

Design Control Guidelines

Property Services 2026

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1.0 Introduction

1.1 Purpose

The design guidelines are intended to detail the University's Mandatory and minimum requirements for the design and construction of its buildings and facilities. Throughout the document, it will be clearly defined when a requirement is Mandatory; otherwise, any requirement is a 'guideline' only. The information is offered for the benefit of the design consultations. It is not intended to replace the consultant's trade specification, nor should it be used as a substitute for that specification.

1.2 Abbreviations

AS	Australian Standard
BCA	Building Code Australia
CMWM	Capital and Minor Works Manager
DCG	Design Control Guidelines
NCC	National Construction Code
PS	Property Services
SD	Standard Drawing
SCU	Southern Cross University (the Superintendent under all Agreements and Contracts)
TS	Technology Services

1.3 Associated Documents

- Data & Telecommunications Design Specifications.
- Signage & Wayfinding Strategy.

1.4 Standards and Legislation

All work shall be designed and constructed to comply with the requirements of relevant legislation, including Australian Standards (AS), the Building Code of Australia (BCA), the Workplace Health and Safety Act 2011 and Local Government Ordinances.

Wherever an Australian Standard (AS) exists that impacts any matter pertaining to the facility's design, construction, operation or maintenance, the AS shall set the minimum criteria to be applied to the project. If the SCU requires a higher standard as outlined later in this document or stated in a Project Brief, the SCU's requirement shall take precedence. Assumptions as to acceptable standards should not be made.

All necessary approvals shall be obtained and lodged with the University before the commencement of work unless otherwise agreed upon.

1.5 Mandatory Requirement

Where a requirement is designated in this document as being **Mandatory**, no alternative design, specification, material or manufacturer will be entertained by the University, and the requirement shall be incorporated into the documentation or construction without variation.

Consultants or Contractors may offer alternative innovative solutions to these Mandatory requirements for consideration and analysis by CMWM. No such alternative solution may proceed to design or construction without the written approval of SCU.

If there is conflict between the DCG and other legislated requirements, then the standard which provides the highest standard of risk mitigation shall take precedence. In all cases of potential conflict, appropriate consultation with CMWM must occur.

1.6 Guideline Requirement

If a requirement is not designated as mandatory, SCU will consider alternative designs, specifications, materials or manufacturers, provided that the alternatives satisfy the minimum standards for that requirement as outlined in this document.

1.7 Departures from the DCG

Departures from these DCGs or any applicable AS, if allowed, must advise the University by the relevant design consultant or contractor and be confirmed in writing by SCU. Any departure made without such confirmation, which is incorporated into the design or construction of a project, shall be rectified at no cost to SCU.

1.8 Contractor or Consultant

The term 'Contractor' used throughout this document shall mean the Contractor or Manager appointed after a competitive procurement process.

The term 'Consultant', where used throughout this document, shall mean any design or technical consultant, including but not limited to Architects, Engineers, Surveyors, Quantity Surveyors etc. and

any other individual or firm providing its services on a project either appointed directly under an Agreement with SCU or employed by a 'Contractor' who has been appointed by SCU to undertake the design and construction management of a project.

1.9 Superintendent

'SCU' for all university projects shall be 'Southern Cross University' (PO Box 157 Lismore 2480). Unless nominated otherwise the 'Superintendent' shall be the Director Property Services, Capital and Minor Works Manager or nominated representative. In this document, the words "submitted to the university", "approved by the University", etc., shall normally be referred to the Superintendent or nominated representative in the first instant.

1.10 Product Brand Names

Reference is made in the DCG to product brand names, models and in some cases, suppliers. Where this occurs, the reference has been made in the interests of product continuity and efficiency of maintenance. SCU has no objection in principle to considering alternative products for possible use on building projects. Any such product however should not be specified by consultants without the prior written approval of the Superintendent.

The existence and specification of a product referred to by brand name in the DCG will not relieve the Consultant from any duty of care in the assessment of the suitability of the product for its proposed purpose. Where a product is considered unsuitable by a Consultant, the Consultant must submit details on the product in question to the SCU Superintendent together with a recommendation of a proposed alternative. Any such recommendation must contain the reasons for the recommendation.

1.11 Use of this Document

This document does not relieve any person or company commissioned by or contracted to the University or its appointed Design & Construction Managers, from the preparation of comprehensive Specifications for inclusion in Tender or Construction documentation. Such persons or companies should incorporate the requirements contained in the various Sections of this document, as appropriate, in the preparation of those Specifications, but no part of this document should be issued in tender or construction documentation as a substitute for a Specification.

1.12 Document Revision

This is the second revision of the Design Control Guidelines. Feedback is welcome and can be directed to propertyservices@scu.edu.au. All feedback will be assessed and if required integrated to future releases of the document.

2.0 Planning and Design Controls

2.1 General Approach

The planning of SCU projects should be based on the following general guidelines. The primary objectives of the DCG are to:

- Increase the overall efficiency and effectiveness of the project design, documentation and delivery process to the advantage of SCU.
- Assist SCU in delivery of facilities that meet the Universities objectives and policies while managing the cost of operating and maintaining facilities within acceptable limits.

2.2 Campus Planning Control

The University has approved Master Plans for its Lismore and Gold Coast Campuses. These Master Plans undergo periodic review, and copies of the current version of each Plan are available upon request. Planning permission requirements vary by specific location of the project site, and clarification should be sought from SCU during the briefing stage.

2.3 Queensland Airport Building Approvals

The Gold Coast Campus is located on Gold Coast Airport (GCA) land and must comply with the GCA Development Guidelines. GCA is required to consent to development for the Airport Building Controller (ABC) to consider a building application. Following consideration of the application, the Airport will grant consent, refuse consent, or grant consent subject to conditions that must be met as prescribed in the approval. When granted, the consent enables the submission of a building application to ABC.

The Airport is located on Federal land rather than State land, and as such, the State Legislation as it relates to the building approval process does not necessarily apply. Federal Legislation in the form of the Airports Act 1996 prescribes the Airport (Building Control) Regulations 1996 to administer the building approval process. The ABC's role is to administer this legislation as it relates to construction and other building activities.

2.4 Other Approvals

All work shall be designed and constructed to comply with statutory requirements including the Building Act, the Building Code of Australia, Local Government Ordinances, the Fire Safety Act, Anti-Discrimination Legislation, Environmental Protection Legislation and the Work Health & Safety Legislation. All approvals necessary shall be obtained before construction commences or during construction, as appropriate, such that progress of the works is not delayed. Evidence of all such approvals and the payment of associated fees shall be lodged with the University. Where necessary, SCU will engage Newton Denny Chapelle (NDC) service to provide town planning advice.

2.5 Whole of Life Considerations

It is imperative to ensure that all facilities constructed incorporate sustainability, life-cycle costs and maintainability in their design. Designs and installations must embrace and make adequate provision for:

- Servicing and maintenance.
- Removal and replacement of plant equipment.
- Access for people with disabilities.
- Durability.
- Energy and water minimisation.
- Flexibility of use/re-use.
- Safety in Design.

Designs that opt for minimising capital cost at the expense of ongoing maintenance, energy and operating costs will be rejected by SCU.

2.6 Crime Prevention Through Environmental Design (CPTED)

To promote safety and reduce the potential for crime, all new university construction, renovation, and landscaping projects must adhere to the principles of Crime Prevention Through Environmental Design (CPTED). This includes strategies that aim to enhance natural surveillance, territorial reinforcement, and access control. Designs must incorporate CPTED principles as follows:

Visibility: Ensure building layouts and landscaping maximise visibility and natural surveillance opportunities. Avoid obstructing sightlines with large, dense vegetation, fences, or walls.

Lighting: Provide adequate lighting for all outdoor areas, including walkways, parking lots, and building entrances. Lighting should be designed to eliminate dark areas and improve visibility during all hours.

Defensible Space: Design and maintain clear boundaries between public, semi-public, and private spaces. Use landscaping, fencing, and signage to define these spaces and signal ownership and control.

Isolation: Isolated placement of facilities such as toilets, public telephones, car parks, bus stops can increase fear of users and the opportunities for crime. Designers shall carefully consider mitigating the sense of isolation by using opportunities for "natural surveillance" to be enhanced. Toilets shall not be located within isolated corridors or adjacent to a fire exit.

Entry Points: Control access to buildings and sensitive areas by employing secure entry points, including access control systems, gates, and barriers where appropriate.

Design Layout: Design pathways and entrances to direct foot traffic and discourage unauthorised access. Utilise natural barriers and design features to guide movement and enhance security.

Engage with campus safety experts, law enforcement, and CPTED professionals during the planning stages of design projects, to ensure compliance with CPTED principles and conduct a thorough risk assessment of the site to identify potential security concerns and address them in the design phase.

2.7 Design for Bushfire-prone areas

The design of buildings in or adjacent to bushland must take account of the possibility of bushfire and incorporate the necessary provisions to minimise the possibility of loss or damage by bushfire. The principles set down in AS 3959 - 2009, 'Construction of Buildings in Bushfire-prone Areas', shall be considered and incorporated into building design where deemed necessary by SCU.

2.8 Design for People with Disabilities

Buildings and external walkways shall be designed to provide access and use by people with disabilities in accordance with the requirements of the current suite of AS 1428, Disability (Access to Premises – Buildings) Standards 2010, and the NCC.

For all new buildings and major campus works involving modifications to pedestrian travel and access through the Campus, the services of a DDA Consultant shall be utilised to review and comment on the design solution for compliance with the foregoing Standards and Codes. SCU may elect to appoint this consultant direct or may instruct a design consultant to include this service as part their consultancy; or instruct a Contractor to include a DDA consultant in their design team.

The provision of Changing Places for people with profound disabilities will be determined on a project-by-project basis following consultation with the relevant elements within SCU. The Information Kit prepared by the Association for Children with a Disability (ACD) provides acceptable comprehensive design options for these facilities (www.changingplaces.org.au).

The provision of car parking for people with disabilities is assessed on a campus wide basis considering the location of car parking areas and access roadways.

2.9 Design for Safety in Maintenance & Use

All buildings, structures and associated services shall be designed to meet the legal obligations of designers imposed by the WH&S Act. When that building or structure is being used for the purpose(s) for which it was designed, users shall not be exposed to safety or health risks arising from the design of that building, structure or services. Designers shall consider, as a minimum, the following to facilitate normal maintenance and other foreseeable work tasks when developing the design:

- Normal cleaning operations and waste disposal.
- Maintenance of plant and services through ease of access, provision of sufficient lighting and adequate space to carry out necessary tasks.

- The height above f.f.l of valves, VAV units, cable trays and the like, which require regular servicing or will be subject to future cable installation to kept to a minimum.
- Storage of materials and equipment within expected requirements.
- Clear space and access around the building perimeter for machinery and equipment necessary to maintain and clean the building façade.

The design of buildings and services shall eliminate the following:

- Unnecessary need to access hazardous areas such as roof surfaces or confined spaces for maintaining plant or services.
- Generation of mould and other indoor air quality issues affecting the health of users.

Electrical exclusion zones and disabled access clearances shall be marked and identified on the architectural floor plans.

2.10 Sustainability Strategy

To support the University's commitment to environmental stewardship and sustainability, all projects must align with the University's sustainability strategy and targets.

SCU released an interim Sustainability strategy in 2023, which is published on the website and is actively targeting specific Sustainable Development Goals, as part of its Times Higher Education ratings; and is developing a comprehensive strategy that includes our Net Zero by 2035 target.

As part of the project briefing process, SCU will also consider the merits of an external rating systems such as NABERS or Greenstar for the building type.

2.11 Sustainability Principles

Design and Construction - SCU seeks to minimise the construction of new facilities to those that are necessary for the University's expansion and development. Wherever possible, existing buildings are recycled and modified for new purposes rather than being demolished and reconstructed.

Design Guidelines - These Design Guidelines have been developed to establish a range of measures, both passive and active, which impact the design and operation of SCU facilities to achieve energy efficiency, water use minimisation, and the creation of buildings that provide a pleasant, comfortable and functional environment. These measures include:

- Orientation, fenestration and sun-shading requirements to minimise the impact of climate.
- Balancing excessive solar heat gain and collecting natural lighting into the building.
- Selection of colours of buildings and paint types to minimise solar gain.
- Insulation to roofs and walls to minimise energy consumption.
- Use of central energy plants to minimise energy usage for air conditioning.

- Use of central control and monitoring systems to optimize building operations for minimum wastage.
- Specification of energy-efficient building services.
- Water conservation requirements for toilets, showers and irrigation systems.
- Selection of materials that have low or no VOC emissions and which can be recycled.
- The adoption of 'Crime Prevention through Environmental Design' (CPTED) as a method of using good design and low technology to provide good security.
- The specification of indigenous species for replanting of vegetation on sites, to minimise the need.
- for excessive artificial irrigation following the establishment of the plants.
- Requirements for environmental site management, which regulates waste management, erosion control.
- Pollution control on construction sites.

Energy Management –Aligned to our Net Zero by 2035 commitment, the University's objective is to build buildings that are exemplars for low energy consumption. Targets will be discussed and agreed on collaboratively with the design team for the project at the early stages of the project design process.

Water Management – SCU seeks design principles and initiatives in its buildings which embrace current technology and practices to minimise or avoid the use of water. Such principles may include:

- The installation of rainwater tanks.
- Water-efficient sanitary fixtures and tapware.
- Waterless urinals.
- Eliminate the need for landscape irrigation systems through careful plant selection.

Waste Reduction - SCU requires the amount of construction waste going to landfill is minimised, and resources are conserved through avoidance, reuse and recycling. These principles are to be incorporated into the design of its buildings through careful material selection and dimensioning, to Utilise standard material sizes in building fabric and fittings.

Material Selection - SCU is continually evaluating material alternatives to optimise their total life cycle performance. This includes material property alternatives complying with the following:

- A high recycled content.
- Locally/regionally produced.
- Ability to be reused, recycled, or that are biodegradable.
- Maximum durability based on the anticipated life of interior construction, equipment, finishes and furnishings.

2.12 Asbestos and PFAS

The University maintains Registers and Management Plans for asbestos materials in its existing buildings. Contractors and Consultants involved in the refurbishment or alteration of any building constructed or approved before 1 January 1990, must obtain copies of these documents for all tender and construction documentation.

2.13 Cultural and Indigenous Requirements

In alignment with our commitment to cultural sensitivity and respect for indigenous traditions, all major projects undertaken by the University must involve consultations with Gnibi and local elders. This process ensures that the design and implementation of projects reflect an understanding and respect for cultural significance and historical context.

3.0 Architectural Design

3.1 General

As a general principle, SCU requires the design of its new buildings to incorporate flexibility for future changes in internal layout or use. This requirement should be reflected in the design of the building structure. SCU does not seek to impose any structural design principles or methodologies on Consultants or Contractors, however, it does require a structural design that combines both flexibility and economy.

3.2 Ceiling Heights

Minimum ceiling heights shall be 2.7m, subject to the degree of services required. Specific brief requirements regarding ceiling heights shall prevail. Ceilings as specified, however in general they are to be 1200 x 600 two way suspended 'T' bar grid with in-lay panels. The 'T' grid is to be installed prior to internal partitioning.

3.3 Slabs

Floor slabs shall be designed for the most economical construction and flexibility of use, with due consideration to long-term deflections, and the need to provide for penetrations both initially and during the building's life. All buildings shall be designed for floor loadings generally in accordance with AS 1170. Provision must be made for the installation of compactus shelving in areas specifically nominated in the SDs.

The slab design shall provide for the need to core holes, now or later, up to 200mm diameter adjacent to columns and/or communication rooms, or to provide penetrations up to 1200mm square in selected areas. All floors are to be finished within a maximum tolerance of + 3mm in a 3000mm straight edge. All internal ground slabs must have an effective membrane complying with the appropriate Australian Standards turned up at the perimeter and with all joints taped in accordance with good building practice. Floors and walls must be fully tanked and/or drained where below ground or subject to hydrostatic pressure. Adequate provision for relief of hydrostatic pressure and subsoil drainage must be provided whenever required.

3.4 Structural Walls

Concrete or masonry walls should be kept to minimum to ensure flexibility for future internal modifications or alterations. Masonry walls should be limited to lift shafts, fire stairs and plant rooms wherever possible. Masonry walls required for bracing purposes should be carefully located so as not to impact severely on flexibility.

3.5 Natural Light

Perimeter rooms are not to block the transmission of natural light into interior corridors or other spaces. Daylight may be borrowed using glazed walls or windows. All glazed walls must be clear glass except for safety decal, unless prior approval is obtained from SCU.

3.6 Acoustic Control

Regulatory Requirements – Authority and code requirements relevant to acoustic considerations include:

- EPA Environmental Protection Policy (Noise) 1997.
- EPA Environmental Protection Amendment Regulation No 2 1999.
- BCC Planning Policies.
- Current Australian Standards including AS 1035, AS 1045, AS 1296, AS 2021, AS2822, AS 2436, AS 3671, AS/NZS 2107.
- WH&S Act & relevant regulations.

Vibration levels must comply with the maximum vibration levels for human comfort defined in ISO 10137 Bases for design of structures - Serviceability of buildings and walkways against vibrations. In the design of new buildings, or in the refurbishment of existing facilities, acoustic considerations may include:

- External noise intrusion.
- Noise generated within the building due to building services.
- Noise emissions from the building as they affect adjoining buildings or residents.
- Noise interactions between spaces and consequent privacy considerations.
- Acoustic quality of spaces such as speech intelligibility.
- Special acoustic requirements such as sound or video recording.

Typical noise from external sources to be dealt with in the design include:

- Traffic noise (road, rail and/or aircraft sources).
- Equipment associated with adjacent buildings and industrial activities.

Construction Noise – Construction activities inherently produce noise. The levels of noise and their intrusiveness are generally most significant during the early stages of a new project (e.g. excavation and rock breaking) and diminish as the project advances. Given the intensive nature of campus development, construction noise can be a significant impact on adjoining university buildings. Designers must consider the potential noise impacts of design options (e.g. extra basements extend the excavation period and the likely duration of noise impacts).

As a minimum, compliance with AS 2436 is required. Considerations include:

- Timing/programming of noisy activities to avoid student teaching hours.
- Choice of excavation technologies.
- Logical and sensitive site layout and sequence.
- Choice of construction equipment.

3.7 Cleaners Store

Provide one 6 - 12m² room in each building to be used as a Cleaners' Store. This space is required to store consumables and equipment and shall include shelving, mop and broom racks and a cleaners' sink with a hot and cold water only supply. The room shall be in a central location.

3.8 Termite Control

Protection from subterranean termites shall be provided to all new buildings. All workmanship and materials shall conform to the requirements of AS 3660. All tree stumps and root boles which have been exposed during excavation, together with any dead logs and other timber debris, shall be removed from the building site. The Contractor shall provide the Superintendent with a Certificate of Installation in accordance with AS 3660.

3.9 Signage and Wayfinding

Refer to the SCU Signage and Wayfinding Strategy.

3.10 Valve Room

Provision for isolation of all incoming services into the building is essential. The isolating valves/provisions shall be readily accessible without ladders or other access equipment. This valve room may be incorporated into a service duct or services plant room and is ideally situated at ground level close to the building perimeter to minimise runs within the building prior to the isolation valves. Meters, irrigation controls and RPZDs may also be located within this room.

3.11 Electrical Riser Cupboard

A dedicated electrical services riser shall be provided for the reticulation of electrical services throughout the building.

3.12 Waste and Gas Storage Areas

Each building shall be provided with a combined general and recyclable waste collection station at each level. The stations shall be easily accessible to the occupants and preferably located in a recess to a corridor wall. The number of general and recyclable waste bins at each station shall reflect the volume and type of waste generated by the activities on that level.

Where the provision of industrial waste containers and wheelie bin storage is associated with a project, particular care is to be taken in the design of these areas, to ensure unrestricted access for waste collection vehicles, while at the same time providing suitable visual screening from the campus generally.

Adequate provision shall be made for the secure and ventilated storage of gas bottles, whether located internally or externally of a building. This clause applies only to buildings which require medical/laboratory gases for teaching or research purposes.

3.13 Vending Machines

Consideration shall be given in the design of public external spaces adjoining 24x7 accessible facilities, collaborative learning centres, commercial or other buildings generally on the campuses; for the installation of vending machines to be provided by others. The vending machines should be housed in an alcove or isolated structure designed to accommodate the varying machine sizes, and to minimise their visual impact. Allowance should be made for lighting and power.

3.14 Telecommunications Rooms

Allocation of adequate plant areas and vertical riser space to accommodate all necessary plant and services reticulations, shall be provided in the preliminary design sketches and compliant to the requirements laid down in the **Southern Cross University Data & Telecommunications Design Specifications** document.

3.15 End of Trip Facilities

Provision of end of trip facilities shall be considered on a building-by-building basis, considering proximity of existing facilities provided on campus.

3.16 Links to Adjacent Buildings & Open Spaces

The design of new buildings shall address linkages to adjacent buildings by pathways, covered links or bridges, depending on the building function, location of the building relevant to those adjacent, the topography of the site or other considerations. The design of covered links or bridges should utilise open and lightweight structural principles to minimise their visual impact.

4.0 Roofs

All the requirements of this Section are Mandatory.

4.1 Roof Materials

Pitched metal pan deck roofs shall generally be provided to all buildings manufactured from colorbond steel or zincalume in 0.48BMT, in accordance with AS 1297, and installed in accordance with manufacturers written instructions. Installation of air-cell insulbreak insulation laid on industrial roof wire to AS-NZS4389.2015. All sealants, fixings and accessories shall match the colour of the roof. Ends of sheets must be turned up at ridges, penetrations and abutments, and turned down into gutters using specialist tools. The colour of the roof sheeting must be approved by SCU. Light colours to reduce solar absorbance are to be adopted wherever possible.

4.2 Flashings and Cappings

Roof flashings, capping's and trims shall be designed to minimise the use of sealants and shall be fabricated and installed in accordance with the roof deck manufacturer's recommendations. Flashings, cappings etc. associated with the roofing shall be fabricated from Colorbond steel of the same thickness and colour as the roof sheeting. All fixing types are to be as recommended by the roof deck manufacturer and colour matched to the flashing. Where the ends of the roof sheeting are clearly visible above the eaves gutter, install a colour matched steel angle trim with the vertical leg positioned downwards and the other leg fixed to the top of the rib; with sufficient space between the vertical leg and the end of the decking pans to allow water run-off.

