FOR TIMBER FLOORING ON CONCRETE SUBSTRATES

### Primer MF

Description: Solvent-free, two-component 100% solid epoxy resin with low viscosity and high penetration capability in the pores of the substrates. Due to the total absence of solvents, Primer MF is not flammable and can be used in confined areas. Use in installations up to 100% RH.

- VOC content: 29.9 g/l.

### Mapeproof 1K Turbo

Description: Solvent-free one-component moisture curing and rapid drying polyurethane surface membrane with a very low emission of volatile organic compounds. Can be used in projects up to 95% RH.

- VOC content: 0 g/l.

## 2.11 MAPEI ADHESIVES FOR CERAMIC AND STONE TILING

### Adeflex R

Description: Premium grade deformable rubber modified cement-based adhesive for bonding most types of tiles in interiors. Available in an off-white colour.

- VOC content: 0.01 g/l.
- Classification to ISO 13007-1: C1 S1.

**Adeflex R + Isolastic 50**

Adeflex R + Isolastic 50: Premium grade deformable rubber modified cement-based adhesive for bonding most types of tiles in interiors. Improved adhesion strength and deformability if mixed with Isolastic 50 instead of water. Available in an off-white colour.

- VOC content: 0.01 g/l.
- Classification to ISO 13007-1: C2 S2.

**Adesilex P9**

Description: High performance cement-based adhesive with no vertical slip and extended open time for installing ceramic tiles. Floor and wall adhesive. Interior and exterior installations. Available in an off-white colour.

- VOC content: 0.01 g/l.
- Classification to ISO 13007-1: C2TE.

**Kerabond Plus**

Description: Easily trowellable cement-based adhesive with superior bond strength, low slump and high initial grab suitable for most tile types of ceramic tiles and stone material. Floor and wall adhesive. Interior and exterior installations. Available in grey and white.

- VOC content: 0.01 g/l.
- Classification to ISO 13007-1: C2T.

**Kerabond Plus + Isolastic 50**

Description: Easily trowellable cement-based adhesive with superior bond strength, low slump and high initial grab suitable for most tile types of ceramic tiles and stone material. Floor and wall adhesive. Interior and exterior installations. Mixing with Isolastic 50 instead of water will improve the characteristics of the adhesive to meet the requirements of S1. Available in grey and white.

- VOC content: 0.01 g/l.
- Classification to ISO 13007-1: C2T S1.

**Kerabond Plus + Isolastic**

Description: Easily trowellable cement-based adhesive with superior bond strength, low slump and high initial grab suitable for most tile types of ceramic tiles and stone material. Floor and wall adhesive. Interior and exterior installations. Mixing with Isolastic latex additive instead of water will improve the characteristics of the adhesive to meet the requirements of S2. Available in grey and white.

- VOC content: 0.01 g/l.
- Classification to ISO 13007-1: C2T S2.

**Keraflex**

Description: High performance cement-based adhesive with no vertical slip and extended open time for installing ceramic tiles and stone material. Floor and wall adhesive. Interior and exterior installations. Available in grey and white.

- VOC content: 0.01 g/l.
- Classification to ISO 13007-1: C2TE.

**Keraflex Maxi S1**

Description: One-component, high performance, deformable cement-based adhesive with no vertical slip and extended open time for installing ceramic tiles and stone material. Especially suitable for the installation of large-sized porcelain tiles and natural stone. Floor and wall adhesive. Interior and exterior installations. Available in grey and white.

- VOC content: 0.01 g/l.
- Classification to ISO 13007-1: C2TE S1.

**Tixobond Fine S1**

Description: White, super smooth, deformable cement-based adhesive with extended open time and no vertical slip for the thin bed and thick bed installation of ceramic tiles on walls and floors.; Interior and exterior installations. Available in white. Classified as C1TE S1 according to ISO 13007-1.

- VOC content: 0.01 g/l.

- Classification to ISO 13007-1: C1TE S1.

**Ultralite S1**

Description: One-component, high performance, deformable, lightweight cement-based adhesive with no vertical slip, long open time, extremely high yield, easy to apply by trowel for the installation of ceramic and stone material. Floor and wall installations. Interior and exterior installations. Available in grey and white.

- VOC content: 0.01 g/l.
- Classification to ISO 13007-1: C2TE S1.

**Adesilex P4**

Description: High performance, rapid setting, full contact cement-based adhesive for the installation of ceramic tiles and stone material. Also, a levelling compound for interior and exterior installations from 3 to 20 mm thick. Also, ideal as a mortar for fixing brick and concrete block walls. Available in grey.

- VOC content: 0.01 g/l.
- Classification to ISO 13007-1: C2F.

**Granirapid**

Description: Two-component, high performance, fast setting and hydrating cement-based adhesive for the installation of ceramic tiles and stone material. Floors can be set to light foot traffic after 3 hours and completely cured after 24 hours. Very low shrinkage and excellent bonding characteristics making it suitable for most difficult substrates. Available in both grey and white.

- VOC content: 0.01 g/l.
- Classification to ISO 13007-11: C2F S1.

**Keraquick S1**

Keraquick S1: One-component, high performance, fast setting, deformable cement-based adhesive with no vertical slip for the installation of ceramic tiles and stone material stable in the presence of humidity. Floors can be set to light foot traffic after 2-3 hours and completely cured after 24 hours making this adhesive ideal for rapid re-tiling projects in supermarkets, airports etc. Available in grey and white.

- VOC content: 0.01 g/l.
- Classification to ISO 13007-1: C2FT S1.

**Keraquick S1 + Latex Plus**

Description: One-component, high performance, fast setting, deformable cement-based adhesive with no vertical slip for the installation of ceramic tiles and stone material stable in the presence of humidity. Floors can be set to light foot traffic after 2-3 hours and completely cured after 24 hours making this adhesive ideal for rapid re-tiling projects in supermarkets, airports etc. Mixing with Latex Plus instead of water improves the deformability of the adhesive. Available in grey and white.

- VOC content: 0.01 g/l.
- Classification to ISO 13007-1: C2FT S2.

**Mapemastic Easy**

Description: Ready to use paste adhesive with no vertical slip and extended open time for the installation of ceramic tiles on interior walls and floors. Available in white.

- VOC content: 53 g/l.
- Classification to ISO 13007-1: D1TE.

**Ultramastic III**

Description: High performance, ready to use paste adhesive with no vertical slip and extended open time for the installation of ceramic tiles on interior walls and floors. Available in white.

- VOC content: 53.4 g/l.
- Classification to ISO 13007-1: D2TE.

**Keralastic T**

Description: High performance, two-component, improved reaction resin, polyurethane adhesive for installing ceramic tiles and stone material. Interior and exterior wall and floor installations. Available in white.

- VOC content: 33.7 g/l.
- Classification to ISO 13007-1: D2TE.

**Kerapoxy**

Kerapoxy: Two-component acid resistant epoxy grout for joints of at least 3 mm. Can also be used as an adhesive. Available in 17 colours from the Mapei Coloured Grout Range. Interior and exterior grouting of ceramic tiles and natural stone floors and walls. Also, suitable for acid-resistant bonding and rapid setting of ceramic tiles, stone materials, fibre-cement, concrete and any other building material on all types of substrates normally used in construction.

- VOC content: 8.2 g/l.
- Classification:
  - . To EN 13888: RG.
  - . To EN 12004: R2T.

**Kerapoxy Design**

Description: Two-component, decorative, acid resistant epoxy grout available in a variety of colours from the Mapei Coloured Grout Range. Ideal for grouting mosaics and may also be used as an adhesive. Can be mixed with Mapeglitter for an outstanding aesthetic grout. Classification of RG according to EN 13888 and R2 according to EN 12004.

- VOC content: 2.8 g/l.
- Classification:
  - . To EN 13888: RG.
  - . To EN 12004: R2.

**2.12 MAPEI GROUTS****Keracolor SF**

Keracolor SF: Super fine, high performance cementitious grout, polymer modified for joints up to 4 mm. Easy to apply and finish, smooth and compact, particularly fine, interior and exterior, floor and wall grouting of all types of ceramic tiles and stone material. Available in white.

- VOC content: 0.01 g/l.
- Classification to EN 13888: CG2WA.

**Keracolor FF**

Keracolor FF: High performance, polymer-modified, water repellent cementitious grout with DropEffect technology for joints up to 6 mm. Easy to apply and finish, smooth and compact, interior and exterior, floor and wall grouting of all types of ceramic tiles and stone material.

- VOC content: 0.01 g/l.
- Classification to EN 13888: CG2WA.

**Keracolor GG**

Keracolor GG: High performance, polymer-modified, cementitious grout for joints from 4 to 15 mm. Easy to apply and finish, interior and exterior, floor and wall grouting of all types of ceramic tiles and stone material.

- VOC content: 0.01 g/l.
- Classification to EN 13888: CG2WA.

**Ultracolor Plus**

Description: Fast-setting and drying, high performance, anti-efflorescent grout, polymer modified for joints from 2 to 20 mm. Water repellent with DropEffect and anti-mould properties. Interior and exterior grouting of floor and wall tiles, mosaics and stone material. Ideal for grouting external facades, swimming pools, balconies, bathrooms and kitchens. Especially suitable for grouting floors of supermarkets, restaurants, airports due to its fast setting characteristics.

- VOC content: 0.01 g/l.
- Classification to EN 13888: CG2WA.

**Kerapoxy**

Kerapoxy: Two-component acid resistant epoxy grout for joints of at least 3 mm. Can also be used as an adhesive. Available in 17 colours from the Mapei Coloured Grout Range. Interior and exterior grouting of ceramic tiles and natural stone floors and walls. Also, suitable for acid-resistant bonding and rapid setting of ceramic tiles, stone materials, fibre-cement, concrete and any other building material on all types of substrates normally used in construction.

- VOC content: 8.2 g/l.

- Classification:
  - . To EN 13888: RG.
  - . To EN 12004: R2T.

### **Kerapoxy Design**

Description: Two-component, decorative, acid resistant epoxy grout available in a variety of colours from the Mapei Coloured Grout Range. Ideal for grouting mosaics and may also be used as an adhesive. Can be mixed with Mapeglitter for an outstanding aesthetic grout. Classification of RG according to EN 13888 and R2 according to EN 12004.

- VOC content: 2.8 g/l.
- Classification:
  - . To EN 13888: RG.
  - . To EN 12004: R2.

## **2.13 MAPEI FLEXIBLE JOINTS**

### **Mapesil AC**

Description: Pure acetic silicone sealant with a low modulus of elasticity and no solvents. Mould resistant, high strength, high thermal and chemical resistance. Available in 34 colours and transparent. For use with glass, ceramic, sanitary wares and varnished surfaces. Ideal for floor joints and grouting tiles in damp environments and swimming pools. May be used on concrete, wood, metal, plastics and rubber after treating with Primer FD.

- VOC content: 25.8 g/l.
- Colour: Refer schedule of selections

### **Mapesil LM**

Description: Neutral silicone sealant with high bond strength with no primer on a wide range of substrates. Odourless and does not stain stone surfaces. Excellent resistance to inclement weather and ageing. Available in white (100), silver grey (111), cement grey (113), grey (114), black (120), Jasmine (130), beige 2000 (132). Ideal for natural stone and ceramic tiles on façades.

- VOC content: 50.6 g/l.
- Colour: Refer schedule of selections

### **Mapeflex PU 45 FT**

Description: One-component, thixotropic polyurethane sealant and adhesive. Single product for flexible bonds and seals. High modulus of elasticity, high resistance to traffic. High sucker effect for bonding on vertical surfaces and ceilings. Paintable with high bond strength, no primer required. Compatible with all absorbent mineral substrates, metal surfaces, varnished surfaces, wood, stone, brickwork and glass. Available in silver grey (111), (300 ml); silver grey (111) (600 ml). Ideal for sealing civil and industrial floors and flexible bonding of construction features instead of using screws, nails and lightweight fittings.

- VOC content: 0.6 g/l.
- Classification to ISO 11600: F25 LM.
- Colour: Refer schedule of selections

### **Mapeflex PU 40**

Description: Paintable polyurethane sealant with a low modulus of elasticity for movements up to 25%. Internal and external, horizontal or vertical applications.

- VOC content: 2.1 g/l.
- Classification to ISO 11600: F20 HM.
- Colour: Refer schedule of selections

## **2.14 MAPEI SEALANTS**

### **Mapefix PE SF**

Description: Two-component, styrene-free, polyester resin chemical fastener for heavy loads. Adhesive for chemical anchoring metal bars in holes made in building materials. Recommended for anchoring lightweight elements in internal and external substrates with a horizontal, vertical, inclined or overhead axis and is particularly recommended for anchors in perforated substrates. May also be used for anchors in damp substrates and in substrates at temperatures down to - 5°C.

- VOC content: 0 g/l.

**Mapefix VE SF**

Description: Two-component chemical anchoring adhesive, styrene-free made from a mixture of synthetic resins. Specially formulated for anchoring zinc-plated threaded and deformed steel bars which transmit structural loads in solid and perforated substrates such as non-cracked concrete, lightweight concrete, stone, wood, bricks and mixed masonry.

- VOC content: 0 g/l.

**Mapepur Universal Foam G**

Description: One component expanding polyurethane foam for filling gaps and for soundproofing and insulating work. Impermeable and resistant to temperatures from - 40°C to + 90°C, humidity and the effects of ageing. Adheres well to all materials normally used in the building industry such as brickwork, concrete, gypsum, wood, metal, glass, polystyrene foam, PVC and rigid polyurethane foam. Resistant to the formation of mould and mildew.

- VOC content: 0.7 g/l.

**2.15 GENERIC ADHESIVES****High strength adhesive tape**

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

Product classification: Select tape to suit substrate as follows:

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

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

**2.16 GENERIC SEALANTS****Standards**

General: To ISO 11600.

**External masonry joints**

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

Bond breaking backing:

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

**Fire-resisting control joints**

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

- Fire-stopping: To AS 4072.1.

**Lightweight building element joints**

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

**Floor control joints**

General: Provide trafficable sealants.

Bond breaking backing:

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

**2.17 FASTENERS****General**

Masonry anchors: Proprietary expansion or bonded type anchors conforming to **SELECTIONS, ANCHORS**.

Plain washers: To AS 1237.1.

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

Plugs: Proprietary purpose-made plastic.

Stainless steel fasteners: To ASTM A240/A240M.

Steel nails: To AS 2334.

Length: At least 2.5 times the thickness of the member being secured, and at least 4 times the thickness if the member is plywood or building board less than 10 mm thick.

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

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

### Bolts

Coach bolts: To AS/NZS 1390.

Hexagon bolts Grades A and B: To AS 1110.1.

Hexagon bolts Grade C: To AS 1111.1.

### Corrosion resistance

Atmospheric corrosivity category: To 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	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 316
C3	Hot-dip galvanized	50	Stainless steel 316
C4 and T	Stainless steel 316	-	Stainless steel 316

### Finishes

Electroplating:

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

Galvanizing:

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

Mild steel fasteners: Galvanize if:

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

Epoxy coated: CCA treated timber.

### Nuts

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

Hexagon nuts Grade C: To AS 1112.3.

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

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

### Screws

Coach screws: To AS/NZS 1393.

Hexagon screws Grades A and B: To AS 1110.2.

Hexagon screws Grade C: To AS 1111.2.

Hexagon socket screws: To AS 1420.

Self-drilling screws: To AS 3566.1.

Self-tapping screws:

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

#### **Blind rivets**

Description: Expanding end type with snap mandrel.

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

End material:

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

Size:

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

### **3 EXECUTION**

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#### **3.1 ADHESIVES**

##### **General**

Requirement: Install to the manufacturer's recommendations.

##### **Preparation**

Substrates: Conform to the following:

- Remove any deposit or finish which may impair adhesion.
- If framed or discontinuous, provide support members in full lengths without splicing.
- If solid or continuous, remove excessive projections.
- If previously painted, remove cracked or flaking paint and lightly sand the surface.
- Concrete substrates for Mapei products: Uniformly dry, solid, sound, and free of dust, loose particles, cracks, paint, wax, oil, rust, traces of gypsum and other products that can interfere with bonding. Prepare to the Mapei Technical Data Sheets (TDS).

##### **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, consult the manufacturer.

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

### 3.2 JOINT SEALING

#### General

Requirement: Install to the manufacturer's recommendations.

#### Joint preparation

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

Bond breaking: Install bond breaking backing material.

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

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

#### Sealant joint proportions

General weatherproofing joints (width:depth):

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

#### Sealant application

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

#### Weather conditions

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

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

#### Joint finish

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

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

#### Protection

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

#### Rectification

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

### 3.3 TESTING

#### Installed sealant tests

Sampling: For each sealant test, take 3 samples of installed and cured sealant, each at least 50 mm long, from completed joints.

Reinstatement: Repair-as-new the joints from which the samples were taken.

### 3.4 FASTENERS

#### General

Requirement: Install to the manufacturer's recommendations.

**Fastening to wood and steel**

Timber substrates: To AS 1720.1 Section 4.

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

**Masonry anchors**

Installation: To the manufacturer's recommendations.

**4 SELECTIONS****4.1 ADHESIVES****Application schedule**

<b>Application</b>	<b>Mapei product group</b>	<b>Mapei product</b>	<b>Relevant worksections</b>
Adhesive fixed timber strip flooring and parquetry systems	Mapei Products for the Installation of Timber flooring	Ultrabond P990 1K or Ultrabond S955	0655 Timber flooring.
Colourback glass faced wall panels or splashbacks		Mapeflex PU45 FT or Mapesil AC. Refer to Selection Chart of Grouts and Flexible Joints	0551 Joinery, 0641 Applied wall finishes.
Drywall lining/wall panels		Mapeflex PU45 FT or Mapesil AC. Refer to Selection Chart of Grouts and Flexible Joints	0511 Lining, 0522 Partitions – framed and lined.
Engineered panel floors	Mapei Products for the Installation of Timber flooring	Ultrabond P990 1K or Ultrabond Eco S955 1K	0654 Engineered panel flooring.
Joinery doors	Selection Chart of Grouts and Flexible Joints	Mapeflex PU40, Mapeflex PU45 and Mapesil AC.	0453 Doors and access panels.
Mirrors	Selection Chart of Grouts and Flexible Joints	Mapeflex PU45 FT and Mapesil AC.	0467 Glass components.
Stainless steel faced wall panels or splashbacks	Selection Chart of Grouts and Flexible Joints	Mapeflex PU45 FT and Mapesil AC.	0551 Joinery, 0553 Stainless steel benching.
Timber joinery fitments			0551 Joinery.
Trims, mouldings, skirtings and architraves	Selection Chart of Grouts and Flexible Joints	Mapeflex PU40, Mapeflex PU45 FT and Mapesil AC	0511 Lining.
Mechanical services		Mapeflex PU40 Mapepur Universal G	0732 Air filters, 0744 Ductwork insulation, 0752 Mechanical piping insulation, 0762 Cool rooms.
Hydraulic services	Selection Chart of Grouts and Flexible Joints	Mapeflex PU45 and Mapesil AC	0802 Hydraulic design and install, 0812 Tapware.

**4.2 RESILIENT ADHESIVES****Application schedule**

<b>Application</b>	<b>Mapei product group</b>	<b>Mapei product</b>	<b>Relevant worksections</b>
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Application	Mapei product group	Mapei product	Relevant worksections
Floors	Mapei Products for resilient adhesives	Refer to Selection Guide for Resilient Adhesives	0651 Resilient finishes, 0652 Carpets.
Wall coverings	Mapei Products for resilient adhesives	Refer to Selection Guide for Resilient Adhesives	0641 Applied wall finishes
Steps, profiles, covings and skirtings.	Mapei Products for resilient adhesives	Refer to Selection Guide for Resilient Adhesives	0651 Resilient finishes.

### 4.3 ADHESIVES FOR CERAMIC TILING AND STONE MATERIAL

#### Application schedule

Application	Mapei product group	Mapei product	Relevant worksections
Thin porcelain tiles on internal and external surfaces	Mapei ceramic and stone tiling adhesives	Refer to Selection Chart of Adhesives for Ceramic Tiles and Stone Materials	0631 Ceramic tiling, 0632 Stone and terrazzo tiling.
Ceramic tiles, mosaics and stone on internal floors	Mapei ceramic and stone tiling adhesives	Refer to Selection Chart of Adhesives for Ceramic Tiles and Stone Materials	0631 Ceramic tiling, 0632 Stone and terrazzo tiling.
Ceramic tiles, mosaics and stone on internal walls	Mapei ceramic and stone tiling adhesives	Refer to Selection Chart of Adhesives for Ceramic Tiles and Stone Materials	0631 Ceramic tiling, 0632 Stone and terrazzo tiling.
Ceramic tiles, mosaics and stone on external surfaces	Mapei ceramic and stone tiling adhesives	Refer to Selection Chart of Adhesives for Ceramic Tiles and Stone Materials	0631 Ceramic tiling, 0632 Stone and terrazzo tiling.

### 4.4 GROUTS AND FLEXIBLE JOINTS

#### Application schedule

Application	Mapei product group	Mapei product	Relevant worksections
External surfaces	Mapei Elastic Joints	Refer to Selection Chart of Grouts and Flexible Joints	
Ceramic tiles, mosaics and stone on internal floors	Mapei cementitious grouts	Refer to Selection Chart of Grouts and Flexible Joints	0631 Ceramic tiling, 0632 Stone and terrazzo tiling.
Ceramic tiles, mosaics and stone on internal walls	Mapei cementitious grouts	Refer to Selection Chart of Grouts and Flexible Joints	0631 Ceramic tiling, 0632 Stone and terrazzo tiling.
Ceramic tiles, mosaics and stone on external surfaces	Mapei cementitious grouts	Refer to Selection Chart of Grouts and Flexible Joints	0631 Ceramic tiling, 0632 Stone and terrazzo tiling.
Ceramic tiles, mosaics and stone for commercial applications	Mapei epoxy grouts	Refer to Selection Chart of Grouts and Flexible Joints	0631 Ceramic tiling, 0632 Stone and terrazzo tiling.

### 4.5 ANCHORS

#### Bonded anchor schedule

Property	A	B	C
Adhesive	Mapefix PE SF Mapefix VE SF		

#### 4.6 SEALING, POINTING AND BEDDING

##### Application schedule

Application	Product	Relevant worksections
Metal flashings and rainwater goods	(generic product)	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	(generic product)	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	Mapesil AC Mapeflex PU40 Mapeflex PU45 FT	0432 Curtain walls, 0451 Windows and glazed doors, 0453 Doors and access panels, 0463 Glass blockwork.
Mechanical services		0724 Air handling plant – combined, 0725 Air handling plant – built-up, 0726 Air handling plant – minor, 0727 Air handling plant – packaged, 0732 Air filters, 0741 Ductwork, 0702 Mechanical design and install, 0752 Mechanical piping insulation, 0762 Cool rooms.
Hydraulic services	Mapesil AC	0811 Sanitary fixtures, 0812 Tapware, 0813 Water heaters, 0815 Boiling, chilled and filtered water dispensers.

##### Adhesives, sealants and fasteners combined function schedule

Application	Product	Relevant worksections
Cool rooms fixing and sealing	Mapesil AC Mapeflex PU40	0762 Cool rooms.
Fixing and sealing acoustic ceiling tiles	Mapeflex PU45 FT	0531 Suspended ceilings – combined.
Control joints, tile adhesives and wet area sealants	Mapeflex PU40 Mapeflex PU45 FT	0631 Ceramic tiling, 0632 Stone and terrazzo tiling.
Timber floor control joints, adhesives and fixings	Mapeflex PU40 Mapeflex PU45 FT	0655 Timber flooring, 0654 Engineered panel flooring.
Wet area sealants and lightweight detail items	Mapesil AC	0525 Cubicle systems, 0551 Joinery, 0811 Sanitary fixtures.

#### 4.7 SEALING STRUCTURALLY DESIGNED CONTROL JOINTS

##### Application schedule

Application	Mapei product group	Mapei product	Bond breaking	Sealant colour	Relevant worksection
Masonry control joints	Mapei flexible joints	Mapeflex PU40 Mapeflex PU45 FT	Yes	Grey or white	0322 Tilt-up concrete, 0331 Brick and block construction, 0332 Stone masonry.

Application	Mapei product group	Mapei product	Bond breaking	Sealant colour	Relevant worksection
Trafficable masonry control joints	Mapei flexible joints	Mapeflex PU40 Mapeflex PU45	Yes	Grey or white	0274 Concrete pavement, 0275 Paving – mortar and adhesive bed.

#### 4.8 FIRE-RESISTING SEALANTS

##### Application schedule

Application	Sealant type	Bond breaking	Sealant colour	Fire-resistance level to AS 1530.4 (FRL)	Relevant worksection
Masonry control joints					0322 Tilt-up concrete, 0331 Brick and block construction, 0332 Stone masonry.
Pointing and stopping (including acoustic applications)					0182 Fire-stopping, 0346 Structural fire protection systems, 0472 Acoustic insulation.
Sealing of structural steel fire protection systems					0346 Structural fire protection systems.

**0183 METALS AND PREFINISHES****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirements: Provide metal and prefinishes, as documented.

**Performance**

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

**1.2 PRECEDENCE****General**

Order of precedence:

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

**1.3 CROSS REFERENCES****General**

Requirement: Conform to the following:

- 0171 General requirements.

**1.4 SUBMISSIONS****Samples**

General: Submit samples of the following:

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

**2 PRODUCTS****2.1 METALS****Aluminium and aluminium alloys**

Drawn pipe: To AS/NZS 1867.

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

Extrusions: To AS/NZS 1866.

Plate and sheets: To AS/NZS 1734.

**Coated steel**

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

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

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

Steel wire: To AS/NZS 4534.

**Copper and copper alloys**

Casting: To AS 1565.

Plate, sheet and strip: To AS 1566.

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

Composition and designations: To AS 2738.

**Stainless steel**

Bars: To ASTM A276/A276M.

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

Welded pipe (plumbing applications): To AS 1769.

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

### **Steel**

Sheet: To AS/NZS 1595.

Structural bars and sections: To AS/NZS 3679.1.

Structural hollow sections: To AS/NZS 1163.

### **Steel for prefinishes**

Cold rolled bar: To AS 1443 - Bright.

Cold rolled sheet: To AS/NZS 1595.

- Designation: CA2S-E.

Electric resistance welded tube: To AS 1450.

## **3 EXECUTION**

### **3.1 GENERAL**

#### **Metal separation**

Incompatible sheet metals: Prevent direct contact between incompatible metals. Provide separation by one of the following:

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

Incompatible fixings: Do not use.

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

#### **Brazing**

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

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

Filler metal: To AS/NZS 1167.1.

#### **Finishing**

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

#### **Preparation**

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

Standard: To AS 1627 series.

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

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

#### **Welding**

Aluminium: To AS 1665.

Stainless steel: To AS/NZS 1554.6.

Steel: To AS/NZS 1554.1.

### **3.2 STAINLESS STEEL FINISHES**

#### **General**

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

Note the item and location e.g. Endorsed stainless steel sample (150 x 150 mm No. 4 brushed finish) retained at site office until practical completion. If there is a sample register with a coding system, enter the code here.

**Pre-assembly**

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

**Post-assembly pre-treatment**

Heat discolouration: Remove by pickling.

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

**Post-assembly finish**

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

Brushed electropolish finish: Conform to the following:

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

Mirror electropolish finish:

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

**Completion**

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

Protection: Secure packaging or strippable plastic sheet.

**3.3 NON-FERROUS FINISHING****Mechanical finishes**

Bright finished copper alloy surfaces: For indoor applications, apply a clear lacquer protective coating.

**3.4 ELECTROPLATING****Electroplated coatings**

Chromium on metals: To AS 1192.

- Service condition number: At least 2.

Nickel on metals: To AS 1192.

- Service condition number: At least 2.

Zinc on iron or steel: To AS 1789.

**3.5 ANODISING****General**

Standard: To AS 1231.

Thickness grade: To AS 1231 Table H1.

**Sample**

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

**3.6 METAL SPRAYING****Metal spray**

Standard: To ISO 2063.2.

Minimum thicknesses:

- Indoor applications: 125 µm.
- Outdoor applications: 175 µm.

Process: Electric arc.

Seal coat: Cover the metal spray finish with two coats of vinyl seal to a total dry film thickness of 80 µm.

### 3.7 PREPAINTING

#### **Air-drying enamel**

Application: Spray or brush.

Finish: Full gloss.

General use:

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

Oil resistant use:

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

#### **Equipment paint system**

Description: Brush or spray application using paint as follows:

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

#### **Prepainted metal products**

Standard: To AS/NZS 2728.

Product type as noted in AS/NZS 2728: Not lower than the type appropriate to the atmospheric corrosivity category.

#### **Stoving enamel**

Application: Spray or dip.

#### **Two-pack liquid coating**

Application: Spray.

Finish: Full gloss.

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

Topcoat:

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

### 3.8 COMPLETION

#### **Damage**

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

#### **Repair**

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.

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

Requirement: Provide termite management systems, as documented.

**Performance**

Objective: To achieve building protection.

**1.2 CROSS REFERENCES****General**

Requirement: Conform to the following:

- 0171 General requirements.

**1.3 STANDARD****General**

Termite management systems: To AS 3660.1.

**1.4 SUBMISSIONS****Certification**

Certificate of installation: Submit certificate to AS 3660.1 Appendix A3.

**Operation and maintenance manuals**

Maintenance regime: For systems requiring post construction monitoring, provide a maintenance manual with the details of the following:

- Inspection frequency.
- Instructions for inspection of termite activity and treatment effectiveness.
- Contact details of installers and manufacturer's authorised supplier of replacement parts/components.
- Reapplication requirements.

**Products and materials**

Product data: Submit manufacturer's data for each product/material of the following:

- Construction details, material description and dimensions of individual components.
- Treatments and application procedures.

Type tests: Submit results, as follows:

- Termite management systems to AS 3660.3.

**Records**

Soil treatment application report: After completing treatment application, submit a report with the following details:

- Date and time of application.
- Moisture content of soil before application.
- Termiticide brand name and manufacturer.
- Quantity of undiluted termiticide used.
- Dilutions, methods, volumes used, and rates of application.
- Areas of application.
- Water source for application.
- Termiticide brand name and manufacturer.
- Quantity of termiticide used.