Flashings to penetrations for roof access hatches, skylights, exhaust vents and the like shall incorporate a soaker flashing, which shall extend to the roof ridge whenever possible. Flashings to all roof penetrations shall be designed to minimise the collection of leaves and debris. All box gutters shall have over flashings fitted under the end of the roof decking to the trimming purlin. 'Decktite' flashings are acceptable for circular penetrations, only where they are installed in a manner which does not impede roof drainage or allow ponding, and strictly in accordance with the manufacturers printed instructions. Where possible, combine vents under roof line to minimise penetrations. Ensure vent penetrations occur as close as possible to the ridge line. Where flashings abut walls, a double 'K' flashing is required.

4.3 Gutters

Gutters shall be installed on all buildings unless otherwise advised by SCU. Box gutters shall not be installed unless there is no other viable design solution. Flow rates (l/sec) and average rainfall intensities (ARI) are to be shown on the design drawings for all downpipes, spreaders, balcony drains, roof deck drains, overflow's etc. Where flows exceed the maximum flow rates indicated in AS3500.3

then a certified performance solution and associated form 15 must be provided in accordance with the National Construction Code.

Materials – All gutters (including box gutters and accessories) shall be fabricated from Type 304 stainless steel, with a minimum thickness of 0.9mm with a pacified polished finish. All joints shall be riveted, and silicon sealed. In corrosive environments, such as the Gold Coast and NMSC campus locations, gutters shall be fabricated from Type 316 stainless steel.

Expansion Joints – Continuous lengths of gutter shall have expansion joints as stated in AS2180. These joints shall comprise stop ends with a saddle flashing over.

Overflows & Spitters – Any box gutters shall incorporate overflows as a safeguard against flooding caused by downpipe or drain blockages. Overflows shall be located and designed as per AS3500, and the discharge from the overflow shall be visible. Horizontal overflows shall discharge a minimum of 150mm from the face of the fascia or building façade. The cross-sectional area of each overflow shall be to AS3500.

Where the overflow discharges directly from the gutter end through the fascia or external wall, the material shall match the gutter lining. Where spitters are used, they shall also discharge 150mm from the face of the fascia or external wall and shall be fabricated in No. 4 polished Type 304 stainless steel.

Leaf Guards – All box gutter sumps shall be fitted with stainless steel mesh removable leaf guards. Leaf guards shall project above the top of the sump no less than half the gutter depth at the sump.

4.4 Downpipes

All exposed downpipes shall generally be constructed of 1.6mm thick Type 304 stainless steel with all joints welded. In corrosive environments such as the Gold Coast and NMSC campus locations, down pipes shall be fabricated from Type 316 stainless steel. Tested UPVC will be considered as an alternative for particular applications, in which case they shall be painted to blend with the external wall finish where exposed. The minimum diameter of downpipes shall be 100mm. All downpipe brackets shall be a stand-off type, fabricated from stainless steel for stainless steel downpipes and painted hot dip galvanised steel for UPVC downpipes.

Downpipes shall not be built into walls or columns. If a downpipe is located internally, it shall be insulated to eliminate noise transfer into occupied spaces. The downpipe foot shall not be connected directly to drains but shall discharge over a grated stormwater sump designed to prevent leaves from entering the drains and to avoid water splashing over paths and walls. Sumps to drains which connect to storage tanks shall be fitted with a stainless-steel mesh removable basket to minimise the possibility of small leaves and other debris entering the tanks. All downpipes and all gutters shall be hydrostatically tested to the maximum head possible.

4.5 Roof Access and Walkways

Access is required to all roofs. Where this cannot be achieved via the continuation upward of an external escape stair, access from inside the building shall be via a lockable roof hatch or a door. Where an external stair is utilised to gain access, a secure barrier shall be provided at the landing on the highest occupied floor level to prevent unauthorised access to the roof. A permanent steel stair should be provided where access is via a roof hatch. The stair shall preferably be located in a plant room, or in a separately enclosed space. Ladders fabricated from hot dip galvanised steel shall be provided between changes in roof levels, and between access doors from plant rooms and the roof surface if required.

Walkways shall be provided across roofs to provide access to equipment, mechanical fans etc. Walkways shall be of aluminium construction. Walkways which do not require supports that penetrate the roof decking are preferred. All access stairs, ladders and walkways shall comply with AS 1657.

4.6 Roof Safety System

Provide a fall-restraint safety system in accordance with the provisions of the NCC BCA. The installation shall also comply with the relevant Australian Standards. Preference shall be given to systems where the anchorage points or cable supports are mechanically attached to the roof deck ribs, and do not rely on posts penetrating the roof sheeting to attach to the roof framing. Consultation with SCU is required when selecting the system, to ensure the components of the selected system are compatible with existing systems utilised on other campus buildings. The system installer must provide all appropriate certification that the system complies with the relevant Standards and regulations.

5.0 Staircases and Ramps

All the requirements of this Section are Mandatory.

5.1 Generally

Internal and external stairs and ramps shall comply with the requirements of the NCC BCA and AS 1428. Ramps shall be provided externally as required to provide access to buildings for people with disabilities. The use of ramps internally as a means of interconnecting floors is not an acceptable alternative to providing a lift. SCU will not accept designs which combine maximum height risers with minimum width treads. Treads widths and riser heights shall generally comply with the requirements of AS 1428.2, with goings a minimum of 280mm wide.

5.2 Internal Stairs

There shall be a general circulation stair to access all levels of the building to minimise the use of lifts. This circulation stair may be a fire-isolated stair, provided all access doors are controlled with magnetic hold-open devices connected to the fire alarm system. The following points are to be considered in the design and placement of circulation stairs:

- Placement of stairs to maximise their visibility and use.
- Finishes to stair treads, risers and landings shall be ceramic tiles, and walls shall be rendered and painted with matching tile skirting.
- Comply with the requirements of AS 1428.2.
- Design of stairs to be social spaces where conversations can occur.
- Design of stairs to act, where appropriate as natural ventilation shafts.
- Stairs shall be provided with natural light if possible and ensure fire services (fire hydrants and test drains) rising through stairwell do not encroach on minimum stairwell widths.

Fire isolated stairs shall be provided to satisfy the requirements of the NCC BCA and AS 1428.2. These stairs may be fully enclosed within the building envelope or may be open framed stairs external to the building façade.

5.3 Handrails

Internal general access stairs, including fire-isolated stairs for general access, shall have stainless steel handrails on both sides. Where the general access stairs are in an open well with exposed strings to flights, a balustrade incorporating glass, perforated metal or other approved solid panels is desirable. Handrails and balustrades to fire isolated stairs that are not general access stairs may be galvanised steel.

5.4 Finishes

General-use access stairs shall have a tiled finish to treads, risers and landings. Tiles to stairs shall be non-slip to suit the application with tread, riser and nosing tile of a contrasting colour and matching grout. Tiled stair landings and walls adjoining stairs shall have a matching skirting tile ½ tile height or a minimum of 100mm high.

Fire isolated stairs, which are not general access stairs, shall have an integral non-slip finish to treads and landings, with a 'Yellow' painted nosing on both tread and landing edges.

Where carpet finishes are approved for internal non fire isolated stairs, tread nosings shall be aluminum with adhesive fixed contrasting-coloured inserts. All stair nosings shall be non-skid of dimensions to comply with AS 1428.2. Consideration should be given to the use of 'self-illuminating' nosings where step edge contrast is required, or would be enhanced, in low light conditions.

5.5 Tactile Ground Surface Indicators (TGSIs)

Provide warning type TGSIs in accordance with the National Construction Code, Australian Standards AS1428.0 & 1428.4.1. Directional-type TGSIs shall be used where dictated by the specific project's needs. TGSIs shall be selected to suit the particular application, taking into account the substrate, appearance, consistency with surrounds, pedestrian/vehicular traffic, standards and code requirements.

6.0 External Walls

6.1 Generally

The colour, materials and texture of external walls shall reflect the proposed use and functionality of the project and shall be selected on a life-cycle cost basis, taking into account the long-term maintenance and operation of the wall and its finishes over twenty (20) years, as well as the initial cost of construction.

SCU shall approve the colour, materials and texture of external walls at the preliminary sketch design stage. Highly combustible materials such as Expanded Polystyrene (EPS) panels are prohibited. External walls to buildings shall be designed with particular care and consideration given to the possible future effects of shrinkage, cracking and thermal movement. Façade staining shall be avoided by careful design and detailing to shed water clear of the building, clear of lower projections and clear of pathways. Parapet capping's and window framing shall be designed to avoid facade staining.

It is a Mandatory requirement that all walls shall be waterproof.

6.2 Applied Finishes

The applied finish on external walls shall be a three-coat roller-applied membrane coating system comprising a primer and two finishing coats. Membrane coating on concrete masonry block walls shall be applied over a 6mm minimum thick cement render coat. The render and membrane coating systems shall be sourced from the same manufacturer, and applied strictly in accordance with the relevant manufacturer's technical specifications by accredited applicators, to ensure validity of the manufacturer's guarantees. The membrane coating and render system shall have a minimum ten (10) year unconditional guarantee.

6.3 Sun Shading & Screening

Sun shading and screening shall be provided as required by the project to minimise air conditioning life cycle costs and eliminate the need for curtains and blinds as sun control measures. The effectiveness of the proposed devices shall be further tested during design development by producing floor plans that indicate the sunlight penetration into the building. These floor plans shall incorporate the indicative furniture layouts.

6.4 External Building Signage

Provision shall be made in the design of the facade around the main entry to the building, for the installation of the building name and number. Building identification signage shall be in accordance with the requirements of the SCU Signage and Wayfinding Strategy.

6.5 External Protection

Provide approved bollard protection to all external areas of buildings, plant and equipment liable to vehicle damage. Bollards and fixings are to be of sufficient size to prevent vehicular damage. Spacing of the bollards shall be such that a vehicle shall not strike the building plant and equipment from between the bollards.

7.0 Windows

7.1 Generally

The amount of glazing in the building façade shall be determined to satisfy aesthetic and functional needs but shall also take into consideration all of the factors that impact on the total life cycle of the proposed building, including capital cost of building elements, services and operating costs, the cost of glare reduction, maintenance, cleaning and energy.

Care shall be taken to minimise the impact of solar load and internal glare through windows by carefully considering the options of sun shading, the use of solar or tinted glass or a combination of these measures. An analysis of the life cycle costs of the proposed solution shall be submitted for consideration by SCU before a final design solution is adopted.

Windows shall be of commercial quality, designed in accordance with all relevant codes, and shall be suitable for the specific application, taking into account the requirements for security, cleaning, ventilation, maintenance and operability. All windows must be designed for a wind velocity as specified in AS 1170.2 for a 1,000-year return period. Corner effects must be considered in determining the design wind pressure.

7.2 Window Styles

Open ability is to be provided for ventilation purposes in non-air-conditioned spaces. Pivot hinge windows can open outwards or inwards but must be able to be cleaned from within the building. Where an external pathway, link bridge or staircase abuts the external wall of the building, any windows in that wall, are not to protrude beyond the face of the wall at that level when opened. For purposes of design, Terrain Category 2.5 shall be used as a minimum. All open-able windows, irrespective of level, shall be factory-fitted with window locks that comply with the requirements of Section 9 – Doors and Hardware. Louvre windows shall not be used except in special SCU-approved applications.

7.3 Finishes and Frames

Windows and doors shall have anodised aluminum frames of an approved colour, consistent with other buildings in the vicinity. The minimum thickness of anodising shall be not less than 20 microns. All exposed screw fixings, rivets and cut edges etc, shall be coloured to match the frames. Where windows or glazed panels have a common jamb with a door unit, provide strengthening to ensure that the window/door jamb does not twist and prevent the door lock from latching.

7.4 Glazing

The selected glass type and colour are to be approved and shall meet the following criteria:

- Solar control.
- Good light transmission with subtle reflectivity.
- Glare control.
- Low UV transmittance.
- Neutral light transmittance, which maintains toned glass colour and clarity.
- Low U-value to limit energy consumption and readily available with reasonable lead time.

Site-applied film on windows to achieve thermal and glare control shall only be used when refurbishing existing buildings and is subject to the approval of SCU. Any frameless fully glazed doors, sidelights, shopfronts or glazing that might be mistaken for a doorway or opening which do not incorporate a chair rail, handrail or transom; shall be marked for the full width of the glass panels with a solid and non-transparent contrasting line not less than 75mm wide.

7.5 Window Locks

All openable window sashes accessible from external to the building shall be fitted with a lock equivalent to Lockwood 780 or 880. All locks shall be keyed alike, and keys shall be handed to SCU only at Practical Completion. The locking requirement shall be confirmed with SCU in consultation with the CMWM.

7.6 Window Cleaning

All external surfaces of glass must be easily accessible for cleaning from the inside. If this is not possible, a proposed methodology for cleaning shall be submitted to SCU for consideration and approval. All provisions shall be made in the design for the approved cleaning methodology, including providing safe access to the external glass surface and all safety anchors, tracks, hoisting equipment, harnesses, etc.

7.7 Window Blinds

Curtains and blinds shall not be used as a substitute for external sun shading, screening of windows or for general glare control where specialist glass is used. Where blinds may be required for privacy or other reasons, they shall be 'Verosol' or equal manually operated roller blinds. Blind fabric shall be a type to suit the application of a colour approved by SCU. Teaching spaces and meeting rooms require controllable light conditions, which enable the effective use of audio-visual facilities. This may be achieved by fitting any windows with roller blinds and having a selected fabric with sufficient opaqueness to achieve an appropriate light level within the space.

7.8 Teaching Spaces

Windows in teaching spaces shall be located so that no direct sunlight falls on projection surfaces. The extent of windows, the level of natural light entering the space, and the potential for uncontrolled light through reflection off surfaces must be assessed and managed to ensure adequate contrast ratios are achieved on all screens. Consultation must be undertaken with TS on the extent and location of proposed windows, as this will also impact on the selection of projectors.

8.0 Internal Walls & Partitions

8.1 Generally

Building interiors shall be designed to provide maximum flexibility for future modifications or changes in use. Load-bearing walls shall be minimised and restricted to areas such as the building core for stairwells, lift shafts and toilets. All other internal walls and partitions shall be non-load bearing and able to be readily removed and altered at minimum cost.

8.2 Masonry Walls

Load-bearing walls shall be concrete or concrete masonry as determined by application and economy. Non-load bearing masonry walls shall be restricted to plant rooms, service ducts and the like, or where required to achieve fire ratings or acoustic requirements not achievable by other wall systems.

Any exposed concrete walls shall have a minimum Class 2 'off-form' finish. All face blockwork shall have half round radius ironed joints. Adequate control and expansion joints shall be provided to prevent cracking due to building structure settlement.

8.3 Framed Partitions & Linings

Internal partitions shall be constructed using not less than 76 x 0.55mm BMT steel stud and track framing components. Size and thickness of framing components will be dictated by height and load imposed by wall mounted fittings and equipment.

All framing shall generally extend to the underside of the slab, and adequate noggings shall be provided for the installation of wall-mounted fittings and equipment. Deflection head tracks shall be used to accommodate slab deflection.

Framed partitions shall be sheeted with recessed edge plasterboard with flush set joints. The thickness and number of layers of plasterboard sheeting shall be to suit the application, or to satisfy acoustic and fire separation requirement, but sheets shall not be less than 13mm thick. For spaces where the SDF nominates a significant number of fittings or equipment items mounted on or supported by the partition, consideration should be given to substituting individual framing noggings with a structural plywood lining to the full extent of the partition/s faced, with 10mm thick plasterboard.

The lining shall extend from floor level to underside of slab above on at least one side of the partition between functional spaces and corridors, foyers and other public spaces for security; and between all spaces to achieve acoustic separation. Linings need only extend full height both sides if required to satisfy acoustic or other criteria.

Where the top floor of the building is covered by a steel framed roof, partition linings need not extend to underside of roof, except for acoustic or fire separation reasons, but shall extend at least 300mm above ceiling level on both sides.

All penetrations in partition linings shall be sealed to maintain the required acoustic rating.

8.4 Linings to Masonry Walls

Plasterboard linings to masonry walls shall generally be adhesive fixed in accordance with the manufacturer's printed instructions. If the wall to receive the plasterboard lining requires power points, data outlets and the like, then the plasterboard should be fixed on metal furring channels. Chasing masonry walls for cabling, etc. is not acceptable. All fibre cement linings to masonry walls shall be fixed on metal furring channels. Fibre cement linings to receive ceramic wall tiling shall be fixed strictly in accordance with the manufacturer's printed instructions. Sheets shall be installed to allow expansion joints to be full depth of tiles and lining.

8.5 Wall Protection

Suitable wall protection shall be provided to external corners of all partitions.

8.6 Acoustics

Particular attention shall be paid to acoustics and noise transmission. Details of the intersection of partitions and external windows shall ensure sound insulation is maintained at that intersection that is equivalent to that of the remainder of the partition. Partition walls between toilet/shower areas and academic offices or teaching spaces shall be constructed to eliminate the transmission of noise from voices and the closing of cubicle doors.

8.7 Operable Walls

Where there is a requirement to open up adjacent similar spaces into a larger space, for example, seminar rooms, this shall be achieved by the use of operable walls. The acoustic performance of the operable wall and baffle wall over in ceiling space, shall be equal to that of a fixed partition between the spaces.

8.8 Glazed Partitions & View Panels

Glazed view panels shall be provided in internal partitions to provide surveillance or transmission of natural light.

The corridor wall to all offices shall be fully glazed from floor to ceiling including a glass highlight panel above the door. In instances where this is not possible or practical, the glazing shall at least comprise a 300mm minimum wide sidelight panel and/or a highlight panel over the door. In refurbishment projects where the existing corridor wall is stud framed and plasterboard lined, an opening is to be cut in the wall to accommodate a glazed panel adjacent to the door to allow the transmission of

natural light into the corridor. This panel should extend from 150mm above floor level to door head height, but does not need to abut the door frame, and the width should be to suit the wall stud centres.

All glazed walls and panels shall be installed in an anodised aluminium frame to the full perimeter. Door frames shall also be aluminium, but reinforced if required, to ensure that the frame jambs do not twist and prevent the door from sagging or the lock from latching. Glazed panels fitted into cut openings in stud partition walls in refurbishment projects may have timber frames. Full-height glass to internal walls is to be safety glass according to requirements of the relevant Australian Code. Where no mid-rail exists in full-height glazed partitions, each glass panel shall be marked full width with a solid, non-transparent contrasting line, no less than 75mm wide.

Where SCU determines that there are particular privacy requirements, frosted film shall be applied to the glass on the room side from 300mm above the floor level to 300mm below the head of the screen or panel. Solid frosting is discouraged, and consideration shall be given to the use of a patterned film which allows a percentage of the filmed glass area to remain clear, while preventing direct vision into the room from outside the room. The use of such frosting as 'artwork' and the creation of themes appropriate to the building function is encouraged.

8.9 Toilet Cubicle Partitions

Toilet cubicle partitions shall be equal in all respects to the 'Laminex FAOB' self-supporting partitioning system. Panels shall be Laminex 13mm multipurpose compact Laminate with privacy strips to doors.

8.10 Sealing Penetrations

Fire-rated sealing of penetrations through walls and partitions shall be done in accordance with the requirements of the NCC BCA and AS3000. Fire-rated walls and partitions must have their fire-stopping capabilities restored after the installation of cabling, conduits, cable trays, ducting or pipework that passes through any penetrations. Firestop foam, blocks, logs, plugs and mastic, or tested equal, are the preferred materials for the sealing of penetrations through fire-rated floors and walls, installed strictly in accordance with the manufacturer's printed instructions.

9.0 Doors and Hardware

9.1 Aluminium Framed & Glazed Doors

Door leaves shall have a mid-rail no less than 200mm wide and shall be glazed with safety glass. Framing shall have an anodised finish no less than 20 microns thick to both doors and frames. All building entry doors shall be glazed doors. Door leaves exceeding standard sizes must be fitted with appropriate hinges, closers, etc. to accommodate the door weight and to prevent movement and misalignment. Preference is for a single-door leaf with a side light rather than a pair of doors.

Double-action swing doors shall not be permitted. Sliding doors shall be used for all main exit/entry doors fitted with an automatic opening/closing mechanism. At least one external door to each building should be fitted with an approved automatic opening and closing device. This door or doors shall also be linked into the Electronic Access Control system.

The jambs and heads of aluminium door frames shall be reinforced to avoid twisting and misalignment of the door leaf which will prevent locking, where door leaves exceed standard sizes and where door closers or magnetic locking devices are fitted to the door head.

Frameless hinged and sliding doors are permitted in certain circumstances, however any proposal to use this type of door must be presented to SCU for approval, particularly where access control is an issue. Any such doors must have a solid and non-transparent contrasting line full width of the door panel/s.

9.2 External Doors

All doors in the external building façade other than entry doors, such as to plant rooms, service ducts, fire egress etc. shall be aluminium framed with aluminium faced plywood or aluminium louvre infill panels as appropriate for the application. All aluminium shall have an anodised finish.

Timber doors shall not be used unless they are fully protected from the weather by building overhangs and the like. Any timber doors shall be solid core with marine grade plywood facing both sides, edge stripped all round with hardwood. Glue used in timber doors shall be Type A bond 'waterproof' glue, not 'water resistant' glue. Timber doors shall be finished with an approved full gloss enamel paint system.

All external doors shall be fitted with seals as necessary to prevent ingress of water, dust and insects to the building. Louvre panels in external doors shall be fully insect-screened. External doors, unless stipulated, are to be controlled via electronic mortise locks controlled by 'Gallagher'.

9.3 Internal Doors

Internal doors must be 920mm solid core doors. Doors in high traffic areas and laboratories, where allowed by fire regulations, must provide for a viewing panel in accordance with the relevant Australian Standards:

- AS 2688 – Timber and composite doors.
- AS/NZS 4505 – Garage doors and other large access doors.
- AS 2047 – Windows and doors.
- AS 4545 – Locksets and hardware for doors and windows.
- AS 1428 – Design for access and mobility.

Doors to lecture theatres, tutorial rooms and similar teaching spaces and plantrooms must be designed to match the acoustics of the room and must include seals and double-glazing where required. Doors to cleaners' rooms, service ducts and small storage cupboards shall also open outwards. Doors in high-traffic areas and where allowed by fire regulations, shall have a viewing panel where allowed by fire regulations doors, to comply with the requirements of AS 2982. Viewing panels in laboratory doors shall have '3M Ultra 400 Series' security film applied.

Air grilles may be installed in doors only where their installation does not affect acoustic and physical security. Where installed, air grilles shall be fixed with concealed screw fixings on the inside face. (Note: Doors to Disabled toilets and doors which provide access to laboratories, are not to be fitted with an air grille).

Door sizes shall generally be of a standard size, unless nominated otherwise, or required to be larger for particular purposes or to meet statutory requirements. Doors to fully enclosed sanitary compartments for people with disabilities shall comply with AS 1428.1 and shall open outward.

9.4 Fire Doors

Fire doors shall be provided to satisfy the requirements of the NCC BCA and shall be finished as previously nominated for either internal or external timber doors. The use of fire doors in lieu of standard timber doors to provide access to and from spaces that experience high levels of traffic shall be avoided wherever possible. However, if this cannot be avoided, then doors shall be held open by magnetic hold-open devices interlinked with the Fire Alarm system. Fire doors are not to be used as acoustic doors unless the door is required to be both fire-rated and acoustic.

9.5 Frames

All doors other than aluminium framed glazed doors and timber doors installed in glazed internal screens and partitions, shall be hung in a one piece fully welded metal door frame which shall fully wrap around sheet wall linings to both stud framed partitions and masonry walls. Frames to doors installed in in-situ concrete walls shall not wrap around the opening reveals. All metal frames shall be

securely fixed into the wall or partition opening, and fully grouted where in masonry walls or acoustically sealed to the partition framing. Aluminium door frames shall be sufficiently rigid to avoid distortion by the door weight or the twisting action of the door closer. Generally, all door frames shall have three hinges per leaf with the middle hinge approximately 200mm below the top hinge. Doors with leaves 1000mm or greater in width shall have four hinges.

9.6 Hinges

Except for aluminium doors, all hinges shall be stainless steel, screw-fixed to door leaves and frames with stainless steel screws. Hinges shall be left unpainted.

9.7 Locks

Door locks are to be PD7000 Carbine lever set with Bi-Lock keying. Keying is to be in accordance with SCU's BiLock grand master system with the keying sequence to be approved by the University. Details of approved suppliers can be obtained from the CMWM.

Mechanical Door Lock: KABA SMB30-SCP Mechanical Mortice Lock fitted with:

- Bi-Lock Cylinders supplied by Ballina Locksmiths.
- "001" Cylinder - Electrical risers.
- "002" Cylinder - Mechanical.
- "004" Cylinder - Data.
- "AZ01" Lismore, "STE" Gold Coast, any door forming part of an access control perimeter.
- KABA 600 Series furniture, with 25 lever, Satin Chrome.

Note: Drop Bolts are not to be installed in the mid rails of aluminium doors.

Electronic Door Lock: Where electronic locks are installed, any required card readers shall be located so as to be accessible to people with disabilities, and where possible installed on a solid or sheeted walls and not on glass walls with thin (less than 75mm wide) aluminium mullions. The preference is generally for electronic locks where specified. When installing electronic or magnetic locks, the Contractor shall provide the following for connection to the Gallagher system by an approved specialist Sub-Contractor:

- Conduit access to from the card reader position to an access point in the ceiling space.
- Conduit access from door frame head to ceiling space for magnetic locking devices;
- Conduit access from the electric locking power transfer device to an access point in the ceiling space.

- Conduit access from the hinge side to the lock side in all doors fitted with electric locking devices;
- Install suitable power transfer devices equivalent to 'Abloy 8810' at time of hanging the doors and provide horizontal separation where a card reader is installed externally and internally on the same door to prevent electronic interference.

9.8 Door Furniture

Door furniture shall be Lockwood 1800/1900/70 Series with SCP finish and 'Dalco 1353-04' offset D handles surface mounted to aluminium doors. Push/pull plates and handles shall be stainless steel. All plates are to be glued and screwed with stainless steel countersunk head screws. Fire egress doors from buildings and entry doors to laboratories, shall be fitted with approved strike shields to inhibit unauthorised access. Door furniture for electronic doors shall have an LED indicator light to indicate status of lock i.e. Green – unlocked, Red – locked.

9.9 Door Closers

Surface Mounted door closers shall be provided to entrance doors, external doors, internal doors from general office space to public corridors, lecture theatre doors and doors to all teaching spaces, plant rooms, toilets, airlocks and fire doors. Closers shall not be mounted on the outside face of the door leaf.

Closer type shall be 'Dorma TS 73' with hold open and delayed action controls for disabled access as directed. Non-hold open door closers shall be provided between all air-conditioned spaces and non-air-conditioned spaces, except for individual staff offices. Non-hold open door closers shall be provided for all electronically locked doors, unless specified otherwise by the Manager, a mounting plate is to be used when mounting door closers on aluminium doors. Care shall be taken to ensure that closers do not puncture wall linings when the door is opened.

When mounting door closers in conjunction with acoustic seals, provide suitable mounting packers to keep the arm of the door closer clear of the seal. In all cases screws are not to penetrate glazing beads or acoustic seals.

Note: All outward opening doors shall have parallel arms and inward opening doors shall be regular arms.

9.10 Electro Magnetic Hold-Open Devices

Electromagnetic hold-open devices (EMHODs), as required, shall be 'Dorma' type and be provided to all fire doors in high-traffic areas and all fire-isolated stairs used for circulation. These shall be activated by the building fire alarm system and can be mounted at 1800mm above the finished floor level near the leading edge of the door. Where fitted to external doors, Electromagnetic hold-open devices will be linked to the Gallagher system for time-controlled lockdown of the building.

9.11 Kick Plates

Kick plates where required, for example, toilets, shall be 0.9mm satin stainless steel, screw fixed with countersunk head screws. Where timber doors are subject to excessive damage from trolleys etc, the stainless-steel kick plates shall be provided and shall extend to the top of the door furniture.

9.12 Door Stops

To any door where the door may strike a wall, provide an aluminium and rubber door stop, floor/or wall mounted, in a position that will allow full access clear of door furniture.

9.13 Cabin Hooks

Cabin Hooks shall be provided as required to doors without door closers.

9.14 Acoustic Seals

Where acoustic seals are required to doors to achieve the acoustic performance of the wall in which they are installed, these seals shall be fitted as follows:

- Seals to the bottom edge of the door shall be surface mounted and not rebated into the face of the door.
- Where heavy duty acoustic seals are required to the door perimeter, the door frames shall have plain jamb and head sections, and the seals shall be planted on the frame to form the door stops.

Acoustic seals shall not be fitted to the bottom edge of office doors.

9.15 Automatic & Special Door Operating Systems

Automatic doors shall comply with the requirements of AS 5007-2007 Powered Doors for Pedestrian Access & Egress. The manufacturer and installer shall supply documentation for the installation, technical data, acceptance tests, commissioning, operation, use and maintenance, including servicing and troubleshooting instructions in case of failure.

The operating mechanism shall be able to interface with electronic access and fire control systems. The door shall be compatible with a manual Request to Exit (REX) button and have the provision for a dual input door override from both the REX button and the access control system. The rechargeable battery back-up module shall be self-monitoring and capable of sustaining full operation of the door for a minimum of two (2) hours. The doors are to remain closed and locked in after-hours power failure.

9.16 Automatic Swing Doors

The operator shall be DORMA ED250 NATA certified and fully compliant with AS5007-2007. The operator shall be finished in a clear or silver anodised aluminium, with the operators capable of operating door weights up to 250kgs. The operator shall have a hold open device function as standard, to effect an indefinite open status of the door if necessary. The operator shall accept all fire, security and BMS connections as may be required. The automatic door operator shall be connected to 240 Volt GPO's and operate at "Full Energy" requiring safety sensors to be fitted to the face of each door.

Door parameters:

- Door-leaf widths from 700mm to 1,600mm;
- Maximum door-leaf weight of 250kg at a door-leaf width of 1,600mm;
- Mounting on hinge side with slide channel (pull version) – no loss of power with lintel depths from -30 to +30mm and mounting on opposite hinge side (push-version) with arm lintel depths from 0 to +225mm.

9.17 Auto Doors

Automatic doors shall comply with the requirements of AS 5007-2007- Powered Doors for Pedestrian Access & Egress. The manufacturer and installer shall supply documentation for the installation, technical data, acceptance tests, commissioning, operation, use and maintenance, including servicing and troubleshooting instructions in case of failure.

9.18 Keying System & Keys

Only master keying shall be used. Maison keying will not be approved. The lock/hardware schedule will be prepared by the architect in consultation with the Superintendent. Construction cylinders will be used during construction of any new buildings or alteration works. At practical completion of the construction and before handover to SCU, the construction cylinders shall be removed and replaced with barrels and keys to University Restricted series

The Contractor shall source all final keys and barrels from the University's Locksmith. The standard number of keys to be cut is to be set out in the Lock Schedule. The lock cylinder supplier shall stamp all keys with a continuous numbering system for that campus. These numbers are to be entered into ProMaster Key Manager to ensure key matrix is kept up to date.

10.0 Wall Finishes

10.1 Generally

All internal wall surfaces including those in Plant Rooms, Lift Motor Rooms and Service Cupboards, but excluding inaccessible service ducts, shall be painted unless noted otherwise elsewhere in this Section. The requirements of this Section with respect to paint finishes shall apply equally to paint on any other surfaces.

10.2 Paint Finishes, Materials

Generally – Only 'premium lines' from Dulux, Taubmans or Wattyl shall be used. Contractors are informed that other brands / lines are generally not acceptable to SCU. The proposed paint types shall be specified in the tender documents and shall not be changed without the approval of SCU. Paints shall be delivered to the site in the manufacturer's labelled and unopened containers. Paints and/or colours from different manufacturers shall not be combined in a paint system. MSDS forms of materials must be available on site at all times.

Colour tinting shall be by the relevant manufacturer unless otherwise approved. The addition of tint or stainers must be in accordance with the manufacturer's recommended colour without detriment to the formula, and provided the tinting produces the required colour without detriment to the durability or aesthetic performance of the product.

Generally only paints made with no or low VOC emissions are to be used. This applies to both interior and exterior applications. Low VOC emissions equate to non-flat paints having a VOC content of less than 150g/L and flat paints 50g/L. For door and frame finishes, use water borne formaldehyde free polyurethane with total VOC content below 200g/L. The use of all other paints is to be approved by the Superintendent.

Gloss Level - Flat, low gloss, semi gloss, gloss and full gloss finishes shall be to AS 2310 and AS 2311. Light coloured internal finishes shall be utilised in order to minimise lighting power densities. Ceiling/wall/floor reflectance shall be at least 70% / 50% / 15% respectively.

10.3 Paint Finishes, Workmanship

Paint and related materials shall be applied in accordance with the requirements of AS 2311, AS 2312, and the manufacturer's recommendations. Where recommended by the manufacturer, sanding between coats from top to bottom and dust down before recoating shall be specified. Spray painting of any external or internal surface is not permitted without prior approval from the Superintendent.

Warning notices etc. must be placed conspicuously and not removed until paint is dry, unless approval is given, and precautions are taken to deny access to all but painting staff. Painting will not be permitted in dusty conditions, or in unsuitable weather, such as when the relative humidity exceeds 85%, or when the surface temperature of the substrate is less than 10C or more than 50C, unless the

paint is suitable and recommended for such conditions. During preparation of surfaces, painting and inspection, light levels must be maintained such that the luminance (photometric brightness) of the surface is at least equal to that produced under daylight and/or maximum permanent artificial illumination conditions.

The areas in which painting is being carried out must be adequately ventilated, and precautions must be taken to prevent fire and accumulation of solvent fumes. Paint-soiled rags, waste, empty cans and other debris arising out of the painting work must be removed from the site upon completion of each day's work. Paint must be mixed and applied in accordance with the manufacturer's printed recommendations. Paint shall not be mixed in areas or on surfaces liable to damage from spillage. A suitable container for the washing of brushes, rollers and utensils must be provided by the Contractor. The container must be removed from the site on completion of works in accordance with current environmental practices.

Prior to surface preparation and application of material, remove all items such as locks, furniture, hardware, switches and the like, and replace upon completion of painting. For light switches and general-purpose outlets, precautions must be taken when releasing from surfaces to be painted.

10.4 Paint Systems

The following paint manufacturers and their painting systems are acceptable to SCU:

- Dulux.
- Taubmans.
- Wattyl.

Other brands of paint shall not be used without the prior written approval of the Superintendent. The manufacturers recommendations, with regard to the number of coats and type of paint for each coat, must be strictly adhered to for the location and surface to be painted.

10.5 Paint Colours

Generally, the paint colours specified shall be from the Dulux, Taubmans or Wattyl standard range. Differing colours may be selected for individual walls, ceilings, trims, doors, frames, cupboards or any other distinct element of the building. All colour schemes are to be approved by the Superintendent prior to issue.

10.6 Ceramic Wall Tiles

The use of ceramic wall tiles shall generally be limited to applications where other impervious materials are not suitable. Where ceramic tiles are used internally as a wall finish, they must not be adhesive fixed directly to off form concrete surfaces or masonry but shall be fixed to a fibre cement

sheet substrate as outlined in Section 10 Internal Walls & Partitions. Wall tiles shall be glazed or semi glazed with grouting in a dark colour. White grout shall not be used. As a minimum, provide sealed expansion joints at all internal angles and abutments with door frames. Joints shall be full depth of tiles and wall linings.

10.7 Sealants

Sealants shall be selected to be appropriate for their application and shall be colour-matched to the finished surface.

10.8 Acoustic Wall Finishes

If fabric faced acoustic treatment is used on walls in lecture theatres, it shall be located above head level or protected by handrails, chair rails or similar, to avoid damaged by traffic alongside aisles.

10.9 Chair Rails

Provide a chair rail 180mm min. high x 20mm thick comprising custom wood with a plastic laminate finish to exposed face, top and bottom edges, to all walls of seminar rooms, tutorial rooms, video conferencing rooms, computer rooms, open learning areas and meeting rooms. Consideration shall also be given to the protection of operable walls from damage by chairs.

10.10 Wall Finish to Toilets or Wet Areas

Wall finish to toilets and showers shall be 13mm thick 'Laminex Multipurpose' or approved equal compact laminate panels 1800mm high, with 10mm wide expressed ship lap vertical joints. The top edge of the panels shall align with the top edge of the toilet cubicle partitions. Corner joints shall be mitred. The panels shall be installed utilising the concealed 'Quantum Innovation Smartfix' system, all in accordance with the manufacturers printed instructions.

Wall surfaces above and below the panels shall be lined fibre cement, with paint finish above to ceiling and the floor finish below. There shall be a minimum of 20mm overlap between the panels and other finishes.

In refurbishment projects where the use of the fixing system will constrain cubicle widths and essential clearances, the use of visible screw fixings to furring channels or battens will be permitted.

Provide splashbacks to all sink units, cleaners' sinks, hand basins and safety showers. Where these exist in isolated locations, provide a splashback which shall extend from the top edge of the skirting to at least 300mm above the top edge of the fixture and on each side. Splashbacks shall generally be a single sheet of 10mm thick compact laminate attached to the wall with mechanical fixings. Splashbacks to safety showers in laboratories may be a continuation of the sheet vinyl coved skirting and shall extend to the ceiling line.

11.0 Floor Finishes

11.1 Colours

Colours of all floor finishes shall form part of the overall colour scheme and maintainability for the building. Light and plain colours should generally not be used, particularly in high traffic areas or adjacent to external entries. Colours and patterns to carpet and vinyl finishes shall be selected from the nominated manufacturer's standard product range. No custom patterns will be permitted without the written permission of the Superintendent. Carpet and vinyl selections shall be submitted to the Superintendent for approval prior finalising the building colour scheme to be presented to Users.

11.2 Carpet Finishes

SCU has adopted 100% solution-dyed nylon modular carpet tiles as its standard finish. The use of light and plain colours in floor finishes is subject to the approval of the CMWM. Where such features are proposed utilising bright colour for effect, the feature colour must be uniformly mottled with charcoal or black. Samples of the proposed feature carpet tile must be submitted to the Superintendent for approval.

Carpet tiles shall be classified as commercial extra heavy duty/stair in accordance with the Australian Carpet Classification Scheme (ACCS) and Level 4 (A) in accordance with the Environmental Classification Scheme (ECS). Material selection and installation of all carpeting must comply with the applicable portions of the current Australian Standards:

- AS 1385- Textile floor coverings - metric units and Commercial Tolerances for Measurements.
- AS 2454 -Textile floor coverings - Definitions, Terminology and structure clarification.
- AS/NZS 455 -Textile floor coverings - Laying Practice and maintained in accordance with AS 3733.
- AS/NZS 3733 -Textile floor covering – cleaning and maintenance of residential and commercial carpeting.

Carpet tiles shall be selected to meet the following criteria:

- Critical radiant flux values shall be in accordance with the current version of the NCC BCA.
- The total VOC limit shall be 0.5mg/sqm;
- The electrostatic propensity shall be 2500v max. at a relative humidity of 25%.
- 15-year warranty for wear, dimensional stability, electrostatic propensity and chair castor impact.

The carpet finish in individual buildings shall be sourced from a single manufacturer from the same batch and dye lot, including spare tiles. Whenever small areas of carpet require replacement in an

existing building already fitted with carpet finishes, matching carpet shall be installed. If a matching colour cannot be obtained, then a substitute colour, or alternative carpet, will be advised by the Superintendent.

Carpet tiles shall be fully adhered to the substrate with a low VOC (<50g/L) water based acrylic pressure sensitive adhesive approved by the tile manufacturer. Carpet on risers shall be fixed using a double bond system. Cut tiles shall not be less than half a tile unless necessary with the prior approval of the Superintendent. Spare tiles equivalent to 1% of the area installed shall be provided to the Superintendent in sealed cartons labelled 'Spare Carpet Tiles + Building No. + Date'. The batch number and dye lot shall be clearly noted on each carton.

11.3 Vinyl Finishes

Vinyl shall only be used in those areas specified. All vinyl finishes in an individual building shall be sourced from the one manufacturer. All vinyl flooring shall comply with the BCA and current Australian Standards AS 1884 – Floor coverings – resilient sheet and tiles.

Corridors and circulation areas directly connecting laboratories, but not comprising primary circulation through the building, shall have a vinyl finish. All joints shall be welded. Vinyl shall be fixed to the floor using adhesive equal in all respects to 'Polymer 265'.

Vinyl to wet areas such as toilets, cleaner's rooms, common rooms at servery counters, isolated basins and drinking fountains, shall be an approved non-slip safety sheet vinyl with a minimum slip resistance of R10.

In areas where foot traffic noise may cause disturbance or where the foot surface needs to be softer, such as physiotherapy areas where staff and students will be standing/working for long periods, cushion vinyl may be required.

Concrete floor slabs to receive vinyl flooring shall be properly prepared in accordance with the sheet manufacturer's printed instructions, including grinding to remove ridges and all hollows filled with an approved levelling compound to provide a clean level surface.

Lift car floors shall be covered with an approved 3mm thick studded sheet rubber flooring to meet critical radiant flux values in accordance with the current version of the NCC BCA. Flooring shall be adhesive fixed strictly in accordance with the manufacturer's recommendations.

11.4 Vinyl Skirtings

Black vinyl feather-edge skirtings of 150mm height shall be provided to all internal partitions, except where walls are tiled or where other floor finishes are turned up walls. In all laboratories and other wet areas, the flooring shall be covered up the walls to a height of 150mm. Coves shall be to a maximum 25mm radius and shall be fully backed with a rigid cove former. The height of coved skirtings in toilets and showers shall be determined by the height above f.f.l. of the wall panelling. Painted skirtings will not be accepted in any areas.

11.5 Ceramic Tile Finishes

The use of ceramic tiles on floors shall be to the approval of SCU. Floor tiles shall be anti-slip with dark grout (charcoal or similar) and shall finish level with adjacent finishes. Careful consideration must be given to the colour selection of floor tiles to ensure an acceptable visual appearance of the tiles after cleaning as a result of the anti-slip finish. Appropriate caulked expansion joints shall be provided as required, including the junction of tiles floors with walls. All tile layouts shall be approved by the Superintendent.

11.6 Nosings, Junctions & Trims

Nosings to step treads shall be a proprietary AS 1428.1-2009 compliant anodised aluminium nosing with a non-slip insert. The nosing shall be securely screw-fixed direct to the surface of the tread. The tread finish shall be scribed and butted to the rear edge of the nosing. However, the front lip of the nosing is required to overlap the riser finish. Junctions of dissimilar floor finishes shall be achieved using brass angles or strips set into the slab. Separation strips are not required between vinyl finishes and carpet tile.

11.7 Door Mats

Provide internal 'door mats' to carpeted areas at external entry doors. Provide similar mats where the internal entry finish is ceramic tiles, stone paving or other hard finish. Provide a brass or stainless-steel angle or strip trim at the junction between the mat and the hard finish. Recessed mat wells with drainage are not required.

11.8 Plant Room

Floors to Plant Rooms, Lift Motor Rooms and accessible Service Cupboards shall be painted with an approved paving paint.

1.9 Thresholds

Provide an approved tapering clear anodised aluminium threshold at all external doors.

1.10 Alternative Finishes

Where finishes other than carpet, vinyl or ceramic tile finishes as previously nominated are proposed, full details/data relating to the durability, the cleaning regime and manufacturer's warranty associated with those finishes must be submitted to SCU for consideration and approval prior to their incorporation into a project.

12.0 Ceilings

12.1 Generally

Suspended ceilings shall be provided in all occupied areas in buildings unless noted otherwise.

The minimum acceptable ceiling height throughout all SCU buildings shall be 2,700mm, with a minimum clearance from the top of the ceiling grid to the lowest soffit of floor or roof structure over of 400mm. Where ceilings with different types of drop-in tile occur within the building, the same grid suspension system should be used throughout, and shall be the grid utilised for the predominant ceiling system. Suspension hanger rod fixing clips shall be anchor bolt fixed to concrete soffits or screw fixed to steel roof structure. The use of 'shot' fixings is strictly prohibited. Where proprietary suspension systems are not used, all ceiling system components shall be mechanically fixed with details submitted to SCU for approval prior to tender.