Management system report: At the end of the defects liability period, submit a report on the efficacy and status of the termite management system.

**Tests**

Site tests: Submit test results for chemical termite management systems.

**Warranties**

Management system warranty: Submit the manufacturer's warranty.

**1.5 INSPECTION****Notice**

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

- Completed earthworks or substrate preparation before system application/installation.
- The completed termite management system.

**2 PRODUCTS**

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**2.1 PHYSICAL SYSTEMS****Concrete slab**

Standard: To AS 3660.1 Section 4.

**Termite caps and sheeting**

Standard: To AS 3660.1 Section 5.

**Granular materials**

Standard: To AS 3660.1 Section 6.

**2.2 CHEMICAL SYSTEMS****General**

Standard: To AS 3660.1 Section 7.

**3 EXECUTION**

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**3.1 PHYSICAL SYSTEMS****Concrete slab**

Standard: To AS 3660.1 Section 4.

**Termite caps and sheeting**

Standard: To AS 3660.1 Section 5.

**Granular materials**

Standard: To AS 3660.1 Section 6.

**3.2 CHEMICAL SYSTEMS****General**

Standard: To AS 3660.1 Section 7.

**Testing**

Site test: To AS 3660.1 Appendix E.

**3.3 COMPLETION****Termite management system notice**

General: Permanently fix a durable notice in a prominent location to BCA B1.4(i)(ii) or BCA 3.1.4.4.

**Waste materials**

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

**Warranties**

Type: Renewable.

**Completion inspection**

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

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**0201B 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.

**1.4 INTERPRETATION****Definitions**

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

- Demolition: The complete or partial dismantling of a building or structure, by pre-planned and controlled methods or procedures.
- Dilapidation record: The photographic or video and written record 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****Execution details**

Requirement: Submit the following, as documented:

- Hazardous Substances Management Plan.
- Investigation and work plan.

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

Recycling: Submit details of the proposed recycling facility.

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

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

**Records**

Dilapidation record:

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

**Tests**

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

**1.6 INSPECTION****Notice**

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

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

## 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 <b>Recovered items for re-use in the works schedule</b>	Principal/proprietor
Recovered items for delivery to the principal	Recover without damage items identified in the <b>Recovered items for delivery to the principal schedule</b>	Principal/proprietor
Demolished material for recycling in the works	Stockpile material identified in the <b>Demolished material for recycling in the works schedule</b>	Contractor
Demolished material for recycling off-site	Demolish and deliver for recycling material identified in the <b>Demolished material for recycling off-site schedule</b>	Contractor
Dismantle for relocation as part of the works	Dismantle without damage and store items identified in the <b>Dismantle for relocation schedule</b>	Principal/proprietor
Demolish for removal	Remove from the site demolished materials identified in the <b>Demolish for removal schedule</b> . 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 clause 1.6.1. Include the following:

- Asbestos or material containing asbestos.
- Flammable or explosive liquids or gases.

- Toxic, infective or contaminated materials.
- Radiation or radioactive materials.
- Noxious or explosive chemicals.
- Tanks or other containers which have been used for storage of explosive, toxic, infective or contaminated substances.

### **Removal of hazardous substances**

Standard: To AS 2601 clause 1.6.2.

## **3.2 INVESTIGATION AND WORK PLAN**

### **General**

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

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

## **3.3 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 which are to be altered and which normally rely for support on work to be demolished.

Ground support: Support excavations for demolition of underground structures.

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

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

### **Permanent supports**

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

## **3.4 PROTECTION**

### **Encroachment**

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

### **Weather protection**

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

### **Dust protection**

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

### **Security**

General: If walls or roofs are opened for alterations or additions, provide security against unauthorised entry to the building.

**Temporary screens**

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

Type: Timber framed screens 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 adjacent structures exposed by demolition.

**Existing services**

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

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

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

**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****Encroachment**

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

**Concrete slabs**

General: Using a diamond saw, neatly cut back or trim to new alignment with a clean true face existing concrete slabs to be partially demolished or penetrated. Do not overcut at corners.

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 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.

**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 adjacent structures may be inspected following completion of demolition.

**Reinstatement**

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

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

**Temporary support**

General: Remove at completion of demolition.

**4 SELECTIONS****4.1 DEMOLITION****Recovered items for re-use in the works schedule**

Item	Location for re-use
Nil	

**Recovered items for delivery to the principal schedule**

Item	Delivery location
Undamaged slate pieces	Stockpile within the site boundaries for client relocation.

**Demolished material for recycling in the works schedule**

Material
Nil

**Demolished material for recycling off-site schedule**

Material
Nil

**Dismantle for relocation schedule**

Item	Location for storage	Location for re-assembly
Nil		

**Demolish for removal schedule**

Item
All elements apart from slate tiles.

**0223 SERVICE TRENCHING****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide trenching for underground services, as documented.

**1.2 DESIGN****Requirements**

Trench design: 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.**

Authority requirements: Refer approvals documents

**1.3 CROSS REFERENCES****General**

Requirement: Conform to the following:

- 0171 General requirements.

**1.4 STANDARDS****Trenching**

Earthworks: To AS 3798.

Electrical services: To AS/NZS 3000.

Hydraulic services: To AS/NZS 3500.1.

Communication services: AS/CA S009.

**1.5 TOLERANCES****Surface levels**

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

- Under building slabs and load bearing elements: + 0, - 25 mm.
- Pavement subgrades: + 0, - 40 mm.
- Batters: No steeper than the slope shown on the drawings. Make sure flatter slopes do not impact on boundaries or required clearances to buildings, pavements or landscaping.
- Other ground surfaces:  $\pm 50$  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:  $\pm 10$  mm.
- Concrete: + 10 mm, - 0 mm.
- Paving:
  - . Finished level:  $\pm 8$  mm.
  - . Height deviation between adjacent units (lippage):  $\pm 2$  mm.
- Granular surfaces:  $\pm 10$  mm.
- Lippage between restored surface and adjacent existing surface:  $\pm 5$  mm.

## 1.6 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 procedures proposed for trenching and/or boring.
- 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 locations 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 to show the location of the installed services.

## 1.7 INSPECTION

### Notice

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

- Items to be measured as listed in **GROUND CONDITIONS, Records of measurement**.
- 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 clause 4.4 including inorganic, non-perishable material suitably graded and capable of compaction to the documented density.

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

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

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

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

### 2.2 SURFACE RESTORATION MATERIALS

#### General

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

**Subbase and base**

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

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

**Pathways and paved surfaces generally**

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

**Concrete surfaces**

Material requirements: Normal-class to AS 1379.

Concrete strength grade: N25.

Slump: Maximum 100 mm.

**Asphalt surfaces**

Aggregate: To AS 2758.5 or to AS 2758.2 for sprayed bituminous surfaces.

Hot mix asphalt: To AS 2150.

Medium cut back bitumen: To AS 2157.

Bitumen emulsion: To AS 1160.

Bitumen binder: Class 170.

**Segmental paving**

Concrete and clay pavers: To AS/NZS 4455.2.

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

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

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

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**3 EXECUTION**

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**3.1 EXISTING SERVICES****Location**

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

Utility services: Contact DIAL BEFORE YOU DIG 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.

**Segmental paving**

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

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

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

**Grass**

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

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

Unsuitable grass: Remove and dispose of off-site.

#### **Small plants, shrubs and trees**

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

Unsuitable vegetation: Remove and dispose of off-site.

### **3.3 GROUND CONDITIONS**

#### **As found site conditions**

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

- Bad ground.
- Discrepancies to 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 commence backfilling or place permanent works in the excavation until the following have been agreed and recorded:

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

### **3.4 EXCAVATION**

#### **General**

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

- To required lines and levels, with uniform grades.
- Straight between access chambers, inspection points and junctions.
- With stable sides.
- Width tolerance:  $\pm 50$  mm, unless constrained by adjacent structures.
- Tree protection: To AS 4970.

#### **Adjacent structures**

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

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

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

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

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

#### **Trench widths**

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

#### **Trench depths**

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

#### **Obstructions**

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

**Dewatering**

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

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

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

**Excess excavation**

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

**Stockpiles**

Topsoil removal: Stockpile topsoil intended for re-use to a maximum height of 1.5 m.

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

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

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

**Unsuitable material**

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

**Boring**

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

**3.5 TRENCH BACKFILL****General**

Place fill: To AS 3798 clause 6.2.2 and 6.2.6.

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

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

**Marking services**

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

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

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

**Trees**

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

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

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

**Compaction**

Control moisture within backfill: To AS 3798 clause 6.2.3.

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

Compaction: To AS 3798 Section 5.

Frequency of testing: To AS 3798 clause 8.7.

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

### **Density tests**

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

Test methods: Conform to the following:

- Compaction control tests: To AS 1289.5.4.1 or AS 1289.5.7.1.
- Field dry density: AS 1289.5.3.2 or AS 1289.5.3.5.
- Standard maximum dry density: AS 1289.5.1.1.
- Dry density ratio: AS 1289.5.4.1.
- Density index: AS 1289.5.6.1.

## **3.6 SURFACE RESTORATION**

### **Subbase and base**

Compaction: Uniformly compact each layer of the subbase and base courses over the full area and depth within the trench to a relative compaction of 100% when tested in conformance with AS 1289.5.4.1.

Compacted layer thickness:

- Maximum: 200 mm.
- Minimum: 100 mm.

Compaction test frequency: Minimum 1/every second layer/50 m<sup>2</sup> of restoration surface area.

### **Concrete surfaces**

Construction: Conform to the following:

- Prime coat the cut edges of the existing surfaces with cement slurry. Lay and compact concrete so that the edges are flush and the centre is cambered 5 mm above the adjoining existing surfaces.
- Surface finish and pattern: Match existing adjoining work.
- Minimum thickness: 75 mm or the adjacent pavement thickness, whichever is thicker.
- Reinforcement and dowels: If required, provide steel reinforcement with dowels into the adjacent concrete.
- Expansion joints: 15 mm thick preformed jointing material of bituminous fibreboard placed in line with joints in existing concrete.
- Control joints:
  - . Form control joints strictly in line with the control joints in existing concrete.
  - . Around service poles: Terminate the concrete paving 200 mm from the pole and fill the resulting space with cold mix asphalt.

Weather: Do not place concrete in ambient temperatures above 30°C or below 10°C, without adequate precautions. Protect surface from rain damage, if required.

Compaction: Compact as follows:

- Thickness 100 mm or less: Compact by placing, screeding and finishing processes. If required use a hand-held vibrating screed at the surface. Do not use immersion vibrators.
- Thickness more than 100 mm and downturns: Use an immersion vibrator.

Curing: Cure by keeping continuously wet for 7 days.

### **Asphalt surfaces**

Placement: To AS 2150.

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 Section 8.

**Segmental paving units**

Bedding: Replicate the bedding used for the original paved surface. Use bedding methods and materials which 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 paving units unsuitable for relaying: Replace paving units with new units 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.

Lawn: Re-lay stockpiled turf. If existing turf is no longer viable, re-sow the lawn over the trench and other disturbed areas.

Planted areas: Overfill to allow for settlement.

**3.7 COMPLETION****General**

As-built documentation: Upon completion, record the location of all installed services on the as-built documentation.

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<b>0241 LANDSCAPE – WALLING AND EDGING</b>
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## 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

Submit samples as follows: Rockcote finish

### 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.

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## 2 PRODUCTS

### 2.1 STEEL

#### Steel tubes

Posts, rails, stays: To AS/NZS 1163.

- Grade: C350L0.

#### Wire

Chainwire, cable wire, tie wire and barbed wire: To AS 2423.

### 2.2 CONCRETE

#### General

Standard: To AS 1379.

Exposure classification: To AS 3600 Table 4.3.

Grade, if there are cast-in metal items: To AS 3600 Table 4.4.

### 2.3 MASONRY SEGMENTAL WALLS

#### General

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.

### 2.4 GEOTEXTILES

#### General

Type: Polymeric fabric formed from a plastic yarn composed of at least 85% by weight of propylene, ethylene, amide or vinylidene chloride and containing stabilisers or inhibitors to make the filaments resistant to deterioration due to ultraviolet light.

Identification and marking: To AS 3705.

### 2.5 EDGING

#### Concrete

Standard: To AS 1379 – Grade N20.

Edge strip profile: Equal angle

Concrete kerb profile to AS 2876.

**Steel**

Finish: Hot-dip galvanized.

**3 EXECUTION**

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**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 EDGING****Concrete**

Edging strip: Place in a shallow trench between timber forms. Wood float finish flush with the adjacent finished level. Provide control joints, filled with resilient bituminous material, at 3 m maximum centres.

Concrete kerb: Fixed form, extrusion or slip forms to AS 2876.

**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.

**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.

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<b>0275 PAVING – MORTAR AND ADHESIVE BED</b>
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## 1 GENERAL

### 1.1 RESPONSIBILITIES

#### General

Requirement: Provide paving, as documented.

#### Performance

Requirements:

- Consistent in colour and finish.
- Firmly bonded to substrates for the expected life of the installation.
- Resistant to expected impacts in use.
- Set out with joints accurately aligned in both directions.
- To direct all water flowing from supply points to drainage outlets without leakage to the substrate or adjacent areas.

### 1.2 CROSS REFERENCES

#### General

Requirement: Conform to the following:

- 0171 General requirements.

### 1.3 STANDARDS

#### Slip resistance

Classification: To AS 4586.

### 1.4 INTERPRETATION

#### Definitions

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

- Absolute level tolerance: Maximum deviation from design levels.
- Adhesives - cementitious (C): Adhesive in which the binders are hydraulic, e.g. General purpose cement, with aggregates and organic additives.
- Bedding: Mixtures of materials which are applied to substrates in a plastic state and which dry, cure and adhere tiles to substrates:
  - . Adhesive bedding: Paving/tiling adhered by adhesives.
  - . Mortar bedding: Paving/tiling adhered in a cementitious mortar bed.
- Lippage: Height deviation between adjacent units.
- Pavers: Units made from clay, stone, precast concrete, ceramic, terrazzo and/or other inorganic raw materials, generally over 20 mm thick, used as coverings for horizontal surfaces. Larger pavers are often referred to as flags.
- Relative level tolerance: Maximum deviation from a 3 m straightedge laid on the surface.
- Substrate: The surface to which a material or product is applied.

### 1.5 TOLERANCES

#### Completed paving

Lippage:

- Unpolished pavers: Less than 2 mm.
- Polished pavers 300 x 300 mm or less: 1 mm, with 5% not exceeding 1.5 mm.
- Polished pavers over 300 x 300 mm: 1.5 mm, with 5% not exceeding 2 mm.

#### Paving surface level tolerances table

Item	Level tolerance	
	Absolute	Relative
Vehicular pavements	± 5 mm	5 mm

Item	Level tolerance	
Pedestrian pavements	± 10 mm	10 mm

## 1.6 SUBMISSIONS

### Execution details

Grouting: Submit proposals for grouting methods and materials.

Margins: If it appears that minor variations in joint widths or overall dimensions will avoid cut pavers, submit a proposal.

### Operation and maintenance manuals

General: Submit a manual describing care and maintenance of the paving, including procedures for maintaining the slip-resistance grading stating the expected life of the slip-resistance grade.

### Products and materials

Product conformity: Submit current assessments of conformity as follows:

- Marking and classification of adhesive to AS ISO 13007.1.

Type tests: Submit results, as follows:

- Slip resistance of pavers.
- Accelerated wear test of pavers.
- Stone paver properties.

### Samples

General: Submit labelled samples of pavers, grout and sealants, illustrating the range of variation in colour and finish.

Sample panel: Prepare a sample panel of each type of finish as follows:

- Size: ≥ 2 m<sup>2</sup>.
- Include samples of junction details and trim.
- Preserve each panel until related work is complete.

### Tests

Site tests: Submit results, as follows:

- Slip resistance of completed installation.
- Stone paver properties tests.
- Salt efflorescence of paver prototype testing.

## 1.7 INSPECTION

### Notice

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

- Substrate immediately before paving.
- Trial set-outs before execution.
- Control joints before sealing and grouting.

## 2 PRODUCTS

### 2.1 ADHESIVES

#### General

Standard: To AS ISO 13007.1.

#### Type

General: Provide adhesives compatible with the materials and surfaces to be adhered.

Prohibited uses: Do not provide the following combinations:

- 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.

## 2.2 MORTAR

### Materials

Cement: To AS 3972.

- Type: GP.
- Iron salt content:
  - . White cement:  $\leq 1\%$ .
  - . Off-white cement:  $\leq 2.5\%$ .

Lime: To AS 1672.1.

Sand: Fine aggregate with a low clay content selected for grading, sharp and free from efflorescing salts.

Water: Clean and free from any deleterious matter.

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): Select from the range 1:3 to 1:4 to obtain satisfactory adhesion. Provide minimum water.

Mixing: To AS 3958.1 clause 2.15.

Gauging: Site gauged by volume.

## 2.3 GROUT

### Type

Portland cement based grout: Mix with fine sand. Provide minimum water to achieve workability.

- Mix proportion (cement:sand): 1:3.

### Pigments

Pigments for coloured grout: Provide colourfast pigments compatible with the grout material. For cement-based grouts, provide inorganic mineral pigments or lime-proof synthetic metallic oxides compatible with cement.

### Water

General: Clean and free from any deleterious matter.

## 2.4 PAVERS

### Stone pavers

Description: Provide sound stone pavers of uniform quality. Reject stone pavers with any of the following defects liable to affect strength and durability:

- Vents.
- Cracks.
- Fissures.
- Seams.
- Porous inclusions.
- Foreign material.
- Loose surface material.
- Discolouration.

Matching: Select for optimum matching of colour and pattern.

Split flagging thickness: Minimum 50 mm, maximum 75 mm.

Face size: Use smaller sizes for pathways and larger sizes for open areas and maintain traditional stone flagging appearance.

### Stone setts

Description: Igneous stone, cubed, cobble-style setts.

## 2.5 OTHER MATERIALS

### Tactile ground surface indicators

Standard: To AS/NZS 1428.4.1.

**Control joint types**

General: As documented.

Divider strip: A proprietary expansion joint consisting of a neoprene filler sandwiched between plates with lugs or ribs for mechanical keying. Set flush with the finished surface.

Proprietary slide plate divider strip: An arrangement of interlocking metal plates grouted into pockets formed in the concrete joint edges.

Sealant: Two-pack self-levelling flexible mould resistant, one-part silicone or polyurethane sealant applied over a backing rod. Finish flush with the paver surface.

- Floors: Trafficable, shore hardness more than 35.

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

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**3 EXECUTION**

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**3.1 PREPARATION****Trial set-out**

General: Prepare a trial paving set-out to each area as follows to:

- Maximise the size of equal margins of cut pavers.
- Locate control joints.
- Note minor variations in joint widths to eliminate cut pavers at margins.

**Ambient temperature**

General: If the ambient temperature is less than 5°C or more than 35°C, do not lay pavers.

**Substrates**

General: Make sure substrates are as follows:

- Clean and free of any deposit or finish which may impair adhesion or location of pavers.
- Projections are hacked off and voids and hollows are filled with a cement:sand mix not stronger than the substrate nor weaker than the bedding.

Drying and shrinkage: Before paving, allow at least the following times to elapse (for curing and initial shrinkage) for these substrates:

- Concrete slabs: 28 days.
- Toppings on slabs: A further 21 days.

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.

**Fixtures**

General: Before paving make sure that fixtures interrupting the surface are accurately positioned in their designed or optimum locations relative to the paving layout.

**3.2 PAVING GENERALLY****Variations**

General: If necessary, distribute variations in hue, colour, or pattern uniformly, by mixing pavers or paving batches before laying.

**Paving joints**

Joint widths: Set out pavers to give uniform joint widths of 6 to 12 mm.

**Margins**

General: Provide whole or purpose-made pavers at margins where practicable, otherwise set out to give equal margins of cut pavers. If margins less than half paver width are unavoidable, locate the cut pavers where they are least conspicuous.

**Protection**

Traffic: Keep pedestrian and vehicular traffic off paving until the bedding has set and attained its working strength.

Cleaning: Keep the work clean as it proceeds and protect finished work from damage.

### 3.3 MORTAR BEDDING

#### Preparation of pavers

Suction: Soak porous pavers in water for half an hour and then drain until the surface water has disappeared.

#### Bedding

General: Use bedding methods and materials which are appropriate to the paver, the substrate, the conditions of service, and which leave the paver firmly and solidly bedded in the bedding material and adhered to the substrate. Form falls integral with the substrate.

#### Mortar beds

Substrate preparation: 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, on to the paver back. Do not provide mortar after initial set has occurred.

#### Sandstone flagging

Mortar bed thickness: Minimum 50 mm to maximum 60 mm.

Laying pattern: Random, with smaller stones filling the gaps to produce roughly uniform joint widths. Lay flags and fill joints in one operation.

#### Stone setts dry bed

Description: Lay and tamp setts on to a dry sand and cement mix, compact and moisten as follows:

- Mortar bed mix proportion (cement:sand): 1:3 screeded to the level required to allow setts to be firmly tamped.
- Select the top side of the sett for surface uniformity and tap into the mix to the pre-compaction position.
- Compact with a hand ram or mechanical compactor.
- Water spray the surface and allow the bedding to harden.
- Grout joints.

### 3.4 ADHESIVE BEDDING

#### Preparation of pavers

Adhesive bedding: Fix pavers dry.

#### Bedding

General: Use bedding methods and materials which are appropriate to the paver, the substrate, the conditions of service, and which leave the paver firmly and solidly bedded in the bedding material and adhered to the substrate. Form falls integral with the substrate.

#### Thick adhesive beds

General: Provide on substrates with deviations up to 6 mm when tested with a 2 m straight edge, and with pavers having deep keys or frogs.

Nominal thickness: 6 mm.

#### Adhesive bedding application

General: Apply adhesive by notched trowel to substrates and direct to pavers if required, to provide evenly distributed coverage of more than 90% after laying.

Pattern of distribution of adhesive: Conform to AS 3958.1. Verify by examining one paver in ten as work proceeds.

Grouting: Allow the adhesive to cure for the period recommended by the manufacturer before grouting.

### 3.5 MOVEMENT JOINTS

#### General

Requirement: Provide control joints as follows:

- Location:
  - . Over structural control joints.
  - . At internal corners.
  - . Close to external corners in large paved areas.
  - . Around the perimeter at abutments.

- . At junctions between different substrates.
- . To divide large paved areas into bays, maximum 5 m wide, maximum area 16 m<sup>2</sup>.
- . At abutments with the building structural frame and over supporting walls or beams where flexing of the substrate is anticipated.
- Depth of joint: Right through to the substrate.
- Sealant width: 6 to 25 mm.
- Depth of elastomeric sealant: One half the joint width, or 6 mm, whichever is the greater.

### **3.6 GROUTED JOINTS**

#### **Grouting**

General: Commence grouting as soon as practicable after bedding has set and hardened sufficiently. Clean out joints as necessary before grouting.

Face grouting: Fill the joints solid and tool flush. Clean off surplus grout and wash down as the grouting proceeds.

### **3.7 TESTING**

#### **Completion tests**

Slip resistance of completed installation: To AS 4663.

### **3.8 COMPLETION**

#### **Spares**

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**

Completion: Clean progressively and leave pavements clean on completion.

## **4 SELECTIONS**

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Refer to selections schedule.

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**0314 CONCRETE IN SITU****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide concrete in situ, as documented.

**Performance**

Requirements:

- Conforming to the design details and performance criteria.
- Satisfying the quality and inspection requirements.

**1.2 CROSS REFERENCES****General**

Requirement: Conform to the following:

- *0171 General requirements.*
- *0311 Concrete formwork.*
- *0312 Concrete reinforcement.*
- *0315 Concrete finishes.*

**1.3 STANDARDS****General**

Reinforced concrete construction: To AS 3600.

Specification and supply of concrete: AS 1379.

Concrete structures for retaining liquids: To AS 3735.

Design, installation and testing of post-installed and cast-in fastenings: To AS 5216.

**1.4 INTERPRETATION****Definitions**

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

- Ambient temperature: The air temperature at the time of mixing and placing of concrete.
- Average ambient temperature: Average value of the daily maximum and minimum ambient temperatures over the defined period at a site.
- Batch: A quantity of concrete containing a fixed amount of ingredients and produced in a discrete operation.
- 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 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 clause 1.5.4.
- Early age strength: A mean compressive strength at 7 days exceeding the values shown in AS 1379 Table 1.2.
- Green concrete: Concrete which has recently set but has not achieved any design strength.
- Production assessment: An assessment procedure for concrete defined by strength grade, carried out by the supplier and based on the statistical assessment of standard compressive strength tests on concrete, specified by compressive strength and produced by a specific supplying plant.
- Project assessment: An assessment procedure for concrete defined by strength grade, specified at the customer's option, which provides additional test data for the statistical assessment of concrete supplied to a specific project.
- Sample: A physical example that illustrates workmanship, materials or equipment, and establishes standards by which the work will be judged. It includes samples and sample panels.
- Specimen: A portion of a sample which is submitted for testing.

- Weather – cold: Ambient shade temperature less than 10°C.
- Weather – hot: Ambient shade temperature greater than 30°C.

## 1.5 SUBMISSIONS

### Execution details

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

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

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

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

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

### Products and materials

Product conformity: Submit evidence of conformity, as appropriate, as follows:

- Certification by a JAS-ANZ accredited third party.
- Report by an accredited testing laboratory describing tests and giving results which demonstrate that the product conforms.

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

Curing compounds: Submit details of any proposed curing compounds, including the following:

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

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

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

### Samples

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

- Number: 4.

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

**Shop drawings**

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

**Subcontractors**

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

**Tests**

Requirement: Submit test results, as follows:

- Concrete compressive strength test results to AS 1012.9.
- Other concrete properties: Test results as documented in the **Tests schedule**.

**1.6 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.
- Completed formwork and reinforcement, tendons, cores, fixings and embedded items fixed in place before placing concrete.
- Concealed surfaces or elements before covering.
- Commencement of concrete placing.

**2 PRODUCTS****2.1 CONCRETE****General**

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

**Properties**

Concrete mix and supply: Conform to the following:

- Normal-class: To AS 1379 clause 1.5.3.
  - . Properties: As documented in the **Concrete properties schedule - performance**.
- Special-class: To AS 1379 clause 1.5.4.
  - . Performance properties: As documented in the **Concrete properties schedule - performance**.
  - . Prescription properties: As documented in the **Concrete properties schedule - prescription**.

**Aggregates**

Standard: To AS 2758.1.

**Cement**

Standard: To AS 3972.

Age: Less than 6 months old.

Storage: Store cement bags under cover and above ground.

Supplementary cementitious materials:

- Fly ash: To AS/NZS 3582.1.
- Slag: To AS 3582.2.
- Amorphous silica: To AS/NZS 3582.3.

**Water**

Standard: To AS 1379 clause 2.4.

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

**Concrete colour**

Standard: To AS 3610.1.

**Chemical admixtures**

Standard: To AS 1478.1, used to manufacturer's recommendations.

**2.2 MISCELLANEOUS****Polymeric film underlay**

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

**Curing compounds**

Liquid membrane-forming compounds: To AS 3799.

**3 EXECUTION****3.1 POLYMERIC FILM UNDERLAY****Location**

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

**Base preparation**

Requirement: Conform to base type, as follows:

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

**Installation**

Standard: To AS 2870 clause 5.3.3.

Requirement: Lay underlay over the base, as follows:

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

**3.2 CONCRETE SUPPLY****Elapsed delivery time**

General: Make sure that the elapsed time between the wetting of the mix and the discharge of the mix at the site is in conformance with the **Elapsed delivery time table**. Do not discharge at ambient temperature below 10°C or above 30°C unless approved heating or cooling measures are taken to deliver concrete within the range 5°C to 35°C.

**Elapsed delivery time table**

Concrete temperature at time of discharge (°C)	Maximum elapsed time (minutes)
5 – 24	120
24 – 27	90
27 – 30	60
30 – 35	45

**Pre-mixed supply**

Addition of water: To AS 1379 clause 4.2.3.

Transport method: Select to prevent segregation, loss of material and contamination of the environment, and not to adversely affect placing or compaction.

**Site mixed supply**

Emergencies: If mixing by hand, provide details.

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

**3.3 TESTING****General**

Test authority: Concrete supplier or an Accredited Testing Laboratory.

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

#### Assessment process of test results

Standard: To AS 1379.

Method of assessment: Project assessment.

#### Sampling

Method of sampling: AS 1012.1.

Sampling locations: To AS 1012.1 and the following:

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

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

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

#### Project assessment strength grade sampling table

Number of batches for each type and grade of concrete per day	Minimum number of samples: Columns and load bearing wall elements/batch	Minimum number of samples: Other elements/day
1	1	1
2-5	1	2
6-10	1	3
11-20	1	4
each additional 10	1	1 additional

#### Making and curing of specimens

General: To AS 1012.8.1 and AS 1012.8.2.

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

Specimen size:

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

#### Test methods

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

Acceptance criteria:

- General: As documented in the **Concrete properties schedule – performance**.
- Early age compressive strength: As documented in the **Control tests schedule**.

Drying shrinkage at 56 days: To AS 1012.8.4 and AS 1012.13.

Other concrete properties tests: As documented in the **Tests schedule**.

#### Liquid retaining structures

Testing for liquid tightness: To AS 3735.

### 3.4 CORES, FIXINGS AND EMBEDDED ITEMS

#### General

Requirement: Install fasteners to manufacturer's recommendations and the assumptions of AS 5216 Appendix D.

#### Adjoining elements

Fixings: Provide fixings for adjoining elements. If required, provide temporary support to the adjoining elements during concreting, to prevent movement.

#### Protection

General: Grease threads. Protect embedded items against damage.

Compatibility: Provide inserts, fixings and embedded items that are compatible with each other, with the reinforcement and with the documented concrete mix and surface finish.

Corrosion: In external or exposed locations, galvanize anchor bolts and embedded fixings.

**Structural integrity**

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

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

**Tolerances**

General: Maximum deviation from correct positions:

- Anchor bolt groups for structural steel: To AS/NZS 5131.
- Cores and embedded items generally: 10 mm.
- Other fixing bolts: 3 mm.