12.2 Tile Suspended Ceiling Systems

Mineral fibre tile suspended ceiling systems shall be Armstrong, USG or CSR systems including tiles and prefinished steel grid suspension system. The ceiling tiles shall be 16mm thick medium texture square edged board tiles suitable for both internal air-conditioned and non-air-conditioned spaces. Any change to the ceiling tile type to suit particular acoustic requirements must be approved by the Superintendent.

The suspension system shall be hot dipped galvanised steel two-way exposed suspension system comprising main runners, cross tees and shadowline wall angles. The main runners shall be suspended and accurately levelled on 5mm dia. galvanised steel rod hangers, all in accordance with the manufacturers printed instructions and recommendations. Additional hangers shall be provided at all light fittings and air conditioning registers. Main and cross runners shall not be notched over the wall angle trim at the ceiling perimeter, but attached to the trim using the standard system purpose made clip. The wall angle trim shall be mechanically fixed to the wall framing or structure, not adhesive fixed to the wall lining.

The University requires a thirty (30) year warranty from the manufacturer of the ceiling system against ceiling panel sagging and warping and rusting of the grid components.

Where ceiling tiles are subject to uplift from wind or air flow from mechanical systems, they shall be secured by use of hold down clips. In these situations, the suspension system shall also incorporate down bracing to prevent movement of the grid. Ceilings to all toilets, showers, food preparation kitchens (not tea making kitchenettes) and laboratories shall have 1200 x 600 x 6mm thick vinyl faced fibre cement ceiling tiles.

12.3 Flush Plasterboard Ceilings

This type of ceiling shall be avoided unless required for specific applications such as laboratories. If used for aesthetic reasons in building foyers etc. subject to the approval of the Superintendent, adequate access to the ceiling space must be provided for maintenance and future equipment and services installations.

Flush plasterboard bulkheads at changes in levels of tile ceilings are acceptable and shall be framed with metal stud framing, fixed to the soffit over and adequately braced. Plasterboard linings shall be installed strictly in accordance with the manufacturer's printed instructions, including providing control joints as appropriate. Particular attention shall be made to setting of the joints to provide a clean seamless surface.

12.4 Ceiling Mounted Fixtures

Where fixtures or fittings such as light fittings, speakers, thermal alarms, etc. are to be mounted on the ceiling tiles, approved timber backing pieces shall be provided, which shall span the full width of the tile to provide bearing on the ceiling grid. Timber backers shall not be bonded to tiles. Data projectors shall not be supported off the ceiling grid, but from the slab soffit or steel roof framing above.

12.5 External Soffit Linings

Soffit linings shall be prefinished materials such as 'Colorbond' profiled metal sheeting or metal faced cladding systems. The use of timber or metal section battening is prohibited. Painted fibrous cement, adequately fixed and sealed against the ingress of moisture and corrosion, is acceptable only for soffits no more than eight metres above the ground. Soffit design and selection of materials shall be carried out to minimise spider webs and insect nesting, an ongoing problem at the Lismore Campus. Installing light fittings and other fixtures in profiled metal sheeting shall be avoided.

12.6 Plant Room Ceilings

All concrete slab soffits over Plant Rooms, Lift Motor Rooms and accessible Service Cupboards shall be painted.

Plant rooms on upper levels under a steel framed roof do not require a ceiling, however, perimeter walls must extend up to and be sealed to the underside of the roof, and the roof insulation shall extend over the plant room.

12.7 Equipment and Servicing Access

Wherever access is required to the ceiling to service or remove equipment, the ceiling shall be designed for easy removal, including removing T bars. In flush ceilings, access panels shall be a

minimum of 900 x 900mm and shall be an approved proprietary hinged metal panel with frame and budget recessed square or triangle drive lock (not keyed or flat blade), opening downward with safety chain. Lift-out panels will not be acceptable.

13.0 Fixtures and Fittings

13.1 Generally

Joinery fixtures and other fittings shall generally be outlined for each space. This Section outlines the mandatory requirements for particular spaces. If these requirements do not appear on a standard drawing, then the requirement shall be checked with SCU prior to finalising the design documentation.

13.2 Whiteboards & Pinboards

Whiteboards shall be white vitreous porcelain finished steel sheet with a clear anodised 'Fineline' aluminum perimeter trim with mitred corners, a pen rail full width along bottom edge.

Whiteboards to teaching walls shall be located to allow simultaneous projection onto the wall surface or a screen when used. All boards shall be mounted on concealed fixing brackets. Brackets shall be securely fixed using 'Ramset Hollow Wall' or 'Hilti Cavity' anchors or screw fixed directly to studs. 'Wall Mate' fixings or plastic plugs in wall linings are not permitted. Screw fixing through the perimeter frame or using adhesives to attach boards to walls is expressly forbidden. Where Pinboards other than Noteboards are nominated as required externally to room entry doors, consideration must be given to the location of Room signage so that no conflict occurs.

13.3 Built-in Joinery Generally

As noted on the SD's, built-in joinery units such as cupboards and laboratory benches shall be provided.

13.4 Kitchenettes & Tea Preparation Stations

Bench cupboard units to kitchenettes shall be, as previously described, with laminate bench tops and splashbacks generally in accordance with SD's, with provision for a dishwasher, microwave oven or refrigerator if nominated. Microwaves shall be mounted on a wall mounted shelf unit fixed at 600mm above the bench top. Tea preparation stations may be located in recesses off circulation corridors rather than be installed in an enclosed room.

Each kitchenette or tea preparation station shall be provided with a 'Zip Hydro Tap G5 Four-in-One' or approved equal under bench chilled, boiling, hot and cold water unit, completed with a bench mounted mixer tap for hot/cold water and a hydro tap with extended levers for chilled/boiling water. The unit size shall be determined by the number of building occupants to be served by the unit. Ventilation to zip unit to be provided as per manufacturers recommendations. Where the SD's requires a dishwasher to be installed, it shall be a high quality energy efficient and 4 Star WELS rated brand. All dishwashers shall be built-in. Provide a 'surface mounted' Hand Towel Dispenser with integral waste receptacle if required.

Each kitchenette shall be provided with a fridge unit with freezer, with an energy rating not less than 5. The size of the unit shall be commensurate with the number of building occupants who will use the facility. Each tea preparation station shall have a bar fridge with an energy rating of no less than 4 installed under the bench. Where a Microwave oven is required, it shall be an approved model with automatic sensors and reheat function and utilising inverter technology. The minimum size of Microwave oven shall be 19 litres.

13.5 Waste & Recycle Bin Enclosures

Internal bin enclosures shall suit 80-litre wheeled bins. Enclosures shall be provided in Utility Rooms and Common Rooms. The number of bins in each enclosure and their location shall be determined in consultation with SCU.

13.6 Drinking Fountains

Provide a minimum of one 'Zip Chill Fountain CFB140FWA wall-mounted chilled water drinking fountain to serve both adults and wheelchair users at each building floor level. Each unit shall be fitted with one fixed gooseneck spout suitable for bottle filling. This spout is to be controlled by either a switch or spring-loaded tap.

13.7 Works of Art

Liaison with the Director, Library Services should occur at an early date in the development of the plans to designate 'gallery' areas in public spaces such as corridors, foyers and meeting rooms. These walls are to be kept clear of notice boards and other fittings such as clocks, power points, phones, drinking fountains, air conditioning equipment, etc.

13.8 Engineered Stone

The use of engineered stone (also called manufactured stone and reconstituted stone) is expressly forbidden in SCU facilities.

14.0 Mechanical Services

The requirements of this Section are generally Mandatory.

Deviations from these guidelines shall require written permission from the Superintendent. Departure from these requirements without prior approval shall be rectified by the Consultant/Contractor at no expense to SCU.

14.1 Mechanical Equipment Identification

Equipment identification shall be in accordance with the requirements of SCU.

14.2 Air Conditioning & Ventilation

Mechanical services shall conform to the:

- National Construction Code and regulations.
- Workplace Health and Safety Act and regulations.
- Electrical Safety Act.
- Fire and Rescue Services Act and Regulations.
- Environmental Protection Act and Regulations.

Air-conditioning systems shall be designed to meet the requirements of AS 1668 Parts 1 and 2 and AS 3666 as well as any other applicable Standard, Regulation or Act, including but not limited to AS 1851.

14.3 Design Documentation

The consultant will develop and maintain design documentation available for review by the CMWM.

As a minimum requirement, design documentation will include the following:

Air Conditioning Heat Loads;

- Maximum Demand Calculations for MSSB.
- Air Conditioning Zoning.
- CHW Diversity.
- Equipment selections.

Refurbished Buildings – Special requirements apply to all refurbished buildings in relation to the existing chilled water system. The scope of work for the project shall include the following steps:

- Provide a dilapidation report on the air conditioning system prior to starting on the project, identifying any issues or potential problems for the new work.

- Measure all existing chilled water flows in the building and provide a report.
- Allow to rebalance all the chilled water units in the building back to either original design or the previously measured values as part of the work.

All ductwork, AHUs, filters, fans and the like, retained when undertaking refurbishment works, shall be cleaned to remove accumulated dust and mould and treated to prevent mould regrowth. Whenever there is any new construction, refurbishment or modification work for the whole or part of a building, or a chiller plant, which involve changes to the existing chilled water piping schematic such as changes on pipe sizes, pipe routing, AHUs or FCUs connected, addition or deletion of chillers, pumps etc.; the mechanical consultant engaged for the project shall be responsible for updating the complete piping schematic drawing for the whole system. The BMS contractor shall also revise and update the BMS control graphics and diagrams accordingly.

14.4 Design Criteria

All mechanical designs shall consider the following:

- Lowest life cycle cost.
- Service access for maintenance.
- Compatibility with existing systems.
- Flexibility for future alterations.
- Energy efficiency.
- Supported locally (subject to campus location), with respect to servicing and parts.
- Designed for the installation environment.

All air-handling systems shall have adequate fresh air drawn from outside the building via ductwork at locations well away from cooling towers discharges, fume exhausts or traffic. Air handling units shall not serve more than one floor. The use of window-mounted or through-the-wall room air-conditioners (RACs) is strictly prohibited.

Equipment requiring regular service and maintenance shall not be mounted in ceiling spaces. Fan coil units shall be mounted below the ceiling, while air handling units shall be floor mounted in dedicated plant rooms or cupboards of adequate size to allow servicing of all components. Ventilation fans shall be mounted in plantrooms wherever possible, rather than above roofs or in ceiling spaces.

Wet Area Ventilation – the design must ensure the containment of odours and steam when designing the mechanical systems.

Mixed Mode Ventilation – When designing mechanical services for new buildings or major refurbishments, the feasibility of combining natural ventilation, mechanical ventilation and air conditioning shall be investigated, including life cycle costings and proposed payback considering actual usage.

Data Rooms – Data rooms shall be air-conditioned via a cool-only wall-mounted inverter style split DX system. The air conditioning system shall run continuously and automatically restart upon power failure. The SCU TS team must be consulted for final approval for the solution.

Laboratory Space – Any building or part of a building used or intended to be used for scientific or technical work which may be hazardous, including research, quality control, testing, teaching, preparation, analysis, support areas etc. must comply with the National Construction Code, AS 2982, AS 2243 Parts 1-10 inclusive, AS 1940, AS 4332, AS/NZ 2982.1, AS60079.10; and referenced and related documents including the Workplace Health and Safety Act and regulations as nominated by end users.

For Physical Containment (PC) laboratory spaces, the design consultant shall provide an airflow schematic drawing detailing the method of achieving a negative differential air pressure in the laboratory relative to the spaces outside the boundary of the PC space. It may be necessary to achieve an air pressure differential between adjoining rooms and air locks.

Negative pressure/inward air flow (as required) shall be maintained by a dedicated exhaust system controlled by the BMS to achieve the nominated differential pressure across the boundary to the facility. Provide a dedicated exhaust fan controlled from differential pressure sensor controlling to -10Pa. +/-5Pa.

On completion of the project and during the commissioning of the facility, an air pressure differential test shall be carried out to confirm the design and compliance with physical containment requirements. Provide an LCD screen adjacent to the entry door to indicate the room pressure achieved.

Coil UV systems – Provide off coil UV systems for all new AHU's. The system shall meet the requirements of AIRAH DA15 Manual Section 12.7.4 and to provide a minimum dose of UVC not less than 1225 $\mu\text{W}/\text{cm}^2$ at the edge of the coil.

Gold Coast and NMSC campus locations – All external metal work, such as outside air grilles, equipment supports, external mesh, filter frames, etc. shall be a minimum of 316 stainless steel.

14.5 Design Conditions

The following design conditions shall generally be adopted:

Summer External Ambient Condition	32.00 C DB and 25.50 C WB
Winter External Ambient Condition	9.00 C DB

14.6 Performance Criteria

Air Conditioning systems shall be designed to maintain the following unless specifically noted otherwise:

Summer Internal Design Condition	23.00 C DB \pm 10 C and 50% RH \pm 5%
Winter Internal Design Condition	21.00 C DB \pm 10 C

Normal Hours of Operation: Monday to Friday: - 8:00am to 10:00pm

14.7 Population Densities

The following population densities shall generally be adopted:

General Working Space	10 m ² / person
Learning Centre	2.5 m ² /person
Laboratory	3.7 to 4.7 m ² /person
Teaching Space (Tutorial)	1.8 m ² / person
Computer Lab	2.5 m ² /person

14.8 Humidity Control

Humidity control will not be provided unless specifically called for or where special circumstances dictate. Where special conditions are required, these will be nominated by the user and agreed by the Superintendent's representative. Consideration shall be given to the possibility of mould occurring in the air-conditioned space at the design phase and systems to limit mould shall be included in the design i.e. dehumidification cycle to keep internal humidity under 70% RH.

14.9 Plant Rooms

Plant rooms shall be provided with mechanical exhaust ventilation to AS1668.2. Fresh air intake and exhaust grilles shall be located to provide effective air flow through the space and to remove heat from equipment and switchboards installed in the plant room. There shall be a Water Supply within each A/C Plant Room. A floor waste charging device shall be fitted, and a line shall be fed to each drain that is connected to Sewer.

Tundishes and floor wastes from plantroom shall be designed so that they do not connect directly to sewer systems, i.e., air gaps required. Provide advice to the hydraulic consultant to ensure that no smells can come back up into the mechanical plant rooms or spaces.

14.10 Noise of Operation

Noise Levels - Noise levels shall conform to current version of AS2107. The system shall be designed to eliminate the transmission of noise and vibration from air-conditioning and mechanical equipment to the space and the building structure. Sound attenuators and/or insulated ductwork shall be installed where necessary to eliminate the transmission of fan noise.

Where reciprocating or rotating equipment is installed, it shall be isolated from the structure by vibration isolators. All pipe work that is connected to chillers, pumps, cooling towers etc., shall include flexible connections. All ducts connected to fans or any rotating equipment shall be provided with vibration isolation, such as flexible duct connections. The Consultants and/or Contractors shall replace any equipment or system found to exceed the nominated noise levels at no cost to the University.

14.11 Pipework, Valves & Fittings

Chilled water and condenser water lines shall generally be up to 150mm diameter. Type B Copper and condensate drains shall be Class 12 PVC. Where fixing brackets or clips to copper pipework are of a dissimilar metal, they shall be effectively isolated from the pipework with plastic tape or similar material to prevent corrosion. Paint finishes are not acceptable as an isolating medium. Internal pipework shall be installed in service ducts, risers or ceiling spaces.

All the return chilled water pipes at the Chiller Plant shall be installed to allow for complete mixing of all return water before passing the Chiller staging sensor.

Pipework immediately before the inlet of any water meter, energy meter or any measuring device installed on the pipework, shall be in a straight length of not less than six (6) times the pipe diameter or a minimum of 1 metre.

Valves shall be of approved manufacture to confirm to AS MP52 and shall be in easily accessible positions. Valves and fittings laid in-ground shall be flanged and located in drained concrete service pits and shall have 316 Stainless Steel bolts and washers. Transition from one material to another should be made adjacent to the buildings in a concrete services pit.

Chilled water control valves shall be rated to resist the system pressure when shut and offer satisfactory authority of the system pressures at that point, typically a pressure drop of 20% of total system pressure drop. All valves shall be labelled for their service and function using engraved discs to the approval of the Superintendent. Valves shall be scheduled and detailed in the maintenance manuals. All valves shall have extended shafts to accommodate complete insulation of the pipework.

Incoming mains and main distribution pipes shall be installed of a size adequate to permit connection of future buildings or any expansion. The requirements are to be discussed with the Superintendent and generally follow the site master plan. Pipes that pass-through floors or walls shall have sleeves filled with appropriate insulation or fire rated material to suit the application.

Provide suitably sized pipework risers within the building to service every building level. Provide dirt legs and drains at the bottom of each riser, fitted with hose cocks. Pipework risers shall incorporate dedicated isolating valves at every building level take-off and at all other significant subbranch pipework runs. It shall be possible to isolate each building level and subbranch without disrupting the chilled water service to other levels and sub-branches. Provide STAT valves at each level take off. Provide drains at the lowest points in the chilled water system on each building level. Automatic air bleeds complete with an isolation valve and drain to nearest waste pipe, shall only be installed at the highest point of the chilled water reticulation system, such as the top of vertical risers via a T junction and a short riser extension, and not on horizontal pipe runs.

Underground chilled water campus reticulation pipework between buildings etc. shall be direct buried and shall be HDPE pipe to AS4130 – installed to AS2033 and AS2566, selected for the design pressure. All underground pipework shall be installed as per the manufacturer's recommendation. Pipework shall be factory pre-insulated by an approved manufacturer to comply with the requirements of the NCC. Provide engraved brass marker plates 100x100mm minimum c/w direction arrows at each change of direction, including concrete sub structure where required. Thrust blocks must be installed at all junctions and changes in direction where required – provide calculations. Where future buildings are planned, provide valved take-offs for future connections located in services pits located adjacent future building sites.

All screwed valves and fittings shall have unions for easy removal without cutting the pipework.

'Binda' cocks shall be fitted to all at all air-handling units, fan coil units, pumps etc and shall extend a minimum of 15mm beyond the outside surface of the insulation. 'Binda' cocks shall be located next to all BMS sensors for calibration and test purposes.

Ductwork, solid and flexible, shall be constructed and installed in accordance with AS 5254. Flexible ductwork shall be supported by packaging straps, buckles and mesh saddles not less than 300mm long, to suit the duct diameter. Provide locking quadrants to all adjustable dampers including spigot and butterfly dampers. Supply air ductwork immediately prior to the inlet of a VAV box shall be in a straight length of not less than 4.5 times the equivalent diameter of the duct.

Insulation to air conditioning ductwork shall generally be external. Internal insulation of ductwork shall only be installed with the prior approval of the Superintendent. Provide easily accessible access panels in the ductwork for cleaning and inspection. Internal insulation in plenums shall be faced with perforated galvanised steel. Where ductwork is exposed to view in occupied spaces, all ductwork whether insulated, or uninsulated, shall be spiral wound circular or oval duct. Where ductwork is exposed to weather, it shall be profiled to shed water. Ductwork exposed above roofline excluding fume exhausts shall be constructed from or covered by 'Colorbond' sheet steel to match the roof colour. External ducts shall be graded to prevent ponding and all joints shall be sealed with an approved sealant. Joints in exposed ductwork shall be pocket and tail joints or similar, to provide a smooth neat appearance. Longitudinal joints shall be of the Pittsburgh type with a smooth interior finish. Standing seams shall not be permitted. Duct supports shall not be used to support piping, ceiling and any other loads additional to the ductwork.

Provide duct access panels in the risers at each floor and in each branch or sub-branch for cleaning purposes. Duct access panels shall be not more than 10 metres apart. Duct access panels minimum size 300 x 200mm shall be 'Bullock' brand and the location of access panels above ceilings shall be coordinated with the ceiling grid, light fittings and equipment layout. Where these access panels are visible, they shall be fitted with 'Larkspur' catches.

Outside air intakes shall be provided with easily removable media filters to pre-filter the air before it enters the unit(s). Outside air grilles shall be anodised (20 microns min.) or powder coated aluminium, to match the exterior colour scheme of the building (no 'Colorbond' steel permitted). Provide removable vermin mesh behind all external louvers.

To eliminate condensation on ductwork which can potentially cause water damage to ceilings, light fittings, electronic equipment etc, the following must be considered:

- All return, discharge and exhaust ductwork including all applications for air conditioning, fume cupboard extraction, laboratory pressurisation systems, vacuum systems, dangerous goods cabinet discharge etc. which are subject to an internal air temperature lower than the surrounding air temperature, may be subject to the formation of condensation on its external surfaces.
- The forming of condensation on external duct surfaces will be more prevalent when the ducts pass through plant rooms, service risers, ceiling voids and any enclosed spaces which will contain stagnant untreated ambient air.
- Ceiling voids shall not be assumed to have the same controlled indoor conditions as exist in the airconditioned spaces over which they occur.
- External insulation shall be provided around ductwork wherever there is a chance that condensation may form including in addition to all locations required by section J of the National Construction Code.

14.12 Mechanical Equipment

Pumps

Pumps shall be selected based on their suitability to duty. The pump casing and electric motor shall be sized to accommodate an impeller one standard sizes larger than selected. Stainless steel drip trays are to be mounted on concrete inertia bases complete with spring mounts.

Pumps shall be provided with variable speed drives (VSD) for balancing or controlling purposes. Secondary and tertiary chilled water pumps shall be provided as two pumps in a Lead/Lag arrangement each pump sized to accommodate 65% of the required design water flow. Where more than one (1) chiller/pump combination is utilised together, a single primary chilled water pump and VSD is acceptable.

Motors shall be totally enclosed fan cooled and normally be limited to 1450 rpm maximum or as approved by SCU. Motors shall have an IP56 rating. Belts, pulleys and couplings shall be protected by the use of easily removable and replaceable guards. Motors rated at more than 10kW shall be provided

with a lifting eye. All motors rated at 5.5kw and above shall be of the Premium Efficiency type. Motors shall be capable of operating down to 20% of full load speed continuously.

Hot Water Heating Coils

Heating of air shall be by means of hot water coils fitted to Air Handling Units (AHU) or air Pre-Conditioners located generally in plant rooms. Hot water shall be generated by heat pumps and circulated by an in-line pump with a controlled variable speed drive that varies the rate of circulation of the water through the coils depending on the amount of heat required.

Heat pumps for air heating shall be commercial range units located centrally in a separate plant room with cold air discharge to the outside of the building. If three or more units are required, they shall be manifolded together to achieve an equal flow output.

Electric Heater Banks

The use of electric heater banks shall only be considered if there is no alternative and is to be approved. Heater banks shall be located generally in plant rooms and shall be clearly identified. The maximum sizing of a heater bank stage shall not exceed 12kW for three phase heater or 4kW for a single-phase heater. Heater banks shall be of a physical size that gives maximum coverage to allow for effective heat transfer and to ensure that no air bypasses the heater bank. There shall be an isolating switch to isolate the heater located immediately adjacent to the heater bank. Isolating the control circuit only is not acceptable.

Refrigerant Gas Detection for Chiller Plant Rooms

Where there is a dedicated Plantroom for Chillers and where there is the potential for Refrigeration Gas to accumulate beyond an acceptable amount then the following shall be installed:

- Gas Detection shall be by an Infrared Type Detector.
- The Alarm shall be connected to the University BMS System with SMS alarms set up.
- Must have a Red Strobe Light and a Sign saying 'Gas Alarm' inside the room in a place where it will be seen.
- Must have a Red Strobe Light and a Sign saying 'Gas Alarm' outside the room and above each Entry point.
- Must have a Green LED Light constantly illuminated and a Sign saying 'Safe to Enter' outside the room and above each entry point.
- Both the Constantly illuminated Green Light and the Red Strobe Alarm Light shall be interconnected, but only one Light is to be illuminated at a time and MUST be fed from the same Power Source.
- The alarm shall initiate the plantroom ventilation system to the required air flow Provide Breathing Apparatus in accordance with AS5149.

Chillers

Chillers shall be 'York', 'Trane', 'Carrier', or other approved manufacturer. Additional chillers shall be compatible with existing equipment. All chiller units shall be raised above plant room/enclosure floor slabs on corrosion protected supports to allow easy removal of leaf litter and the like which may accumulate under the unit. All chillers installed in a corrosive environment shall have enhanced corrosion protection to painted and galvanised surfaces, and the condenser coil fins to air cooled units shall be protected with a factory applied treatment to the approval of Engineering Services. Provide marine water boxes to all water-cooled chillers.

Undertake a review of appropriate chillers and provide a report determining the optimum chiller selection for the project in terms of life cycle cost taking into account energy, maintenance, water usage, refrigerant etc.

All chillers shall be provided with at least 1 High Level Interface (HLI) connection at the chiller local panel. The other shall be connected to the BMS system for all control and monitoring functions. All connection works outside the chiller local panel will be done by others, not by the chiller supplier.

Cooling Towers

Cooling Towers shall be stainless steel or fibre glass. Towers shall be manifolded together and be provided in an N+1 cell arrangement for future cleaning. Towers shall comply with all relevant codes, standards, acts and regulations i.e. AS3666, AS1055 and AS1657 as a minimum requirement. Tower placement shall consider the potential for dispersal of Legionella bacteria and the associated risks to the University Community. Particular care shall also be taken to ensure that statutory requirements relating to noise levels are met. Cooling Tower fan motors shall be provided with variable speed drives for controlling purposes. Provide side stream filtration systems to prevent deadlegs.

The Water Treatment System shall ensure plant operation meets all current legislative standards and be capable of remote monitoring. All details shall be agreed with the superintendents' representative in advance (in consultation with the current University water treatment maintenance contractor). Cooling tower drift loss performance shall comply with AS4180.1. Cooling towers, support beams and associated walkways shall be documented as one package.

Air Cooled Condensers

Air Cooled Condensers shall be of approved manufacture and should preferably be of the vertical airflow type. Where multiple compressors are installed, each compressor shall be capable of being individually isolated for maintenance and for fault.

14.13 Electrical Services

All equipment shall be located in easily accessible and adequately sized plant rooms unless otherwise approved by the Superintendent. Clearances around the mechanical switchboards shall meet the requirements of AS 3000.

Switchboards and Motor Control Centres shall normally be of type-tested construction with an IP rating approved by the Superintendent prior to tendering. Switchboards shall be electrical orange (X15 to AS 2700) externally and white internally. External switchboards shall be constructed from powder coated 304 stainless steel.

All components shall be located on the rear panel in an orderly manner. No components are to be mounted on the sides or base of the switchboard, and they shall be mounted not less than 300mm above the floor. Permanent, clearly legible 'Traffolyte' labels shall be screw fixed to all internal and external controls. Provide a screw fixed 'Traffolyte' label to the front of the MSSB that includes the size and origin of the sub-mains.

Fire Alarm Relays shall be provided in accordance with the requirements of AS 1668 and AS 1670 as applicable.

Provide spare space and capacity in all switchboards, sub-boards and control panels to allow for future expansion. This spare capacity also applies to the switchboard sub-mains etc. The amount of spare capacity shall suit the situation and be agreed upon and approved by the Superintendent prior to manufacture, but in no instance shall be less than 10%.

Provision for temporary power at the Main Switchboard will be generally preferred, but the requirement for a temporary generator connection point on the MSSB shall be considered for special research installations, where power interruption to carry out MSB maintenance cannot be tolerated. This will be by exception and agreed with SCU.

All cables shall be run on cable trays, ladders, catenary wire etc. and terminated in terminal strips. All cables entering switchboards shall enter the switchboards through a gland nut and be terminated on a terminal block, labelled as to its origin and numbered. All active, neutral, earth and control wiring shall be number ferruled both in the switchboard and at field terminations corresponding to circuit breaker numbers. Wrap around tape numbering systems are not acceptable to the Superintendent. Multi-joining of cables prior to termination on bars is not acceptable. Neutral and earth bars shall have the same number of terminations as circuit breaker positions and shall include two grub screws per terminal. All cabling shall comply with the requirements of Section 19 Electrical Services.

The MSSB shall include 'Auto/Off/Manual' switches for each piece of equipment served, except for VAV boxes which will have a heater 'Auto/Off switch (refer to GU Standard Drawing No. GSD-600, as noted in section 31 of this document gives link to internet site). For all VAV heater banks, an HPT fault indicator light for each VAV unit shall also be provided on the MSSB fascia. Provide a surface mounted LED batten in each switchboard cupboard greater than 2m² in face area.

All mechanical switchboards shall have a lamp test facility incorporated into the control system via relays and not diodes. All mechanical boards shall be adequately vented to remove heat and locked

via an 'L&F 92268' key. Mechanical services switchboards shall be supplied directly from the building main switchboard with dedicated submains cabling to each individual switchboard. No mechanical services should be supplied from general light and power switchboards.

All Electrical & Mechanical services inside the ceiling void which will generate heat such as recessed light fittings, transformers etc. shall not be covered by any thermal insulation or the like which will impede the heat rejection. For small transformers, it is suggested that they be hung on independent support wires.

All pipes and ductwork shall be identified in accordance with AS 1345 – Identification of the contents of Piping, Conduits and Ducts, and AS 1318 – SAA industrial Safety Colour Code and AS 2700 – Colour Standards for General Purposes. Extra labelling shall be provided if requested by the Superintendent for clear identification of any pipework or ductwork.

The location of identification marking shall be at intervals of no more than 3m and adjacent to branches, junctions, valves, both sides of walls and control points. Such marking shall be placed so that they are easily seen from all approaches.

'Safetyman' adhesive labels are an acceptable method for identification of pipework. Flow direction arrows shall be provided to all pipework and the Flow and Return-pipes shall be identified with labels, which read 'Chilled Water Flow' and 'Chilled Water Return' as appropriate.

Proper consideration must be given to the design of mechanical services which initially will not be fully utilised or which form part of a Master Plan. Design issues to be considered shall include, but, not be limited to chilled water supply, size of plant rooms, provision and/or size of service ducts and risers, capacity of equipment, electrical supplies etc. These requirements shall be confirmed by SCU. Where required, outside air shall be provided to ensure minimum fresh air requirements are met.

For ceiling fan coil unit (FCU) installations where outside air is required, a pre-conditioner shall be used. Pre-conditioner shall be fully BMS controlled and function in conjunction with the FCUs that it feeds.

Provide a water meter to all water supplies to the mechanical systems e.g. cooling tower, expansion tank etc. The meters shall conform to the Hydraulic Section 17.13 and be located in a plant room, a readily accessible service duct or the valve room and shall be easily readable without the use of a ladder. They shall also be capable of interface to the BMS or sitewide historian system for remote monitoring and data collection purposes.

All spaces with a population exceeding 100 persons or 100% outside air shall be investigated for the use of enthalpy control and/or heat transfer systems on outside air and a lifecycle cost analysis provided.

Controls, thermostats and motorised dampers to allow for automatic operation on all outside air whenever conditions permit shall be incorporated wherever possible.

All chilled water pumps and large air handling units incorporating VAV boxes shall have variable speed, variable frequency drives as manufactured by 'ABB' or 'Danfoss' with minimal harmonic effect and be capable of being controlled by the BMS for all parameters. HLI interface to BMS required.

All relevant requirements of Section 15 Hydraulic Services and Section 18 Electrical Services shall apply.

- The minimum opening of the VAV box shall be set at 40% flow to achieve the best savings in energy consumption. This setting can be adjusted slightly up or down to suit the particular requirements of an area, however with the reduced minimum flow and proper zoning as outlined above, the possibility of having to provide heating to an overcooled space will be much reduced.
- For better air distribution and to minimise cold air dumping during low air flow, linear slot type diffusers shall be used instead of louvre type.
- The outdoor air supply to the AHU shall be maintained by a dedicated fan such that the design flow rate of outdoor air will be constant even when the supply/return air flow of the AHU is low. The outdoor air fan shall operate whenever the AHU fan is on.

14.14 Air Filters

Any individual mechanical supply air ventilation system incorporating heating/cooling coils or humidifiers, or both, shall incorporate an air filter rated to AS 1324.1. Such filters shall be positioned before supply air fans and any coils or humidifiers and both the outdoor and recycle air shall be filtered as applicable.

NOTE: This requirement does not preclude the use of additional filters in other parts of the air handling system.

Filter modules shall be readily accessible and removable and shall be securely held in position. Frames shall be mounted so as to provide an adequate seal and prevent air from bypassing the filter media. The entire filter assembly shall be adequately supported to prevent distortion of frames or media under all anticipated loadings.

14.15 Building Management System (BMS)

Nexo Controls are the incumbent provider of all Building Monitoring Systems (BMS) at all SCU campuses. All new mechanical equipment and controls shall be compatible with the local controls. Mechanical Contractors shall liaise with Nexo Controls to ensure compatibility between existing and new systems. All buildings, regardless of the campus location, shall be integrated into the BMS monitoring system at the Lismore Campus.

All installations must provide for KWHR Meters on all Mechanical Services Switch Boards (MSSB) equal to Crompton Instruments, Integra 1630 with BACnet/IP Output.

Note: separate metering is required to each Building.

Please refer to Appendix B (Building Management System [BMS] – Nexo Controls) and Appendix C (Southern Cross University Data and Telecommunications Design Specifications) for further details.

14.16 Plant Shut Down and Response Times

The mechanical engineering consultant shall consult with the CMWM and the approved specialist BMS provider to develop the air conditioning control strategy for all areas of a new building or a major refurbishment. Where possible, mechanical plant or zonal control shall be connected to occupancy sensors, which may also be connected to the lighting or security system, to implement plant shut down or reversion (set back) to an 'idle state'. The time till such states are triggered shall be programmable, but typically be 30 minutes with no occupancy sensor triggering. Out-of-hours operation for the system shall be provided by a local on/off switch for each VAV, complete with an illuminated indicator.

Consideration must be given to the plant and equipment response time so that the thermal comfort criteria is achieved within a reasonable period. Particular attention shall be given to the following:

- Start-up response time from the “off” state to the scheduled start time, e.g. the target internal temperature, should be achieved no more than one hour after the plant start time.
- Transient response time from idle state to occupied state, e.g. where occupancy controls are used for temperature set back (or plant shut down), the target internal temperature should be re-established within 10 minutes.

14.17 Fume Cupboards

The fume cupboard installation and associated services shall be designed, supplied, installed, tested and maintained to the requirements of the following standards:

- AS 2243.8 – Safety in Laboratories, Fume Cupboards.
- AS 2982 – Laboratory Construction.
- AS 60079.10.1 – Classification of Hazardous Areas – Examples of Area Classification – Laboratories Including Fume Cupboards and Flammable Medical Agents.
- AS 1482 – Electrical Equipment for Explosive Atmospheres – Protected by Ventilation – Type of Protection.
- AS 3000 – Electrical Installations – Buildings, Structures and Premises and the Workplace Health and Safety Regulations.

The requirements of this Clause relate to fume cupboards intended for general chemical use. Further requirements shall be incorporated in fume cupboards intended for special applications as established by the SD's, e.g. perchloric and HF acid, radioactive substances high hazard operations.

Where it is possible that the discharge from the cupboard or group of cupboards is likely to impact an adjacent building or installations, a detailed investigation including wind analysis is to be undertaken before the final design is submitted for consideration. If it is found that the proposed installation will have an adverse impact on the surroundings, recommendations for the elimination of these factors are to be included in the report.

Manifolded fume cupboard systems consistent with AS2243.8 can be considered in discussion with the CMWM where the project is suited to it. Fume cupboards shall be single-sided, of proprietary manufacture and shall be based on a proven standard design. Cupboards shall be dimensions to suit the particular requirements of the SD's.

Cupboards shall be constructed of fire-retardant glass reinforced plastic (GRP) and shall comply with AS1530.3. Fume cupboards shall be 'Hamilton', 'S2M', 'Chemical Fume Handling', 'or equal approve by SCU.

Provide an infill panel at the top of each cupboard to the ceiling to conceal the exhaust duct and include a removable access panel to allow for servicing of glass door, pulleys and other equipment. Access panels for maintenance shall be easily accessible. Where multiple cupboards are installed side by side, ensure any access panels in sides of cupboards are not obstructed.

Inner Chamber – The inner chamber shall be a single piece molded design from chemical resistant GRP with large radiused corners. The roof shall be aerodynamically shaped evenly on three sides towards a flanged rectangle outlet at the rear of the chamber which shall not be less than 45% of the width of the inner chamber and containing no exposed fixing bolts. A flat non-aerodynamic type roof will not be acceptable. The inner chamber shall have a smooth finish for ease of maintenance and shall accept any runback from the exhaust.

Sash – Access to the fume cupboard shall be via a single 6mm thick safety glass door panel stamped by the manufacturer together with the SAS approval stamp. The door shall slide vertically in special PVC extrusions. The door panel shall be carefully balanced to ensure even and easy operation using stainless steel cables and low friction pulleys. Closure cushions shall be installed at the bottom of the door tracks to allow a 50mm minimum opening. Sash shall incorporate an automatic return to minimum position after 15 minutes (adjustable), function.

Front Fascia – The aerodynamically shaped fascia and door assembly having a full-length aerofoil section shall be incorporated and constructed to ensure a smooth even airflow pattern entering the fume cupboard.

Rear Baffle – Molded baffles are required at the rear of the cupboard and shall be designed to provide a laminar airflow at all levels and across the width of the cupboard. The baffles shall be readily removable for maintenance. The baffles shall be specifically designed, contain no exposed bolts and allow the whole chamber to be effectively scavenged.

Base – The base of the chamber shall contain a full width sump molded in one piece from GRP and fitted with a waste outlet.

Worktop – The worktop shall be as required by the end user and may or may not incorporate a sink.

Lighting – Provide a LED light fitting mounted in a purpose made molded cover and armour plate front panel in the roof of the chamber to provide lighting levels in accordance with AS 2243.8. The light fitting shall not disturb the airflow within the cupboard. The 240V electrical supply and final connection shall be undertaken by the mechanical sub-contractor. The light fitting shall be easily accessed for tube replacement and maintenance, via an access hatch in the front face of the cupboard.

The fume cupboard can have a range of services including gases, water and electricity, refer to the SDF's. Service outlets shall generally be located in the inner side walls of the fume cupboard with the sink located under the water outlets. The outlets shall be finished in an electrostatically applied epoxy.

Controls to services shall be mounted on the fascia panel below the door. All outlets shall be clearly identified both inside and outside the cupboard at outlets and controls with engraved plastic labels.

Provide double GPOs as required appropriately labelled mounted in the bottom half of the vertical fascia, in accordance with AS 2243.8. Each GPO shall come complete with neon indicator lamps and shall be RCD protected.

Where a user has nominated a requirement for a scrubbing fume cupboard for the use of perchloric and hydrofluoric acids, a hand-held spray with flexible hose connection shall be provided to allow a gentle cold water washdown of the cupboard interior. This washdown system shall be connected to a dedicated cold water service outlet. See also Clause 17.5.6 Electrical and Controls of this Section.

Cupboards shall be mounted at normal bench height and the entire unit shall have a neat aesthetic appearance. Provide disabled access to at least one fume cupboard per laboratory. The support structure shall be designed to support the cupboard and where required in the space description forms, provide storage space complete with adjustable shelving, doors and handles. The rear panel shall be removed to access services run on the back wall.

An electronic control system shall be coupled to the fume cupboard sash to control the speed of the extraction fan and maintain a velocity in accordance with AS 2243.8 across the open sash regardless of position. At minimum sash opening the fume cupboard shall be scavenged at a minimum rate of five (5) air changes per minute. The controller shall be easily accessed for adjustment of minimum and maximum flow rates. A discharge cone could be fitted which ensures a suitable discharge velocity even at minimum exhaust rates. Provide a control system complete with switches, timers, relays, pre and post purge functions and audio/visual alarms in full accordance with AS 2243.8, AS 2430 and AS 1492. Provide a manual reset switch to reset the alarm systems. No BMS interface is required to the fume cupboard.

The exhaust system shall modulate to maintain negative pressure or inward air flow as required for the specific use of the area.

The fume cupboard manufacturer shall completely pre-wire the fume cupboard. Terminals shall be provided for the single-phase electrical supply to the cupboard and the three-phase connection between the cupboard and extraction fan.

14.18 Fume Exhaust Systems

The sound pressure level measured at each fume cupboard with the air conditioning in operation, should not exceed that nomination in AS 2243.8. When all fume cupboards in each laboratory are running at full capacity the overall sound pressure levels within the room shall not exceed the levels in AS2107. All equipment shall be installed so as to prevent vibration.

The exhaust fans shall be of the forward curved centrifugal type with overhung wheel, constructed of PVC and being of approved design and manufacture capable of being adjusted to run at 110% of the specified rating. The fan casing shall be fabricated entirely from chemical resistant reinforced plastic in one piece without seams or joints. The impeller shall be of all PVC welded construction except for a stainless-steel centre. Shafts are to be stainless steel, liberal in size to afford rigid support for the overhung fan impeller.

All metal parts which may be exposed to corrosive fumes shall be completely covered with PVC. The impeller centre shall be extended outside the fan casing and shall be fitted with a high-quality plastic seal which is resistant to chemical corrosion, wear and tear. The motor/fan base shall be constructed of fibreglass and mounted to a concrete plinth via spring or rubber vibration mounts with stainless steel nuts and bolts. Fan bearings shall be of the maintenance free ball or roller type.

Fans shall be belt driven with drives designated for the motor starting torque and no less than 150% of the motor rated kW. Belts shall be matched sets, and a minimum of two belts shall be used on each fan. Motors shall be of totally enclosed fan cooled, running at not more than 24 rev/s, and suitable for operation on 3-phase, 415 volt, 50Hz supply. Provide belt guards on all fan drives with DZUS fasteners. Pulleys shall be 'Taperlock'.

A drain connection shall be provided in the bottom of the fan casing. PVC drains shall run from each fan directly into the Laboratory waste system. Ensure fan drain lines do not cross access paths creating trip hazards.

Exhaust air fans shall be selected for an outlet velocity to comply with AS 2243.8, however where optimum static efficiency can be achieved by exceeding this velocity, an alternative fan selection may be submitted for approval.

A combination scrubbing and mist eliminator shall be fitted directly to the outlet of each fume cupboard capable of removing 98% of perchloric acid fumes by weight. Fume scrubbers shall be installed to all new fume cupboards except where specifically excluded in the space description forms. Cupboards not fitted with fume scrubbers shall be constructed with provisions to allow easy fitment at a future date if required. The scrubber shall be constructed of fire-retardant GRP incorporating eliminator pads and spray jet section. Scrubbers shall use recirculated neutralising solution and shall incorporate a storage tank of adequate size at the base of the unit together with all necessary connections, pumps etc, automatic bleeds, make-ups etc. Provide a GRP spillage tray beneath the neutralising tank with raised edges to contain any accidental spillage.

The fume scrubber shall be completely pre-plumbed for easy connection to waste plumbing and water supply points provided by the Hydraulics subcontractor. Scrubbers mounted on top of fume cupboards with service access required through walls and ceilings are not acceptable. Adequate service access including visual inspection panels shall be provided through the front only. All ducting shall be labelled with 'Safetyman' labels.

Conditioned make-up air is required to the laboratory during the operation of the fume cupboards and the quantity of air conditioned make up air shall be proportional to the number of cupboards operating and to the requirements of AS 2243.8. This shall be achieved by the use of static pressure

indicators in each cupboard linked to the BMS, which shall increase/decrease the speed of Variable Speed Drive fan in the Air Handling Unit, together with an adjustment to the blade position of the outside air damper to vary air flow.

The makeup cooling system shall provide conditioned air for the full air quantity and to meet the internal lab requirements for both temperature and humidity. Ductwork shall be circular Unplasticised Poly Vinyl Chloride (uPVC) in accordance with the following schedule:

- | • Duct Diameter | Minimum Thickness of PVC |
|-----------------|--------------------------|
| • Up to 400mm | 3mm |
| • 410-600mm | 4mm |

Horizontal ductwork shall be installed with a minimum fall of 1:100 back to the fume cupboard, and shall be adequately supported to prevent flexing, 'drumming' or sagging. Ductwork routes shall be as short and direct as possible to minimise the risk of fire within the building.