**3.5 CONCRETE WORKING BASE****Finish**

Membrane support: Wood float finish or equivalent.

**Installation**

General: Lay over the base or subgrade and screed to the required level.

**Surface flatness tolerance**

Maximum deviation: 6 mm from a 3 m straightedge.

**3.6 PLACING AND COMPACTION****Placing**

Horizontal transport: Use suitable conveyors, clean chutes, troughs, hoppers or pipes.

Methods: Avoid segregation and loss of concrete, and minimise plastic settlement. Maintain a nominally vertical and plastic concrete edge during placement.

Horizontal elements: Place concrete in layers not more than 300 mm thick. Compact the following layer into previous layer before previous layer has taken initial set.

**Compaction**

Methods: Use immersion and screed vibrators accompanied by hand methods as appropriate to remove entrapped air and to fully compact the mix.

Vibrators: Do not allow vibrators to contact set concrete, reinforcement or items including pipes and conduits embedded in concrete. Do not use vibrators to move concrete along the formwork. Avoid causing segregation by over-vibration.

**Placing records**

Log book: Keep on site and make available for inspection a log book recording each placement of concrete, including the following:

- Date.
- Specified grade and source of concrete.
- Slump measurements.
- The portion of work.
- Volume placed.

**Rain**

Protection: During placement and before setting, protect the surface from damage.

**Time between adjacent placements**

Minimum time delay: As documented in the **Minimum time delay schedule**.

**Vertical elements**

Placement: Limit the free fall of concrete to maximum of 2000 mm.

**Placing in cold weather**

Cement: Do not use high alumina cement.

Temperature limits: Maintain the following:

- Freshly mixed concrete:  $\geq 5^{\circ}\text{C}$ .
- Forms and reinforcement before and during placing:  $\geq 5^{\circ}\text{C}$ .
- Water: Maximum  $60^{\circ}\text{C}$  when placed in the mixer.

High early strength cement: If deteriorating weather conditions are predicted, use high early strength cement.

Temperature control: Heat the concrete materials, other than cement, to the minimum temperature necessary so that the temperature of the placed concrete is  $\geq 5^{\circ}\text{C}$ .

Admixtures: Do not use calcium chloride, salts, chemicals or other material in the mix to lower the freezing point of the concrete.

Frozen materials: Do not allow frozen materials or materials containing ice to enter the mixer, and keep free of frost and ice any forms, materials, and equipment coming in contact with the concrete.

Freezing: Prevent concrete from freezing.

### **Placing in hot weather**

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

Temperature limits: Maintain the following:

- Normal concrete in footings, beams, columns, walls and slabs:  $\leq 35^{\circ}\text{C}$ .
- For concrete strength grade less than 40 MPa with section thickness  $\geq 1$  m in all dimensions:  $\leq 27^{\circ}\text{C}$ .
- For concrete strength grade 40 MPa or greater with section thickness  $\geq 600$  mm in all dimensions:  $\leq 27^{\circ}\text{C}$ .
- Forms and reinforcement before and during placing:  $\leq 35^{\circ}\text{C}$ .

Evaporation control barriers: Erect barriers to protect freshly placed concrete from drying winds.

Temperature control: Select one or more of the following methods of maintaining the temperature of the placed concrete at  $35^{\circ}\text{C}$  or less:

- Cool the concrete using liquid nitrogen injection before placing.
- Cover horizontal transport containers.
- Spray the coarse aggregate using cold water before mixing.
- Use chilled mixing water.

### **Placing under water**

General: Do not place under water unless conditions prevent dewatering.

Minimum cement content for the mix: Increase by 25%.

## **3.7 JOINTS**

### **Construction joints**

Location: Do not relocate or eliminate construction joints, or form undocumented construction joints. If emergency construction joints are made necessary by unforeseen interruptions to the concrete pour, submit a report on the action taken.

Finish: Butt join the surfaces of adjoining pours. In visually important surfaces make the joint straight and true, and free from blemishes impermissible for its surface finish class.

Preparation: Roughen and clean the hardened concrete joint surface. Remove loose or soft material, free water, foreign matter and laitance. Dampen the surface just before placing the fresh concrete and coat with a neat cement slurry.

### **Expansion joints**

Joint filling: Fill with jointing materials as documented. Finish visible jointing material neatly, flush with adjoining surfaces.

Preparation: Before filling, dry and clean the joint surfaces, and prime.

Watertightness: Apply the jointing material so that joints subject to ingress of water are made watertight.

Jointing materials: Provide jointing materials compatible with each other, and non-staining to concrete in visible locations.

Bond breaking: Provide back-up materials for sealants, including backing rods, which do not adhere to the sealant.

Foamed materials (in compressible fillers): Closed-cell or impregnated, not water absorbing.

### **Slip joints**

Requirement: If concrete slabs are supported on masonry, provide proprietary slip joints.

### 3.8 CURING

#### General

Requirements: Taking into account the average ambient temperature at site over the relevant period affecting the curing, adopt procedures to make sure of the following:

- Curing: Cure continuously from completion of finishing, 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 the following, unless accelerated curing is adopted:
  - . Fully enclosed internal surfaces/Early age strength concrete: 3 days.
  - . Other concrete surfaces: 7 days.
- End of curing period: Prevent rapid drying out at the end of the curing period.
- Protection: Maintain at a reasonably constant temperature with minimum moisture loss, during the curing period.

#### Curing compounds

Liquid membrane-forming compounds: Provide a uniform continuous flexible coating without visible breaks or pinholes, which remains unbroken for at least the required curing period after application.

Substrates: Do not use wax-based or chlorinated rubber-based curing compounds on surfaces forming substrates to applied finishes, concrete toppings and cement-based render.

Self-levelling toppings: If used also as curing compounds, conform to AS 3799.

Visually important surfaces: Apply curing compounds to produce uniform colour on adjacent surfaces.

#### Cold weather curing

Temperature: Maintain concrete surface temperatures above 5°C for the duration of the curing period.

#### Hot weather curing

Requirement: If the concrete temperature exceeds 25°C, or the ambient shade temperature exceeds 30°C, protect from drying winds and sun by using an evaporative retarder until curing is commenced.

#### Water curing

Method: Select a method of ponding or continuously sprinkling to prevent damage to the concrete surface during the required curing period.

### 3.9 COMPLETION

#### Protection

General: Protect the concrete from damage due to construction loads, physical and thermal shocks, and excessive vibrations, particularly during the curing period.

Surface protection: Protect finished concrete surfaces and applied finishes from damage.

**0331 BRICK AND BLOCK CONSTRUCTION****1 GENERAL****1.1 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.

**1.4 INTERPRETATION****Definitions**

General: For the purposes of this worksection the definitions in AS 3700 clause 1.5.2, AS/NZS 4455.1 clause 1.4 and the following apply:

- Facework: Masonry intended to be exposed in a wall.

**1.5 TOLERANCES****General**

Requirement: To AS 3700 Table 12.1.

**1.6 SUBMISSIONS****Fire performance**

Fire-resistance level: Submit evidence of conformance to PRODUCTS, **FIRE PERFORMANCE, Fire-resistance of building elements.**

**Products and materials**

Type tests: Submit results, as follows:

- Characteristic unconfined compressive strength of masonry unit: To AS/NZS 4456.4.

**Samples**

Face units: Submit face units of each type illustrating the range of variation available, including colour, texture, surface irregularities, defective arrises, and shape.

- Number of each type: 6.

Facework sample panel: Submit a sample panel in a suitable position for each type of facework including face or pointing mortar and a finished vertical control joint.

- Minimum size (face of panel): 1200 mm high x 1190 mm or closest unit module long.

Sand: Submit a 2 kg sample of each type of sand required to be of a particular colour, grade or source.

**Tests**

Site tests: Submit results as follows:

- Mortar.
- Special masonry.

**1.7 INSPECTION****Notice**

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

- Set-out.
- Unit type, colour and texture.
- Bottoms of cavities, after cleaning out.
- Bottoms of core holes, before grouting.

- Reinforcement type and diameter.
- Positioning of reinforcing before grouting.
- Control joints, ready for insertion of joint filler.
- Damp-proof courses, in position.
- Flashings, in position.
- Lintels, in position.
- Structural steelwork, including bolts and shelf angles, in position.

## 2 PRODUCTS

### 2.1 FIRE PERFORMANCE

#### Fire-resistance of building elements

Fire-resistance level: Tested to AS 1530.4.

### 2.2 DURABILITY

#### General

Exposure locations: To AS 3700 clause 5.4.

### 2.3 MATERIALS

#### Brick and block units

Selections: As documented.

Standard: To AS/NZS 4455.1 and AS/NZS 4455.3.

Salt attack resistance grade: To AS 3700 Table 5.1.

Minimum age of clay bricks: 7 days.

#### Mortar materials

Mortar class: To AS 3700 Table 5.1.

Cement: To AS 3972.

White cement: With  $\leq 1\%$  iron salts content.

Lime: To AS 1672.1.

Sand: Fine aggregate with a low clay content and free from efflorescing salts, selected for colour and grading.

Water: Clean and free from any deleterious matter.

Admixtures: To AS 3700 clause 11.4.2.4.

Pigment: To EN 12878, and as follows:

- Integral pigment mix proportion:  $\leq 10\%$  by weight of cement.

#### Masonry cement mortar mix proportions table (cement:lime:sand), by volume

Mortar class to AS 3700	Clay	Concrete	Calcium silicate	Water thickener
M3	1:0:4	1:0:4	n/a	Yes
M4	1:0:3	n/a	n/a	Yes

#### Cement (GP/GB) mortar mix proportions table (cement:lime:sand), by volume

Mortar class to AS 3700	Clay	Concrete	Calcium silicate	Water thickener
M2	1:2:9	n/a	n/a	No
M3	1:1:6	1:1:6	n/a	Optional
M3	1:0:5	1:0:5	1:0:5	Yes
M4	1:0.5:4.5	1:0.5:4.5	n/a	Optional
M4	1:0:4	1:0:4	1:0:4	Yes
M4	1:0-0.25:3	1:0-0.25:3	n/a	Optional

**Grout**

Standard: To AS 3700 clause 11.7.

Minimum characteristic compressive strength: 12 MPa.

**2.4 BUILT-IN COMPONENTS****General**

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

**Steel lintels**

Angles and flats: To AS/NZS 3679.1.

Cold formed proprietary lintels: Designed to AS/NZS 4600.

Corrosion protection: To AS/NZS 2699.3.

Galvanizing: Do not cut after galvanizing.

**Reinforcement**

Standard: To AS/NZS 4671.

Corrosion protection: To AS 3700 clause 5.9.

Minimum cover: To AS 3700 Table 5.1.

**Wall ties**

Standard: To AS/NZS 2699.1.

Corrosion protection: To AS/NZS 2699.1.

**Connectors and accessories**

Standard: To AS/NZS 2699.2.

Corrosion protection: To AS/NZS 2699.2.

**Flashings and damp-proof courses**

Standard: To AS/NZS 2904.

**Slip joints**

Standard: To AS 3700 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 frames, 470 x 160 mm.
- Cut brick: 2 cut bricks laid vertically and evenly spaced in a 230 mm wide x 2 course high opening, backed with bronze wire mesh built in.
- Terracotta: Perforated, 230 x 160 mm.

**3 EXECUTION**

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**3.1 GENERAL****Mortar mixing**

General: Measure volumes accurately to the documented proportions. Machine mix for at least six minutes.

**Protection**

Masonry materials and components: Protect from ground moisture and contamination.

During construction: Cover the top surface of brickwork and blockwork to prevent the entry of rainwater and contaminants.

**Bond**

Type: Stretcher bond.

**Building in**

Embedded items: Build in wall ties and accessories as the construction proceeds. If not practicable to obtain the required embedment within the mortar joint in 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.

**Clearance for timber frame shrinkage**

General: In timber frame brick veneer construction, leave clearances between window frames and brick sill and between roof frames and the brick veneer as follows:

- Single storey frames and ground floor windows (not for slab on ground): 10 mm.
- Two storey frames and upper floor windows: 20 mm.
- Additional clearance: To 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 brick and block header units, to AS 3700 clause 4.11.2.

- 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.

Face-shell bedded hollow units: 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 brickwork and blockwork 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.

Acid solution: Do not use.

**Colour mixing**

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

**Below ground**

Facework: Commence face brickwork at least 1 full course for blockwork, or 2 full courses for brickwork, below adjacent finished surface level.

**Double face walls**

Selection: Select face units for uniform width and double-face qualities.

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, leave door width openings beneath doorways to give access to underfloor areas.

**Air vent locations**

General: Provide air vents to give adequate cross ventilation to the space under suspended ground floors.

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 underpinning and 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 1 course above adjacent finished (ground) level. Fall the top surface towards the outer leaf.

**Cavity width**

General: Construct minimum cavity widths in conformance with the following:

- Masonry walls: 50 mm.
- Masonry veneer walls: 40 mm between the masonry leaf and the load bearing frame and 25 mm minimum between the masonry leaf and sheet bracing.

**Openings**

Jambes 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 1 course above.
- 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 area.
- 50 mm above the finished paved or concreted area and protected from the direct effect of the weather.

### Installation

General: Lay in long lengths. Lap full width at angles and intersections and at least 150 mm at joints. Step as necessary, but not exceeding 2 courses per step for brickwork and 1 course per step for blockwork. Sandwich damp-proof courses between mortar.

Junctions: Preserve continuity of damp-proofing at junctions of damp-proof courses and waterproof membranes.

Lap sealing: Seal with a bituminous adhesive and sealing compound.

## 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 2 courses above for brick and 1 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 1 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: Full width of outer leaf immediately above the lintel, continuous across cavity, turned 30 mm into the inner leaf 2 courses above for brick and 1 course above for block or turned up against the inner frame and fasten to it. Extend at least 150 mm beyond the lintels.
- At abutments with structural frames or supports: Vertical 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. Step as necessary, but not exceeding 2 courses per step for brickwork and 1 course per step for blockwork.

Lap sealing: Seal with a bituminous adhesive and sealing compound.

Pointing: Point up joints around flashings, filling voids.

### Weepholes

Requirement: Locate weepholes to external leaves of cavity walls in the course immediately above flashings, and cavity fill, and at the bottoms of unfilled cavities.

Form: Open perpend.

Maximum spacing: 1200 mm.

### 3.7 WALL TIES

#### Location

General: Space wall ties in conformance with AS 3700 clause 4.10 and at the following locations:

- Not more than 600 mm in each direction.
- Adjacent to vertical lateral supports.
- Adjacent to control joints.
- Around openings.

#### Installation

Fixing of masonry veneer ties:

- To timber frames: Screw fix to outer face of timber frames with fasteners to AS 3566.1.
- To concrete: Masonry anchors.
- To steel frames: Screw fix to outer face of steel studs with fasteners to AS 3566.1.

### 3.8 CONTROL JOINTS

#### General

Location and spacing: Provide contraction joints, expansion joints or articulation joints to AS 3700 clause 4.8.

#### Control joint filling

Filler material: Provide compatible sealant and bond breaking backing materials which are non-staining to brickwork and blockwork. Do not use bituminous materials with absorbent masonry units.

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

Installation: Clean the joints thoroughly and insert an easily compressible backing material before sealing.

Sealant depth: Fill the joints with a gun-applied flexible sealant for a depth of at least two-thirds the joint width.

#### Fire-resisting control joints

General: If a control joint is located in an element of construction required to have a fire-resistance level (FRL), construct the control joint with fire stopping materials which maintain the FRL of the element.

Fire-stopping: To AS 4072.1.

### 3.9 BRICKWORK BED JOINT REINFORCEMENT

#### Location

General: Locate as follows:

- In 2 bed joints below and above head and sill flashings to openings.
- In 2 bed joints below and above openings.
- In third bed joint above bottom of wall.
- In second bed joint below top of wall.

Maximum vertical intervals: 500 mm.

#### Installation

General: Lap 450 mm at splices. Fold and bend at corners so that the longitudinal wires are continuous. Stop 50 mm short of control joints. Extend 450 mm beyond each side of openings.

#### Reinforcement

Material: Galvanized welded wire mesh.

Width: Equal to the width of the leaf, less 15 mm cover from each exposed surface of the mortar joint.

### 3.10 REINFORCED AND GROUTED BLOCKWORK

#### Cleaning core holes

General: Provide purpose-made cleanout blocks or machine cut a cleaning hole at the base of each grouted core.

Location: Locate on the side of the wall which is to be rendered or otherwise concealed.

Cleaning: Rod cores to dislodge mortar fins protruding from the blocks and mortar droppings from reinforcement. Remove through the clean-out blocks.

### **Grouting**

Commencement: Do not commence until grout spaces have been cleaned out and the mortar joints have attained sufficient strength to resist blow-outs.

Height of lift: Limit the height of individual lifts in any pour to make sure that the grout can be thoroughly compacted to fill all voids.

Compaction: Compact by vibration or by rodding.

Topping up: On the completion of the last lift, top up the grout after 10 min and within 30 min, and vibrate or rod to mix with the previous pour.

## **3.11 LINTELS**

### **Location**

General: Install one lintel to each wall leaf as documented in the **Lintel schedule**.

### **Installation**

General: Do not cut on site. Keep lintels 10 mm clear of heads of frames.

Steel lintels: Pack mortar between any vertical component and supported masonry units. For angles, install the long leg vertical.

Minimum bearing each end:

- Span  $\leq$  1000 mm: 100 mm.
- Span  $>$  1000 mm  $\leq$  3000 mm: 150 mm.
- Span  $>$  3000 mm: To structural drawings.

Propping: Provide temporary props to lintels to prevent deflection or rotation.

- Minimum propping period: 7 days.

## **3.12 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.

## **3.13 ARCHES**

### **Arch voussoirs**

General: Cut units using a masonry saw.

### **Shapes and dimensions**

General: Form arches using solid or cored (not hollow) masonry units.

## **3.14 BAGGING**

### **Preparation**

General: Cut joints flush before bagging.

### **Dry bagging**

Application: Apply laying mortar to the surface using a hessian bag or similar. Flush up irregularities, but leave a minimum amount of mortar on the surface.

### **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.

### 3.15 TESTING

#### **Mortar**

Durability: Scratch index test to AS 3700 Appendix E.

Compressive strength: To AS 3700 Appendix C.

Flexural strength: To AS 3700 Appendix D.

#### **Special masonry**

Sampling and testing: To AS 3700 clause 12.7.

Performance: As documented in the **Brick and block construction performance schedule for special masonry**.

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**0341 STRUCTURAL STEELWORK****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide structural steelwork, as documented.

Adjoining elements: Provide for the fixing of adjoining building elements that are to be connected to or supported on the structural steel.

**1.2 CROSS REFERENCES****General**

Requirement: Conform to the following:

- 0171 *General requirements.*
- 0344 *Steel – hot-dip galvanized coatings.*
- 0345 *Steel – protective paint coatings.*
- 0346 *Structural fire protection systems.*

**1.3 STANDARDS****General**

Materials and design: To AS 4100.

Materials and design of cold-formed decking, purlins and girts: To AS/NZS 4600.

Composite steel-concrete construction including profiled steel sheeting and shear connectors: To AS/NZS 2327.

Fabrication and erection: To AS/NZS 5131.

**1.4 INTERPRETATION****Abbreviations**

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

- AESS: Architecturally Exposed Structural Steelwork.
- CC: Construction Category.
- NDE: Non-Destructive Examination.

**Definitions**

General: For the purposes of this worksection the definitions given in AS/NZS 5131 apply.

**1.5 TOLERANCES****General**

Requirement: To AS/NZS 5131 Section 12 and Appendix F.

Tolerance class: 1.

AESS: To the **AESS schedule**.

**1.6 SUBMISSIONS****Fabrication details**

Distortions: Submit proposals for the following:

- Preventing or minimising distortion of galvanized components, welded components or welded and galvanized components.
- Restoration to the designed shape.

Identification marks: If members and/or connections will be exposed to view, submit details of proposed marking.

Program: Submit a fabrication program showing the proposed sequence of operations and time required.

**Execution details**

Anchor bolts: If anchor bolts do not meet documented location tolerances, submit proposals for rectification before proceeding.

Bolting connections: For connections not documented, submit proposals.

Bolt tensioning procedure: Submit details of procedure, equipment to be used and calibration of the process.

Site base plate holing: If hand cutting of bolt holes in column base plates is required, submit details.

Purlins and girts: If purlins and girts support components other than roofing or cladding, submit details.

Site modifications: Submit details of proposed on-site modifications or rectifications to any steel member, connection component, mechanical fastener, weld or corrosion protection.

Splices: If variations to documented splice locations or additional splices are proposed, submit details.

Temporary connections or attachments: If not documented, submit details.

Undocumented weld types: Submit proposals for weld type and electrodes.

Welding plan: Submit a welding plan to AS/NZS 5131 clause 7.2.

Work method statement: Before any erection work commences, submit a work method statement to AS/NZS 5131 clause 11.2.3.

**Products and materials**

Steel members and sections: Submit test reports or test certificates conforming to AS 4100 clause 2.2.2.

Bolts, nuts and washers: Submit test reports or test certificates conforming to AS/NZS 1252.1 Section 6.

Verification testing of bolt assemblies: Submit test reports or certificates conforming to AS/NZS 1252.2 Section 2, together with the Supplier Declaration of Conformity (SDoC).

Anchor bolts: If anchors, other than those documented, are required or proposed for supporting or fixing structural steel, submit evidence of the anchor capacity to carry the load.

Substitution: If alternative sections or connections are proposed, submit details.

**Records**

Survey: Submit survey of erected structural steel to verify components have been installed as documented.

Drawings: Submit as-built structural drawings, upon completion.

**Samples**

AESS: Submit samples of AESS to the **AESS schedule**.

Special finishes: Submit samples of finished steel to the **Special finishes schedule**.

Minimum sample size: 0.1 m<sup>2</sup>.

**Shop detail documentation**

General: Submit shop detail documentation to a scale that best describes the detail, conforming to AS/NZS 5131 clause 4.4.

**Subcontractors**

General: Submit names and contact details of proposed fabricator, detailer and installer.

Responsibilities: Submit names and contact details corresponding to the person/organisation assigned responsibility to the items listed in AS/NZS 5131 Table B3.

**Tests**

Site tests: Submit results, as follows:

- Bars and sections: Non-destructive tests.
- Plates: Ultrasonic tests.
- Welds: Non-destructive examinations.

**1.7 INSPECTION****Notice – off-site**

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

- Materials including welding consumables before fabrication.
- Testing of welding procedures and welder qualification tests.

- Commencement of shop fabrication.
- Commencement of welding.
- Complete penetration butt welds before the placement of root runs.
- High-strength bolt tensioning (when completed off-site).
- Completion of fabrication before surface preparation.
- Surface preparation before protective coating.
- Completion of protective coating before delivery to site.

**Notice – on-site**

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

- Steelwork on-site before erection.
- Anchor bolts in position before casting in.
- Steelwork and column bases erected on site, before grouting, encasing, site protective coating or cladding.
- Tensioning of bolts in categories 8.8/TB and 8.8/TF.
- Reinforcement and formwork in place before any encasement.
- Completed grouting, encasement, fire protection or site applied protective coating.

**2 PRODUCTS****2.1 GENERAL****Materials**

Requirement: To AS/NZS 5131 Section 5.

**Storage and handling**

Requirement: Pack, support, transport and handle members and components without overstressing, deforming or damaging them or their protective coating.

Damaged items: Rectify or replace. Do not assemble into the structure without approval.

Protection: Wrap or otherwise protect members or components to prevent damage to surface finishes during handling and erection.

Storage: Store off the ground.

Lifting points: Do not allow steel slings to come into direct contact with coated steelwork.

**Purchasing and traceability**

Purchasing documentation and procedure: To AS/NZS 5131 clause 4.6.

Level of traceability: As defined in AS/NZS 5131 clause 4.7 and the following:

- CC1: Basic traceability.
- CC2: Partial traceability.
- CC3: Full traceability.
- CC4: Full traceability.

**2.2 STRUCTURAL STEEL****Steel members and sections steel grade table**

Type of steel	Minimum grade
Hot-rolled sections to AS/NZS 3679.1 and SA TS 102	300
Welded sections to AS/NZS 3679.2	300
Hot-rolled plates, floor plates and slabs to AS/NZS 3678 and SA TS 102	250
Hot-rolled flat products to AS/NZS 1594	HA300
Hollow sections to AS/NZS 1163 and SA TS 102: Circular sections less than 166 mm nominal outside diameter	C250
Hollow sections to AS/NZS 1163 and SA TS 102: Sections other than circular sections less than	C350

Type of steel	Minimum grade
166 mm nominal outside diameter	
Cold-formed purlins and girts to AS 1397	G450, Z350 or Z450

**Certification**

Steel: Minimum requirements for test and inspection certificates, to the following:

- Hot-rolled bars or sections: To AS/NZS 3679.1 clause 11.2.4.
- Welded I sections: To AS/NZS 3679.2 clause 11.2.4.
- Hot-rolled plate: To AS/NZS 3678 clause 11.2.4.
- Cold-formed hollow sections: To AS/NZS 1163 clause 11.2.4.

**Testing**

Requirement: To the **Non-destructive testing of bars and sections schedule**.

**2.3 MECHANICAL FASTENERS****Standards**

Bolts: To AS 1110.1, AS 1111.1 and AS/NZS 1252.1.

Nuts: To AS 1112.1, AS 1112.2, AS 1112.3, AS 1112.4 and AS/NZS 1252.1.

**Bolting category**

Requirement: To the **Bolting category schedule**.

**Certification**

High-strength bolt assemblies: Minimum requirements for test reports, to AS/NZS 1252.1 clause 6.4.2.

**Finish**

Bolts, nuts and washers: Hot-dip galvanized to AS/NZS 1214, corrosion-free, and in serviceable condition.

**Anchor bolts**

Hexagonal bolts: To AS 1111.1.

Hexagonal nuts: To AS 1112.3.

Plain washers: To AS 1237.1.

Requirement: Provide each anchor bolt with 2 nuts and 2 oversize washers with sufficient thread for the levelling nut and washer to set below the base plate.

Mechanical and chemical anchors: To AS 5216, installed to manufacturer's recommendations.

**2.4 OTHER MATERIALS****Welding consumables**

Requirement: To the relevant part of the AS/NZS 1554 series.

**Studs and shear connectors**

Requirement: To AS/NZS 5131 clause 5.6.

**Grout**

Requirement: To AS/NZS 5131 clause 5.8.

**3 EXECUTION****3.1 PREPARATION, ASSEMBLY AND FABRICATION****Identification**

Traceability: To AS/NZS 5131 clause 6.2.

Marking: Provide marks or other means of identifying each member compatible with the finish, for setting out, locating, erecting and connecting the steelwork to the marking plans.

High-strength bolting: If the work includes more than one bolting category, mark high-strength structural bolted connections with a 75 mm wide flash of colour, clear of holes.

Cold-formed members: Clearly mark material thickness.

Monorail beams: Identify and mark rated capacity in conformance with AS 1418.18 clause 5.12.6.

**Natural beam camber**

General: If steel beams have a natural camber, within the straightness tolerance, fabricate the steelwork element with the camber up.

**Cutting**

Shearing: Do not shear edges in areas designated as yielding regions for seismic design to AS 4100 earthquake design categories D and E.

**Shaping**

Requirement: Where forming, shaping or correcting distorted members, avoid damage and conform to AS/NZS 5131 clause 6.6.

**Holing**

Slotted holes: Do not use slotted holes for connections, other than those documented.

**Tolerances**

Measurement: Check tolerances by measurement after fabrication and application of corrosion protection.

**3.2 WELDING****General**

Requirements: To AS/NZS 5131 Section 7.

Standard: To AS/NZS 1554.1.

**Weld category**

Weld categories not documented: Category GP.

**Weld type**

Weld type not documented: Submit proposals for weld type and electrodes.

**Non-destructive weld examination (NDE)**

Requirement: To AS/NZS 5131 clause 13.6.2.

Non-visual NDE: By a third party testing authority.

Repairs: Repair welds revealed as faulty by NDE and repeat the examination.

**Site welds**

Completion: Weld only when correct alignment and preset or camber have been achieved.

**3.3 MECHANICAL FASTENING****Connection contact surfaces**

General: To AS/NZS 5131 clause 8.4.1.

Bolting category 8.8/TF: Clean, as rolled and free from applied finishes.

**Washers**

Requirement: Place one washer under the part rotated during tightening process (nut or bolt head).

**Tensioning of bolting categories 8.8/TB and 8.8/TF**

Method: Use part-turn method or a direct tension indicator device.

**Permanent bolting**

Completion: Bolt only when correct alignment and preset or camber has been achieved.

**3.4 SURFACE PREPARATION AND TREATMENT****General**

Requirement: Conform to *0344 Steel – hot-dip galvanized coatings* and/or *0345 Steel – protective paint coatings*, as appropriate.

**3.5 SPECIAL FINISHES****General**

Requirement: Apply special finishes to the **Special finishes schedule**.

**3.6 METAL SPRAYING****General**

Standard: To ISO 2063.2.

Requirement: Apply sprayed metal finishes to the **Metal spray schedule**.

Process: Electric arc.

Application: Apply the coating as soon as possible after blasting.

### 3.7 FIRE PROTECTION COATINGS

#### General

Requirement: Apply fire protection to structural steelwork to 0346 *Structural fire protection systems*.

### 3.8 ARCHITECTURALLY EXPOSED STRUCTURAL STEELWORK

#### General

Requirement: Provide AESS to AS/NZS 5131 Section 10 and the **AESS schedule**.

#### Fabrication

Additional requirements: To AS/NZS 5131 clause 10.4.

Corners and edges: Grind smooth sharp, marred, or roughened corners and edges.

Rough surfaces: Deburr and ground smooth.

#### Erection

Additional requirements: To AS/NZS 5131 clause 10.5.

### 3.9 ERECTION

#### General

Execution: Make sure every part of the structure has sufficient design capacity and is stable under construction loads produced by the construction procedure.

#### Temporary work

General: Provide all necessary temporary bracing or propping.

Temporary connections: Detail required cleats, if not shown on shop detail documentation.

Temporary members: If temporary members are required, fix so as not to weaken or deface permanent steelwork.

#### Anchor bolts

General: For each group of anchor bolts, provide a template with set-out lines clearly marked for positioning the bolts when casting in.

#### Beam camber

Requirement: If beam elements have a camber (natural or induced), erect them with the camber up.

#### Site work

General: Other than work shown on the shop detail documentation as site work, do not fabricate, modify or weld structural steel on-site.

#### Purlins

Trimming members: Provide to support edges of roof sheeting along hips, valleys and roof penetrations.

#### Movements

General: Allow for thermal movements during erection.

#### Grouting at supports

Preparation: Before grouting steelwork supported by concrete or masonry, set steelwork on packing or wedges.

- Permanent packing or wedges: Form with solid steel or grout of similar strength to the permanent grout.
- Temporary packing or wedges: Remove before completion of grouting.

Timing: Grout at supports before constructing supported floors, walls and roofing.

Temperature: Do not grout if the temperature of the base plate or the footing surface exceeds 35°C.

#### Drifting

Limitation: Use drifting only to bring members into position, without enlarging holes or distorting components.

### 3.10 REPAIRS

#### General

Requirement: Repair finishes to restore the full integrity of any coating.

**3.11 COMPLETION**

**Tolerances**

Conformance: After completing erection, verify conformance with AS/NZS 5131 Section 12 and Appendix F.

**Temporary connections**

General: Remove temporary cleats on completion and restore the surface.

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**0342 LIGHT STEEL FRAMING****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide light steel floor, wall, roof and truss framing, as documented.

**Performance**

Requirements:

- Suitable for having flooring, linings, cladding and roofing fixed to it.
- Conforming to the documented performance criteria.
- Independently designed and documented.
- Independently certified by a professional engineer for the design and the erected framing.

**1.2 CROSS REFERENCES****General**

Requirement: Conform to the following:

- 0171 General requirements.

**1.3 STANDARDS****General**

Design, materials and protection: To AS/NZS 4600.

Residential and Low-rise steel framing: To NASH-1 (National Association of Steel Housing) and NASH-2.

**1.4 INTERPRETATION****Definitions**

General: For the purposes of this worksection the definitions given in the NASH-1 and NASH-2 Standards apply.

**1.5 TOLERANCES****General**

Manufacturing, assembly and installation tolerances: To NASH-1 Appendix D and NASH-2 Appendix A.

**1.6 SUBMISSIONS****Design documentation**

General: Where the structural documentation defines performance criteria, submit independent design, documentation and certification from a professional engineer including certification for the erected work.

Reactions: Submit the location and magnitude of reactions that are to be accommodated by the support structure.

Floor and wall frame member sizes: Submit a schedule of proposed member sizes, certified as meeting stated project, and AS/NZS 4600 requirements for span, spacings and loadings.

**Shop drawings**

General: Submit shop drawings, to a scale that best describes the detail, requirements for the documented configurations and loadings, certified by a professional engineer stating that the design has been carried out to AS/NZS 4600 or NASH-1 and NASH-2.

Prefabricated roof trusses: Include the following:

- Plan: Truss layout.
- Elevations: Arrangement of members, allowing for the accommodation of in-roof services, and the size and section type of each member.
- Method of assembly and connection details.
- Holding down and bracing: Details demonstrating capability to resist lateral and uplift forces.

Prefabricated wall frames: Include the following:

- Plan: Wall layout.
- Elevation: Arrangement of members, and size and section type of each member.
- Method of assembly, connection, holding down and bracing.

#### **Warranties**

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

### **1.7 INSPECTION**

#### **Notice**

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

- Steel framing erected on site before lining or cladding.

## **2 PRODUCTS**

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### **2.1 GENERAL**

#### **Storage and handling**

Requirement: Transport all components to site and store if required in a manner so as not to damage or distort the components.

### **2.2 COMPONENTS**

#### **Cold-formed steel framing**

General: Cold-form sections from steel, metallic-coated to AS 1397.

Corrosion protection: To NASH-2 Section 8, Durability.

#### **Framing members**

Cold-formed steel framing for proprietary systems: To NASH-1 and NASH-2.

## **3 EXECUTION**

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### **3.1 GENERAL**

#### **Fabrication**

Length: Cut members accurately to length so that they fit firmly against abutting members.

Service holes: Form holes by drilling or punching.

Bushes: Provide plastic bushes or grommets to site cut holes.

Swarf: Immediately remove swarf and other debris from cold-formed steel framing.

#### **Fastening**

Type: Select from the following:

- Bolting.
- Self-drilling, self-tapping screws.
- Blind rivets.
- Proprietary clinching system.
- Structural adhesives.
- Welding. On-site welded connections are not permitted.

#### **Welding**

Burning: Avoid procedures that result in greater than localised burning of the sheets or framing members.

#### **Prefabricated frames**

General: Protect frames from damage or distortion during erection.

#### **Metal separation**

General: Install lagging to separate non-ferrous service pipes and accessories from the framing.

#### **Unseasoned or CCA treated timber**

General: Do not fix in contact with framing without fully painting the timber and/or the steel.

#### **Earthing**

Permanent earthing: Required.

Temporary earthing: Provide temporary earthing during erection until the permanent earthing is installed.

#### **Protection**

General: Restore coatings which have been damaged by welding or other causes. Thoroughly clean affected areas back to base metal and coat with a zinc rich organic primer.

Grommets: Provide grommets to isolate piping and wiring from cold-formed steel framing.

### **3.2 FLOOR FRAMING**

#### **General**

Protection: If floor framing is for ground floor construction, make sure that it is protected from moisture.

Construction loads: If construction loading exceeds design loading, provide additional support so as to avoid overstressing of members.

#### **Decks and balconies**

Attachment to external walls: To BCA 3.10.6.

### **3.3 WALL FRAMING**

#### **Wall studs**

General: Provide studs in single lengths without splices. Place a stud under each structural load point from the roof or ceiling (except at openings). Provide multiple studs at points of concentrated load.

Maximum stud spacing: 600 mm.

#### **Heads to openings**

Requirement: Provide lintels appropriate to load and span.

#### **Additional support**

General: Provide additional support in the form of noggings, trimmers and studs for support and fixing of lining, cladding, hardware, accessories, fixtures and fittings.

#### **Vermin barriers**

Brick veneer barrier: Close nail 10 mm 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 or as follows if not documented otherwise:

- External walls (not masonry veneer): Turn up a minimum of 75 mm on the inside and tack to studs. Project 10 mm beyond the external slab edge or dwarf wall and turn down at 45°.
- Walls of bathrooms, shower rooms and laundries: Turn up a minimum of 150 mm on the wet side and tack to studs.

Installation: Lay in long lengths. Lap full width at angles and intersections and at least 150 mm at joints.

Junctions: Preserve continuity of damp-proofing at junctions of damp-proof courses, sarking and waterproof membranes.

#### **Flashings**

Location: Provide flashings to external openings sufficient to prevent the entry of moisture. Form trays at the ends of sill flashings.

Masonry veneer construction: Extend across cavities and build into brickwork.

### **3.4 ROOF FRAMING**

#### **Beam framing**

General: Construct framing for flat or pitched roofs where the ceiling follows the roof line, consisting of rafters or purlins supporting both ceiling and roof covering.

#### **Additional support**

General: Provide additional frame members at fibre cement or plasterboard sheeting or lining joint locations.

#### **Battens**

Requirement: Supply and fix battens suitable for span, spacing and proposed roofing material.

**Anti-ponding boards**

Standard: To AS 4200.2.

**3.5 TRUSSES****Fabrication**

Assembly: Factory assemble trusses.

**Supports for in roof services**

General: If walkways, mechanical plant or other services are to be supported within the roof space, provide support and make sure trusses have been designed to accommodate such loads.

Water tank and heater: If a water tank or heater is located in the roof space, provide a support platform to AS/NZS 3500.4 clause 5.5.1 and make sure trusses have been designed to accommodate such loads.

**Marking**

General: Permanently mark each truss to show:

- Project identification.
- Manufacturer.
- Tag or number.
- Location.
- Support points.

**Installation**

Support: Support and fix trusses on the bottom chord only, at the nominated support points, unless designed for additional support.

Vertical movement: Over internal walls not providing support to trusses, provide at least 10 mm vertical clearance and use wall bracing methods which allow for vertical movements.

**3.6 ROOF TRIM****Fascia, valley and barge boards**

Requirement: Fix fascia, valley gutter boards and barge boards in conformance with the manufacturer's recommendations.

**3.7 COMPLETION****Cleaning**

General: On completion of framing remove debris from any gaps between members and make sure void between bottom chord of roof trusses and top of any non-supporting internal wall is clear.

**Warranties**

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

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

**0411P MAPEI IN WATERPROOFING – EXTERNAL AND TANKING****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide Mapei waterproofing membrane systems for roofing, podiums, decks, balconies, swimming pools, concrete slabs over below ground spaces, brick and concrete walls with negative lift, lift shafts, landscape and planter boxes, and tanking, as documented.

**Performance**

Requirements: Conform to the following:

- 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 COMPANY CONTACTS****Mapei technical contacts**

Website: [www.mapei.com/AU-EN/contacts.asp](http://www.mapei.com/AU-EN/contacts.asp)

**1.3 CROSS REFERENCES****General**

Requirement: Conform to the following:

- *0171 General requirements.*

**1.4 STANDARDS****External waterproofing**

Membrane materials: To AS 4654.1.

Membrane design and installation: To AS 4654.2.

**Stormwater drainage**

Standard: To AS/NZS 3500.3.

**1.5 MANUFACTURER'S DOCUMENTS****Mapei Technical manuals**

Data sheets: [www.mapei.com/AU-EN/products.asp](http://www.mapei.com/AU-EN/products.asp)

Systems: [www.mapei.com/AU-EN/systems.asp](http://www.mapei.com/AU-EN/systems.asp)

**1.6 INTERPRETATION****Definitions**

General: For the purposes of this worksection the definitions given in AS 4654.1 and AS 4654.2 and the following apply:

- Bitumen: A viscous material from the distillation of crude oil comprising complex hydrocarbons, which is soluble in carbon disulphide, softens when it is heated, is waterproof and has good powers of adhesion. It is produced as a refined by-product of oil.
  - . APP Bitumen: Bitumen modified with Atactic (meaning non-crystalline or amorphous) polypropylene wax to form a plastomeric sheet. The membrane is reinforced with fibreglass or non-woven polyester (NWP).
  - . SBS bitumen: Bitumen modified with Styrene Butadiene Styrene, a thermoplastic rubber that undergoes a phase inversion at elevated temperature and converts to an elastomeric material. The membrane is reinforced with fibreglass or non-woven polyester (NWP).
- Bond breaker: A system preventing a membrane bonding to the substrate, bedding or lining.
- Double detail joint: A joint formed by turning up and bonding the horizontal membrane to a vertical substrate and adding an overflashing of membrane material bonded to the vertical substrate and folded over and bonded to the horizontal membrane. In certain situations the double detail can be

achieved by bonding an angle profile of membrane material to the junction prior to laying the membrane.

- Liquid applied: A water-based formulation which cures to form an elastomeric membrane.
- Polyurethane: Water or solvent based formulations which moisture cure to form an elastic rubber membrane.
- PVC membrane: Flexible plastic sheet membrane (vinyl).
- Slip sheet: A sheet used to isolate the membrane system from the supporting substrate or from the topping or mortar bedding. The most common material is polyethylene.
- Substrate: The surface to which a material or product is applied.

## 1.7 SUBMISSIONS

### Products and materials

Manufacturer's documentation: Submit copies of the following data:

- Product technical data sheets.
- Safety data sheets (SDS).
- Preventative maintenance procedures.
- Instructions and procedures for the repair of the membrane.
- Type test certificates verifying compliance with AS 4654.1 Section 2, Tables 2.1 to 2.3.

### Prototypes

General: Apply waterproofing to 10 m<sup>2</sup> of substrate to demonstrate surface preparation, crack and joint treatment, corner treatment, and execution quality. Install final surface finish to demonstrate aesthetic affects, physical properties, and quality of materials and execution as applicable.

### Records

Placing records: Photographically record the application of membranes and label with the following information:

- Date.
- Portion of work.
- Substrate preparation.
- Weather during application and curing.
- Protection provided from traffic and weather.

Liquid membrane applications:

- Record wet film thickness once every 10 m<sup>2</sup> and compare to the manufacturers requirements.
- On completion of every 100 m<sup>2</sup> of each coat compare the amount of membrane used with the manufacturer's application rate and record the result.

### Samples

Requirement: Submit 300 x 300 mm samples of each type of membrane including the finish of the visible surface.

### Shop drawings

Requirement: Submit shop drawings showing the following:

- Junctions with vertical surfaces.
- Drainage details.
- Control joints.
- Flashings.
- Penetrations.
- Corners.
- Terminations and connections.
- Membrane layers.
- Insulation and protection.

### Subcontractors and suppliers

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

**Warranties**

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

**1.8 INSPECTION****Notice**

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

- Substrate preparation completed.
- Secondary layers preparation completed.
- Before membranes are covered up or concealed.
- Underflashings complete before installation of overflashings.
- After flood testing.

**2 PRODUCTS**

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**2.1 GENERAL****Product substitution**

Other products: Conform to PRODUCTS, **GENERAL, 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.
- Material composition and characteristics such as volatility, flash point, light fastness, colour and pattern.

**2.2 MAPEI REPAIR MORTAR****Mapegrout T40**

Description: Medium strength (40 MPa) shrinkage-compensated, fibre-reinforced thixotropic mortar for repairing concrete.

- VOC content: 0.01 g/l.

**Mapegrout T60**

Description: Sulphate resistant, fibre-reinforced shrinkage-compensated, thixotropic mortar for the repair of concrete.

- VOC content: 0.01 g/l.

**Mapegrout Fast-set**

Mapegrout Fast-set: Fast-setting and drying, shrinkage-compensated, fibre-reinforced mortar for concrete repair.

- VOC content: 0.01 g/l.

**Mapegrout Hi-flow SP**

Mapegrout Hi-flow SP: Shrinkage-compensated, fibre-reinforced mortar to repair structures where particular thicknesses and the state of deterioration require the use of a high flow mortar.

- VOC content: 0.01 g/l.

**Planitop Smooth and Repair R4**

Planitop Smooth and Repair R4: Structural R4-class, rapid-setting, shrinkage-compensated, thixotropic, fibre-reinforced cementitious mortar for structural repairs and smoothing over internal and external horizontal and vertical concrete surfaces.

- VOC content: 0.01 g/l.

**Planitop Fast 330**

Description: Quick-setting, fibre-reinforced cementitious levelling mortar for internal and external floors and walls, applied in layers from 3 to 30 mm to even out irregularities.

- VOC content: 0 g/l.

**Planiprep SC**

Description: High performance, rapid-setting, fibre-reinforced skim-coating and patching compound in interiors.

- VOC content: 0.01 g/l.

**Mapecem Quickpatch**

Description: High performance, high flow, fast-setting ramping and patching compound for use in interiors and exteriors.

- VOC content: 0.01 g/l.

**Mapegrout SV**

Description: Fast-setting and hardening shrinkage-compensated, easy flow mortar for repairing concrete and for fixing inspection shafts, manholes and highway coating materials.

- VOC Content: 0.01 g/l.

**2.3 MAPEI CEMENTITIOUS SCREEDS****Mapecem Pronto**

Mapecem Pronto: Pre-blended ready-to-use, quick-setting (24 hours) and drying, controlled shrinkage screed with a hydraulic binder base, admixtures and selected aggregates. Simply mix with water as per Technical Data Sheet.

- VOC content: 0.01 g/l.

**Topcem Pronto**

Description: Ready to use normal setting controlled-shrinkage mortar for quick-drying screeds (4 days). Simply mix with water as per the Technical Data Sheet.

- VOC content: 0.01 g/l.

**Planicrete SP**

Description: Multipurpose latex additive for screed mortars and cementitious adhesives.

- VOC content: 0.11 g/l.

**2.4 MAPEI LIQUID APPLIED MEMBRANES****Plastimul**

Description: Solvent-free bitumen waterproofing emulsion for general purpose use. For horizontal and vertical surfaces. For foundations, retaining walls, layers beneath tiles etc.

- VOC Content: 4.1 g/l.

**Aquaflex Roof Grey**

Description: Ready to use, flexible liquid membrane with fibres for continuous waterproofing layers on exposed external surfaces.

- VOC Content: 3.8 g/l.

**Aquaflex Roof HR**

Description: Fibre-filled liquid membrane in water emulsion with high solar reflectance and thermal emittance with a high SRI solar reflectance index (105). Ready for use. Lowers the surface temperature of the roof by more than 50% compare with dark coloured roofs. For continuous exposed waterproofing layers. High reflectance white colour.

- VOC Content: 54.9 g/l.

**Mapelastic AquaDefense**

Description: Ready-to-use, flexible, liquid waterproofing membrane. Solvent-free. Ultra-quick drying. For internal and external waterproofing applications. Ceramic and stone material may be applied after only 4 hours.

- VOC content: 54 g/l.
- Classification to AS/NZS 4858: Class III.

## 2.5 MAPEI CEMENTITIOUS WATERPROOFING MEMBRANE

### Mapelastic Smart

Description: Two-component, high flexibility cementitious waterproofing membrane for protection and waterproofing in both internal and external applications. Used in conjunction with Mapenet 150, Mapeband SA or Mapetex Sel. Mapelastic Smart may be also used on surfaces particularly stressed or crazed and helps to improve both elongation at break and crack bridging.

- VOC content: 0 g/l.
- Classification:
  - . To AS/NZS 4858: Class II.
  - . To AS 4654.1: Non-exposed waterproofing membrane.

### Mapelastic Foundation

Description: Two-component flexible cementitious mortar for waterproofing concrete surfaces subject to negative or positive hydrostatic pressure. For foundation walls, car parks, environments below ground level, water channels and swimming pools. To be applied by roller or spray. For horizontal and vertical surfaces at a thickness of at least 2 mm.

- VOC content: 0 g/l.

### Idrosilex Pronto

Description: Osmotic cementitious mortar suitable for contact with drinking water. For waterproofing foundations, walls, cellars, basements, lift-rooms, swimming pools, canals and reservoirs. Also, safe for use on containers holding drinking water. To be applied by brush, trowel or roller.

- VOC content: 0.01 g/l.

## 2.6 MAPEI PRE-APPLIED MEMBRANE REINFORCING

### Mapenet 150

Description: Alkali-resistant glass fibre mesh for reinforcing protective waterproofing layers. Anti-fracture membranes and thermal insulation systems.

### Mapei Mapetex Sel

Description: Non-woven, macro-holed polypropylene fabric for reinforcing waterproofing membranes.

## 2.7 MAPEI JOINT AND FILLET TAPE

### Mapeband

Mapeband: Rubber tape with alkali-resistant fabric for cementitious waterproofing systems.

### Mapeband TPE

Mapeband TPE: TPE tape for flexible sealing and waterproofing structural joints subject to movements up to 5 or 10 mm. For expansion joints in road-works, water tunnels and covering applications.

### Mapeband SA

Mapeband SA: Self-adhesive butyl tape with alkali-resistant, non-woven fabric for elastic waterproofing systems.

## 2.8 MAPEI HYDRAULIC BINDER FOR WATERPROOFING

### Lamposilex

Lamposilex: Ultra-fast setting and drying hydraulic binder for plugging water leaks. Use to plug any source of water even under pressure in basements, tunnels, subways, etc. For sealing watertight rigid joints in hydraulic concrete structures, sewers, tanks and canals.

- VOC Content: 0 g/l.

## 2.9 MAPEI WATERPROOFING SEALANT

### Mapeflex PU 45 FT

Mapeflex PU 45 FT: One-component, thixotropic polyurethane sealant and adhesive. Single product for flexible bonds and seals. High modulus of elasticity, high resistance to traffic. High sucker effect for bonding on vertical surfaces and ceilings. Paintable with high bond strength, no primer required. Compatible with all absorbent mineral substrates, metal surfaces, varnished surfaces, wood, stone, brickwork and glass. Available in silver grey (111), (300 ml); silver grey (111) (600 ml). Ideal for sealing civil and industrial floors and flexible bonding of construction features instead of using screws, nails and lightweight fittings.

- VOC Content: 0.6 g/l

- Classification to ISO 11600: Class F25 LM.

#### **Mapeflex PU 40**

Mapeflex PU 40: Paintable polyurethane sealant with a low modulus of elasticity for movements up to 25%. Internal and external, horizontal or vertical applications.

- VOC Content: 2.1 g/l
- Classification to ISO 11600: Class F20 HM.

#### **Mapeproof Swell**

Mapeproof Swell: Hydro-expansive, rubber-based hydrophilic sealant paste in tubes applied using an extrusion gun.

### **2.10 ACCESSORIES**

#### **Internal roof outlets**

General: Proprietary funnel shaped sump cast into the roof slab, set flush with membrane, with a flat removable grating and provision for sealing the membrane into the base of the outlet.

#### **Control joint covers**

Corners, crossovers, tees and bends: Factory mitred, welded and provided with 500 mm legs.

End closures: Factory folded and sealed to match joint cover profile.

## **3 EXECUTION**

### **3.1 PREPARATION**

#### **Substrates**

General: Prepare substrates as follows:

- Fill all cracks in substrates wider than 1.5 mm with a filler compatible with the membrane system.
- Fill voids and hollows in concrete substrates with a concrete mix not stronger than the substrate.
- Remove projections.
- Remove deleterious and loose material.
- Remove all traces of a concrete curing compound if used.
- Leave the surface free of contaminants, clean and dust free.

Concrete substrates: Cure for more than 28 days.

- Concrete substrates for Mapei products: Uniformly dry, solid, sound, and free of dust, loose particles, cracks, paint, wax, oil, rust, traces of gypsum and other products that can interfere with bonding. Prepare to the Mapei Technical Data Sheets (TDS).

#### **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 AS 1884 Appendix A.

#### **Falls**

Requirement: Verify that falls in substrates are greater than 1:80.

#### **Joints and fillets**

External corners: Round or arris edges.

Control joints: Prepare all substrate joints to suit the membrane system.

#### **Priming**

Compatibility: If required, prime the substrates with compatible primers for adhesion of the membrane system.

### **3.2 APPLICATION**

#### **Protection during installation**

Damage: Protect membrane from damage during installation and for the period after installation until the membrane achieves its service characteristics that resist damage.

#### **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: 100 mm.
- Method: Heat welded.

Synthetic rubber membranes:

- Factory-vulcanized laps: More than 40 mm.
- Field side laps: More than 50 mm for side laps.
- Field end-laps: More than 100 mm for end laps.

PVC membranes:

- Factory welded laps: More than 30 mm.
- Field-welded laps:
  - . If used over insulation boards: More than 100 mm.
  - . Other instances: More than 75 mm overlaps.

### **Curing of liquid applied systems**

General: To Mapei recommendations.

### **Control of movement**

General: Provide control joints located over control joints in the substructure.

Fillets and bond breakers: Size to allow the membrane to accommodate movement.

Control joint covers: Install after fixing hobs and membranes.

Bonded membranes: Carry control joints in the substrate through to and into the surface finish.

### **Membrane terminations**

Membrane upturns: Provide upturns above the maximum water level expected from the exposure conditions of rainfall intensity and wind.

- Height: To AS 4654.2 Appendix A, Table A1.
- Anchoring: Secure sheet membranes along the top edge.
- Edge protection: Protect edges of the membrane.

Waterproofing above vertical terminations: Waterproof the structure above the termination to prevent moisture entry behind the membrane using cavity flashings, capping, waterproof membranes or waterproof coatings.

Horizontal terminations: Do not provide. Use vertical terminations.

### **Membrane vertical penetrations**

Pipes, balustrades, ducts, and vents: Provide separate sleeves for all pipes, ducts and vents, and fix to the substrate.

### **Membrane horizontal penetrations**

Sleeves: Protect rigid PVC-U conduits and pipes with a sleeve of SBS bitumen in order to seal to the membrane 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 the fixing of door or window frames.

Hobless and flush thresholds: Install membrane before the fixing of door or window frames with 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.

**Membrane at parapets**

Requirement: Terminate membrane upstands under parapet flashing or capping giving 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 to planter boxes**

Membrane: Extend root-resistant membrane at least 100 mm vertically above the soil 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.

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.

Reinforcement: Provide reinforcement to the membrane at junctions, corners and over joints 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 systems: 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 not to 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 which is compatible with the membrane.

**3.3 TESTING****Flood test**

Application: Perform a flood test before the installation of surface finishes.

Moisture content measurement method: Conform to AS 1884 Appendix A.

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 to allow 50 mm water level but no higher than 25 mm below the weir level of the perimeter flashings.
- Provide temporary overflows of the same capacity as the roof outlets to maintain the flood level.
- Fill space with clean water and leave overnight.

Evaluation:

- Make a visual inspection after a minimum period of 2 hours, of the wall/floor junction of adjacent spaces and of the slab soffit below for obvious water or moisture.
- 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.
- No visual evidence of water: Proceed with the moisture meter test.
- Increase in test results before and after flooding: Failure.

Records: Submit records of all flood tests.

### 3.4 COMPLETION

#### Protection

General: Keep traffic off membrane surfaces until bonding has set or for 24 hours after laying, whichever period is the longer.

Reinstatement: Repair or replace faulty or damaged work. If the work cannot be repaired satisfactorily, replace the whole area affected.

#### Warranties

Materials:

- Form: Mapei product warranty.
- Period: 10 years.

Workmanship:

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

## 4 SELECTIONS

### 4.1 EXTERNAL WATERPROOFING

#### Planters

Property	Mapei product	A	B	C
Membrane	Plastimul			
Repair mortar to radius internal horizontal/vertical corners	Mapegrout Fast-set			

#### Joints

Property	Mapei product	A	B	C
Structural joint	Mapeband TPE			
Construction joint	Mapeband TPE			
Through bodies				

**0423P STRATCO ROOFING - PROFILED SHEET METAL****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide a STRATCO profiled sheet metal roofing system and associated work, as documented.

**Corrosion resistance**

Material: To the manufacturer's recommendations for distance from marine influence.

**Roof access**

Requirement: To 0193 Building access safety systems.

**1.2 COMPANY CONTACTS****STRATCO technical contacts**

Website: [www.stratco.com.au/au/roofing-walling-cladding](http://www.stratco.com.au/au/roofing-walling-cladding)

**1.3 CROSS REFERENCES****General**

Requirement: Conform to the following:

- 0171 General requirements.
- 0193 Building access safety systems.

**1.4 STANDARDS****General**

Standard: To AS 1562.1 (2018).

**1.5 MANUFACTURER'S DOCUMENTS****Technical manuals**

Website: Visit [www.stratco.com.au/au/roofing-walling-cladding](http://www.stratco.com.au/au/roofing-walling-cladding) to access comprehensive technical details.

**1.6 INTERPRETATION****Definitions**

General: For the purposes of this worksection, the definitions given in AS 1562.1 (2018) apply.

**1.7 TOLERANCES****Sheet metal roofing**

Supporting members: To AS 1562.1 (2018) clause 4.2.3.

**1.8 SUBMISSIONS****Operation and maintenance manuals**

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

**Products and materials**

Type tests: Submit test results for the following:

- Profiled sheet metal roofing: To PRODUCTS, **STRATCO PROFILED SHEET METAL ROOFING, Tests.**

Recycled material content: Submit documentation from the roofing material manufacturer showing an average recycled steel content of 17.4%.

Environmental Product Declaration (EPD): Submit an EPD to ISO 14025 (2006) with a Product Category Rule (PCR), used to calculate environmental impact indicators, to EN 15804 (2012) or ISO 21930 (2017).

**Samples**

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

**Warranties**

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

**1.9 INSPECTION****Notice**

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

- Roof supports before covering up or concealing.
- The parts of the roofing, sarking, vapour barrier, insulation and roof plumbing installation before covering up or concealing.

**2 PRODUCTS**

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**2.1 GENERAL****Product substitution**

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

**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.
- Sheet metal finishes.
- Sealants.

**Storage and handling**

Storage: To the manufacturer's recommendations and as follows:

- Keep clean, dry and unexposed to weather.
- 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.
- Stack flat and off the ground on at least 3 evenly placed bearers.

Handling: Handle metal roofing materials as follows:

- Use gloves when handling precoated metal roofing material.
- Use soft soled shoes when fixing or working on roofs.
- Protect edges and surfaces from damage. Do not drag sheets across each other or over other materials.

Storage area conditions: Allocate a safe and trade free area.

**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.

**Welded safety mesh**

Standard: To AS/NZS 4389 (2015).

**2.2 STRATCO PROFILED SHEET METAL ROOFING****Standards**

Design and materials: To AS 1562.1 (2018).

**STRATCO roofing**

Requirement: STRATCO profiled steel sheet roofing, as documented.

**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.

#### **Tests**

Resistance to concentrated loads: To AS 1562.1 (2018) clause 5.4.

Resistance to wind pressures:

- Non-cyclonic wind regions: To AS 1562.1 (2018) clause 5.5.
- Cyclonic wind regions: To AS 1562.1 (2018) clause 5.6.

### **2.3 ROOF PLUMBING**

#### **General**

Description: Flashings, cappings, gutters, rainheads, outlets, external downpipes and accessories necessary to complete the roofing system.

Products: STRATCO steel roof plumbing, including gutters, capping, fascia's and downpipes, as documented.

Flashing and capping: Notched to match profile of roofing.

Matching fascia/arge capping: If the selected eaves gutter is a proprietary high front pattern forming part of a combined system of gutter, fascia and barge, provide matching proprietary fascias and barge cappings to roof verges and edges.

#### **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).

## **3 EXECUTION**

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### **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 inserting a separation layer.

**3.3 STRATCO PROFILED SHEET METAL ROOFING****Roof sheet installation**

Standard: To AS 1562.1 (2018).

STRATCO steel roofing: To the manufacturer's recommendations.

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.
- 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 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: Where 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 all box gutter sumps.
- 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. 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.

## **3.5 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.

Protection: After completion, remove protective coatings using methods to the manufacturer's recommendations.