Welds shall be V-type, using hot air welding equipment, one run of 3mm thick welding rod shall be used for 3mm and 4mm material and 3 runs of 3mm or triple welding rod for material 4.5mm or over. Welding shall be in accordance with AS 1477 Part 5.

Exposed exhaust ductwork external to the building shall be an appropriate grade of stainless steel unless it is required to match existing ductwork installations. This shall particularly apply to discharge ductwork projecting above the roof. Provision shall be made in each exhaust duct on the discharge side of the fan for the insertion of pitot tubes to enable air flows to be measured.

Provide access openings in the ductwork to enable cleaning of PVC ductwork internally. Access openings shall not be installed in the invert of horizontal ducting.

Discharge ducts shall be adequately braced and shall comply with AS 2243.8 and AS 1668.2 for height above roof and discharge velocity and shall be to the approval of the Air Pollution Council. The final height of discharge stacks shall be determined after consideration of the surrounding environment and the building's aerodynamic wake. Exhaust stacks should extend above the aerodynamic wake of the building wherever possible.

Fire protection shall be provided to all slab penetrations to meet Building Act requirements and to the approval of the Superintendent.

All electrical work shall be carried out in accordance with the requirements of Section 18 Electrical Services, AS 2430-3 and as described below.

Power to the fume cupboards exhaust and scrubber systems and associated controls and services shall be supplied from the mechanical switchboard serving that area. Provide a control cubicle incorporated within the fume cupboard easily accessible for maintenance for all necessary fuses, relays, timers, contactors etc. Each cubicle shall be fitted with a label which states the sub-boards and fuses which supply that fume cupboard.

Power to the GPOs on each fume cupboard shall be supplied from the local electrical sub-board associated with that laboratory and shall use 2 x 15 A circuits. All GPOs must be labelled as per the requirements of Section 19 Electrical Services.

In addition to the above requirements, each reticulated system to the laboratory including those points serving the fume cupboards shall be isolated by a local laboratory isolating device as required by AS 2982 located adjacent the exit door. The power to the GPOs on the fume cupboards shall be disconnected by the local sub-board shunt trip and the total gas to the laboratory isolated by operation of a gas solenoid valve on the gas supply line serving the laboratory.

The venting of dangerous goods and safety cabinets, unless mandatory under Australian Standards, shall be subject to a risk and safety assessment to be undertaken in conjunction with the CMWM and the SCU Work Health & Safety Manager. Reference shall be made to the following Australian Standards with respect to the design of ventilation systems, duct materials and fan types:

- AS 1940 – The Storage & Handling of Flammable & Combustible Liquids.
- AS/NZS 5026 – The Storage & Handling of Class 4 Dangerous Goods.
- AS 4326 – The Storage & Handling of Oxidizing Agents.
- AS 2414 – The Storage & Handling of Organic Peroxides.
- AS/NZS 4452 – The Storing & Handling of Toxic Substances.

14.19 Laboratory Piped Services

LP Gas shall only be used where required for laboratory purposes, where there is not a cost-effective alternative solution. LP Gas shall not be provided for any other usage including, but not limited to, food tenancies and water heating.

Where building renovations or a change of use shall occur, consideration shall be given to remove any installed LP gas services as part of SCU's net zero carbon emissions target. Alternative solutions are to be provided to the CMWM as part of the schematic design phase for approval. Pipework shall be Type 'B' copper. The minimum sizes shall comply with the latest version of AS/NZS 5601.

All joints shall be silver soldered using 15% silver solder. Isolation valves shall be of the ball type. A gas meter shall be provided to the building main supply. All underground pipes shall be pre-lagged to the required colour and all joints colour taped after installation. Pressure reticulation shall be as determined by the relative authority.

LP Gas delivered from bulk storage tanks shall include two stage regulation. LP gas shall be reticulated at high pressure after the first stage of regulation from the storage vessel to the building. A second stage regulator shall be provided adjacent the gas meter at each building. MJ/hr ratings for all equipment to be indicated on design drawings along with developed pipework length and pipework materials.

Emergency slam shut isolation valve to be installed in a deemed safe space adjacent all gas manifolded services for commercial areas to isolate gas in case of emergency fire event.

Laboratory gases shall conform to the requirements of the following standards:

- AS2982 Laboratory Design and Construction.
- AS2896 Medical Gas Systems.
- AS4332 The Storage and Handling of Gases in Cylinders.
- AS2243 Safety in Laboratories.

Gases to be supplied from bottles, shall be located within a secure ventilated storage compound located external to the building and which is easily accessible from a service road. Where this is not possible or practical e.g. refurbishment projects, the bottles shall be stored internally in an appropriate secure, ventilated storeroom adjacent to the laboratory readily accessible from the circulation corridors and the building lift for the replacement and removal of gas bottles. Cylinders shall be manifolded with non-return valves in such a way that any cylinder can be removed and still allow the effective operation of the pressure manifold. Pipework and valves shall be of a material or type appropriate to the particular gas. Gas pipework shall be tested at 1000kPa or twice the working pressure whichever is the greater. High purity and ultra-high purity gases shall be run in 316 stainless steel or equal approved.

14.20 Compressed Air

Compressed air shall be supplied from a central air compressor station comprising duplicate air compressors and other necessary equipment such as refrigerated dryers, water/oil separators and filtration to meet the proposed User requirements. Compressors shall be from a manufacturer acceptable to SCU. The quality of the air shall be determined by the User and shall be classified to ISO8573 in terms of particulate, water and oil. Provide ISO8573 Class 0 oil free air for Laboratories as a minimum. The compressor shall be effectively silenced.

Pipework shall be type 'B' copper with 15% silver soldered joints used for compressed air. All valves shall be ball valves. Provide a suitably valved connection point outside the compressor plant room for connection of temporary air compressors or bottles. Pipework shall be high-pressure PVC. Plugged tees shall be used in place of bends to allow for cleaning or piping. Isolation valves shall be of Teflon-lined ball valves. Pipe reducers shall be of the eccentric type.

All pipework shall rise in direction of flow. Bacterial filters shall be fitted where required by the Australian Standards or other applicable regulations. All control systems shall be checked and commissioned by the manufacturer or its authorised representative. Commissioning data shall be provided to the Superintendent.

Provide a suitably valved connection point outside the plant room for connection of a temporary vacuum pump. Pipe this emergency connection point to the vacuum storage tank.

14.21 RO Water Systems

A general laboratory RO water system capable of delivering Type 2 pure water shall be provided to all laboratories. If higher quality water e.g. Type 1 is required in a particular laboratory by the SD's, then additional purification equipment shall be provided locally within the nominated space.

Storage tanks shall be fabricated from a suitable plastic such as HDPE and sealed with a hygienic breather. Tanks shall have a lid complete with access manhole, and internal and external ladders shall be provided where required. All tanks shall be fitted with a water meter to the outlets. Water supply valves to demineralised plant shall be an RPZD in accordance with AS 3500.

All piped services within a laboratory or workshop space shall have isolation points located within, or within reasonable distance of the laboratory. Isolation of piped services serving laboratories and other research facilities shall be possible without the interruption of those services to other areas of the building.

Provide the relevant safety isolators for gas and other services as required by the relevant Standards and Regulations. Position isolators adjacent to doors and away from light switches. Individual reset buttons for each gas service may be required and this must be clarified with the CMWM and the space User.

All pipes shall be identified in accordance with Australian Standard AS 1345 for the Identification of Piping Conduits and Ducts; and AS 1318 – Industrial Safety Colour Code and AS 2700 Colour Standards for General Purposes.

Provide alarms, grouped as one alarm for each of the following to be connected to the BMS via a BMS control panel in the building:

Alarm Type	Details
Compressed air alarms	Common fault from control panel Low air pressure
Vacuum alarms	Loss of vacuum
Reverse Osmosis plant alarms	High- and Low-level alarms to tank Common fault from RO plant

14.22 Commissioning and Handover

The entire mechanical installation shall be inspected and tested to the satisfaction of the Superintendent and the CMWM, to ensure commissioning has been completed and the systems are calibrated. The Contractor shall perform all tests as requested and as necessary to prove the operation of each individual system. Witness tests shall vary from project to project but shall include the following checks:

- Flushing of all pipework.

- Hydrostatic testing of all pipework (or pneumatic testing were approved by SCU).
- Air and water flows.
- Temperature and Humidity.
- Control operation and calibration.
- Exhaust ventilation rates.
- Supply air ventilation rates.
- Compressed air and vacuum flow rates and pressures.
- Chiller operation and capacity.
- Cooling tower operation and capacity.
- Pump operation conditions.
- Electrical tests and operation of fire prevention and safety equipment.

Additional testing and verification procedures may be required for specialised mechanical systems not identified above. In addition, the level of quantity of checks may vary depending on the project type and size. Verification checks and witness procedures will be undertaken until the Superintendent is satisfied all systems are operating in accordance with the acceptable tolerances. Recorded commissioning data for all mechanical systems shall be provided, via the Superintendent's representative, for review before scheduling any verification inspections. All commissioning shall be carried out by NEBB certified persons.

Mechanical systems found operating outside acceptable limits will be rejected. These systems shall be repaired/replaced at no cost to GU. The Contractor shall also allow for fine tuning the systems during the Defects Liability Period.

The Contractor shall carry out air flow tests and scrubber tests on all fume cupboards. These tests shall be carried out on fume cupboards as installed within the laboratory. The contractor shall also allow to carry out tests on proprietary line or prototype fume cupboards in a premises provided by the Contractor prior to site installation. The minimum requirements for testing and commissioning shall be as detailed in AS 2243.8, Safety in Laboratories – Part 8 – Fume Cupboards. The following data shall be submitted as a minimum:

- Verification of specified discharge velocity.
- Verification of specified fume cupboard face velocity.
- Smoke tests to determine correct air flow patterns around fume cupboards.
- Motor running tests.
- Noise levels.
- Control and safety equipment tests.
- Lighting levels.

If the fume cupboard fails any of the tests specified above, the rectification of the system shall be entirely at the cost of the consultants and/or contractors. All tests shall be repeated until acceptance

performance is achieved. All tests are to be carried out by a technician licensed to carry out NATA testing. Tests shall be carried out in the presence of the Superintendent or his representative.

Contractors shall carry out all necessary and required test including the payment of fees, provision of labour and test equipment. All tests shall be carried out to the applicable Australian Standard, the requirements of any Act or Authority having jurisdiction or these Guidelines, whichever is the greatest. This includes point to point, and purity testing. Gas pipes shall be scavenged with Nitrogen then tested with Helium.

No pipework, fixtures or equipment shall be concealed or covered by any means before they have been pressure tested, flow tested and inspected by the Superintendent and GU Mechanical Engineer. All work shall be completely installed and tested as required by this Section 18 and the Code requirements and shall be leak tight before inspection of the particular work is requested. Tests shall be repeated to the satisfaction of the Authorities having jurisdiction. All defects shall be remedied immediately, and the tests reapplied to the satisfaction of the Superintendent and the Authorities.

At least 72 hours' notice shall be given to the Superintendent prior to the carrying out of tests. Where construction vehicles or similar equipment have been used on the site, allowance shall be made for retesting pipelines under concrete slabs on ground immediately prior to placing membrane and reinforcing steel. Test results for tracer tapes placed above non-metallic pipework laid in the ground shall be provided to the Superintendent.

14.23 Depiction of Airflows on Mechanical Drawings for Consultants & Contractors

For all new building and refurbishment projects, the Mechanical layout drawings shall include simple arrow diagrams of the airflow paths, and numeric notations of the airflow and fresh air rates. The objective of this requirement is to provide an understanding of the Mechanical systems from the commencement of design through to completion of the systems installation, and to calculate the impact of any future modification. The diagrams and notations shall consist of but not be limited to the following:

- On each Mechanical layout, the airflow path shall be clearly indicated starting from the AHU in the plant room wherever located, through the main supply air duct, branch duct, terminal outlets, into the room, and the return-to-return grille, return duct or ceiling void etc, all the way back to the AHU.
- The supply and return airflow rates shall be noted, preferably marked on every supply, return, transfer, intake and exhaust air grilles with the airflow direction arrow. The airflow rate of all AHUs and fans shall also be marked on the drawing.
- The fresh air flow rate shall be indicated. It can be expressed as a ratio of outdoor air to total supply air for central AHU systems. The designed outdoor air flow rate expressed in L/s per person shall be indicated.
- As a portion of the supply or return air will transfer to corridors, toilets or be assumed to escape through door/window gaps without any mechanical means, and while the assumptions made in the design with respect to such air transfers or losses cannot be

shown diagrammatically, a note outlining any such assumptions shall be included on the drawing.

In summary, the diagrams and notations, together with the layout drawing shall fully indicate the whole airflow path, airflow rates and associated outdoor air quantities. For all projects involving new special Mechanical systems where pressurization or directional airflow is required, including, but not limited to PC2 or PC3 labs, clean rooms etc, airflow schematics shall be provided as follows:

- Airflow schematics showing airflows into and out of each room (with maximum and minimum air flows indicated where the air flow can vary such as with fume cupboards or other exhaust systems).
- Return and outside air flows at air conditioning units and the pressures in each room.
- Single line ductwork, pressure sensors, motorized dampers, air conditioning units, exhaust fans and VSDs shall be indicated on airflow schematics.
- Any filtering device such as HEPA filter with gastight casing, isolation valves, etc. shall be clearly indicated.
- In addition to the schematic diagram, details of air flows as required by Clause 18.06.01 shall be provided on the same drawing for easy and thorough understanding of the systems.

14.24 Water Meters for Cooling Towers

Water meters of appropriate size shall be provided for water make up pipe and dumping pipe of each cooling tower. Remote reading/monitoring function shall be included in the meters.

15.0 Hydraulic Services

The requirements of this Section are Mandatory.

15.1 General Requirements

All new installations after 1 May 2023 shall comply with the lead-free plumbing product requirements in the National Construction Code and shall carry the lead-free watermark. Certificates shall be provided with the as built documentation.

Fixture unit loadings to be clearly indicated on all sanitary plumbing, drainage and trade waste schematics and sewer connection points. Access to serviceable items (I.O's, valves, etc) shall not be obstructed and be readily accessible. All water supply services shall be thoroughly flushed to prior pressure testing of the installation of any fixtures and fittings. Pipes laid in the same trench as electrical, or data conduits shall be separated in accordance with the requirements of AS 3000 and AS 3500.

Where possible all services shall be run in accessible service ducts, fire rated at the floor. Duct sizes shall be such to allow for the safe and easy removal and repair of pipework and valves. Duct layout plans are to be included with all design drawings showing all details including fire collar overall dimensions.

Where services are installed in service ducts (such as backflow devices, water meters, fire hose reels etc.) which have the potential to leak/cause flooding during servicing or use the service duct, shall be banded and have a floor waste and water proofing to the floor area, to prevent water damage to any adjacent areas.

15.2 Underground Services

Where water supply infrastructure is being installed external to building, scour valves shall be located to allow for all water mains to be flushed and drained where required for maintenance purposes. Scour valves shall discharge directly to a visible storm water connection point where possible otherwise to kerb and channel which discharges to a stormwater culvert.

All underground pipework shall have a minimum of 600mm cover to topmost surface of pipe or pipes. Pipes shall be laid to the requirements of AS 3500 and/or any other relevant standards rules and regulations. Pipes shall be laid side by side and not one above the other. Pipework laid in trenches less than 600mm of cover will require mechanical protection and GU approval. Trenches shall be backfilled only with selected fill and compacted in layers not exceeding 200mm to a relative density of 90%. Selected fill material to be determined on drawings by the project engineer with corresponding soil test report also submitted.

All underground non-metallic pipework other than irrigation pipework under 32mm diameter shall be identified by a 2mm (#12 AWG) hard drawn, high carbon 1055 grade steel, solid extra-high-strength

copper-clad steel conductor (EHS-CCS) rated at 30 volts and insulated with a 45 mil, HDPE insulation rated for direct burial use at 600 volts. EHS-CCS conductor must be 21% conductivity for locate purposes. Breaking strength of trace wire to be a minimum of 520kg.

All allowances shall be taken to protect the stormwater, sanitary drainage and trade waste systems where they pass from natural ground to either under slab or through structural slabs, or to a fixed structure by means of articulation via swivel and expansion joints in accordance with AS2870 and the site soil classification prepared by others.

15.3 Sewerage System

All pipework to be installed in accordance with manufacturers installation instructions and requirements of AS3500 and its normative references, and any other relevant standards:

- A minimum of SN8 DWV PVC-U with solvent welded joints or Earthenware pipework should be given consideration in the design depending on the current and future building occupants.
- Sewer inspection chambers shall be provided at major changes of direction and junctions external of the building.
- Inspection chambers shall be installed in accordance with Local Authority requirements and AS3500.
- All chambers over 1200mm in depth shall have hot dipped galvanised step irons or ladder coated with approved protective material to promote anti slip surfaces.
- Pipelines to be identified with approved marker tape.

15.4 Sanitary Plumbing and Drainage

Materials for pipework above ground shall be UPVC, HDPE, Copper type B or Stainless steel subject to Building Act requirements and project specific requirements. HDPE Pipe Fire Hazard – Where HDPE pipe is to be used and is located within 1.5m of an energy source, it must be fire rated to a FRL of -/30/30 to prevent the fire spread of ignited droplets to other fire compartments. This fire rating is in addition to fire collars at floor level. The reason for the fire rating is explained below:

- If installed in the vertical plane and the material is ignited by a local external energy source, fire spread will occur on lower floors due to choke collars not responding quickly enough to burning HDPE droplets, thus remote spot fires will result in other fire compartments.
- If installed in the horizontal plane and the material is ignited by a local external source, fire spread will occur throughout the fire compartment by way of flame spread along the HDPE surface.
- Multiple fire starts will be caused by burning droplets.

Plumbing ducts, access panels, false ceilings etc. - Drawings shall be checked by the hydraulic consultant to ensure all sizes and clearances etc. to conform to the Authorities minimum requirements and the architectural layout. (Refer to Section 12 - Structural Design with this clause). The installation shall be designed to gain full benefit of the systems as set out in the current Queensland Standard Sewerage Law, Standard Water Supply Law and AS3500.

15.5 Trade waste

Trade waste shall conform to relevant Australian Standards, Regulations, Codes and Local Authority requirements. shall be submitted to the local authority for approval. All buildings with trade waste shall have a trade waste register which shall be indicated on the hydraulic services drawings, included in the O&M Manual and shall also be made available as an excel spreadsheet for the building asset register. Trade waste register shall include the following:

- Arrestor type e.g. Acid, Silt, Grease, Oily water, Cooling, Balance Tank.
- Arrestor size in litres.
- Fixture and quantity.
- Peak Flow in Litres/Hour.
- Total Peak Flow in Litres/Hour.
- Storage Factor / Loading Multiplier.
- Pump Out frequency.

All pre-cast concrete grease or silt arrestors are to be protected by an internal acid-resistant protective coating installed during manufacture and prior to the delivery and installation of the arrestor.

All trade waste arrestors shall have a non-potable Hose tap (with an RPZD located upstream) within 5 metres of the arrestor. Trade waste pipework shall be of an approved material and must be resistant to the chemicals used within the laboratories connected to the trade waste system. In some circumstances HDPE may not be considered a suitable material, and the hydraulic engineer shall submit an alternative pipework material to SCU for approval.

- Underground services – HDPE with electro fusion welded joints (Butt welded joints are not to be used underground).
- Above ground - HDPE with electro fusion welded joints on grade and butt fusion welded joints on the vertical.

15.6 Greywater Systems

Systems for the collection, storage and reticulation of waste 'grey' water for landscaping irrigation and the like, shall be installed strictly in accordance with AS3500, AS1547, The NSW/Qld Plumbing and wastewater code, Local Authority and all other relevant standards and regulations.

All HDPE stored on site during construction shall be stored under appropriate cover to prevent any physical or UV damage. Pipework and fittings shall also be stored in a manner that ensures pipework and fittings remains straight and round with no deformities before, during and after the installation process. Any pipework found onsite at any time with deformities shall be removed and replaced at the cost of the installer/supplier. Underground pipework to be kept a minimum of 100 dia. for all drainage where possible.

15.7 Sewer Inspection Chambers and Openings

Inspection chambers shall not be installed within buildings unless prior approval has been granted by SCU. Chambers in landscaped areas shall be identified by a “Dura-Post” Premium Steel cream painted marker post with top 100mm painted black with reflective coloured coded sticker and custom lettering to suit pit type, with dimension distance indicated under in metres, along with direction arrow or approved equal.

All inspection chamber lids to have a minimum of a 150mm structural concrete surround around the lid and tied to inspection riser and inspection chamber roof slab to prevent movement between the inspection lid, riser and adjacent finished surfaces. Top of chamber lids in landscaped areas (not turfed) shall be installed 100mm above landscaped levels to the same gradients as the landscape. All inspection openings shall be brought to finished ground level and capped with a stainless-steel gas tight bolted trap screw. Inspection openings located in landscape areas to have concrete surround to prevent mechanical damage. The use of brass or stainless-steel screw top type covers are not permitted on inspection openings.

Lid Markings:

- Roadways – Solid top cover with “sewer” stamped into the cover a minimum of Class “D”.
- Landscape Areas - Solid top cover with “sewer” stamped into the cover a minimum of Class “B”.
- Concrete Pathways and Turfed Areas – Infill top cover with “sewer” stamped into the cover a minimum of Class “B”.

15.8 Stormwater Drainage

All surface water resulting from a storm having a minimum average recurrence interval of 100 years must not enter the building. Finished surface levels around the building perimeter shall include a step down from any internal floor level entry heights and any weep holes to help prevent surface water >100-year average recurrence interval entering the building. Finished surface levels around the building perimeter shall naturally grade away from the building to the designated overland flow paths and shall be free gravity draining (without the use of pumps).

All surface and drainage must comply with the NCC BCA “Part F1 Damp and weatherproofing performance requirements” along with any other relevant rules and regulations.

Access to buildings must still comply with the Disability (Access to Premises) standard and AS1428 whilst maintaining surface water protection to the building.

Reduced levels “R.L.” are to be clearly identified on both the design and as constructed drawings indicating the minimum height separation levels (around the building perimeter) which must be maintained to prevent surface water ingress at an average recurrence interval of 100 years.

All existing buildings on site shall not be affected by surface water resulting from the construction of a new building or associated external building works e.g. a change in the concentration of surface water to an existing building. It is the responsibility of the project team for the new building to ensure adjacent buildings shall not be affected and as such any additional design calculations external of any nominated project boundary will still be deemed part of the project.

Materials shall be sanitary grade PVCU or HDPE pipes and fittings, Class X reinforced concrete pipe or fibre reinforced cement pipe and fittings.

All HDPE stored on site during construction shall be stored under appropriate cover to prevent any physical or UV damage. Pipework and fittings shall also be stored in a manner that ensures pipework and fittings remains straight and round with no deformities before, during and after the installation process. Any pipework found onsite at any time with deformities shall be removed and replaced at the cost of the installer/supplier.

Design for flooding frequency shall be designed on 1 in 50-year 30-minute rainfall intensity event. All stormwater drainage shall be in accordance with the local Authority, QUDM and AS 3500 and as otherwise amended by these Design Guidelines.

Litres per second and the “ARI” for each downpipe to be clearly indicated on the design drawings.

15.9 Safety Showers

Safety showers and eyewash stations are to be provided in accordance with AS 2129 for safety showers and eyewash. Where a safety shower and eyewash combination are to be installed, the units shall supply balanced water supply to both the safety shower and eyewash at the same time, whilst providing the appropriate flow rates and pressures as per the Australian standards. The eyewash portion of the combination unit must discharge direct to drain, the shower must be self-draining to reduce legionella risk. The main pipework, eye wash bowl, handles and valves shall be of 316 stainless steel construction and shall be Enware or approved equal.

Consideration must be given to the location of the safety shower and eyewash station to ensure their use does not constitute a slip hazard for other laboratory users. They should not be located in the travel path of the main exit from the laboratory. A floor drain shall not be provided under the safety shower unless prior approval is granted by SCU (this is to prevent unwanted contaminants leaving the lab space). Eye wash stations are not to be drained onto the floor but to waste. The drain shall be connected to the trade waste drainage for that particular lab.

External Safety Showers and Eye wash stations are to be installed in a manner that protects the user from being hurt due to external conditions e.g. Temperature of equipment and water supply, contamination or damage to equipment by being exposed to the elements.

15.20 Water Reticulation Generally

All water systems shall be designed to include back flow prevention devices to comply with the latest versions of AS 2845.3 and AS 3500.1 and other relevant Australian Standards. Reticulation within buildings shall be copper tube type B to AS 1432 with silver soldered joints. Compression and crimped fittings are not to be used unless prior approval is granted by the CMWM. All potable mains within buildings shall be Type B copper with silver soldered joints. Where mains pass through walls and floors they shall be sleeved and caulked. All exposed pipework and fittings in toilets, changerooms, showers and kitchens shall be chrome plated.

All PE100 stored on site during construction shall be stored under appropriate cover to prevent any physical or UV damage. Pipework and fittings shall also be stored in a manner that ensures pipework and fittings remains straight and round with no deformities before, during and after the installation process. Any pipework found onsite at any time with deformities shall be removed and replaced at the cost of the installer/supplier.

Screwed fittings, barrel unions and flanged connections only shall be used for easy removal of all fittings. Compression and crimp fittings shall not be used under any circumstances.

15.21 Backflow Devices

All water systems shall be designed to include back flow prevention devices. Backflow devices are to be installed in locations that permit access for servicing and testing from floor level without ladder assistance. All testable Backflow valves (double check valves, single check valves and reduced pressure zone devices) shall be Emerson 'ValvCheq'.

The Contractor shall ensure that all backflow valves installed on a project are tested and registered with the Local Authority and provide copies of the test and registration certificates to the Superintendent. The Contractor shall also ensure that the backflow valves are tested just prior to Final Completion, and that the test results are submitted to the Superintendent.

Backflow valves which require drainage due to intermittent discharge shall have drainage installed under to an appropriate legal point of discharge. The discharge pipework shall be sized to ensure it can withstand a full flow discharge event from the backflow discharge ports whilst also ensuring no flooding within the building will occur. Designer to indicate on the design drawings the maximum discharge from the discharge ports on the backflow devices. The use of water check valves are generally not permitted on campus and will be acceptable only under special circumstances with the prior written approval of SCU.

15.21 Cold Water Service

Buildings shall be supplied through a two-piped system from mains pressure one for potable water only and the second via an RPZD in the Valve Room for entire building zone protection of the non-potable supplies.

All laboratories shall be supplied from the non-potable system except for safety showers, eyewash stations and hand wash basins. The installation shall comply with AS 3500 and other relevant Australian Standards such as AS 2845.1 and AS 2243.3. Additional backflow devices may be required within the buildings to provide separate lab protection or individual device containment. Branch line sizing and outlet pressures shall also comply with the latest versions of AS 3500 and other relevant Australian Standards.

Generally, cold water shall be run in a minimum 20mm NB pipe. Short branches up to 1.5m may be 15mm NB if serving only one outlet.

Dead legs in cold water pipework shall be minimised to a maximum of 1 pipe diameter in length.

The cold water service to equipment (including but not limited to laboratory glass washers, autoclaves and ice machines) shall be terminated in a ball valve, the same size as the supply pipework.

Commissioning sheets shall also be provided along with engraved services tags indicating the commissioned settings of the valves.

15.22 Hot Water Service

Hot water systems to be designed as continuous recirculating loop systems. Temperature reduction valves (thermostatic mixing valves and tempering valves) shall be a maximum of 6 metres from point of use.

The hot water pressure shall match/balance the cold-water supply pressure to the fixtures throughout the building. High pressure hot water systems are not permitted e.g. >500kpa. All hot water pipes shall be insulated with Thermotec 4-zero pipe insulation or approved equal for temperatures up to 90°C. Where temperatures exceed 90°C Thermotec F.P.I (preformed Fibreglass Pipe Insulation) or approved equal to be used.

The minimum insulation thickness to hot water piping ring mains shall be 25mm, for pipes less than 50mm nominal bore and 38mm for pipes of 50mm and above. Hot water ring main lines shall not be encased in walls. The minimum insulation thickness for hot water branch lines up to 20mm, shall be 13mm.

Insulation shall be installed in strict accordance with manufacturer's recommendations. All insulation shall be installed around the pipe work surface as tight as possible without gaps. The edges and ends shall be tightly butted together and all joints and foil overlaps to be taped using an approved manufacturers tape.

Metal Sheathing & Cladding shall be used in plant rooms, walk in ducts and external of buildings where exposed to the weather, subject to mechanical damage and/or waterproofing is required. Sheathing

material to be a metal product with edges swaged, overlapped and appropriate for the elements. Where mechanical protection is required the pipework and insulation shall be metal sheathed to a height of 2700mm. All spacer blocks at hangers and supports shall be inorganic closed cell high density polyurethane insulating blocks. Wood blocks are prohibited. Under no circumstances will 'Polylag' be permitted as a form of insulation.

In addition to areas specifically noted in the SD's, hot water shall be provided to the following points:

- All showers and changerooms.
- Kitchenette and tea preparation station sinks. An additional outlet shall be provided for a dishwasher.
- Laboratory Glass Washers. This service shall be terminated in a ball valve the same size as the supply pipework.

Toilet Hand Basins should not be provided with hot water unless specifically called for in the SD's.

Thermostatic mixing valves (located a maximum 10 metres total pipework length from point of use) are required to all showers and any other areas required by the relevant Australian Standards. Thermostatic mixing valves shall be Enware Aquablend, Watts AVG or approved equal and must have thermal flushing capabilities and a cold-water bypass located within a recessed cabinet. They shall be located to permit easy access for servicing and testing from floor level without ladder assistance. All thermostatic mixing valve and associated valving access hatches to be a square drive budget lock or barrel keyed to a lockwood "QFES" 003 keying.

Where tempering valves are required, they must have thermal flushing capabilities downstream of the tempering valve and a cold water bypass located within a recessed cabinet. They shall be located to permit easy access for servicing and testing from floor level without ladder assistance.

15.23 Hot Water Generation Systems

Systems for the collection, storage and reticulation of hot water supply shall be installed strictly in accordance with AS3500, Local Authority and all other relevant standards and regulations. A centralised hot water generation system shall be incorporated where there is a significant requirement for hot water in a project.

Solar Hot Water Systems

Prime consideration should be given to the installation of electrically boosted solar hot water units. In all cases, the Consultant should check that the flows and temperatures available are suitable to the application. If solar hot water is not viable, the use of electric systems may be adopted.

Heat Pump Systems

Hot water may be provided by single or multiple Commercial heat pumps, or approved with equal mains pressure hot water generation unit included downstream for hot water recirculation system losses.

Quick Recovery or Boiling Water Units

Hot water to single isolated applications such as tea preparation stations, may be provided by the use of a local quick recovery unit such as 'Zip' or approved equal, under sink mounted units.

Overflows

Overflows to hot water units shall discharge over stainless steel safe trays under all units at sufficient height to face the overflow pipe to a drainage connection point. Units shall be mounted within the safe tray and the tray drained in accordance with the current addition of AS 3500.4.

Space Requirements

Allow for sufficient space around the unit for removal of elements and above the unit for the withdrawal of anodes. Where multiple units are installed, each unit must be able to be removed individually without the need to isolate any other equipment located in the same plant area.

Instantaneous hot water units

The use of instantaneous electric hot water units are not permitted unless prior approval is granted by SCU.

15.24 Pumps

General

Pumps shall be designed to ISO 2858 or EN733 end suction. Close coupled pumps shall not be used. All seals shall be mechanical seals. Pumps shall be mounted on a concrete inertia base complete with spring mounts. Pumps used in campus water reticulation shall have variable speed drives.

Cold Water Booster Pumps

Grundfos Multistage variable speed drive pumps and pressure tanks or equal and approved by the Superintendent shall be provided. The multistage pump sets shall be capable of providing the flow and pressures required with some indicated redundancy for future building use. Controls shall include for automatic 24hr changeover for duty and standby pumps. Provide control switching positions for

24hr automatic pump changeover, manual switching and 'off' for all pumps. Hours-run meters shall be provided for each pump. Loss of suction control is to be provided to all pumps.

Hot Water Pumps

Duplicate hot water circulating pumps shall be provided in hot water loops to minimise dead legs, where a central system is installed. One pump shall be capable of providing the flow and pressures required, the other pump shall act as standby. Provide control switching for auto, off, manual switching on each pump (auto is BMS control).

The hot water circulating pumps shall be installed in the return water loop. Care shall be taken to ensure that pressure in the hot water circuit is not greater than the pressure in the cold water main. Pumps shall be of the 'Grundfos' in line model with totally enclosed single phase motor. Pump casings shall be bronze with bronze impellers and mechanical seals. Open motors are not acceptable.

Hot water circulating pumps shall be controlled by the BMS for scheduled change over or fault/status fail condition. 240V contactors shall be provided on the pump control panel for this purpose. Control via the BMS shall be via interposing 24V ac relays.

15.25 Rainwater Supply System

All new projects shall investigate the feasibility of installing rainwater/stormwater tanks with the intention of reusing stormwater, Fire testing water, air-conditioning condensate, RO wastewater etc. for irrigation and toilet flushing. There shall be close collaboration and coordination between the consultants and SCU in regard to stormwater reuse.

A feasibility and cost report listing storm water re-use opportunities must be provided to SCU. The proposed pumping method and controls shall be discussed. The pumping system shall automatically change over to mains supply if there is a loss in power supply or a fault on the pumping equipment. All pumps for rainwater water reuse systems must have a flooded suction. Foot valves will not be accepted.

15.26 Sanitary Fixtures and Fittings

All sanitary fittings and fixtures shall be WELS compliant and 'White' unless noted otherwise. All handles except hose cocks will be fixed anti vandal, and all taps shall be chrome plated brass. All tapware shall have ceramic disks unless directed otherwise by SCU. Flow regulators shall be fitted to all tapware to minimise water consumption.

15.27 Water Meters

Water meters are required on all potable and non-potable cold water supply pipelines as follows:

- Supply to building.
- Supply to commercial tenancies.
- Supply to centralised circulating hot water systems.
- Supply from building to landscape irrigation system.
- Supply to rainwater change over devices.
- Other specialised areas as nominated by SCU.

Water meters shall be in an accessible location within the buildings main valve rooms or plant rooms. Above ground services cages may be deemed acceptable subject to approval where water meters are required to be installed externally away from buildings (e.g. irrigation of ovals).

15.28 BMS Control & Alarm Points

Provide alarms, grouped as one alarm for each of the following to be connected to the BMS via a BMS control panel in the building:

- Booster pump(s) alarms - failure and low pressure
- Cold and Hot water circulating pumps - failure.

15.29 Inspection & Testing

Contractors shall carry out all the necessary and required tests, including the payment of fees, provision of labour and test equipment. All tests shall be carried out to the applicable Australian Standard, the requirements of any Act or Authority having jurisdiction or these Guidelines, whichever is the greatest.

ITP's (Inspection Test Plans) shall be submitted for approval prior to construction for approval by the CMWM.

All fusion welded pipework shall have weld times, depth indicator, etc clearly indicated on fittings (e.g. white marker pen) and photographed as part of the ITP's during the construction phase.

No piping work, fixtures or equipment shall be concealed or covered by any means before they have been pressure tested, flow tested and inspected by the Superintendent. All work shall be completely installed and tested as required by this Section and the Code requirements and shall be leak tight before inspection of the particular work is requested. Tests shall be repeated to the satisfaction of the authorities having jurisdiction.

Pressurised pipe work shall be hydrostatic tested for 60 minutes at pressure of 1.5 times, the maximum operating pressure of the pipe work. Gravity flow drainage lines shall be hydrostatically tested at maximum hydrostatic pressure for a minimum 60 minutes, or other approved methods as required by the manufacturer or statutory and legislative requirements.

All defects shall be remedied immediately, and the tests reapplied to the satisfaction of the Superintendent and the Authorities.

At least 72 hours' notice shall be given prior to the carrying out of tests. Where construction vehicles or similar equipment is used on site, allowance shall be made for retesting pipelines under concrete slabs on ground immediately prior to placing membrane and reinforcing steel.

Inspections of all under slab pipework shall be carried out by the Local Authority, the Hydraulic Consultant and the Superintendent before backfilling of trenches. All under slab services shall be documented accurately (for as constructed submission) and supplied to the Superintendent for verification prior to backfilling of the trenches along with photographs of all services.

All water supply pipelines shall be tested and generally kept charged thereafter unless being worked upon. Any trace wire or marker tape which has been damaged, due to a defect, shall be reinstated and retested to the satisfaction of SCU.

16.0 Lifts

All the requirements of this Section are Mandatory.

16.1 Lifts Generally

The lift system shall be designed and installed in accordance with the following codes and regulations:

- Building Code of Australia / National Construction Code.
- AS1735 Lifts, Escalators and Moving Walks (including full compliance with AS1735.12 – Facilities for persons with disabilities).
- AS3000 Wiring Rules.

The lift shall be able to be maintained without the use of any 'special' or 'proprietary' tools or controls. If such tools or controls are required, a complete set of tools or controls shall be provided to SCU by the date of Practical Completion. Proprietary controls will need to be modified or an alternative control considered so that maintenance is not restricted to selected industry groups or businesses. Lift companies that cannot comply with this requirement shall not be considered.

16.2 New Project Lift Design

The lift design parameters for new lifts shall be as follows:

- Population based on actual numbers or 1 person per 12m² whichever is the greater.
- 12% two-way handling capacity.
- Average waiting time of 30 seconds.
- Machine room less traction lifts at a minimum and
- Calculations to be based on a maximum 70% car loading.

Each lift shall include the supply of a protective blanket for the walls of the car. The car interior shall be designed to allow easy installation of the blanket.

16.3 Existing Project Lift Design

Lift upgrades shall retain the existing structure, including lift wells, machine rooms, landing frames and doors. Options for upgrading or replacing the lift equipment shall be provided, including compliance with current codes (disability access and stretcher compliance), redundancy of equipment, performance etc. Performance assessment shall be based on the same criteria as for new lifts. Lift upgrades shall fully comply with AS1735 Part 1 regarding code requirements, with any

documented non-compliances due to building constraints. The lift upgrade/replacement components shall be energy efficient and environmentally friendly utilising the latest technology.

16.4 Provision for People with Disabilities

Lifts shall be designed in accordance with:

- AS 1735.12
- NCC Building Code of Australia
- AS1428 Parts 1 and 2

In addition, a continuous handrail shall be provided to three sides of the car and shall be positively located such that it is not subject to vandalism.

The only control panels required, are those for people with disabilities and mounted on the side walls. Two control panels shall be provided in each lift to the requirements of AS1735 part 12.

The floor level number shall also be embossed into the door frame to provide tactile level identification for the visually impaired.

Door scanning devices shall be installed to provide additional protection from closing lift doors.

16.5 Keying System & Keys

Only master keying shall be used. Maison keying will not be approved. The lock/hardware shall include:

- Fire Service.
- Exclusive Service.
- Security key switches.
- Machine Room Access.
- Landing Controllers for MRL Lifts.

Construction cylinders will be used during construction of any new buildings or alteration works. At practical completion of the construction and before handover to SCU, the construction cylinders shall be removed and replaced with barrels and keys to one of the following University Restricted series. The Contractor shall source all final keys and barrels from the University's Locksmith. The standard number of keys to be cut is to be set out in the Lock Schedule.

All keys shall be stamped with a continuous numbering system for that campus by the lock cylinder supplier. These numbers are to be entered into ProMaster Key Manager to ensure the key matrix is up to date.

16.6 Lift Car Finishes

The Lift interior finishes shall be designed to be robust and able to withstand damage from rigorous use. The following shall be provided as a minimum:

- Lift Car Front Wall Linished Stainless Steel
- Lift Car Doors Linished Stainless Steel

Car finishes Side Walls Rear Wall:

- Textured stainless steel Rimex 2WL/5WL or similar.
- Textured stainless steel Rimex 2WL/5WL or similar below handrail, tinted full width mirror above handrail.

Lift car floors shall be covered with an approved 3mm thick studded sheet rubber flooring, to meet critical radiant flux values in accordance with the current version of the NCC BCA. Flooring shall be adhesive fixed strictly in accordance with the manufacturer's recommendations. The slip rating shall be R10 at a minimum.

16.7 Lift Pits and Lift Shafts

Lift Pits

Lift pits should extend to solid earth, in accordance with AS 1735 and that buffer loads are transmitted to cause least effect on the structure. Lift pits must be kept dry at all times.

For any situation where problems with any form of water seepage or run-off are suspected, then suitable means shall be provided for easy removal of the water without accessing the pit. Typically, this shall be provision of a blind sump.

Shafts

Lift shafts shall be fire rated in accordance with the NCC – Building Code of Australia. Shafts shall have fire protection as required by relevant codes; wet head sprinklers shall not be used at the top of lift shafts where MRL lifts are installed. Glass lift shafts shall have some form of cooling when exposed to direct sunlight or heat.

16.8 Telephone

Alarm/Telephone' buttons and all necessary signage shall be installed in accordance with AS 1735.12. Provide a 'hands free' automatic dialing telephone activated by the 'Alarm/Telephone' button in the

car control station. Provide indicator button on establishment of communication adjacent to the hands-free button.

The telephone wiring is to comply with the relevant ACA requirements and be terminated at an FDP mounted in the ceiling space above the LMR door or control panel for MRL lifts and on the external face. Provide a label to read 'FDP Above'.

Optional: Enabling Lift communication via mobile network in addition to the standard telephone line for new lift installations (dual carrier operation).

All lift telephones shall dial direct to the Security Office on the site/campus on which it is located, with the exception of mobile enabled communication, which will contact the lift maintenance call centre first and the lift company shall advise security on arrival on site.

16.9 Workshop Drawings

Provide workshop drawings at a scale of 1:20 for all aspects of the works. The Manufacturer or installation of the lift shall not take place until all relevant shop drawings have been reviewed by the Superintendent. Drawings to be provided in pdf format.

17.0 Fire Services

The requirements of this Section are Mandatory.

The Contractor must consult with SCU and SCU's insurer to determine the minimum fire protection requirements subject to legislative and risk requirements.

Shall be an addressable 'Notifer'/Firesense' AFP-3030 series with Code Red monitoring (if system not currently on site – check current ASE contract) in compliance with AS 7240, AS4428.3, AS 4428.7, AS 1668.1, AS 2220, AS2118, AS 3000, AS1670.1, AS1670.4, the Building Code of Australia and the requirements of any authority having jurisdiction.

17.1 Generally

This Section outlines the minimum requirements for the following Fire Detection Systems and Passive Fire Protection:

- Automatic Fire Detection and Alarm Systems.
- Emergency Warning and Intercommunications Systems (EWIS).
- Occupant Warning Systems (OWS).
- Hydrants and hose reels.
- First Attack Fire Fighting Equipment (Extinguishers & Blankets).
- Fire Hazard Indices.

Each building shall be provided with a system of fire protection in accordance with the relevant Codes and Standards.

In general, all buildings shall be equipped with Automatic Fire Detection & Alarm Systems connected to the Building's Fire Indicator Panel (FIP). The building FIP shall be connected to the Site Master Panel and Site Mimic Panel(s) and the relevant Fire & Rescue Service.

Prior to any building works that impact on the fire detection or emergency warning systems, undertake a dilapidation report of the functionality of the existing systems within the area of works. This should include engaging the SCU Incumbent Fire Equipment Maintenance Contractor to undertake a full building test and recording any defects. This will help identify issues earlier and help assign responsibility to their rectification.

At the conclusion of any building works that impact on the fire detection or emergency warning systems, engage the SCU Incumbent Fire Equipment Maintenance Contractor to undertake a full building retest to ensure that the works have not adversely affected the functionality and operation of the complete system.

Ensure that early handover of the TERs (minimum two weeks prior to practical completion) is documented as a requirement for the builder and fire protection contractor. This includes the

availability of services (power, air conditioning, lighting, fire detection etc), the completion of floors and finishes and the space is cleaned to allow the installation and commissioning.