### **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.

### **Warranties**

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

- Material warranty: Life to perforation and paint flake and peel under normal environment and use conditions.
  - Product performance warranty: Product warranty as per STRATCO published literature.
  - Material warranty period: As offered by Colorbond and BlueScope Steel.
  - Product performance warranty period: Up to 20 years.
-

**0457 EXTERNAL SCREENS****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide external screens, as documented.

**Performance**

Requirement: Conform to the following:

- Plumb, level, straight and true within the building tolerances of the structural system.
- Undamaged and free of surface defects or distortions.
- Fixed or fastened to the building structure.
- Able to resist wind and other actions without vibration or permanent distortion.

**1.2 CROSS REFERENCES****General**

Requirement: Conform to the following:

- 0171 *General requirements*.

**1.3 STANDARDS****General**

Aluminium framed sunscreens, awnings and shutters:

- Stress analysis of members: To AS/NZS 1664.1 or AS/NZS 1664.2.

Horizontal screen loadings: To AS/NZS 1170.1.

Electrically operated external louvres and blinds:

- Drive motors: To AS/NZS 60335.2.97.

Access for maintenance: To AS 1657.

**1.4 INTERPRETATION****Abbreviations**

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

- BMS: Building Management System.
- PVC-U: Unplasticised polyvinylchloride.

**Definitions**

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

- Louvres - continuous: Louvres that run continuously past, and are supported by, concealed framing or brackets.
- Louvres - horizontal: Louvres that span horizontally between frame stiles, mullions or vertical supports.
- Louvres - vertical: Louvres that span vertically between frame heads and sills, or horizontal supports.
- Membrane: A thin and flexible sheet of fabric material.
- Screen: Includes sunscreens, trafficable sunscreens, external louvres and blinds, shutters, awnings and pergolas fixed to building facades or openings; to control sunlight and/or provide privacy, to screen plant and equipment, or to provide an architectural feature. It applies to fixed, adjustable, operable and automatically controlled types.
- Shade fabric: A fabric designed to prevent a proportion of sunlight or other light from reaching the area beyond the shade fabric.
- Tensioned membrane: A thin cloth or sheet that is held in a predetermined 2- or 3-dimensional shape under permanent tension. The shape and the tension are interrelated and designed to safely carry the permanent and imposed loads (such as those resulting from wind actions) in a predictable manner.

## 1.5 SUBMISSIONS

### Certification

Sealant compatibility: Submit statements from all parties to the installation that certify the compatibility of sealants with screen components, finishes and all substrates.

### Execution detail

Embedded fixings: Submit details of any proposed alternative methods of fixing.

### Fire performance

Combustibility: Submit evidence of conformance to PRODUCTS, **FIRE PERFORMANCE, Combustibility.**

Fire hazard properties: Submit evidence of conformance to PRODUCTS, **FIRE PERFORMANCE, Fire hazard properties.**

### Operation and maintenance manuals

Requirement: At completion, submit the screen manufacturer's recommendations for operation, care and maintenance.

### Samples

General: Submit samples of the following:

- Sections proposed for frame members, louvres, accessories, cover panels and trim.
- Joints made, using proposed techniques.
- Colour samples of prefinished production material (e.g. anodised or thermoset powder coated extrusions or sheet, glazing, infill panel material or fabric), each at least 200 x 200 mm, showing the limits of the range of variation in the selected colour, if any, for each component of the screens specified.
- Accessory and hardware items documented descriptively or by performance (i.e. not proprietary items). Include handles, operators, controls, switches, sensors, motors, fixing clips, anchor brackets and attachments, fixings, gaskets and weather seals.

Labelling: Label each sample, giving the brand and product name, manufacturer's code reference, date of manufacture and intended building location.

### Shop drawings

General: Submit shop drawings to a scale that best describes the detail, calculations and specifications conveying the following information:

- Layout of the screen assembly (sectional plans, vertical sections, and elevations of each building face where screens are to be installed).
- Full size sections of typical members including mullions, transoms, subheads, sills, subsills, louvres, infill panel material or fabric, beads, bearings, linkages, exposed fixings, sealant beads, glazing gaskets, splice plates, trays and cover strips, with notes specifying the proposed materials.
- Lubrication requirements for adjustable or operable screens.
- Method of assembly, including isometric or axonometric and exploded views of typical framing junctions, showing panel to panel joints (for modular systems).
- Method of installation, including the following:
  - . Location and magnitude of reactions to be accommodated by the support structure.
  - . Type and location of fasteners and other attachments to be cast or otherwise built into the building structure.
  - . Erection tolerances.
  - . Accurate locations and full size details of machined slots, keyholes and other penetrations in frame extrusions for lifting and installing the units.
  - . Junctions and trim to adjoining surfaces.
  - . Caulking and flashing.
  - . Locations of visible heads of fasteners.
- Provision for differential vertical or horizontal movements, including the following:
  - . Thermal expansion and contraction.
  - . Frame deflections.
- Details of motor and operating mechanism enclosures.

- Method of draining the assembly, including details showing the following:
  - . Pressure equalised drained joints.
  - . Location, number and size of weepholes.
- Connection points to rainwater or stormwater systems.
- Hardware, fittings and accessories including window cleaning restraints and visible heads of fasteners.
- Infill panel stiffening.
- Location and power requirements of motors, sensors and controls.
- Wiring diagrams of control systems BMS interface details.
- Scale drawings and descriptions of prototype external screens.

#### **Subcontractors**

General: Submit names and contact details of the proposed manufacturers and, if the manufacturer is not the installer, the installers recommended by the manufacturers.

#### **Warranties**

Requirement: Submit warranties as documented.

### **1.6 INSPECTION**

#### **Notice**

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

- Fabricated screen assemblies at the factory ready for delivery to the site.
- Fabricated screen assemblies delivered to the site, before installation.
- Prototypes.
- Commencement of installation of screen assemblies.
- Completion of installation.

## **2 PRODUCTS**

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### **2.1 GENERAL**

#### **Storage and handling**

General: Deliver, unload and store external screens, components and accessories in unbroken manufacturer's packaging.

#### **Marking**

Requirement: Before the separate parts of the screens are delivered to the site, provide suitable and sufficient marks or other means for identifying each part, and for showing its correct location and orientation, when installed.

### **2.2 FIRE PERFORMANCE**

#### **Combustibility**

Cladding: Tested to AS 1530.1.

#### **Fire hazard properties**

Bonded laminated materials: Tested to AS/NZS 1530.3. Fire hazard indices, as follows:

- Spread-of-Flame Index: 0.
- Smoke-Developed Index:  $\leq 3$ .

Awning, sunshade, canopy, blind or shading hood:

- Spread-of-Flame Index:  $\leq 9$ .
- Smoke-Developed Index:  $\leq 8$ , if Spread-of-Flame index is  $> 5$ .

### **2.3 MATERIALS GENERALLY**

#### **Structural steel**

Design and materials: To AS 4100.

Welding: To the AS/NZS 1554 series.

Galvanizing: To AS/NZS 4680.

**Wire rope cables**

Materials: Stainless steel type 316 or galvanized steel.

**Fabric**

Supply: Supply fabric by a single manufacturer as part of a single batch.

Inspection: Check each roll of material for flatness, faults in the fabric and the coatings, by visual inspection in directional sunlight at a distance of 4 m and by passing the membrane over a uniformly illuminated surface.

Stitching: Use UV stabilised polyester thread with a minimum tensile strength of 180 N. Use lock type stitching with a twin needle machine.

Perimeter reinforcing: Reinforce the perimeter of each fabric panel with UV stabilised polyester rope, coated with PVC-U and incorporating pockets for the tension cables.

**2.4 METAL FINISHES****Anodising**

Standard: To AS 1231.

Thickness:  $\geq 15$  microns to 20 microns.

**Hot-dip galvanizing**

Minimum coating mass/thickness: To AS/NZS 4680.

**Powder coating**

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

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

**2.5 FIXED PANEL TYPE SCREENS****General**

Requirement: Provide infill panel materials mounted in a metal perimeter frame or subframe as follows:

- To withstand imposed actions and wind actions for the location without failure or permanent distortion, and without panel flutter.
- To shed water without pooling.

**Expansion joints**

Requirement: Allow for expansion and contraction in continuous sections at spacings not exceeding the manufacturer's recommendations, or 6 m, whichever is the lesser.

Fixing: Provide a fixing system appropriate to the panel material that will retain the panel without distortion or dislocation.

**Framing materials**

Requirement: Frames fabricated from solid or hollow metal sections.

Fixing: Provide fastener brackets or arms mounted on the face of the building, and brace as necessary with stays, including tensile elements such as wire cables and turnbuckles.

**3 EXECUTION**

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**3.1 FABRICATION****Aluminium fabrication and construction**

Standard: To AS/NZS 1664.1 or AS/NZS 1664.2.

**Fasteners**

Requirement: Provide fasteners of sufficient strength and quality to perform their required function.

**Joints**

Requirement: Make accurately fitted tight joints so that neither fasteners nor fixing devices create pressure indentations that are visible on exposed faces. Where heads of fasteners are unavoidably visible, finish them to match the adjacent surface.

**Protection**

Corrosion protection: Provide protection against corrosion which may be caused in metals by products or processes normally employed on a building site or by normal atmospheric or other ambient

conditions and by-products including rainwater, potable and non-potable water, airborne salt and airborne pollution.

**Durability:** Provide materials resistant to exposure to weather and UV radiation so that their colour, surface finish, flexibility and water resistance are maintained.

**Temporary measures:** Do not use adhesive tape, film or paper, or applied coatings liable to bond to the substrate, when exposed to sunlight or weather, as temporary measures to protect screen components during the course of the works. If temporary measures are used, remove all traces, particularly from contact mating surfaces before joining up.

### **Operation**

**Requirement:** Provide moving parts which operate freely and smoothly, without vibration, rattling, binding or sticking, and at correct tensions or operating forces. Lubricate if appropriate.

## **3.2 WELDING**

### **General**

**Quality:** Provide finished welds descaled and free of surface and internal cracks, slag inclusion and porosity. Provide continuous welding unless permanently concealed.

**Restrictions:** Do not weld as follows:

- On site.
- On finished surfaces.
- Next to a finished surface or glass, unless the adjacent surface is protected from damage.

## **3.3 EMBEDDED FIXINGS**

### **General**

**Fixing:** Fix screens to the building structure by one of the following methods, and as documented:

- Fasteners cast into the concrete of the building structure. Do not displace reinforcement, when locating embedded items.
- Chemical fixings, expanding bolt sockets.
- Bolting or welding to brackets or structural framing.

### **Standard for embedment**

For concrete: To AS 3600.

For masonry: To AS 3700.

### **Fixing brackets**

**Requirement:** Provide fasteners and other methods of attachment of the screens to the structure with the following characteristics:

- Three-way adjustment to accommodate fabrication and construction tolerances.
- Provision for building movements while fixing the screens in their correct positions.
- Adequacy for structural design actions.

### **Protection**

**Cast-in items:** Prevent the entry of concrete slurry into bolt holes, channels, and other openings for the fasteners. Fill the openings using an easily removed water repellent material before casting in.

### **Placement**

**Tolerance:**

- Maximum deviation from correct position: 13 mm.

**Fastener channels embedded parallel or perpendicular to the edge of a concrete structural member:**

- Minimum length of embedded anchor: 200 mm.
- Minimum distance from the concrete edge to the nearest part of the anchor: 100 mm.

## **3.4 INSTALLATION**

### **Installation tolerance**

**Alignment:**

- Maximum deviation of any member from its true alignment (plumb, level, or line of slope): 1:1000, up to a maximum of 10 mm in a continuous run of members in one direction.
- Maximum misalignment between adjoining members: 1 mm.

Position:

- Maximum deviation of any part from its true position: 10 mm

**Reference lines and marks**

Requirement: Provide on each floor, in agreed locations, accurate perimeter offset reference lines, plumb with corresponding lines on other floors, and height benchmarks.

**Wire rope cables**

Requirement: Preload cables by cyclic loading to achieve a uniform modulus of elasticity and a linear stress/strain relationship within the working range. Use a swaging system to achieve a breaking strength of terminals not lower than the minimum design strength of the cable system.

**Cleaning**

Requirement: During erection, promptly remove foreign matter from the screens without damage to finishes. Do not use abrasive cleaners or acid.

**3.5 COMPLETION****Cleaning**

Method: Clean all visible surfaces with soft clean cloths and clean water or approved cleanser, finishing with a clean cloth. Do not use abrasive or alkaline materials.

**Warranties**

Requirement: Cover materials and workmanship in the terms of the warranty from the manufacturer.

**0471 THERMAL INSULATION AND PLIABLE MEMBRANES****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide thermal insulation and pliable membrane 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 INTERPRETATION****Abbreviations**

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

- IRMA: Inverted roof membrane assembly.
- PMR: Protected membrane roof.

**Definitions**

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

- Fbs-1 (fibre-bio-soluble) mineral wool: Insulation composed of bio-soluble glass or rock fibres.
- Fibre batts: Flexible insulation supplied as factory cut pieces and composed of mineral wool (glass and rock fibre) or polyester fibre.
- Fire hazard properties: Terminology to BCA A5.5.
- Pliable building membrane: To AS/NZS 4200.1 and equivalent to sarking-type materials as defined in the NCC.
- Thermal insulation terminology: To AS/NZS 4859.1.
- 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 conformance to PRODUCTS, **FIRE PERFORMANCE**, **Fire hazard properties**.

**Products and materials**

Thermal insulation properties: Submit evidence of conformance to AS/NZS 4859.1 and AS/NZS 4859.2.

**Warranties**

Manufacturer's published product warranties: Submit on completion.

**1.5 INSPECTION****Notice**

Inspection: Give notice so that inspection may be made of the installed pliable membrane and insulation before covered up or concealed.

## 2 PRODUCTS

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### 2.1 GENERAL

#### Storage and handling

Marking: Deliver mineral wool products to site in packaging labelled FBS-1 BIO-SOLUBLE INSULATION.

### 2.2 FIRE PERFORMANCE

#### Fire hazard properties

Insulation materials: Tested to AS/NZS 1530.3. Fire hazard indices as follows:

- Spread-of-Flame Index:  $\leq 9$ .
- Smoke-Developed Index:  $\leq 8$  if Spread-of-Flame Index  $> 5$ .

Materials with reflective facing: Tested to AS/NZS 1530.3 and the recommendations of Appendix A6.

Pliable membranes: Flammability Index  $\leq 5$  tested to AS 1530.2.

### 2.3 INSULATION AND PLIABLE MEMBRANE MATERIALS

#### Insulation

Standard: Thermal insulation materials to AS/NZS 4859.1.

- Cellulosic fibre (loose fill): To AS/NZS 4859.1 Section 4.
- Wool: To AS/NZS 4859.1 Section 5.
- Polyester (compressible): To AS/NZS 4859.1 Section 6.
- Mineral wool blankets and cut pieces (compressible): To AS/NZS 4859.1 Section 7.
- Rigid cellular foam insulation (EPS, PF, PIR, PUR and XPS): To AS/NZS 4859.1 Section 8.
- IR reflective (formed shapes and compressible with one or more external IR reflective surfaces): To AS/NZS 4859.1 Section 9.

Polyurethane (rigid cellular RC/PUR): To AS 1366.1.

Polyisocyanurate (rigid cellular RC/PIR): To AS 1366.2.

Polystyrene (moulded rigid cellular RC/PS-M): To AS 1366.3.

Polystyrene (extruded rigid cellular RC/PS-E): To AS 1366.4.

Polyurethane (sprayed): To AS 1366.1 Table 2.

Wet processed fibreboard (softboard): To AS/NZS 1859.4.

#### Pliable building membranes

Standard: To AS/NZS 4200.1.

Vapour barrier:

- Vapour control classification: Class 1.

Sarking membrane (other than walls and gables):

- Water control classification: Water barrier.

Vapour permeable (breathable) membrane: Minimum class 4.

#### Fasteners and supports

General: Metallic-coated steel.

#### Mesh support to roof insulation

Metallic-coated steel wire netting: To AS 2423 Section 4.

- Size: 45 mm mesh x 1 mm diameter.

Welded safety mesh: To AS/NZS 4389.

## 3 EXECUTION

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### 3.1 GENERAL

#### Bulk insulation

Requirement: To AS 3999 and BCA J1.2. or BCA 3.12.1.1, as appropriate.

Installation: Firmly butt together fibre blankets or batts, with no gaps except as follows:

- Access openings and vents: Do not obstruct.
- Light fittings: To AS/NZS 3000 clause 4.5.

- Electrical cables: To AS 3999 clause 2.6.

Glass Wool and Rock Wool insulation: Conform to the *ICANZ Industry code of practice for the safe use of glass wool and rock wool insulation*.

#### **Pliable building membrane**

Installation: To AS 4200.2 and BCA J1.2 or BCA 3.12.1.1, as appropriate.

### **3.2 FLOORS**

#### **Under suspended framed floors - bulk insulation**

Product type: Fibre batts.

Installation: Fit tightly between framing members. If support is not otherwise provided, staple nylon twine to the framing and stretch tight.

#### **Under suspended framed floors – rigid insulation**

Product type: Rigid cellular extruded sheets.

#### **Over suspended framed floors**

Product type: Rigid cellular extruded sheets.

#### **Below concrete slab on ground**

Product type: Rigid cellular extruded sheets.

Laying pattern: Stretcher bond, with edges tightly butted.

Damp-proof membrane: Lay over insulation.

#### **Over concrete slab on ground**

Product type: Rigid cellular extruded sheets.

Substrate preparation: Prepare substrates as follows:

- Clean and remove of any deposit or finish which may impair adhesion or location of insulation.
- Remove excessive projections.
- Voids and hollows > 10 mm with abrupt edges: Fill with a cement:sand mix not stronger than the substrate or weaker than the bedding.

Laying pattern: Stretcher bond, with edges tightly butted.

Fixing: Adhesive fixed directly to the concrete floor slab.

#### **Under suspended concrete slab – rigid insulation**

Product type: Rigid cellular extruded sheets.

Joints: Apply reinforced foil tape to all joints.

#### **Under suspended concrete slab – bulk insulation**

Product type: Fibre batts.

Fixing: Mechanical fasteners and support mesh or nylon twine.

### **3.3 WALLS**

#### **Framed walls – thermal break strips**

Product type: Proprietary item.

Application: To steel framing with lightweight external cladding.

R-Value:  $\geq 0.2$ .

Screw fixing: Button head screws at 1 m centres.

Adhesive fixing: Wallboard adhesive walnuts at 1 m centres.

#### **Framed walls – bulk insulation**

Product type: Fibre batts.

Installation: Friction fit between framing members. If other support is not provided, staple nylon twine to the framing and stretch tight.

#### **Masonry veneer cavity walls**

Product: Rigid cellular insulation board.

Application: To steel or timber framing.

Installation: Horizontally with the tongue to the top edge, pushed over prefixed wall ties and held firmly against the wall frame. Keep boards clean and 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 panels. Prevent entry of water behind the insulation boards.

#### **Full masonry cavity walls – inside cavity**

Product: Rigid cellular insulation board.

Application: To the external face of the inner masonry leaf.

Installation: Horizontally with the tongue to the top edge and firmly against the inner masonry skin. Keep boards clean and 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 panels. Prevent entry of water behind the insulation boards.

#### **Full masonry cavity walls – internal face**

Product type: Rigid cellular extruded boards.

Application: To the internal face of internal masonry leaf.

Preparation of substrates: Conform to the following:

- Remove any deposit or finish which may impair adhesion.
- Remove excessive projections and fill voids and hollows with plaster.
- Maximum surface deviation from a 2400 mm straightedge: 6 mm.

Substrate correction: Skim plaster.

Installation: Apply 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**

Application: Provide a vapour permeable membrane behind external facing material which does not provide permanent weatherproofing or which may be subject to condensation forming on the internal face, including the following:

- Boards or planks fixed vertically or diagonally.
- Boards or planks fixed in exposed locations where wind driven rain can penetrate the joints.
- Unpainted or unsealed cladding.
- Masonry veneer.

Installation: Run the vapour permeable membrane horizontally on the outer face of external wall framing, over the flashing, from the bottom plate up. Pull taut over the framing and fix to framing members. Seal across the wall cavity at the top.

Horizontal laps: At least 150 mm wide, lapped to make sure water is shed to the outer face of the membrane.

End or vertical overlaps laps: At least 150 mm wide made over framing.

Openings: Run the vapour permeable membrane over the openings and leave covered until windows and doors are installed. Cut the membrane on a 45° diagonal from each corner of the opening, fold the flaps inside and fix to the inside frame of the opening. If the membrane is used to provide a continuous air tight 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 ROOFS

#### General

Location: 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

Locations: Provide support to the following:

- Sarking, vapour barrier or reflective thermal insulation membranes laid over roof framing members which are spaced at more than 900 mm centres.
- Blanket type thermal insulation laid over roof framing members as sound insulation to metal roofing.

Installing wire netting: Lay over the roof framing allowing only natural mesh sag between members to suit the application. Staple to timber frame, wire to steel frame.

Installing welded safety mesh: To AS/NZS 4389.

#### Pliable building membranes

Sarking membrane:

- Location: Provide sarking under tile and shingle roofing.

Vapour barrier:

- Installation: 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.

#### Metal roofs – thermal break strips

Product type: Proprietary item.

Application: To steel framing supporting metal sheet roof cladding.

R-Value:  $\geq 0.2$ .

#### Metal roofs – bulk insulation

Product: Fibre blankets or batts.

Installation:

- Batt: Fit tightly between framing members.
- 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 blanket and reflective insulation: Lay facing reflective insulation face downwards over safety mesh.

#### Waterproof membrane roofs – IRMA/PMR types

Product type: Rigid cellular extruded sheets.

Preparation: Make sure membrane is clean and free of loose material.

Separation layer: Lay over membrane with edges lapped 300 mm and turned up at upstands and penetrations.

Installation: Lay insulation boards in brick pattern with shiplap edges pushed together firmly, cut neatly around penetrations and extend up upstands.

#### Cathedral ceiling insulation – metal roofing and roofing tiles

Product type: Rigid cellular extruded sheets.

Application: Over ceiling lining that has been fixed to rafters.

Installation: Lay insulation 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. Secure temporarily by occasional nailing to the rafters, the permanent fixing is provided by the nails used to secure the counter battens to the rafters. Cut boards and tightly fit to abutments and penetrations. Seal gaps with polyurethane foam.

#### Ceiling insulation – bulk insulation

Product type:

- Framed ceilings: Fibre batts.
- Suspended ceiling: Fibre blanket.

Application: Over ceiling lining.

Installation:

- Batts: Fit tightly between framing members.
  - Blankets: Butt joint and lay over ceiling panels or lining.
-

**0611 RENDERING AND PLASTERING****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide plaster finishes as documented.

**Performance**

Requirements:

- Resistant to impacts expected in use.
- Free of irregularities.
- Consistent in texture and finish.
- Firmly bonded to substrates for the expected life of the application.
- Without obvious shrinkage cracks.
- As a suitable substrate for the nominated final finish.

**1.2 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:

- CRF: Cement render – finish.
- CRM: Cement render – medium.
- CRS: Cement render – stronger.
- CRW: Cement render – weaker.
- GPF: Gypsum plaster – finish.

**Definitions**

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

- Base coat: A plaster coat applied before the application of the finish coat.
- Bonding treatment: A treatment of a substrate which improves adhesion of a plaster system.
- Finish coat (rendering and plastering): The final coat of a coating system.
- Finishing treatment (plastering): The treatment applied to a finish coat which may include processes and results.
- Plaster: A mixture of binders, aggregate and water which is applied to substrates in a plastic state and dries and cures to a hard surface which may subsequently be decorated:
  - . Cement plaster: Contains Portland cement as the principal binder.
  - . Gypsum plaster: Contains hydrated or anhydrous calcium sulfate as the principal binder.
- Plastering: The process of coating the framing or solid surfaces of a building with a plastic material which hardens and then may be decorated or remain self-finished.
- Plastering system: One or more coats of plaster and associated treatments comprising some or all of the following in sequence:
  - . Base coat 1 or 2.
  - . Bonding treatment.
  - . Finish coat.
  - . Finishing treatment.
- Render, rendering: Plaster, plastering, usually single coat and usually cement:lime:sand.
- Substrate: The surface to which a material or product is applied.

## 1.4 TOLERANCES

### Tolerances table

Description	Alignment	Tolerance
Walls and other vertical structures	Vertical	6 mm in 2400 mm
Reveals sides	Vertical	3 mm in 1800 mm
Reveals head up to 1800 mm	Horizontal	3 mm in 1800 mm
Reveals head over 1800 mm	Horizontal	5 mm max
Reveals, piers, beams, wall stop ends up to 300 mm	Square	3 mm max
Reveals, piers, beams, wall stop ends over 300 mm	Square	5 mm max
Radius of corners	Round	Should not vary by more than $\pm 10\%$ over the length of the arris.

## 1.5 SUBMISSIONS

### Prototype

Plaster systems: Prepare prototypes of each plaster system complete with beads and other embedded items:

- Size: 1200 x 2400 mm.

## 1.6 INSPECTION

### Notice

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

- Prototypes ready for inspection.
- Substrates immediately before applying base coats.
- Finish treatments before decoration.

## 2 PRODUCTS

### 2.1 GENERAL

#### Storage and handling

General: Store materials in a dry, well-ventilated and secure storage area, unaffected by weather.

### 2.2 MATERIALS AND COMPONENTS

#### Accessories

Beads: Provide metal proprietary sections manufactured for fixing to substrates and/or embedding in the plaster to form and protect plaster edges and junctions.

Metal lath: Provide a proprietary product manufactured from raised expanded metal for use with plaster:

- Mass/unit area: 1.84 kg/m<sup>2</sup> or greater.
- Material thickness: 0.70 mm or greater.
- Mesh size: 9.5 x 28.6 mm.

Metallic-coatings to AS 1397: For beads or lath in cement plaster: To the **Corrosion resistance and durability table**.

#### Admixtures

Plasticisers or workability agents: Do not use in cement plasters.

#### Aggregates

Sand: Fine, sharp, well-graded sand with a clay content between 1% and 5% tested to AS 1141.12, and free from efflorescing salts.

#### Sand grading for base coat plaster table

Sieve size	Percent passing
------------	-----------------

Sieve size	Percent passing	
	Minimum	Maximum
4.75 mm	100	100
2.36 mm	90	100
1.18 mm	60	90
600 µm	35	70
300 µm	10	30
150 µm	0	5
75 µm	0	3

#### Plaster for autoclaved aerated concrete

General: Proprietary product manufactured for use with the wall system.

#### Bonding products

General: Proprietary products manufactured for bonding cement-based plaster to solid substrates.

#### Cement

Standard: To AS 3972.

Type: GP.

#### Colouring products

General: Provide proprietary products manufactured for colouring cement plaster.

Integral pigment proportion: 5% maximum weight of cement.

#### Cornice cement

General: Provide a proprietary product manufactured for use with the cornice.

#### Cornices

Cast plaster: Proprietary item.

#### Corrosion resistance and durability

Compliance: To the **Corrosion resistance and durability table** or provide proprietary products with metallic and/or organic coatings of equivalent corrosion resistance and as follows:

- Galvanize: To AS/NZS 4680.

#### Corrosion resistance and durability table

Atmospheric corrosivity category to AS 4312	Metal lath, beads and embedded items	Minimum cement content (mix type) above damp-proof course
C1 and C2	Galvanize after fabrication 300 g/m <sup>2</sup> Stainless 316	CRW
	Powder coated aluminium	CRM
C3	Stainless 316 Powder coated aluminium	CRM
C4 and T <sup>1</sup>	Stainless 316 Powder coated aluminium	CRS

<sup>1</sup> Avoid organic coating in Category T zones.

#### Curing products

General: Provide proprietary products manufactured for use with the plaster system.

#### Gypsum plaster

General: Provide a proprietary product containing calcium sulfate hemihydrate with additives to modify setting.

#### Lime

Limes for building: To AS 1672.1.

#### Lime putty

General: Prepare lime putty as follows:

- Stand dry hydrate of lime to AS 1672.1 and water for 24 hours or more without drying out.
- Stand quicklime and water for 14 days or more without drying out.

**Mixes**

General: Select a mix proportion to suit the conditions of application.

Measurement: Measure binders and sand by volume using buckets or boxes. Do not allow sand to bulk by absorption of water.

Plaster mixing: Machine mix for 3 to 6 minutes.

Strength of successive coats: Make sure successive coats are no richer in binder than the coat to which they are applied.

**Mix proportion table – Cement render, by volume**

Mix type		Substrate	Upper and lower limits of proportions by volume		
			Cement	Lime	Sand
Single or multi-coat systems with integral finishing treatments Base coats in multi-coat systems with cement or gypsum finishes	CRS	Dense and smooth concrete and masonry	1 1	0 0.5	3 4.5
	CRM	Regular clay or concrete masonry	1 1	0.5 1	4.5 6
	CRW	Lightweight concrete masonry and other weak substrates	1 1	1 2	6 9
Second coat - Internal	CRF	Cement render base coats	1	1	6
			1	2	9
Second coat - External	CRF	Cement render base coats	1	1	5
			1	2	6

**Mix proportion table – Gypsum finish coat, by volume**

Mix type		Substrate	Upper and lower limits of proportions by volume			
			Gypsum	Cement	Lime putty	Sand
Gypsum finish coats	GPF	Cement render base coats	1	-	1.5	-
			1	-	2	-

**Mix proportion table – Gypsum finish coat, by weight**

Gypsum plaster (kg)	Lime putty (kg)
17	25
34	50
51	75

**Control joint products**

General: Provide proprietary products manufactured for use with the plastering system and to accommodate the anticipated movement of the substrates and/or the plaster.

**Water**

General: Clean and free from any deleterious matter.

**3 EXECUTION****3.1 PREPARATION****Substrates**

General: Provide substrates as follows:

- Clean and free from any deposit or finish which may impair adhesion of plaster.
- If framed or discontinuous, support members in full lengths without splicing.

- If solid or continuous, remove excessive projections and fill voids and hollows with plaster stronger than the first coat and not weaker than the substrate.

Absorbent substrates: If suction is excessive, control it by dampening without over-wetting, and do not plaster substrates showing surface moisture.

Dense concrete: If not sufficiently rough to provide a mechanical key, roughen by scabbling or the like to remove 2 mm of the laitance and expose the aggregate before applying a bonding treatment.

Painted surfaces: Remove paint and hack the surface at close intervals.

Untrue substrates: If the substrate is not sufficiently true for conformity with the thickness limits for the plaster system, or has excessively uneven suction resulting from variations in the composition of the substrate, apply additional coats without exceeding the thickness limits for the substrate or system.

### Beads

Location: Fix beads as follows:

- Angle beads: At all external corners.
- Drip beads: At all lower terminations of external plaster.
- Beads for control of movement: At all control joints.
- Stop beads: At all terminations of plaster and junctions with other materials or plaster systems.

Joints in beads: Provide dowels to maintain alignment.

Mechanical fixing to substrate:  $\leq 300$  mm centres.

### Bonding treatment

General: If bonding treatment is required, throw a wet mix onto the background. Mix proportions to the following:

- Cement plaster (cement:sand): 1:2.
- Gypsum plaster (gypsum:sand): 1:2.

Curing: Keep continuously moist for 5 days or more and allow to dry before applying plaster coats.

Thickness:  $\geq 3 < 6$  mm.

### Embedded items

General: To the **Corrosion resistance and durability table**. If there are water pipes and other embedded items, sheath them to permit thermal movement.

### Lath

Location: Provide lath as follows:

- Chases: If chases or recesses are 50 mm wide or greater, fix metal lath extending 75 mm or more beyond each side of the chase or recess.
- Metal and other non-porous substrates: Fix metal lath to provide a key.

Installation: Fix lath as follows:

- General: Run the long way of the mesh across supports with strands sloping downwards and inwards from the intended face of the plaster.
- Fixing: Mechanically fix at centres of 150 mm or less.
- Laps: Tie with 1.25 mm galvanized wire at centres of 150 mm or less. Do not stop edges of sheets at corners but bend around.
- On solid substrates: Space the lath 5 mm or more clear of the substrate.
- Support spacing:  $\leq 400$  mm.

## 3.2 APPLICATION

### Plastering

Base coats: Scratch-comb each base coat in two directions when it has stiffened.

Metal lath: Press the plaster through the apertures of expanded metal lath and wings of beads.

### Incidental work

General: Return plaster into reveals, beads, sills, recesses and niches. Plaster faces, ends, and soffits of projections in the substrate, such as string courses, sills, pilasters and corbels. Run neatly finished throating on soffits of external projections. Trim around openings. Plaster exposed internal surfaces of built-in cupboards.

**Joining up**

General: If joining up is required, make sure joints are imperceptible in the finished work after decoration.

**Control joints**

General: Provide joints in the finish to coincide with control joints in the substrate. Make sure the joint in the substrate is not bridged during plastering.

Size:

- Depth: Extend the joint right through the plaster and reinforcement to the substrate.
- Width: 3 mm, or the same width as the substrate joint, whichever is greater.

Damp-proof courses: Do not continue plaster across damp-proof courses.

Plastering on metal lath: Provide control joints to divide the plastering area into rectangular panels of 10 m<sup>2</sup> or less.

V-joints: Provide V-joints, cut right through the plaster to the substrate, at the following locations:

- Abutments with metal door frames.
- Abutments with other finishes.
- Junctions between different substrates.

**Cornices**

General: Accurately cut and mitre corners. Match and align ornament. Do not make butt joints in the length of a cornice unless required, or if full lengths are not available.

Installation: Butter edges, mitres and joins for the full length of the cornice with adhesive.

Mechanical fixing: If cornice projects across a ceiling 400 mm or more, provide additional mechanical fixing as follows:

- Fixing centres: ≤ 600 mm.

**Plaster thickness table**

Substrate	Cement render, total thickness of single or multi-coat work (mm)	Gypsum/lime plaster (mm)
Dense concrete walls	15 max	3 max
Dense concrete ceilings	9 max	3 max
Brickwork and blockwork	12 min	3 max
Lightweight concrete and blocks	12 min	3 max
Metal lath measured from the face of the lath.	18 min	3 max

**Temperature**

General: If the ambient temperature is less than 10°C or more than 30°C, make sure the temperature of mixes, substrates and reinforcement at the time of application are between 5°C and 35°C.

**3.3 FINISHES****Finishing treatments**

Plain even surfaces: Work the hardening plaster as follows:

- Bag: Rub the finish coat when set firm with a hessian bag or similar.
- Carborundum stone: Rub the finish coat when set hard with a carborundum stone to achieve a finish free from sand.
- Foam float: Float finish coat on application with a wood or plastic float to an even surface and finish with a foam float to achieve a fine sand textured finish.
- Steel trowel: Steel trowel finish coat to a smooth dense surface which is not glass-like and is free from shrinkage cracks and crazing.
- Wood or plastic float: Float the finish coat on application to an even surface with a wood or plastic float.

Ornamental patterned surfaces: Work the hardening plaster with a trowel or other tool.

Sprayed textured surfaces: Spray plaster onto a substrate using a purpose-designed machine.

Stippled textured surfaces: Work the hardening plaster with a stiff brush.

Rough thrown surfaces: Throw plaster onto a substrate or pebbles onto a plastic plaster base.

### **Specialist plaster finishes**

Polymer modified render:

- Basecoat render: Proprietary polymer modified cementitious render supplied as a complete plastering system.
- Finish coats: Proprietary trowelled on coloured and textured polymer modified finish coats.

Polished plaster: In situ applied plaster system incorporating selected stone dust in a proprietary matrix producing a smooth polished surface with visual patterning.

Glass bead coatings: Glass beads bound in a proprietary matrix.

## **3.4 COMPLETION**

### **Curing**

General: Prevent premature or uneven drying out and protect from the sun and wind.

Keeping moist: If a proprietary curing agent is not used, keep the plaster moist as follows:

- Base coats and single coat systems: Keep continuously moist for 2 days and allow to dry for 5 days before applying further plaster coats.
  - Finish coats: Keep continuously moist for 2 days.
-

**0632 STONE AND TERRAZZO 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 3958.1 referenced in this worksection.

**Slip resistance**

Classification: To AS 4586.

**1.4 INTERPRETATION****Definitions**

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

- Acoustic underlay: A resilient material laid between the structural floor and the flooring material to provide sound isolation.
- Adhesives - cementitious (C): Adhesive in which the binders are hydraulic, e.g. General purpose cement, with aggregates and organic additives.
- Adhesives - dispersion (D): Adhesives in which the binders are in the form of aqueous polymer dispersion with mineral fillers and organic additives.
- Adhesives - reaction resin (R): Adhesives in which the binders are synthetic resins with mineral fillers and organic additives. The curing occurs by chemical reaction.
- Bedding: Mixtures of materials which are applied to substrates in a plastic state and which dry, cure and adhere tiles to substrates:
  - . Adhesive bedding: Paving/tiling adhered by adhesives.
  - . Mortar bedding: Paving/tiling adhered in a cementitious mortar bed.
- Lippage: Height deviation between adjacent units.
- Stepping: The relative surface level of adjacent paving elements within the expanse of the main pavement.
- Substrate: The surface to which a material or product is applied.
- Tile: Thin slab made from clay and/or other inorganic raw materials used generally as coverings for floors and walls and adhered to continuous supporting substrates.
- Tiles – cementitious: Cement based prefinished tiles.
- Tiles – industrial cast: Tile products of reconstituted stone. Also known as manufactured stone.
- Tiles – natural stone: Tiles cut from natural stone.
- Tiles – terrazzo – cementitious: Manufactured cementitious terrazzo tiles formed in a suitable machine to give sufficient compaction and density to the finished surface, and moisture cured before grinding and honed at the place of manufacture. Thickness usually 35 mm.

- Tiles – terrazzo – resin: Manufactured terrazzo tiles with the facing aggregate in a resin matrix and pre polished. Thickness usually up to 22 mm.
- Wet area: An area within a building supplied with a floor waste.

### 1.5 TOLERANCES

#### Completed tiling

Requirement: To the recommendations of AS 3958.1 clause 5.4.6.

### 1.6 SUBMISSIONS

#### Execution details

Grouting: Submit proposals for grouting methods and materials.

Margins: If it appears that minor variations in joint widths or overall dimensions will avoid cut tiles, submit a proposal.

#### Operation and maintenance manuals

General: Submit a manual describing care and maintenance of the tiling, including procedures for maintaining the slip-resistance classification stating the expected life of the slip-resistance classification.

#### Products and materials

Product conformity: Submit evidence of conformity to the following:

- Marking and classification of tile adhesive to AS ISO 13007.1.
- Weighted normalised impact sound pressure level to AS ISO 717.2 as measured for the acoustic underlay as part of the entire tiling system.

Type tests: Submit results, as follows:

- Slip resistance of tiles.
- Accelerated wear test.
- Stone tile properties.

#### Samples

General: Submit labelled samples of tiles, including fittings, accessories grout and sealants, illustrating the range of variation in colour and finish.

Sample panels: Prepare a sample panel of each type of finish as follows:

- Size:  $\geq 2 \text{ m}^2$ .
- Include samples of junction details and trim.
- Preserve each panel until related work is complete.

#### Tests

Site tests: Submit results, as follows:

- Slip resistance test of completed installation
- Impact sound insulation

### 1.7 INSPECTION

#### Notice

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

- Substrate immediately before tiling.
- Trial set-outs before execution.
- Control joints before sealing and grouting.
- Grout and caulking colours before application.

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## 2 PRODUCTS

### 2.1 PRODUCTS

#### Stone tiles

General: Repair mud veins or lines of separation that are integral to the selected pattern with resin fillers and applied back lining.

Tactile ground surface indicators: To AS/NZS 1428.4.1.

## 2.2 ADHESIVES

### General

Standard: To AS ISO 13007.1.

### Type

General: Provide adhesives compatible with the materials and surfaces to be adhered, 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.

## 2.3 MORTAR

### Materials

Cement type to AS 3972: GP.

- White cement: Iron salts content  $\leq 1\%$ .
- Off-white cement: Iron salts content  $\leq 2.5\%$ .

Lime: To AS 1672.1.

Sand: Fine aggregate with a low clay content selected for grading, sharp and free from efflorescing salts.

Measurement of volume: Measure binders and sand by volume using buckets or boxes. Do not allow sand to bulk by absorption of water.

### Bedding mortar

Mix proportions (cement:sand), by volume: Select proportions from the range 1:3 to 1:4 for satisfactory adhesion. Provide minimum water.

Mixing: To AS 3958.1 clause 2.15.

### Water

General: Clean and free from any deleterious matter.

## 2.4 GROUT

### Type

Cement based proprietary grout: Mix with water. Fine sand may be added as a filler in wider joints.

General purpose cement based grout: Mix with fine sand. Provide minimum water consistent with workability.

Mix proportions (cement:sand), by volume:

- For joints  $< 3$  mm: 1:2.
- For joints  $\geq 3$  mm: 1:3.

Grout to resin terrazzo tiles: Resinous material supplied by the tile supplier.

### 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.

## 2.5 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 35.

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

### 3 EXECUTION

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#### 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.

#### 3.2 PREPARATION

##### Ambient temperature

General: If the ambient temperature is less than 5°C or greater than 35°C, do not lay tiles.

##### Substrates without wet area membranes

General: Make sure substrates are as follows:

- Clean and free of any deposit or finish which may impair adhesion or location of tiles.
- If framed or discontinuous, support members are in full lengths without splicing.
- If solid or continuous:
  - . Excessive projections are removed.
  - . Voids and hollows greater than 10 mm with abrupt edges are filled with a cement:sand mix not stronger than the substrate or weaker than the bedding.
  - . Depressions less than 10 mm are filled with a latex modified cementitious product with feathering eliminated by scabbling the edges.

Absorbent substrates: If suction is excessive, control it by dampening but avoid over-wetting and do not apply mortar bedding to substrates showing surface moisture.

Dense concrete: If not sufficiently rough to provide a mechanical key, roughen by scabbling or the like to remove 3 mm of the surface and expose the aggregate; then apply a bonding treatment.

##### Substrates with wet area membranes

General: Make sure substrates are as follows:

- Clean and free of any deposit or finish which may impair adhesion or location of tiles.
- Compatible with all components of the floor system.

##### Trial set-out

General: Prepare a trial tile set-out to each area as follows to:

- Maximise the size of equal margins of cut tiles.
- Locate control joints.
- Note minor variations in joint widths to eliminate cut tiles at margins.
- Locate fittings on walls.

#### 3.3 FIXING UNDERLAY

##### Underlay fixed on joists

Installation: Lay the length of the sheets at right angles to the supports. Stagger the end joints and locate them centrally over joists. If panels are not tongue and grooved provide noggings or trimmer joists to support the edges.

Fixing centres: Maximum 300 mm on each support.

- Fibre-cement flooring: Fix sheeting to the supports with adhesive and corrosion-resistant countersunk screws. Fill the screw holes with sealant before fixing. After fixing, stop the screw heads with the same sealant, finished slightly below the sheet surface.
- Particleboard and plywood flooring: Fix sheeting to the supports with adhesive and nail.

Membranes: If sheet flooring is the substrate for a wet area membrane, fix with stainless steel countersunk head screws.

### 3.4 TILING GENERALLY

#### Sequence

General: Fix wall tiles before floor tiles.

#### Cutting and laying

Cutting: Cut tiles neatly to fit around fixtures and fittings and at margins where necessary. Drill holes without damaging tile faces. Cut recesses where necessary for fittings such as soap holders. Rub edges smooth without chipping.

Laying: Return tiles into sills, reveals and openings. Butt up to returns, frames, fittings, and other finishes. Strike and point up beds where exposed. Remove tile spacers before grouting.

Resin terrazzo tiles: Apply to thin-bed adhesive.

#### Variations

General: If necessary, 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: Ventilate the space below fully enclosed baths with at least 2 vermin proofed ventilating tiles.

### 3.5 SETTING OUT

#### General

Joint widths: Set out tiles to give uniform joint widths as follows:

- Floors:
  - . Stone tiles 400 x 400 mm or less and with sawn edges: 3 mm.
  - . Stone tiles greater than 400 x 400 mm and all tiles with irregular edges: 6 mm or less than 12 mm.
  - . Terrazzo tile joints: 1.5 mm or gauged by the thickness of the trowel.
- Walls:
  - . Stone tiles: 1.5 mm or less than 4.5 mm.

#### Margins

General: Provide whole or purpose-made tiles at margins where practicable, otherwise, set out to give equal margins of cut tiles. If margins less than half tile width are unavoidable, locate the cut tiles where they are least conspicuous.

#### Fixtures

General: If possible position tiles so that holes for fixtures and other penetrations occur at the intersection of horizontal and vertical joints or on the centre lines of tiles. Continue tiling fully behind fixtures which are not built in to the tiling surface. Before tiling make sure that fixtures interrupting the tile surfaces are accurately positioned in their designed or optimum locations relative to the tile layout.

### 3.6 FALLS AND LEVELS

#### Grading

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, general: 1:100 minimum.

Fall, in shower areas: 1:60 minimum.

Change of finish: Maintain finished floor level across changes of floor finish including carpet.

### 3.7 BEDDING

#### Preparation of tiles

Adhesive bedding: Fix tiles dry; do not soak.

Mortar bedding: Soak porous tiles in water for half an hour and then drain until the surface water has disappeared.

**Bedding**

General: Use bedding methods and materials which are appropriate to the tile, the substrate, the conditions of service, and which leave the tile firmly and solidly bedded in the bedding material and adhered to the substrate. Form falls integral with the substrate.

**Thin adhesive beds**

General: Provide only if the substrate deviation is less than 3 mm when tested with a 2 m straight edge. Cover the entire tile back with adhesive when the tile is bedded.

Thickness: 1.5 to 3 mm.

**Thick adhesive beds**

General: Provide on substrates with deviations up to 6 mm when tested with a 2 m straight edge, and with tiles having deep keys or frogs.

Nominal thickness: 6 mm.

**Adhesive bedding application**

General: Apply adhesive by notched trowel to walls and floors and direct to tiles if required, to provide evenly distributed coverage after laying as follows:

- Domestic internal walls: > 70%.
- Domestic internal floors: > 80%.
- Other wall and floors: > 90%.
- Wet areas and bench tops: 100%.

Pattern of distribution of adhesive: To the recommendations of AS 3958.1 clause 5.6.4.3. Verify by examining one tile in ten as work proceeds.

Wall tile spacers: Do not use spacer types that inhibit the distribution of adhesive.

Curing: Allow the adhesive to cure for the period nominated by the manufacturer before grouting or allowing foot traffic.

**Mortar beds**

For floor tiles: Either lightly dust the screeded bed surface with dry cement and trowel level until the cement is damp, or spread a thin slurry of neat cement, or cement-based thin bed adhesive, on to the tile back. Do not use mortar after initial set has occurred.

- Nominal thickness: 20 to 40 mm.

Thick reinforced beds: Place mortar bed in two layers, and incorporate the mesh reinforcement in the first layer.

**Mechanical fixing**

General: Provide a proprietary system of support and fixing appropriate to the type of tile and the substrate conditions.

**3.8 CONTROL OF MOVEMENT****General**

Requirement: Provide control joints to the recommendations of AS 3958.1 clause 5.4.5 and as follows:

- Floor location:
  - . Over structural control joints.
  - . To divide complex room plans into rectangles.
  - . Around the perimeter of the floor.
  - . At junctions between different substrates.
  - . To divide large terrazzo finished 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 joints.
  - . At junctions with different substrate materials when the tiling is continuous.
  - . At vertical corners in shower compartments.
- Depth of joint: Right through to the substrate.
- Sealant width: 6 to 25 mm.

- Depth of elastomeric sealant: One half the joint width, or 6 mm, whichever is the greater.

### 3.9 GROUTED AND SEALANT JOINTS

#### Grouted joints

General: Commence grouting as soon as practicable after bedding has set. Clean out joints as necessary before grouting.

Face grouting: Fill the joints solid and tool flush. Clean off surplus grout. Wash down when the grout has set. When grout is dry, polish the tiled surface with grout film remover and a clean cloth.

Edges of tiles: Grout exposed edge joints.

Epoxy grouted joints: Make sure tile edge surfaces are free of extraneous matter such as cement films or wax, before grouting.

Grouting cementitious terrazzo tiles: Thoroughly work grout into tile joints by flood grouting.

#### Sealant joints

General: Provide joints filled with sealant and finished flush with the tile surface as follows:

- Where tiling is cut around sanitary fixtures.
- At internal corners of walls in showers.
- Around fixtures interrupting the tile surface, for example pipes, brackets, bolts and nibs.
- 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 suitably fixed to the substrate, with top edge flush with the finished floor. Where changes of floor finish occur at doorways, make the junction directly below the closed door.

Floor finish divider strips for resin terrazzo tiles: A proprietary neoprene T section.

Stepping: Less than 5 mm.

#### Adjustments

Requirement: Check that the height of the floor finish divider is sufficient for the topping and tile thickness. Adjust as required with a matching flat bar adhesive fixed to the divider angle.

#### Weather bars

General: Provide a corrosion-resistant metal weather bar under hinged external doors. Locate under the centres of closed doors.

### 3.11 TESTING

#### Completion tests

Slip resistance of completed installation: To AS 4663.

### 3.12 COMPLETION

#### Cementitious terrazzo tiled surfaces

General: In situ grind and polish the completed installation with equipment nominated by the tile supplier.

#### 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.

#### Cleaning

General: Clean tiled surfaces using an appropriate tile cleaning agent, and polish.

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**0671 PAINTING****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide 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.
- Paint systems which are fully opaque or at the documented level of opacity.
- Clear finishes at the level of transparency consistent with the product.
- Fully adhered.
- Resistant to environmental degradation within the manufacturer's stated life span.

**1.2 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 referenced in this worksection.

**1.4 INTERPRETATION****Definitions**

General: For the purposes of this worksection the definitions in AS/NZS 2310 and the following apply:

- Gloss: The optical property of a surface, characterised by its ability to reflect light specularly.
- Gloss unit: Numerical value for the amount of specular reflection relative to that of a standard surface under the same geometric conditions.
- Levels of gloss finish: When the specular direction is 60 degrees, surfaces with the following specular gloss reading is defined as follows:
  - . Full gloss: Over 85 gloss units.
  - . Gloss: Over 50 and up to 85 gloss units.
  - . Semi-gloss (satin): Over 20 and up to 50 gloss units.
  - . Low gloss (low sheen): Over 5 and up to 20 gloss units.
  - . Flat finish (matt): Up to 5 gloss units.
- Opacity: The ability of a paint or textured and membrane coating to obliterate the colour difference of a substrate.
- Paint or coating system: A product in liquid form, which when applied to a surface, forms a dry film having protective, decorative or other specific technical properties.
- Primer, prime coat: The first coat of a painting system that helps bind subsequent coats to the substrate and which may inhibit its deterioration.
- Sealer: A product used to seal substrates to prevent the following:
  - . Materials from bleeding through to the surface.
  - . Reaction of the substrate with incompatible top coats.
  - . Undue absorption of the following coat into the substrate.
- Substrate: The surface to which a material or product is applied.
- Undercoat: An intermediate coat formulated to prepare a primed surface or other prepared surface for the finishing coat.

## 1.5 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.
- Safety data sheets (SDS) showing the health and safety precautions to be taken during application.
- The published recommendations for maintenance.

### Samples

Clear finish coatings: Submit samples of timber or timber veneer matching those to be used in the works as follows:

- Requirement: Label for identification and prepare, putty, stain, seal and coat in conformance with the documented system.
- Size: Large enough to be cut into 4 segments.

Opaque coatings: Submit labelled samples of each coating system, on representative substrates, showing surface preparation, colour, gloss level, texture, and physical properties.

Use the schedule to list the samples for both clear finish and opaque coatings. Delete if not required.

### Subcontractors

Specialist applicators: Submit name and contact details of proposed specialist applicators.

## 1.6 INSPECTION

### Notice

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

- Painting stages:
  - . Completion of surface preparation.
  - . After application of final coat.
- Clear finishing stages:
  - . Before surface preparation of timber.
  - . Completion of surface preparation.
  - . After application of final coat.

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## 2 PRODUCTS

### 2.1 GENERAL

#### Storage and handling

General: Store materials not in use in tightly covered containers in well-ventilated areas with temperatures maintained at the manufacturer's recommendations.

### 2.2 PAINTING MATERIALS

#### Standards

Paint types: To AS/NZS 2311 Table 4.2 and the following:

- Metal primer for steel, lead and chromate free: To AS 3730.21 and AS/NZS 3750.19.
- Metal primer, latex: To AS 3730.15.
- Metal primer for metallic-coated surfaces, solvent-borne: To AS 3730.21.
- Zinc-rich organic binder/primer for steel: To AS/NZS 3750.9.

#### Combinations

General: Do not combine products from different manufacturers in a system.

Clear timber finish systems: Provide only the combinations of putty, stain and sealer recommended by the manufacturer of the topcoats.

#### Putty and fillers

Material: To the recommendations of the paint system manufacturer, suitable for the substrate and compatible with the primer.

#### Tinting

General: Provide only products which are colour tinted by the manufacturer or supplier.

**Toxic ingredients**

General: To the *Poisons Standard - Schedule 1 (SUSMP)* Part 2 Section 7.

**3 EXECUTION****3.1 PREPARATION****Order of work**

Other trades: Before painting, complete the work of other trades as far as practicable within the area to be painted, except for the installation of fittings, floor sanding and laying flooring materials.

Clear finishes: Complete clear timber finishes before commencing opaque paint finishes in the same area.

**Protection**

General: Before painting, clean the area and protect it from dust contamination. Use drop sheets and masking agents to protect surfaces, including finished surfaces and adjacent finishes, during painting.

Fixtures and furniture: Remove door furniture, switch plates, light fittings and other fixtures before painting, and conform to the following:

- Labelling and storage: Attach labels or mark fixtures using a non-permanent method, identifying location and refixing instructions, if required. Store and protect against damage.

Difficult to remove fixtures: Where removal is impractical or difficult, apply surface protection before substrate preparation and painting.

**Wet paint warning**

Notices: Place in a conspicuous location and do not remove until the paint is dry.

**Substrate preparation – generally**

General: Prepare substrates to receive the painting systems.

Cleaning: Clean down the substrate surface. Do not cause damage to the substrate or the surroundings.

Filling: Fill cracks and holes with fillers, sealants, putties or grouting cements as appropriate for the finishing system and substrate, and sand smooth.

- Clear finish: Provide filler tinted to match the substrate.

Clear timber finish systems: Prepare the surface so that its attributes will show through the clear finish without blemishes, using methods including the following:

- Removal of bruises.
- Removal of discolourations, including staining by oil, grease and nailheads.
- Bleaching where necessary to match the timber colour sample.
- Puttying.
- Fine sanding, with the last abrasive no coarser than 220 grit, so that there are no scratches across the grain.

Treated surfaces: If surfaces have been treated with preservatives or fire retardants, make sure coating is compatible with the treatment and does not adversely affect its performance.

**Unpainted surfaces**

Standard: To AS/NZS 2311 Section 3.

**Previously painted surfaces**

Preparation of a substrate in good condition: To AS/NZS 2311 clause 7.4.

Preparation of a substrate in poor condition: To AS/NZS 2311 clause 7.5.

Preparation of steel substrates with protective coatings: To AS 2312.1 Section 8 and AS 1627.1.

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.

Reconditioned damaged surfaces in galvanized steel: To AS/NZS 4680 Appendix E.

**Cleaning external surfaces**

Sound external surfaces other than timber: Remove dirt, grease, loose and foreign matter, efflorescence and mould by water blasting or steam cleaning without damaging the surface. Remove

remaining loose material with appropriate hand tools. Use sanding blocks to preserve the arrises of masonry and stone details.

Efflorescence: Eliminate the source of salt and water before cleaning. Allow surface to dry for 15 to 30 days before repainting.

New masonry: Allow 30 days for the masonry to cure and pH level to stabilise before painting.

### 3.2 PAINTING

#### Light levels

General:  $\geq 400$  lux.

#### Substrate moisture content

Requirement: Use a moisture meter to demonstrate that the moisture content of the substrate is at or below the recommended maximum level for the type of paint and the substrate material.

#### Paint application

Standard: To AS/NZS 2311 Section 6.

Timing: Apply the first coat immediately after substrate preparation and before contamination of the substrate can occur. Apply subsequent coats after the manufacturer's recommended drying period has elapsed.

#### Painting conditions

General: Unless the paint is recommended for such conditions, do not paint under the following conditions:

- Dusty conditions.
- Relative humidity:  $> 85\%$ .
- Surface temperature:  $< 10^{\circ}\text{C}$  or  $> 35^{\circ}\text{C}$ .

#### Priming before fixing

General: Apply one coat of wood primer, and 2 coats to end grain, to the back of the following before fixing in position:

- External fascia boards.
- Timber door and window frames.
- Bottoms of external doors.
- Associated trims and glazing beads.
- Timber board cladding.

#### Spraying

General: If the paint application is by spraying, use conventional or airless equipment which conforms to the following:

- Satisfactorily atomises paint being applied.
- Does not require paint to be thinned beyond the maximum amount recommended by the manufacturer.
- Does not introduce oil, water or other contaminants into the applied paint.

Paint with known health hazards: Provide personal protection, masking, ventilating and screening facilities to AS/NZS 4114.1 and AS/NZS 4114.2.

#### Sanding

Clear finishes: Sand the sealer using abrasives no coarser than 320 grit without cutting through the colour. Take special care with round surfaces and edges.

#### Repair

Requirement: Clean off marks, paint spots and stains progressively and restore damaged surfaces to their original condition.

Maintenance painting: To AS/NZS 2311 Section 8.

#### Repair of galvanizing

Cleaning: For galvanized surfaces which have been subsequently welded, power tool grind to remove all surface contaminants, including rust and weld splatter. Prime affected area immediately after cleaning.

Primer: Type 2 organic zinc-rich coating for the protection of steel to AS/NZS 3750.9.

**Tinting**

General: Tint each coat of an opaque coating system so that each has a noticeably different tint from the preceding coat, except for top coats in systems with more than one top coat.

**Services**

General: Paint all new services and equipment, including those in plant rooms, if not embedded, except chromium, anodised aluminium, GRP, PVC-U, stainless steel, non-metallic flexible materials and normally lubricated machined surfaces.

Proprietary items: Repaint only if damaged.

**Windows**

Operation: Make sure opening windows function correctly before and after painting.

**Doors**

Drying: Maintain door leaf in the open position during drying. Do not allow door hardware or accessories to damage the door finish during the drying process.

**3.3 COMPLETION****Cleaning**

General: On completion of painting, remove splatters by washing, scraping or other methods which do not scratch or damage adjacent finished surfaces.

Reinstatement: Repair, replace or refinish any damage, including works of other trades. Touch up new damaged decorative paintwork or misses only with the paint batch used in the original application.

Fixtures: Refix removed and undamaged fixture in the original location, make sure they are properly fitted and in proper working order.

**Disposal of paint and waste materials.**

Requirement: Conform to requirements of the local government authority.

**4 SELECTIONS****4.1 PAINTING SYSTEMS****General**

Number of coats: Except where one or two coat systems are documented, each paint system consists of at least 3 coats.

Final coat selection: To the **Interior painting schedule** and the **Exterior painting schedule**.

**Low VOC emitting paints**

General: Provide the VOC limits as documented in the **Interior painting schedule** and the **Exterior painting schedule**.

**New unpainted interior surfaces**

Standard: To AS/NZS 2311 Table 5.1.

**New unpainted exterior surfaces**

Standard: To AS/NZS 2311 Table 5.2.

**Previously painted surfaces**

Standard: To AS/NZS 2311 Tables 8.2 and 8.3.

**Specialised painting systems**

Standard: To AS/NZS 2311 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 4548 series.
- Two-pack gloss pigmented polyurethane: B44.
- Two-pack epoxy: B29.
- Two-pack water based epoxy: B29A.

**0672 TEXTURED AND MEMBRANE COATINGS****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide 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.
- Fully opaque coating systems.
- Clear finishes at the level of transparency consistent with the product.
- Fully bonded.
- Resistant to environmental degradation within the manufacturer's stated life span.
- Accommodating movement in the substrate between control joints.

**1.2 CROSS REFERENCES****General**

Requirement: Conform to the following:

- 0171 *General requirements*.

**1.3 STANDARDS****Textured and membrane coatings**

General: Comply with the recommendations of those parts of AS/NZS 2311 which are referenced in this worksection.

**1.4 INTERPRETATION****Definitions**

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

- Aggregate filled textured latex coating: An aggregate filled medium to high profile textured coating selected for aesthetic purposes to provide maximum relief from underlying surface irregularities according to the application technique used.
- Gloss: The optical property of a surface, characterised by its ability to reflect light specularly.
- Gloss unit: Numerical value for the amount of specular reflection relative to that of a standard surface under the same geometric conditions.
- High-build low profile latex coating: A water based coating designed to be used over textured coatings to increase the exposure performance of the system.
- Latex extensible wall coating (or membrane coating): A non-aggregate flexible watertight finish.
- Levels of gloss finish: When the specular direction is 60 degrees, surfaces with the following specular gloss reading is defined as follows:
  - . Full gloss: Over 85 gloss units.
  - . Gloss: Over 50 and up to 85 gloss units.
  - . Semi-gloss (satin): Over 20 and up to 50 gloss units.
  - . Low gloss (low sheen): Over 5 and up to 20 gloss units.
  - . Flat finish (matt): Up to 5 gloss units.
- Non-aggregate textured latex coating: A latex coating selected for aesthetic purposes to provide decorative profiles according to the application technique used.
- Opacity: The ability of a paint or textured and membrane coating to obliterate the colour difference of a substrate.
- Paint or coating system: A product in liquid form, which when applied to a surface, forms a dry film having protective, decorative or other specific technical properties.

- Primer, prime coat: The first coat of a painting system that helps bind subsequent coats to the substrate and which may inhibit its deterioration.
- 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.

## 1.5 SUBMISSIONS

### Operation and maintenance manuals

Requirement: At completion, submit the manufacturer's published use, care and maintenance instructions.

### Products and materials

General: Submit the selected manufacturer's details at least 3 weeks before the coating is required, as follows:

- Coating brand name.
- Product data sheets.
- Safety data sheets (SDS) showing the health and safety precautions to be taken during application.

### Samples

General: Submit labelled samples of each coating system, on representative substrates, showing surface preparation, colour, gloss level, texture, and physical properties.

### Coated samples schedule

Substrate	Coating system	Colour/texture	Texture application	Sample size

### Subcontractors

General: Submit name and contact details of proposed specialist applicators.

Substrate acceptance: Submit the applicator's certification of the acceptability of the coating substrate before commencing installation.

### Warranties

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

## 1.6 INSPECTION

### Notice

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

- Completion of substrate preparation.
- After application of prime or seal coats.
- After application of undercoat.
- After application of each subsequent coat.

## 2 PRODUCTS

### 2.1 GENERAL

#### Delivery

General: Deliver coatings to the site in the manufacturer's labelled and unopened containers.

#### 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.

### 2.2 COATINGS

#### Standards

Coating types:

- Wall coatings - latex extensible: To AS/NZS 4548.1.
- Latex finish coatings – high-build, low profile: To AS/NZS 4548.2.
- Latex – textured coatings – non aggregate: To AS/NZS 4548.3.
- Latex – textured coatings – aggregate filled: To AS/NZS 4548.4.

**Combinations**

General: Do not combine coatings from different manufacturers in a coating system.

**Tinting**

General: Provide only products which are colour tinted by the manufacturer.

**Toxic ingredients**

General: To the *Poisons Standard - Schedule 1 (SUSMP)* Part 2 Section 7.

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**3 EXECUTION****3.1 PREPARATION****Standard**

General: To AS/NZS 2311 Section 3.

**Order of work**

Other trades: Before applying textured and membrane coatings, complete the work of other trades as far as practicable within the area to be coated.

**Protection**

Fixtures: Remove door furniture, switch plates, light fittings and other fixtures before starting coating, and refix in position undamaged on completion of the coating.

Adjacent surfaces: Protect adjacent finished surfaces liable to damage from coating operations.

**Substrates**

General: Prepare substrates to receive the coating systems.

Cleaning: Clean down the substrate surface. Do not cause undue damage to the substrate or damage to, or contamination of, the surroundings.

Filling: Fill cracks and holes with fillers, sealants or grouting cements as appropriate for the coating system and the substrate.

Moisture content: 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 coating and the substrate material.

**Wet paint warning**

General: Place notices conspicuously and do not remove them until the coating is dry.

**3.2 APPLICATION****Proprietary coating systems**

General: Apply the complete coating system to the manufacturer's technical data sheets.

**Standard**

Methods of application: To AS/NZS 2311 Section 6.

**Light levels**

General:  $\geq 400$  lux.

**Coating conditions**

General: Unless the coating system is recommended by the manufacturer for such conditions, do not apply under the following conditions:

- Dusty conditions.
- Relative humidity:  $> 85\%$ .
- Surface temperature:  $< 10^{\circ}\text{C}$  or  $> 35^{\circ}\text{C}$ .

**Coating application**

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.

**Spraying**

Coatings with known health hazards: Not permitted on site.

**Repair**

General: Clean off marks, coating spots and stains progressively and restore damaged surfaces to their original condition.

**3.3 COMPLETION****Cleaning**

General: On completion of coatings, remove splatters by washing, scraping or other methods which do not scratch or damage adjacent finished surfaces.

Reinstatement: Repair, replace or refinish any damage, including works of other trades. Touch up new damaged coatings or misses with the coating product batch used in the original application.

Fixtures: Refix removed and undamaged fixtures in their original location, make sure they are properly fitted and in proper working order.

**Disposal of products and waste materials**

Requirement: Conform to requirements of the local government authority.

**Warranties**

Requirement: Provide the coating manufacturer's warranty.

Interlocking performance warranty: Provide an interlocking performance warranty that includes materials and application:

- Form: Against failure of materials and execution under the normal environment and use conditions.
-

**0673 POWDER COATINGS****1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide powder coating systems to substrates, as documented.

**1.2 CROSS REFERENCES****General**

Requirement: Conform to the following:

- 0171 General requirements.

**1.3 STANDARDS****General**

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

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

**1.4 INTERPRETATION****Definitions**

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

- Powder coating: The process of preparing, applying, fusing and curing a thermoset powder coating material to a substrate:
  - . Thermoset powder coating: A mixture of finely ground particles of pigment and resin sprayed on to a prepared substrate. Charged powder particles adhere to electrically grounded surfaces until heated and fused into a smooth coating in a curing oven.
  - . Polyester powder coating: Uses an enhanced polyester resin.
  - . Fluoropolymer powder coating: Uses PTFE (poly tetra fluoro ethylene) for aluminium substrates.
- Substrate: The surface to which a material or product is applied.

**1.5 SUBMISSIONS****Products and materials**

Coating manufacturer: Submit the following details at least 3 weeks before fabrication:

- Recommended coating system for the nominated service condition.
- Brand name.
- Storage and handling recommendations.
- Product data sheets.
- Maintenance recommendations.

**Subcontractors**

Specialist applicators: Submit name and contact details of proposed specialist applicators as registered by the coating manufacturer.

**Warranties**

General: Submit the coating manufacturer's warranties, as documented.

**2 EXECUTION****2.1 PREPARATION****Substrate pre-treatment**

Powder coating to aluminium: To AS 3715 Appendix G.

Powder coating to metals, other than aluminium: To AS 4506 Appendix I.

**2.2 COMPLETION****Cleaning**

Aluminium architectural applications: Clean completed assembly to AS 3715 Appendix C.

Metal, other than aluminium, architectural applications: Clean completed assembly to AS 4506 Appendix D.

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**0802 HYDRAULIC DESIGN AND INSTALL****1 HYDRAULIC SYSTEMS****1.1 RESPONSIBILITIES****General**

Requirement: Provide the hydraulic services, as documented.

Summary: The hydraulic services are summarised as follows: Water feature installation

**1.2 DESIGN****Hydraulic constraints**

Constraints: Site and other constraints on this project are as follows: Connect into existing water and waste water systems.

**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 and as documented.

**Hydraulic system design**

General: Design and provide systems, as documented.

Requirement: Provide engineering design that:

- Maximises the functionality, performance, safety, flexibility and reliability of the hydraulic 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.

Authority submissions: Make submissions (including notices) to authorities relating to the works.

Designer qualification: Use only appropriately experienced and qualified persons to undertake design work. If requested, provide documents verifying the qualification and experience.

**Design life of the systems**

Requirement: To *0171 General requirements*.

**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 the **Noise level schedule** in *0171 General requirements*.

Acoustic treatment of hydraulic 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*.
- *042 Roofing* subgroup of worksections for roof plumbing.

**1.4 STANDARDS****General**

Plumbing and drainage: To AS/NZS 3500.0, AS/NZS 3500.1, AS/NZS 3500.2, AS/NZS 3500.3, AS/NZS 3500.4 and the PCA.

Copper pipe and fittings-installation and commissioning: To AS 4809.

Gas: To AS/NZS 5601.1.

Microbial control: To AS/NZS 3666.1, AS/NZS 3666.2 and the recommendations of SA/SNZ HB 32.

**Authorised products**

Authorised products: 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).

**1.5 INTERPRETATION****Abbreviations**

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

- LPG: Liquefied petroleum gas.

**Definitions**

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

- Hot-dip galvanized: Zinc coated to AS/NZS 4680 after fabrication with coating thickness and mass to AS/NZS 4680 Table 1.
- Network Utility Operator: The entity undertaking the piped distribution of drinking water or natural gas for supply or is the operator of a sewerage system or external stormwater drainage system.

**1.6 SUBMISSIONS****Authority approvals**

Authority submissions: Make submissions (including notices) to authorities relating to the works.

**Certification**

Requirement: Submit certification that the plant and equipment submitted meets the requirements and capacities of the contract documents except for departures that are identified in the submission.

**Operation and maintenance manuals**

Requirement: Submit recommendations for the operation, care, maintenance and replacement of gas appliances, storage tanks, valves, regulators and their associated fittings.

**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.

**Shop drawings**

Standard: To AS 1100.101, AS 1100.201, AS 1100.301, AS 1100.401 and AS/NZS 1100.501 as applicable.

Requirement: Submit detail drawings at minimum 1:100 scale, showing the following:

- Pipework and equipment layout and sections showing the work to be installed on the level that the services are installed. Do not submit glass floor drawings.
- Long sections of below ground drainage.
- Riser layouts and sections.
- Piping and other schematic drawings including numbering of each valve to correspond to valve tags notation.
- Inclusions: Include the following on the drawings:
  - . 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 a temporary fire hydrant service in the construction period.
  - . Provision of blue metal back fill to seepage drain system.
  - . Provision of erosion control measures.
  - . Provision of road barriers and lighting.
  - . Provision of site treatment and fire vehicle parking as required adjacent to the fire hydrant booster inlet valve station.
  - . 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.
- Fire services: Show the following additional details on the drawings:
  - . Fire hose reel and extinguisher layout.
  - . Fire hydrant site plan for the entire site.
  - . Fire fan control schematics and layouts.

## 1.7 INSPECTION

### Notice

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

- Excavated surfaces.
- Concealed or underground services.

## 1.8 INSTALLATION

### 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.

### Connections to Network Utility Operator mains

General: Excavate to locate and expose the connection points and connect to the Network Utility Operator mains. On completion, backfill and compact the excavation and reinstate surfaces and elements which have been disturbed such as roads, pavements, kerbs, footpaths and nature strips.

### Movement compensation

Compensation: Arrange piping and wiring crossing building expansion joints so that moment in the joint does not cause damage.

## 1.9 PIPING

### Finishes

Exposed piping: Finish exposed piping, including fittings and supports, as follows:

- In internal locations such as toilet and kitchen areas: Chrome plate copper piping to AS 1192 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.

## 2 SANITARY FIXTURES

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### 2.1 RESPONSIBILITIES

#### General

Requirement: Provide sanitary fixtures, as documented.

### 2.2 STANDARDS

#### General

Design for access and mobility: To AS 1428.1 and AS 1428.2.

### 3 TAPWARE

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#### 3.1 RESPONSIBILITIES

**General**

Requirement: Provide tapware, as documented.

#### 3.2 STANDARDS

**General**

Design for access and mobility: To AS 1428.1 and AS 1428.2.

#### 3.3 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: DN20 diameter brass finish hose tap.
- Riser: DN20 diameter copper riser with a back plated elbow.
- Heads: Provide anti-vandal heads where 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 or as documented.
- Install against a masonry or concrete wall. Fix the back plated elbow to the wall with 3, 20 mm brass screws, screwed into 20 mm 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 TANKS

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#### 4.1 RESPONSIBILITIES

**General**

Requirement: Provide tanks as documented.

#### 4.2 STANDARDS

**General**

Materials in contact with water for human consumption: To AS/NZS 3500.1 clause 2.3.

Metal tanks and rainwater goods: To AS/NZS 2179.1.

Design and installation: To the recommendations of SA HB 230.

### 4.3 SUBMISSIONS

#### Warranties

Manufacturer's warranty: Submit the tank manufacturer's warranty. Include a copy of the warranty in the operation and maintenance manual.

### 4.4 PRODUCTS

#### Accessibility

Interior: Arrange tanks so the interior is accessible for inspection and cleaning. Arrange internal features to permit effective cleaning.

#### Support

Requirement: Provide structural support to withstand the weight of the tank when full without deformation or excessive settling.

### 4.5 BLADDER TANKS

#### General

Type: Proprietary plastic bladder type.

Material: Reinforced polymer conforming to AS 2070, resistant to puncture and microbial attack.

### 4.6 METALLIC-COATED STEEL TANKS

#### Construction

Materials: Conform to the following:

- Top and sides: Metallic-coated steel with polymer film to AS 2070 on the inside and prepainted on the outside.
- Base: Metallic-coated steel with polymer film to AS 2070 on inside and outside.
- Plinth: Provide a plinth under the whole area of the tank.

### 4.7 POLYETHYLENE TANKS

#### General

Standard: To AS/NZS 4766.

### 4.8 ABOVE GROUND TANK INSTALLATION

#### General

Restraint: Restrain the tank to prevent movement, when empty, caused by wind and other loads.

Base: Provide a level base with gaps not exceeding 10 mm, free of sharp projections and projecting beyond the edge of the tank at all points.

#### Foundations

Requirement: Provide foundations for the tanks that are flat, level with irregularities less than 2 mm in any 1 m but no more than 6 mm in any 3 m, measured laterally or diagonally.

Intermittent supports: Continuous across the width of the tank and spaced to manufacturer's recommendations.

#### Polyethylene tanks

Support: Trim and compact the ground and place a level bed of sand at least 50 mm thick.

#### 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. Remove swarf with a magnet if drilling or cutting.

**Bladder tanks**

Support: Locate on level base free from sharp objects. Install with manufacturer's supporting frame.

Relief: Provide over-pressurising relief and air vent.

**4.9 COMPLETION****Cleaning**

Cleaning: Wash and flush tanks to remove manufacturing and other contaminants.

**5 STORMWATER – BUILDINGS****5.1 RESPONSIBILITIES****General**

Requirement: Provide stormwater installation, as documented.

**5.2 DESIGN****General**

Requirement: Design the roof drainage system, as documented, including sumps, rainwater outlets, overflow outlets and downpipes.

**Roof drainage system design, application and calculations**

Standards: Conform to the following:

- AS/NZS 3500.3.
- National Construction Code Series Volume 3: Plumbing Code of Australia (PCA).

Handbooks: Conform to the recommendations of:

- SA HB 39.
- SA HB 114.

Rainfall intensity for design:

- Eaves gutters: 1 in 20 years storm.
- Box gutters: 1 in 100 years storm.

**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.

### 5.3 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

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.

#### Pipe underlay (bedding)

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

General: 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 clause 7.9.

#### Thermal movement

General: Arrange piping to accommodate thermal expansion. Provide proprietary expansion joints in copper and plastic pipes where pipe flexibility does not allow movement. Make sure movement does not strain branch connections.

### 5.4 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.

### Pipe underlay (bedding)

General: Bed piping on a continuous underlay of bedding material, at least 75 mm thick after compaction. Lay the pipe with one line of perforations at the bottom.

Bedding thickness: Minimum 75 mm, maximum 150 mm, after compaction.

Chases: If necessary, 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.

Depth of overlay:

- To the underside of the bases of overlying structures such as pavements, slabs and channels.
- To within 150 mm of the finished surface of unpaved or landscaped areas.

### Geotextile

Requirement: Provide polymeric fabric formed from plastic yarn composed of at least 85% by weight propylene, ethylene amide or vinylidene chloride and containing stabilisers or inhibitors which provide resistance to deterioration due to ultraviolet light.

Marking: To AS 3705.

Protection: Provide heavy duty protective covering. Store clear of the ground and out of direct sunlight. During installation, do not expose the filter fabric to sunlight for more than 14 days.

### Filter socks

General: Provide permeable polyester socks, capable of retaining particles 0.25 mm and greater. Securely fit or join the sock at each joint.

## 5.5 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, as documented.

### Metal access covers and grates

Standard: To AS 3996.

Cover levels: Top of cover or grate, including frame:

- In paved areas: Flush with the paving surface.
- In landscaped areas: 25 mm above finished surface.
- Gratings taking surface water runoff: Locate to receive runoff without ponding.

## 5.6 TESTING

### Pre-completion tests

General: Before backfilling or concealing, carry out the following tests to AS/NZS 3500.3 Section 9:

- Downpipes within buildings: Air or water pressure test.
- Site stormwater drains and main internal drains: Air or water pressure test.
- Rising mains from pumped discharge: Water pressure test .

Leaks: If leaks are found, rectify and re-test.

## 5.7 COMPLETION

### Cleaning

General: Clean and flush the whole installation.

## 6 WASTEWATER

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### 6.1 RESPONSIBILITIES

#### General

Requirement: Provide sanitary plumbing and drainage, as documented.

### 6.2 PRODUCTS

#### Material selection

Environmental conditions: Provide materials capable of withstanding the operational environmental conditions. Select and install to manufacturers' recommendations.

Dissimilar materials: Connect dissimilar materials using adapters to Network Utility Operator requirements and manufacturer's recommendations.

Rubber banded sleeves: Do not provide.

### 6.3 FLOOR WASTES

#### General

Requirement: Provide each floor waste with a trap constructed of the material specified for the sanitary plumbing system. Fit off each riser with a chromium plated brass grating finished flush with the surrounding floor finish. If the floor surfaces are vinyl, provide gratings and outlets designed to permit the vinyl to be turned down into the outlet and the grating clamped down onto the surface.

Waterproofing: Make sure all penetrations through floors and finishes up to the edge of grates are fully waterproof.

Priming: Provide priming of floor wastes. If floor wastes cannot be primed via fixture, provide priming valves to maintain the water seal to AS/NZS 3500.2.

### 6.4 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 easily 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.

**Expansion joints**

Location: Provide expansion joints where pipes cross seismic or movement joints in the building, and from the building to below ground outside the building.

**Inspection openings**

Location: Provide inspection openings at each upstream end of branch and main drains, change of direction, entry to stacks and to AS/NZS 3500.2. 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 anti-slip 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 where 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, as documented. Connect tundishes to nearest waste or floor drain. Connect tundish waste to floor wastes, wastes or drains and provide traps and vents where necessary.

Charging: If tundishes are not provided with a constant discharge from equipment and are connected directly to the sanitary plumbing system or drainage system, provide a trap seal primer valve to ensure that the trap of the tundish is charged at all times.

**Vent pipes**

Requirement : Provide upstream and downstream vents to AS/NZS 3500.2.

Location: Locate vents at least 6 m from any air intake or grille and at least 3 m from exhaust discharges.

Staying to roof: If fixings for stays penetrate the roof covering, seal the penetrations and make watertight.

Terminations: Provide vent cowls of the same material as the vent pipe.

**Wet area floors**

General: Where drainage connections pass through wet area floors, terminate 4 mm below the substrate surface.

## 6.5 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.

Piping: As documented in the **Sanitary drainage piping schedule**.

## 6.6 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 light weight 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 **Differential movement** in *0171 General requirements*.

## 6.7 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, as documented.

### Metal access covers and grates

Standard: To AS 3996.

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.

## 6.8 TESTING

### Pre-completion tests

Requirement: Test to AS/NZS 3500.2 Section 15, before backfilling or concealing.

Leaks: If leaks are found, rectify and re-test.

## 6.9 COMPLETION

### Cleaning

General: On completion clean and flush the whole installation.

## 7 COLD AND HEATED WATER ---

### 7.1 RESPONSIBILITIES

#### General

Requirement: Provide cold water and heated water systems, as documented.

### 7.2 DESIGN

#### General

Requirement: Design the cold water and heated water systems, as documented.

## Design parameters

Standards: Conform to the following:

- AS/NZS 3500.1.
- National Construction Code Series Volume 3: Plumbing Code of Australia (PCA).
- Pressure and velocity: Design potable 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.

## 7.3 PRODUCTS

### Backflow prevention devices

Standard: To AS/NZS 2845.1 and AS 2845.2.

Pressure drop: Select for lowest pressure drop compatible with the required functions.

### Thermostatic mixing valves

Standard: To AS 4032.1.

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.

Installation: To the requirements of the Network Utility Operator.

## 7.4 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 clause 4.12.3 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.

## **7.5 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, AS/NZS 3500.1 and as documented.

### **Installation**

Location: Arrange to be readily accessible and easily removal.

External valve locations: Protect from damage and vandalism.

Arrangement: Provide each backflow prevention device with the following:

- Provide unions if  $\leq$  DN50, flanges for larger sizes.
- Isolating valves upstream and downstream of each backflow prevention devices.
- Dual check valves to AS/NZS 3500.1 clause 4.6.2.3.
- Line strainer upstream of the each backflow prevention device.
- Tundish and drain with connection to waste drain to AS/NZS 3500.1.

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.
- DN50 waste connection.

#### **Vacuum breaker valves**

Requirement: Provide vacuum breaker valves where required to prevent cross-connection of the cold water service.

### **7.6 PIPING INSULATION**

#### **General**

Requirement: Insulate the following:

- Non-chrome plated heated water piping, fittings and valves.
- Non-chrome plated cold water piping in spaces subject to condensation.
- Cold water piping subject to freezing.

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.

### **7.7 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 continuously printed with the words DANGER – BURIED POTABLE 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.

## 7.8 PLANTER IRRIGATION

### General

Location: Where documented, provide a DN20 hose tap within each planter area. Also provide a capped DN20 diameter point for future connection of irrigation system adjacent to each hose tap.

Backflow prevention: Provide backflow prevention devices to AS/NZS 3500.1.

## 7.9 TESTING

### Pre-completion tests

Pressure tests: Before insulation is applied to joints, pressure test piping to AS/NZS 3500.1 and AS/NZS 3500.4 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.

Tapware: Check for leaks.

### Completion test

General: Provide a full operational test to verify conformance.

## 7.10 COMPLETION

### Commissioning

Strainers: Remove, clean and replace strainer baskets.

Cleaning and disinfection: To AS/NZS 3500.1 Appendix I.

Cold water systems: Test and commission to AS/NZS 3500.1 Section 18.

Heated water systems: Test and commission to AS/NZS 3500.4 Section 9.

Testable backflow prevention devices: Test and commission to AS 2845.3 by a licensed plumber with backflow device accreditation. Tag and certify to the requirements of the Network Utility Operator.

### 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: To AS 4032.3.

## 8 GREYWATER SYSTEMS

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### 8.1 RESPONSIBILITIES

#### General

Requirement: Provide greywater systems and ancillaries, as documented.

### 8.2 STANDARDS

#### General

Requirement: To AS/NZS 3500.1.

Sanitary plumbing and sanitary drainage: To AS/NZS 3500.2.

Design and installation: To the recommendations of SA HB 326.

### 8.3 GREYWATER TREATMENT SYSTEMS

#### General

Type: Proprietary greywater treatment system consisting of pumps, filters, storage tanks, controls, disinfection devices and ancillaries.

Authorisation: Provide greywater treatment systems having statutory authorisation for the application.

Treatment performance: As documented.

#### Greywater treatment pumps

Function: To pass water through the greywater treatment processes.

Capacity: To pass the greywater treatment capacity against the maximum pressure drop of the filtration system.

Protection: If located outdoors, protect the pump and controls from weather as follows:

- Motors:  $\geq$  IP54.
- Controls and control panels:  $\geq$  IP44.

### 8.4 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 sewer.

#### Backflow prevention

Standard: To AS/NZS 3500.1 and the requirements of the Network Utility Operator.

### 8.5 BACKFLOW PREVENTION

#### General

Location: Provide backflow prevention devices to AS/NZS 3500.1.

Standard: To AS/NZS 2845.1.

### 8.6 MARKING

#### General

Standards: To AS 1319, AS 1345 and the AS/NZS 3500 series.

#### Safety signs

Location: Provide safety signs where greywater is being used. As a minimum provide the following:

- Internally: At each fixture connected to the greywater system.
- Externally: At each hose cocks. Provide colour coded (purple) hose cocks.
- Irrigation systems: In each area irrigated with greywater.

#### Greywater piping

Above ground piping: Provide continuous purple colour and text, either integral with the pipe material or applied sleeve: WARNING RECYCLED / RECLAIMED WATER – NOT FIT FOR DRINKING.

Below ground piping: Provide continuous purple identification tape above the pipe marked: WARNING RECYCLED / RECLAIMED WATER – NOT FIT FOR DRINKING.

## 8.7 COMMISSIONING

### General

Cleaning: Flush the greywater system. Wash and flush tanks to remove manufacturing and other contaminants.

## 8.8 WATER SUPPLY

### General

Supply: Provide water supply as documented.

Blackflow prevention: Provide backflow prevention to AS/NZS 3500.1 Section 4.

## 8.9 INSTALLATION

### Fire hose reels

Standard: To AS 2441.

Protection from damage: To AS 2441.

Below-ground resilient sated isolating valve: To AS/NZS 2638.2.

## 8.10 COMMISSIONING

### General

Procedure: To AS 2441 clause 12.

Results: Submit commissioning and testing results.

### Baseline data

Requirement: Provide baseline data to AS 1851.

## 9 HYDRAULIC MAINTENANCE

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### 9.1 RESPONSIBILITIES

#### General

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: As documented.

### 9.2 MAINTENANCE

#### Cold and heated water

Maintenance of tanks and piping for potable water: To AS/NZS 3500.1 and AS/NZS 3500.4.

Ball float valves: Check and adjust for no overflow.

Heated water systems:

- Conform to the recommendations of AS/NZS 3500.4 Appendix M.
- Inspection and maintenance: To AS/NZS 3666.2.
- 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 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 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.

#### **Greywater systems**

Requirement: Provide annual maintenance to SA HB 326 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.

Backflow prevention devices: To statutory requirements.

#### **Hydrants and hose reels**

Hydrants: To AS 1851.

Hose reels: To AS 1851.

Pumpset systems: To AS 1851.

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**0902 ELECTRICAL DESIGN AND INSTALL****1 ELECTRICAL SYSTEMS****1.1 RESPONSIBILITIES****General**

Requirement: Provide the electrical services, as documented.

Summary: The electrical services are summarised as follows: Water feature; power and data for future signage.

**1.2 DESIGN****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*.

**Electrical system design**

Fault protection: Automatic disconnection to AS/NZS 3000 clause 2.4.

Fire-resisting protection: Provide for switchboards and associated electrical conductors to BCA C2.13.

Maximum demand: Calculation method to AS/NZS 3000 Appendix C.

**1.3 CROSS REFERENCES****General**

Requirement: Conform to the following:

- *0171 General requirements*.

**1.4 STANDARDS****Electrical services**

Requirement: To AS/NZS 3000, unless otherwise documented.

**Electrical installations**

Electrical design: To AS/NZS 3000 and SA HB 301.

Selection of cables: To AS/NZS 3008.1.1.

Degrees of protection (IP code): To AS 60529.

Electromagnetic compatibility (EMC): To AS/NZS 61000.

Communications systems: To AS/CA S008, AS/CA S009, AS/NZS 3080 and AS/NZS ISO/IEC 14763.2.

**1.5 CONTRACT DOCUMENTS****General**

Requirement: Conform to *0171 General requirements*.

## 1.6 SUBMISSIONS

### General

Requirement: Conform to *0171 General requirements*.

### Certification

General: Submit the following:

- Certification of conformance with AS/NZS 3000, for electrical services.
- Telecommunications cabling: Submit product and installation certification for the installation.

### Samples

Lighting: Submit samples of all luminaires and accessories complete with lamp, control gear and three core flex and plug.

### Samples

Emergency evacuation lighting: Submit samples of all luminaires and exit signs.

### Shop drawings

Lighting: Submit shop drawings for the following:

- Lighting columns.
- Lighting column mounting bases.
- Non-proprietary luminaires.
- Non-standard fixing brackets.

### Shop drawings

Telecommunications cabling: Submit shop drawings for the following:

- Layouts of equipment racks.
- Cross-connect layout.
- Cabling diagram for complete system.
- Cable management system.

### 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.

Type test: Submit photometric test results from an Accredited Testing Laboratory as evidence of luminous efficacy for the applicable CCT for the following:

- Light-emitting diode luminaires.
- Light-emitting diode lamp replacement modules.

Telecommunications cabling: Submit technical data including the following:

- System design parameters: Performance.
- Voice and/or data transfer rate.
- Cable type and characteristics.
- Segregation requirements for EMI/EMR.
- Maximum length of cables.
- Cross-connect type and characteristics.
- Cross-connect block.
- Patch cords.
- Fibre optic terminations.
- Patch panel module.
- Cable management for racks.
- Rack.
- Fly leads.

Emergency evacuation lighting: Submit technical data for each type of luminaire and exit sign including the following:

- Maximum luminaire spacing for a given mounting height.
- Luminaire classification to AS/NZS 2293.3.
- Central battery and charger performance test reports, including discharge and charging characteristics.

Type tests: Submit type test data.

## 1.7 INSPECTION

### General

Requirement: Conform to *0171 General requirements*.

## 1.8 WORK ON EXISTING SYSTEMS

### Demolition

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 where necessary to allow removal.

Recovered materials: Recover all components associated with the listed items. 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, submit 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.

## 2 LOW VOLTAGE POWER SYSTEMS

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### 2.1 RESPONSIBILITIES

#### General

Requirement: Provide low voltage power systems, as documented.

### 2.2 PERFORMANCE

#### Network supply

General: Liaise with the electricity distributor and provide network connection, as documented.

Program: Schedule the works and statutory inspections to suit the construction program.

Prospective fault current: Determine, from the electricity distributor, the prospective fault current and fault protection requirements.

Supply system: 400 V, 3-phase, 4-wire, 50 Hz, multiple earth neutral (MEN) system.

#### Distribution system

General: Provide power distribution system elements, as documented.

### 2.3 SURGE PROTECTION DEVICES (SPD)

#### General

Requirement: Provide all mode metal oxide varistor based series connected SPD to protect equipment in racks and cabinets, as documented.

Standard: To AS 4262.1 and AS 4262.2.

Surge rating ( $I_{max}$ ):  $\geq 20$  kA (8/20  $\mu$ s) phase to neutral and 10 kA neutral to earth.

Voltage protection level ( $U_p$ ):

- < 600 V at 3 kA.
- 700 V at 500 A.

Visual indicator: Provide visual indication of SPD status.

Enclosure and installation: House SPD in an electrical switchboard or panel and protect with a suitable rated circuit breaker equal to or less than the load current rating of the SPD.

### 2.4 SITE ELECTRICITY SUPPLY

#### General

Responsibilities: Provide site electricity supplies, as documented. 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 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, as documented.

**Metering**

Retail: To the requirements of the electricity retailer and the electricity distributor.

Private: As documented.

Photovoltaic metering: As documented.

**2.5 WIRING SYSTEMS****General**

Requirement: Provide 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.

**2.6 POWER CABLES****Standards**

Polymeric insulated cables: To AS/NZS 5000.1.

Aerial cables:

- Copper conductors: To AS 1746.
- Aluminium conductors: To AS 3607 or AS 1531.

**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<sup>2</sup>.
- Power subcircuits: 2.5 mm<sup>2</sup>.
- Submains: 6 mm<sup>2</sup>.

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.

Distribution cables: To AS/NZS 4961.

## 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.

Sheath: White.

## Cable installation

Classifications: To AS/NZS 3013.

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 sub-circuits

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 of diameter greater than 13 mm: Install unenclosed single core cables laid on cable tray or support systems in trefoil (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 Table 27, for an assumed ambient temperature of 55°C.
- Accessible ceiling voids: Support and enclose cables on ceiling surfaces or ceiling suspension systems.
- Plastered or rendered masonry: Install cable in PVC-U conduit.
- Double sided face brick partition: Install cable in PVC-U conduit installed within the brick wall by slotting bricks or using any pathways provided in the brick.
- Stud framed walls with bulk insulation: Install cables in PVC-U conduit.

- Stud framed walls without bulk insulation: Thermoplastic insulated and sheathed cables allowing rewirability.
- Horizontal cable trays or ladders: Fix cables using proprietary nylon cable ties or straps, cable saddles or clips at 2000 mm intervals.
- Vertical cable risers: Fix cables using proprietary nylon cable ties or straps, cable saddles or clips at 1000 mm intervals.
- Plant rooms: Install cable in heavy duty PVC-U conduit or on tray or in duct.

## 2.7 EARTHING

### Earthing systems

Protective earthing system with a multiple earth neutral (MEN) connection: To AS/NZS 3000 Section 5 and as documented.

### Earth electrodes

General: Provide electrodes to AS/NZS 3000 clause 5.3.6.

### Bonding

General: Provide equipotential bonding to AS/NZS 3000 clause 5.6.

### Earth and bonding clamps

General: Provide proprietary earthing and bonding clamps.

Standard: To AS 1882.

## 2.8 ELECTRICAL ACCESSORIES

### General

Style: Provide accessories of the same style and from the same manufacturer, as documented.

### Socket outlets - generally

Standards:

- General: To AS/NZS 3112.
- Industrial: To AS/NZS 3123.

Socket outlet properties: Provide sockets conforming to the following or as documented:

- 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.
- Patient treatment areas: 10 mA Type I to AS/NZS 3190, as documented.

**Multi-switch socket outlets on grid mounted panels**

Type: Separate switch and socket outlets grid mounted on propriety or custom designed panels.

Material: As documented.

Colour: As documented.

Panel finishes: As documented.

**Plugs – 230 volt**

Requirement: Insulated type to AS/NZS 3112 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, as documented.

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/NZS 3133.

**Emergency stop switches**

Standard: To AS/NZS IEC 60947.5.5.

Type: Mushroom head with latch and twist releaser.

**3-phase outlets**

Standard: To AS/NZS 3123.

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:  $\geq 75$  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 face plates: Mount adjacent flush mounted accessories under a common faceplate.

Restricted location: Do not install wall boxes across junctions of wall finishes.

Surface mounting: Proprietary mounting blocks.

### **Installation of ceiling mounted accessories**

Connections for appliances: Flush mounted outlets on the ceiling next to support brackets.

Mounting: Mount appliances independent of ceiling tiles and suspended ceiling suspension system. Fix directly to concrete slab or to roof structure above ceiling.

Connections for fixed equipment: Provide concealed permanent connections.

Fixing: For equipment and appliances heavier than 30 kg, provide support through the suspended ceiling to the building structure. Brace appliances that have excessive bending moments, are heavy or vibrate, to prevent horizontal movement.

### 3 POWER GENERATION – PHOTOVOLTAIC

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#### 3.1 RESPONSIBILITIES

##### General

Requirement: Provide photovoltaic generating system(s), as documented.

##### System components

Requirement: Incorporate the following:

- Photovoltaic array.
- Regulator.
- Battery system.
- Inverter.
- Connection to low voltage power system.

#### 3.2 STANDARDS

##### General

Requirement: For the purpose of this worksection, the following standards relating to stand-alone systems are also applicable to network connected systems:

- Stand-alone power systems: To AS/NZS 4509.1 and AS/NZS 4509.2.
- Grid connected systems: To AS/NZS 4777.1 and AS/NZS 4777.2.
- IEC 61836.

#### 3.3 PHOTOVOLTAIC MODULE

##### General

Selection: To AS/NZS 4509.2, AS/NZS 5033 and as documented.

##### Array

Encapsulation: Required.

Toughened glass: Required.

Protection rating:  $\geq$  IPX6.

Integral bypass diode protection: Required.

##### Cells

Type: Crystalline.

Standard: To IEC 61215-1-1.

Efficiency:  $\geq$  12%.

#### 3.4 REGULATOR

##### General

Selection: To AS/NZS 4509.2 and as documented.

Function: Charge cycle control including:

- Low battery voltage disconnect.
- Pulse width modulation.
- $\geq$  3 step series regulation.

Display: LCD display of:

- Battery voltage.

- Charge current.
- Ampere hours in and out.
- Load current.

Alarms: Visible and audible low and high battery voltage alarms.

Transient protection: Required.

### 3.5 BATTERY SYSTEM

#### General

Selection: To meet the documented performance.

Blocking diodes: Required.

Service life:  $\geq 10$  years.

#### Standards

General: To AS 2676 and AS 4086.1.

### 3.6 INVERTER

#### General

Selection: To meet the documented performance.

Waveform: True Sine wave.

Waveform quality: To AS/NZS 4777 series.

Voltage regulation:  $\pm 8\%$ .

Harmonic distortion of output current:  $< 4\%$ .

Frequency regulation:  $\pm 1\%$ .

Efficiency:  $\geq 90\%$  at 10% load.

Protection: Overload, short circuit and transient required.

Automatic no-load shutdown: Required.

Display:

- Output power.
- Grid stability.

#### Standards

General: To AS/NZS 4777.2.

#### Synchronisation

Requirement: Self commutation modules which automatically synchronise the inverter supply frequency and phase angle to the low voltage network or other embedded generator system.

### 3.7 CONTROL SYSTEM

#### Control panel

General: Provide photovoltaic system control panels, switchgear and controlgear assemblies as documented.

### 3.8 PHOTOVOLTAIC METERING

#### General

Requirement: Provide photovoltaic metering equipment to meter the energy that is exported back to the grid to the requirements of the electricity distributor.

## 4 SWITCHBOARDS – PROPRIETARY

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### 4.1 RESPONSIBILITIES

#### General

Requirement: Provide proprietary switchboards, as documented.

### 4.2 STANDARDS

#### General

Standards: To AS/NZS 3000, and AS/NZS 3439.3 or AS/NZS 61439.3.

### 4.3 PRODUCTS

#### Switchboard connectors

Type: Front connected.

#### Enclosure

Default material: Metallic-coated sheet steel.

#### Separation

Default: Form 1.

#### Metering

Retail: To the requirements of the electricity retailer and the electricity distributor.

Private: As documented.

Photovoltaic metering: As documented.

#### Main switchboard main switches

Spare capacity: Provide at least 25% spare capacity in the ratings main switch/isolators.

#### Busbars

General: Incorporate proprietary insulated busbar systems for the interconnection of isolators, circuit breakers and other circuit protective devices.

Busbar fault rating: Rated to meet the prospective fault current for 1 second or a minimum rating of  $\geq 18\text{kA/second}$ , whichever is the greater.

#### Spare capacity

Default spare poles:  $\geq 20\%$ .

Main switchboard incoming busbar:  $\geq 25\%$ .

#### Earthing

General: Make provision for the connection of the communications earth terminal (CET) at switchboard earth bar to AS/CA S009.

#### Doors

General: Provide lockable doors with a circuit card holder unless enclosed in cupboards or in an area which is not readily accessible to the public.

**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:  $\leq 2 \text{ m}^2$ .
- Floor mounted:  $> 2 \text{ m}^2$ .

**Ventilation**

General: Required to maintain design operating temperatures at full load.

**Cable entries**

General: Neatly adapt one or more cable entry plates, if fitted, to accept incoming cable enclosure. Provide the minimum number of entry plates to leave spare capacity for future cable entries. Do not run cables into the top of weatherproof assemblies.

Single core cables: Pass separately through non-ferrous gland plates. Do not provide ferrous metal saddles.

**Cable enclosures**

Requirement: Continue cable enclosures to or into assemblies and fit cable entry plates so that the IP rating of the assembly and the fire-resistance level of the cable are maintained.

**Cable supports**

Requirement: Support or tie mains and submains cables within 200 mm of terminations. Provide cable supports suitable for stresses resulting from short circuit conditions.

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**5 SWITCHBOARD COMPONENTS**

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**5.1 RESPONSIBILITIES****General**

Requirement: Provide switchboard components, as documented.

**5.2 DESIGN****Statutory authority's equipment**

General: Liaise with the electricity distributor about the installation and coordinate with their protective and control equipment.

**5.3 REQUIREMENTS****General**

Selection: To AS/NZS 3000 clause 1.7 and Section 2.

Rated duty: Uninterrupted.

Rated making capacity (peak):  $\geq 2.1 \times$  fault level (r.m.s.) at assembly incoming terminals.

Utilization category: To AS/NZS IEC 60947.1 clause 4.4 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.

#### **5.4 SWITCH-ISOLATOR AND COMBINATION FUSE-SWITCH UNITS**

##### **General**

Standard: To AS/NZS IEC 60947.1 and AS 60947.3.

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 Table 3.

Rated short-time withstand current: As defined in AS/NZS IEC 60947.1 clause 4.3.6.1 and the manufacturer's recommendation for the prospective fault current conditions.

Rated short-circuit making capacity: As defined in AS/NZS IEC 60947.1 clause 4.3.6.2, to conform to the manufacturer's recommendation for the prospective fault current conditions.

Rated short-circuit breaking capacity: To AS/NZS IEC 60947.1 clause 4.3.6.3 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 IEC 60947.1 clause 4.3.5 to conform to AS 60947.3 Table 3 and the manufacturer's recommendations for the prospective fault current conditions.

Rated short-time withstand current: As defined in AS/NZS IEC 60947.1 clause 4.3.5, to conform to the manufacturer's recommendation for the current conditions.

#### **5.5 OVERLOAD AND FAULT PROTECTION GENERALLY**

##### **General**

Requirement: Provide overload and fault protection devices, including full discrimination and cascade protection, and grade with the electricity distributor's incoming supply protection system and the downstream site protection devices.

#### **5.6 FUSE SWITCH UNITS**

##### **Fuse links**

Requirement: Isolate when switch contacts are open. Provide 3 phase sets of high rupturing capacity (HRC) fuse links.

#### **5.7 MOULDED CASE AND MINIATURE CIRCUIT BREAKERS**

##### **General**

Moulded case breakers: To AS/NZS IEC 60947.1 and AS/NZS IEC 60947.2.

Miniature circuit breakers: Interrupting capacity classification to AS/NZS 60898.1 or AS/NZS 3111.

- 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.

Trip settings: Set as documented, seal, and label.

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.

## 5.8 ELECTRICITY DISTRIBUTOR'S SERVICE PROTECTIVE DEVICES

### General

Low voltage service protective devices: To AS/NZS 3000, 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.

## 5.9 RESIDUAL CURRENT OPERATED CIRCUIT BREAKERS (RCBO)

### General

Standard: To AS/NZS 3190.

Integral non-overload protection type: To AS/NZS 61008.1.

Integral overload protection type: To AS/NZS 61009.1.

Modular type: To AS/NZS IEC 60947.2.

- Type I for patient treatment areas.
  - . Default tripping current: 10 mA.
  - . Switched neutral: Required.
- Type II.
  - . Default tripping current: 30 mA.

## 5.10 FUSES WITH ENCLOSED FUSE LINKS

### General

Standards: To IEC 60269-1 and IEC 60269-2.

Fuses with fuse links for the protection of semiconductor devices: To IEC 60269-4.

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 utilisation category:

- Distribution/general purpose: gG.
- Motors: gM.

Fuse holders: Mount fuse holders so that fuse carriers may be withdrawn directly towards the operator and away from live parts. Provide fixed insulation which shrouds live metal when the fuse carrier is withdrawn.

Barriers: Provide barriers on both sides of each fuse link, preventing inadvertent electrical contact between phases by the insertion of screwdriver.

Spare fuse links: Provide 3 spare fuse links for each rating of fuse link on each assembly. Mount spares on clips within the spares cabinet.

Spare fuse holder carriers: Provide 3 spare fuse holder carriers for each size of fuse holder carrier on each assembly. Mount spares on clips within the spares cabinet.

Busbar mounted fuse holders: Provide fuse carriers with retaining clips, minimum fuse holder 32 A.

## 5.11 CONTACTORS

### General

Standard: To AS/NZS IEC 60947.4.1.

Type: Enclosed, block type, air break, electromagnetic.

Poles: 3.

Rated operational current: The greater of:

- Full load current of the load controlled.
- $\geq 16$  A.

Mechanical durability: 10 million cycles to AS/NZS IEC 60947.4.1.

Electric durability:  $\geq 1$  million operations at AC-22 to AS/NZS IEC 60947.4.1.

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., utilisation category AC-1.

Slave relay: If the number of auxiliary contacts exceeds the number which can be accommodated, provide separate slave relays.

## 6 LIGHTING

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### 6.1 RESPONSIBILITIES

#### General

Requirement: Provide lighting and control systems, as documented.

## 6.2 STANDARDS

### General

Energy efficiency for ballasts and lamps: To AS/NZS 4783.2.

### Minimum energy performance standards (MEPS)

General: To AS/NZS 4782.2, AS/NZS 4783.2, AS 4934.2.

Self-ballasted lamps: To AS/NZS 4847.2.

## 6.3 PROPRIETARY LUMINAIRES

### General

Requirement: Provide proprietary luminaires complete with lamps, luminaire control equipment, lighting control equipment, and accessories as documented. Provide lamps of the same type from the same brand and country of manufacture.

Self-ballasted lamps: To AS/NZS 60968 and AS/NZS 60969.

## 6.4 FLUORESCENT LAMPS

### Standards

Fluorescent lamps: To AS/NZS 4782.1 and AS/NZS 4782.2.

Compact fluorescent lamps: To AS/NZS 4847.1 and AS/NZS 4847.2.

Single capped fluorescent lamps: To AS/NZS 60901.

### Properties

CCT: 4000 K.

Colour rendering: Group 1B to AS/NZS 1680.1.

Linear and circular lamp type: T8 (26 mm diameter) or T5 (16 mm diameter), linear lamps, triphosphor, TL84, as documented.

Compact fluorescent lamps 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 and AS/NZS 60929.
- 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.

### 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: To AS/NZS 61347.2.3 and AS/NZS 60929.

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.

### **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 DIODES (LEDS) LUMINAIRES**

### **General**

Requirement: Provide light emitting diode (LED) luminaires, as documented.

### **Light-emitting diode**

Colour: CRI > 80.

CCT: 3000K.

## **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:  $\geq 1.5$  m.
- Cross sectional area:  $0.75 \text{ mm}^2$ .
- Type: 3-core V75 (minimum) PVC/PVC, connected to a 10 A 3-pin moulded plug to AS/NZS 3112 or multi-pin plug, as documented.

## **6.9 LIGHTING CONTROL**

### **General**

Requirement: Provide the following as documented:

- Lighting switches.
- Dimmers.
- Automatic control systems.

### **Digital control system**

General: Provide a proprietary, microprocessor-based system to control lighting under automatic and user interface control, as documented.

## 6.10 SUPPORTS

### General

Requirement: Install luminaires on proprietary supports by means of battens, trims, 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:  $\pm 3$  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.

## 6.11 COMPLETION

### General

Requirement: Before the date of practical completion carry out the following:

- Verify the operation of all luminaires.
- Adjust aiming and controls for all luminaires under night time conditions.
- Replace lamps which have been in service for a period greater than 50% of the lamp life as published by the lamp manufacturer.

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## 7 TELECOMMUNICATIONS CABLING

### 7.1 RESPONSIBILITIES

#### General

Requirement: Provide a passive telecommunications cabling network system as documented and as follows:

- Network connection.
- Campus distributor.
- Campus cabling.
- Building distributor.
- Backbone cabling.
- Floor distributors.
- Consolidation points.
- Telecommunications outlets.
- Patching.

**System performance**

Application class: To AS/NZS 3080 clause 6.3 Class E.

Balanced system: To AS/NZS 3080 clause 7 (data/voice) Category 6.

Fibre system class: To AS/NZS 3080 clause 8.

System warranty: 15 years minimum.

**Surge protection devices (SPD)**

General: Provide surge protection devices to protect equipment in racks and cabinets to LOW VOLTAGE SYSTEMS, **SURGE PROTECTION DEVICES**.

**7.2 STANDARDS****General**

Authorities: To the requirements of the Australian Communications and Media Authority (ACMA).

Cabling products: To AS/CA S008 and AS/NZS 3080.

Installation of cabling: To AS/CA S009, AS/NZS 3080, AS/NZS 3084, SA/SNZ HB 252 and AS/NZS ISO/IEC 14763.2.

Installation of small office/home office cabling: To AS/CA S009, AS/NZS ISO/IEC 15018 and AS/NZS ISO/IEC 14763.2.

Cable management and documentation: To AS/NZS 3085.1.

Electromagnetic compatibility (EMC): To AS/NZS 3080.

**7.3 NETWORK CONNECTION****External network**

Requirement: Liaise with each external communications carrier and determine the services and site access requirements for the network connection.

**7.4 BUILDING ENTRANCE FACILITIES****Campus distributor (CD)**

Standard: To AS/NZS 3080.

**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.

**7.5 DISTRIBUTORS****General**

Requirement: Provide the Building Distributors (BD) and Floor Distributors (FD) for voice and data to AS/NZS 3080 and as documented for the termination of campus and building backbone cable systems and the horizontal cable distribution systems.

Equipment requirements: Provide cable termination racks, patch panels, equipment mounting racks for servers and routers complete with power outlets as documented.

**Copper cable termination distributors**

General: Provide insulation displacement termination frames for the termination of copper backbone and horizontal cable services.

Certification: Provide vendor certification (including the warranty period) for the integrated voice/data copper cabling systems.

**Equipment racks**

Dimension and type: Conform to the following:

- Equipment racks: 19 inch wide industrial type, or 600 mm or 800 mm wide RUs:
  - . ≤ 18 RU: Wall mounted, 600 mm depth.
  - . > 18 RU: Floor mounted, 800 mm or 1000 mm depth.
- Patch panels – Copper CAT 6 cables: 800 mm wide and 800 mm deep.
- Patch panels – Optical fibre cables: 800 mm wide and 800 mm deep.
- Server racks: 600 mm wide and 1000 mm deep.

Access location: Front, sides or rear.

Cable tray: Locate within outer cabinet void.

Doors: Provide transparent safety glass, lockable doors.

Power provision: Minimum 1 socket outlet for every 3 rack units on vertical rail.

Cable management: Provide as follows:

- 1 module for every 2 patch panels.
- 1 module for each fibre termination panel.
- Location: Vertically, on both sides of the panel.

Provisions for active equipment: 25% minimum, 1 fixed shelf for every 4RU 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 as documented.

Terminations: Terminate directly to the modular connector.

Fixed terminations:

- Rear terminals: Connect to 45° IDC punch down type.
- Front terminals: Connect to RJ45 modular connector.

Patch cords: Terminate cord ends with appropriate registered jacks.

**Optical fibre termination panels**

Requirement: Provide rack mounted termination frames for the termination of optical fibre backbone and horizontal cable services.

Certification: Provide vendor certification, including the warranty period, for the optical fibre cabling systems.

Break out trays: Provide fibre optic cable break out trays at each group of fibre optic cable terminations.

Loom cables: Neatly loom cables and lay stripped cables into the break out tray.

Secure cables: Make sure that cables are secured by the sheath and that there is no stress on the fibre optic cores.

#### **Cross connect patch panels (optical fibre cables)**

Requirement: Provide optical fibre cross connect patch panels as documented for both single and multicore optical fibre cables.

#### **Cable management**

Record book: Provide a record book at each cross-connect.

Location: Secure log books in each distribution frame records holder.

Identification, labelling, and record documentation: To AS/NZS 3085.1.

### **7.6 CABLES**

#### **Copper**

Standard: To AS/CA S008, AS/CA S009, AS/NZS 3080 and AS/NZS ISO/IEC 14763.2.

Campus and building voice backbone cables: Multicore CAT 3 UTP cable as documented or to suit the voice outlet density at each building or floor distributor, with 30% spare capacity allowance.

Horizontal cabling voice and data: CAT 6 UTP cabling to each floor outlet.

Balanced system cables: UTP.

Cable end length: Provide a 5 m cable loop at each end of the cable.

#### **Optical fibre**

Standard: To IEC 60793-2-10.

Campus and building backbone cables:

- Default multimode type: 6 core multi-mode OM3 50/125 µm.
- Default single mode type: single core 9/125 µm.

Length: Provide not less than 1000 mm spare at each end.

Component type: SC.

Safe practices: To AS/NZS 2967.

#### **External**

Standard: Water penetration resistance to IEC 60794-1-2.

### **7.7 TELECOMMUNICATIONS OUTLETS**

#### **General**

Outlets: Provide RJ45 8 way modular jacks, mounted on 6-way faceplate. Provide for up to three modular voice or data outlets on the each faceplate with three spaces for identification inserts.

Pinouts: T568A to AS/NZS 3080.

## 7.8 FLY LEADS

### General

Type: Stranded.

Length: 1200 mm.

Quantity: Provide fly leads to 50% of outlets installed.

## 7.9 PATCH CORDS

### General

Type: Stranded.

Length: 900 mm.

Quantity: 100% of outlets installed.

Termination: Registered jacks.

## 7.10 WIRELESS ACCESS POINT (WAP)

### General

Requirement: Provide WAPs as documented, cabled to patch panels in the nearest FD.

Compatibility: ISO/IEC 8802-11 and IEEE 802.11.

LAN port: 100 Mbps.

Modes: Wireless access point, point-to-point bridge, point-to-multi-point wireless bridge, wireless client and wireless repeater.

Power over ethernet: Required.

Location: Install in ceiling voids distributed around the site buildings and determine the number and location by a site survey using the wireless network to confirm full site coverage.

## 7.11 ENGINEERING SERVICES

### General

Requirement: Provide cabling systems, as documented.

## 7.12 CABLE INSTALLATION

### Installation

Requirement: To the manufacturers' recommendations.

Crossover: Install cables neatly and without crossovers between cables.

Loom size: Loom cables into groups not exceeding 50 cables, and hold looms in place using reusable cable ties at least 20 mm wide. Do not exert compressive force on the cables when installing cable straps.

### Cable separation

Separation for safety: To AS/CA S009, and by at least 150 mm.

Fluorescent luminaires: Maintain a clearance of more than 300 mm.

### External cables

Requirement: To ACIF C524.

### 7.13 TELECOMMUNICATIONS OUTLET INSTALLATION

#### Installation

Mounting: Flush mount.

Flushplate layout: Provide 6-way standard flushplate capable of accepting the installation of three individual modular sockets along the top horizontal axis and three identification inserts on the bottom horizontal axis. Unused socket positions to be filled with blank inserts. Arrange the modular sockets with the locking latch in the bottom position, i.e. pins at the top.

Horizontal cabling termination: Terminate Category 6 cabling to the rear of the outlet modular jack with insulation displacement connections forming a gas tight joint. Arrange cable pairs at each jack conforming to AS/NZS 3080 Fig 15.

### 7.14 EARTHING SYSTEM

#### General

Standard: To AS/CA S009 Section 20.

#### Communication earth system (CES)

Requirement: Provide a communications earth terminal (CET) adjacent to each electrical switchboard. Connect the CET to the local protective earth (PE) system at the switchboard.

Distributor: Provide an earth bar within each distributor and connect to the local CET.

Interconnections: Verify that there are no interconnections between the lightning protective earthing system and the telecommunications earthing system.

### 7.15 COMPLETION

#### Cable management

General: Before the date for practical completion, submit log books for each distribution frame with details of cable terminations and provisions for recording cable, line and jumper information.

## 8 TELEVISION DISTRIBUTION SYSTEMS ---

### 8.1 RESPONSIBILITIES

#### General

Requirement: Provide a system suitable for the reception and distribution of analog and digital television, video, radio and sound signals, as documented.

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 SYSTEM DESCRIPTION

#### System type

Type: As documented.

#### Performance requirements

General: To AS/NZS 1367.

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 as documented.

Local signal source: Provide television input sockets at the premises cabling head-end 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, head end equipment and distribution systems.

Location: As documented.

**Head end equipment**

General: Provide head end equipment to suit signal sources, distribution systems and documented performance.

Location: As documented.

**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**.

**Distribution system**

General: Provide a cabling distribution network from the head end 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 documented.

**Outlets**

General: Provide outlets and feeders from distribution tap(s) as documented.

Quantity: Provide separate sockets for each source and service.

**8.3 STANDARDS****General**

Electromagnetic compatibility: To AS/NZS 1367.

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## 9 ELECTRONIC SECURITY AND ACCESS CONTROL

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### 9.1 RESPONSIBILITIES

#### General

Requirement: Provide electronic security systems, as documented.

#### System components

Requirement: Provide the following components:

- Remote monitoring system.
- Access control system.
- Intruder detection system.
- Closed circuit television system.
- Intercom system.

Security classification: As documented.

System communications: As documented.

### 9.2 STANDARDS

#### Intruder alarm systems

General: To AS/NZS 2201.1.

Alarm transmission system: To AS/NZS 2201.5.

Internal detection devices: To AS 2201.3.

Wireless systems: To AS 2201.4.

#### CCTV systems

General: To AS 4806.2.

Remote monitored systems: To AS 4806.4.

### 9.3 SECURITY SYSTEMS

#### Alarm system panels or processors

Capacity: Provide separate sectors for each nominated internal zone, and for normally-closed and normally-open perimeter zones.

Sector time delay: Provide adjustable time delay entry/exit for each sector, with adjustment range 0 to 30 s.

Batteries and chargers:

- Sealed battery: Provide a sealed battery and charger system contained within each control panel with capacity as documented.

#### Uninterruptible power supply

General: Provide a dedicated uninterruptible power supply and connect to the security systems.

Capacity: At least 15 minutes, for the complete system in normal operation.

#### Activation devices

Activation devices: Provide keypads, cards, card readers and other activation devices for access control and intruder alarm systems as documented.

External: Provide weatherproof (IP56) hoods or housings for external units.

Default mounting height: 1100 mm from floor level.

#### **External audible and visual alarms**

General: Provide a corrosion-resistant weatherproof metal enclosures containing sirens and blue strobe lights. Fix in locations not readily accessible without a ladder.

#### **Anti-tamper devices**

Requirement: Provide anti-tamper devices to control panels, external equipment, control and activating devices, and access control devices.

Function: To register an instantaneous alarm if covers are removed or vital wiring is disconnected.

#### **Remote monitoring**

Monitoring system: Provide a monitoring system in the alarm panel or processor for transmission of alarms and monitoring of the system by parties responsible for attending to alarms.

### **9.4 ACCESS CONTROL**

#### **Access control processors or panels**

Capacity: Provide separate entry/exit control modules for each designated access point.

Users: Program the system to match the number of authorised users with unique access codes.

Time zones: At least 4 per day, with provision for weekends and public holidays.

#### **Door control devices**

Requirement: Provide door control devices as set out in **DOOR CONTROL DEVICES** and as documented.

#### **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.

Mounting of entry access equipment: Where practicable, provide direct wall mounted push-buttons or readers; otherwise provide a robust mounting bollard and extension arm.

Default 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.

## 9.5 SITE VIDEO MONITORING

### CCTV system

General: Provide a closed circuit television system monitoring and recording the areas/spaces as documented.

### CCTV cameras

Selection: Provide cameras selected to provide coverage of designated areas and to enable 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 which provide remote control of camera rotation and tilt, and of lens focal length.

External cameras: Provide corrosion-resistant weatherproof housings for cameras located externally, which allow cameras to perform to manufacturer's specification.

Fixing: Provide mounting brackets and hardware which rigidly fix cameras, monitors and accessories to buildings or structures.

### CCTV monitors

General: Provide LCD colour monitors compatible with the security system, and provide fixing brackets and hardware for wall-mounted and ceiling-mounted monitors.

### CCTV recording system

General: Provide CCTV recording hardware and software systems which store data from each camera in an industry standard compressed digital format.

Functionality: Provide the following:

- Index according to events.
- Fast search.
- Frame by frame search.
- Frame printing.
- Zoom and pan within a recorded frame.
- Back up daily to off-site storage.

Minimum data storage: 30 days.

### CCTV video switching system

General: Provide switching software which enables each camera to be directed to a specific monitor 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.

## 9.6 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.

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