17.2 General Equipment Requirements

All equipment associated with Fire Alarms, EWIS or OWS shall be provided by a recognised Fire Alarm company or Manufacturer, with a proven record of high standard within the Fire Protection Industry for a period of no less than 10 years. Installation of such equipment shall not be regarded as complying with this Section unless it is carried out by the manufacturer of the equipment, or by a Contractor duly authorised by the manufacturer.

17.3 Fire Detection Indicating Panel (FIP) and Digital Voice Command (DVC)

Each building shall be equipped with a FIP showing all alarm circuits. Each FIP shall have a minimum provision of 10% spare space to allow for future circuit installation.

The maximum number of thermal alarms or smoke detectors that shall be provided on any circuit shall be no greater than 90% as permitted by the Code.

FIPs shall be auto testing and equipped with additional 'LED' indication for ease of circuit identification. FIPs shall be fitted with a Check Alarm facility which shall be activated on commissioning of the panel.

The panel manufacturer shall provide to SCU at no additional cost all maintenance tools and software for the servicing and upgrading of the panels. All FIPs and Mimic Panels shall be positioned as outlined in AS 1670, and shall not be positioned on external walls or in sun affected locations.

Digital Voice Command (DVC) by Notifier/Firesense shall be installed in the Fire Alarm control panel. The DVC shall be programmed to have at least control of evacuation, personnel announcement and lockdown messages.

Any upgrades to existing systems are to allow for a hybrid network of AFP-2800 and AFP-303. The existing network shall remain operational at all times. Any disruption to the network will require approval from SCU at least (72) hours prior to commencement.

The system shall be networked to the existing fire systems on each site utilising fibre optics network cards on existing sites, and to be controlled via the "ONYXWorks" PC based graphics package based at the Lismore Security Gatehouse and Property Services building. Remote sites shall be connected via the University's LAN to the Lismore site via an embedded ONYX Works gateway connected to the fire panel network at the remote site.

All new buildings maps, DVC programming for control & indication and installation information, to be updated into the ONYXWorks Graphics package at Lismore or other packages that the University has. This is to be carried out in conjunction with the Universities Fire Services Maintenance contractor

17.4 Detection Systems

Buildings shall be fitted with thermal and/or smoke detectors in accordance with the requirements of the National Construction Code and AS 1670. Detector selection shall take into account any provision of sprinklers. All new detectors and detection systems shall be fully addressable.

Generally, utilise smoke detectors. Use thermal detectors in locations where smoke detectors are likely to have spurious alarms (kitchens, laboratories, kitchenettes, locations exposed to weather, dirt or ingress of vermin). All detectors shall be identified by labels fixed to the base, identifying the circuit and detector number corresponding to the numbering plan on the as installed drawings and 'Schematic Zone' diagram.

Detectors

Notifier protocol System Sensor detectors which are SSL approved and U/L listed and visible for 360 degrees. Smoke detectors model FSP-851 (Optical) and FSI-851 (Ionisation) and FAPT- 851 (Multi Criterion), Thermal detectors model FST-851, Duct probe DNR-AUS. All bases System Sensor model B501 Addressable Detector base.

Detector base

System Sensor model B501 Addressable Detector base.

17.5 Building Occupant Warning Systems

All new buildings or any upgrade of an existing building shall have an emergency warning system installed with visual alarm indicators in accordance with AS 1603.11; comprising dual AMBER and RED flashing lights. The AMBER light shall be programmed to flash on an 'Alert' alarm, and the RED light will be programmed to flash on an 'Evacuate' alarm. Shall be a Notifier Inertia (Evactron) Evacuation amplifier with voice over emergency directions in accordance with AS 1670, AS 1679 Part 1 and BCA. System shall incorporate building lockdown controls with interface to ONYXWorks Graphics PC, Lismore security and access control.

The Evacuation system shall be controlled locally by DVC with keypad. This shall allow for control, from the Control points at each campus and the ONYX Works in Lismore of the DVC in the Fire control panel. When refurbishing spaces, do not re-use speakers which do not comply with standards current at the time of the refurbishment. If speakers are re-used, verify that sound levels of the final installation will comply with current standards. As part of any project, review loading on the OWS/EWIS and rebalance loads or replace amplifier/s as required.

Audible warning systems should automatically go straight to the "evacuate" tone when an alarm is raised, unless a delay is required by the fire engineered solution. Selector switches are no longer required on EWIS. Do not implement a cascading warning system, unless required to do so by the fire engineered solution.

EWIS shall be a Notifier Inertia I2000 EWIS Panel in accordance with AS 1670.4, AS 1679 Part 1 and BCA. System shall incorporate building lockdown controls with interface to ONYXWorks Graphics PC, Lismore security and access control.

The EVAC tones shall be remotely controlled by DVC. No local control is required. This shall allow for control from the Control points at each campus and the ONYX Works in Lismore of the DVC in the Fire control panel.

17.6 Visual Alarm Indicators

All new buildings or any upgrade of an existing building shall have an emergency warning system installed with visual alarm indicators in accordance with AS 1603.11, comprising dual AMBER and RED flashing lights. The AMBER light shall be programmed to flash on an 'Alert' alarm, and the RED light will be programmed to flash on an 'Evacuate' alarm. Provide visual alarms in any areas with public access or high ambient noise (e.g. plant rooms).

17.7 Fire Services Wiring

All fire alarm wiring between floors shall be run in a separate, accessible cable tray or metal duct. Trays and the duct shall be painted RED in colour where exposed or colour banded where concealed. Fire Alarm cables shall not run on the same cable trays as electrically energised cables or be installed in Electrical or Data cable risers.

Fire Resistant Cables – All cable types as required to be installed by Australian Standards AS/NZS 1670.1, 1670.4, 1668.1 and 4214 or as may be required by specific project requirements, must be tested, approved and certified to fully comply with the requirements of AS/NZS 3013 and AS/ACIF S008. Only cables which have been independently tested by a Third Party, NATA registered laboratory and which are currently Activfire listed by the CSIRO are acceptable on this project.

As evidence of testing and approval, an independent "Test Certificates" issued by a Third Party, NATA registered laboratory, must be provided for each cable type providing details of the Fire, Water, Impact and Cutting test ratings achieved to determine the cables WS rating classification.

The WS classification cable rating used on the various essential and emergency circuits must be in accordance with the applicable Australian Standards installation requirements. All cables (screened or unscreened) must have a minimum 2 hours fire rating to WS5X as specified in AS/NZS 3013.

When speaker feeds are used for low-voltage telecommunication transmission paths, the outer sheath of the cable shall be red with a white stripe with contrasting marking 'LV Fire' at intervals not exceeding 2m to AS1670.1-2015.

Conductors on all cables shall be 7 strands of Annealed Copper to AS/NZS1125. Insulation and sheath materials shall be suitable for a continuous conductor operating temperature of 110 °C with Low Smoke, Zero Halogen and Flame Retardant characteristics. The materials shall be X-HF-110 for Insulation and HFS-100-TP for Sheath.

Cable outer sheath must be easy to strip without any binding to the inner insulation cores. The cable outside diameter shall also be a maximum of 10.3mm to enable two cables to be installed in a single conduit.

Stainless Steel cable ties shall be used for fixing cable to cable tray every 1.0 metre when mounted horizontal and every 0.6 metres when mounted vertically. Only stainless steel cable ties which are ActivFire approved for use with active Fire approved Fire Rated cables shall be used in this scope of works.

17.8 Hydraulic Fire Services

The water supply for hydrants and hose reels shall be provided via a separate dedicated water service to the building. The appropriate backflow and isolation valves shall be located in the Valve Room. Mains and fittings buried in the ground shall be PE100 'red' striped SDR 11 PN16 minimum to AS4130 (fusion welded and flanged).

Mains and fittings above ground (including test drains) shall be galvanized steel medium duty, Victaulic system with EZ style 009H installation ready couplings or approved equal.

Hydrants, including signage and block plans, shall be provided in accordance AS 2419.1, state brigade requirements and SCU site specific requirements. Unless otherwise specified, hydrant systems shall be a 'wet pipe' system. System designs, hydraulic calculations and variations shall be submitted and agreed to with SCU prior to installation.

All PE100 stored on site during construction shall be stored under appropriate cover to prevent any physical or UV damage. Pipework and fittings shall also be stored in a manner that ensures pipework and fittings remains straight and round with no deformities before, during and after the installation process. Any pipework found onsite at any time with deformities shall be removed and replaced at the cost of the installer/supplier. Hydrants, including signage and block plans shall be provided in accordance AS 2419.1.

Block plan signage to include the following additional information:

- NCC BCA Building classifications.
- Relevant Australian Standard including version date.
- National Construction Code version including version date.
- Most disadvantaged hydrant/s location/description.
- Dangerous Goods locations and main switch boards.
- Design frictional loss through system in KPA.

Fire block plans templates shall be submitted a minimum of 2 weeks prior to practical completion and to allow for any necessary changes and updates. Hydrant booster installations where required shall meet the requirements of AS 2419.1/2/3.

Where internal hydrants are installed, a safe discharge point (test drain) shall be provided for the testing of the most disadvantaged fire hydrants. The discharge point shall discharge to the stormwater drainage system. Discharge pipework to be installed in fire isolated stairwells away from public spaces where possible. The use of upvc for discharge pipework above ground is not permitted.

Fire hose reels shall be provided to serve all buildings, installation of the hose reel system shall comply with NCC BCA. All External fire hose reel to be installed in a lockable “lockwood cut” “003” keyed enclosure. Hose reels within public access spaces such as loading dock areas require nozzle lock boxes where not located in a lockable enclosure.

Signage to be provided at all fire hose reels in the appropriate format, complying with the latest rules and regulations, and should indicate that the fire hose reel is connected to the dedicated fire system, alarms may activate and that penalties for misuse will apply.

Fire hose reels shall be connected to the dedicated fire hydrant system and not the potable water supply. Backflow prevention to hose reels shall be installed in such a manner that the entire fire hydrant and hose reel system complies with the required backflow requirements, or that multiple hose reels are supplied by the one backflow device. The use of one backflow device per one hose reel is not permitted unless prior approval is granted by SCU e.g. laboratory zone containment area.

A fire sprinkler system shall be provided where required in accordance with NCC BCA and AS 2118. At the request of our insurers, a sprinkler system shall be considered for asset protection for any new building or major refurbishment which will house assets of significant value, high risk occupancy or which will be critical to the University’s operations or services. Ordinary Hazard Group 1 is recommended as a minimum for property risk purposes, but higher classifications shall be considered where there are higher loadings of combustible materials. All water supply pipelines are to be thoroughly flushed prior to flow and pressure testing.

17.9 First Attack Fire Fighting Equipment

Fire extinguishers shall be provided to all areas in accordance with the NCC BCA. Extinguishers should be used where the risk so demands. All extinguishers shall be provided with coded location signs and usage signs in accordance with the requirements of AS 1851. Extinguishers shall be installed in accordance with the requirements of Australian Standard 2444 and at a height agreed with the Superintendent.

Fire blankets shall be installed in all commercial kitchen areas and in laboratories. Locations shall be approved by the Superintendent.

17.10 Special Fire Systems

Where required by Legislation or other reasons, provide special systems such as:

- Gas extinguishment systems.
- High velocity water spray systems.

- High expansion foam systems.
- Sprinklers.

Any proposal for any of the above systems should be discussed with SCU prior to documentation.

17.11 Door Hold Open Devices

The requirements for hold open devices activated by the fire alarm systems are outlined in Section 9 Doors & Hardware. Hold open devices on Smoke or Fire doors shall not be of the 'Combination hold open/Auto door closer' type. The hold open devices shall be wall mounted at 1800mm above finished floor level, and any variation to this height shall be at the discretion of the Superintendent. Electromagnetic hold open devices (EMHODs) shall be provided on all fire doors in fire isolated stairwells used for occupant circulation.

17.12 Door Control

Any doors secured by electric locks must be interfaced with the fire alarm system. Refer to Section 9 for details of electric lock types.

17.13 Hazchem Signage

Appropriate signage shall be determined and installed in all areas deemed to require such signage on the completion of all new buildings and refurbishments.

17.14 Inspections & Documentation

Pre-Approval Inspections - Building Fire Safety Systems shall be fully tested to the approval of the Superintendent prior to final approval inspections being carried out by the relevant authority. Fire hydrant block plans, fire zone plans, evacuation diagrams, constructed drawings, post construction survey etc. shall be provided to SCU and approved prior to requesting any final inspections.

Flow and pressure testing – The incumbent maintenance contractor must be in attendance along with any required personnel for the flow and pressure testing of any wet fire system.

Final Inspections - Authority for final inspections shall be the responsibility of the Building Certifier and/or the Superintendent.

Documentation - The following documentation shall be available at the time of all inspections:

- Installation certificates (fire alarm systems, hydraulics, smoke control, etc).
- Test certificates for installed systems.
- Draft/Final Fire Alarm Zone schematic diagram.

- Draft/Final system 'Block Plan' (if applicable).

All Draft documentation must be provided for review by the Superintendent in advance of the Pre-Approval inspections.

18.0 Electrical Services

The requirements of this Section are generally Mandatory

18.1 Demolition

The Contractor, in conjunction with campus maintenance staff, must identify and label all cables, equipment, boards and accessories which are to remain and which are redundant, prior to the commencement of demolition.

All redundant electrical services including cables, equipment, switch boards, light fittings and accessories shall be removed in their entirety from the site and the 'as constructed' record amended accordingly. Offer removed items to SCU prior to disposal. All electrical equipment should be recycled where possible. Solar panels, inverters and associated wiring in particular must be taken to the closest solar panel recycling facility.

18.2 External Lighting

External lighting design shall comply with AS 1158. When using selection criteria tables to determine the applicable lighting subcategory, the minimum risk/selection criteria is assumed to be 'Medium'. Confirm with SCU if the selection criteria for the areas under consideration are considered 'High'.

Illumination levels, luminaire types and control strategy for each area shall be nominated by the designer and submitted for approval as part of Schematic Design. All external lighting shall be LED luminaires with 3000K-4000K colour temperature, unless specified otherwise to serve a specific purpose. The lighting design must consider the high glare of LED luminaires and must not cause any discomfort glare.

Carpark, pathway and street lighting luminaires shall be WE-EF VFL or an approved equal. Minimise the number of luminaire types and standardise types as much as possible. All pole top mounted luminaires must have a 'quick release' feature for ease of replacement.

If the project scope includes a new path or road, the project scope shall include the lighting of that path or road. Where paths run adjacent to, through or beneath buildings, the luminaire shall be mounted on the external wall of the building; and the mounting location must be easily accessible for future maintenance work via an elevated work platform.

Lighting poles shall be fitted with base plates and mounted on concrete footing with cast-in cage and bolts, completed with levelling nuts and washers. After erection, bolts shall be trimmed and capped to a maximum of 10mm above the lock nut. Poles must be installed with the base plate above the finished level of pavements or garden beds. Poles with bases buried in the footings are unacceptable. A traffolyte label must be strapped to the pole's incoming cable at a visible location to indicate the supply origin i.e. distribution board reference and the building it is fed from.

Install RCDs on street lighting circuits. Reticulate cabling to all lighting poles on a loop-in/loop-out basis. All lighting poles shall have terminals, a circuit breaker and surge protection located in the base (alternatively, surge protection may be integrated into the luminaire power supply), accessible through a removable panel. Provide DIN rail within the base of the pole for mounting.

Hinged poles must be used where the pole height is greater than 3 metres and there is no access for an EWP or 'cherry picker', or there is no flat surface to utilise a work platform.

External lighting shall be served by two separate circuits, one for general external lighting and one for feature lighting. Both circuits must be controlled by BMS lighting control signals for time scheduling and provided with an Auto Manual Off (AOM) switch for isolation/override. All external luminaires selected must have a minimum ten-year replacement warranty, commencing at practical completion.

18.3 Internal Lighting

Internal areas shall be designed in accordance with the minimum requirements of AS 1680 and AS 1428. Provide higher illumination levels or other additions to the lighting system where nominated by users in the SD's. Illumination levels, luminaire types and control strategy for each area shall be nominated by the designer and submitted for approval as part of Schematic Design.

Luminaires manufactured in Australia, comprising Australian-made components and/or assembled in Australia are preferred. LED luminaires shall be used for all lighting. All specified internal LED fittings shall have the following characteristics:

- A CRI >8.3.
- R9 value > 7.
- Gamut Index > 8.
- SDCM value < 3.
- Glare index <19.

Minimise the number of luminaire types and standardise as much as possible. All internal luminaires shall be neutral white (4000K) unless stated otherwise, or to suit specific functions.

All luminaires shall be installed at a maximum of 3000 mm AFFL. Installation shall provide easy access for maintenance. Do not install luminaires over voids or stairs with high ceilings, mount lighting on a lowerable lighting beam system.

Provide lighting in all electrical cupboards and plant rooms. Luminaires in plant rooms shall be chain suspended LED fittings with a clear base to provide more light to the ceiling, located to provide maximum evenly distributed illumination within the space, and shall be IP rated where required.

Luminaires shall incorporate high frequency Osram, Tridonic or approved equal, with a suitable controller and power factor correction. Electronic control gear and other components shall be easily accessible for replacement with the luminaire in-situ, without the need for special tools.

All internal luminaires shall have a minimum 5-year replacement warranty, commencing at practical completion.

Luminaires shall be connected to the wiring loom by means of a three-pin plug and 1500mm of flexible lead. Lighting loom sockets in ceiling spaces shall be circuit numbered using the Sub Board No. and Circuit Breaker No. marked neatly with permanent felt pen. The loom socket shall be firmly fixed to the concrete soffit, purlins, catenary wires or chain suspended off the ceiling grid system. Use a non-conductive material support system such as 'Ezi-Fix'. Supporting off other services or ceiling hangers is unacceptable. All incoming/outgoing cables in a junction box or lighting loom socket must be strapped to the base plate of the socket to avoid movement in the terminal.

In stairs where natural light is sufficient for daytime use, stair lighting shall be switched by the external lighting program of the BMS.

Luminaires in laboratories shall be carefully selected to meet any special requirements which may apply to the space - e.g. PC rating or hazardous zoning. In laboratories with a PC rating of 2 or above, utilise sealed, recessed troffer luminaires with an appropriate IP rating (min IP44).

18.4 Lighting Control

Use the following table as guidance for SCU's preferred lighting control strategies. Discuss and agree project-specific control strategies and control system with SCU at Schematic Design.

Typical Area	Controls	Operation
Offices and Working Spaces	Motion Sensor PE Cell	When lights are off, activation of the motion sensor will turn lights on. If no presence is detected for more than ten minutes, dim lights to 50% for five minutes. If presence is detected, return lighting to 100%. If no presence is detected after this period, turn lights off. Local wall switch will be used as a manual override for users. Turning the switch on, activates the motion sensor control of lighting. Turning the switch off, deactivates the motion sensor and forces lights off.
Teaching Spaces	Local wall switches Motion sensors PE Cell	Same as Offices and Working Spaces. In addition, provide a master on/off switch adjacent the entry door and three gang controls at the teaching position to separately operate lighting the main house lighting, the front row of lighting and whiteboard lighting.
Circulation including foyers,	Motion Sensors	When lights are off, activation of the motion sensor will turn lights on. If no presence is detected for more than



toilets, corridors and storage		ten minutes, dim lights to 50% for five minutes. If presence is detected, return lighting to 100%. If no presence is detected after this period, turn lights off.
Plant Rooms	Local Wall Switch	Switch turns lights on and off.
Lab Spaces	Local wall switches Motion sensors PE Cell	Switches turn lights on and off. In large labs, group luminaires appropriate to function. Where requested, provide dimming controls.
Video Conferencing & Meeting Rooms	Lighting Control Panel	Motion sensor lighting control panel shall have the following minimum functions: <ol style="list-style-type: none"> 1. Automatic (lighting controlled by AV interface or activated by motion sensor) 2. All on 3. All off 4. All to 50% 5. Front row of lighting off, remainder to 50% 6. Dim up 7. Dim down 8. Video conferencing mode (if required)
External Lighting	Contactors control by BMS	Auto-off-manual (AOM) switches. Provide two switching arrangements for external lighting. Switch 1 is switched by the BMS such that lighting is on from dusk until dawn. Switch 2 is switched by the BMS such that lighting is on from dusk until 11pm. Provide AOM switch at distribution board of origin for each lighting control group.

In perimeter zones or other areas with significant daylight contribution, use PE cells to dim artificial lighting such that the illumination level is maintained while minimising energy use. Ensure dimming responses are not noticeable.

Controllers shall be located at the local distribution board, in a clearly labelled segregated section or separate enclosure. Control circuit block diagram drawings must be provided in the local control board. All cables must have circuit ID and must be shown in the control block diagram drawing. An electronic copy of the lighting program, and any hand-held device software required to modify the

lighting control program, shall be included in the 'As Constructed' documentation. All rights, intellectual or otherwise, to the programming shall be vested in SCU. Any special devices or equipment required for programming the system shall be supplied at Final Completion of a project.

For new control systems, provide tuition of up to three SCU staff, nominated by the Superintendent, covering the maintenance, operation and programming of the system. AV to be generally independent of lighting control systems.

18.5 High Voltage

All design on the high voltage networks shall be undertaken by a local electricity distributor accredited consultant. Undertake design in accordance with standard electricity distributor designs, including pit design, conduit arrangements, cabling installation and substation design.

The ownership of the high voltage (HV) network varies from campus to campus. Request up-to-date schematics and ownership information from the University prior to the commencement of design work.

Where required to provide supply for new buildings, joint and extend HV cabling to maintain the ring topology of the network (spurs will not be accepted). Each new substation shall comprise a ring main unit and a transformer. Verify estimated loads for new buildings are within the capacity of the HV ring main. Review balance of loads across ring mains and propose alterations to network configuration, as required, to maintain balance of loads.

Any transformer upgrade or installation of generator must consider the effect of increased fault current rating for all switchboards connected. The consultant is required to submit a full fault current study for review. Include the final study in the O&M manual.

Submit design deliverables to Superintendent for review.

All works on the high voltage networks shall be undertaken by the local electricity distributor's accredited contractors. Undertake all works in accordance with standard electricity distributor procedures. The contractor shall engage an appropriately accredited HV Auditor to audit the work of the HV Electrical Contractor from the commencement of the HV works, to certify compliance of the installation with the relevant Australian Standards.

All HV Switching shall be performed by the local electricity distributor or a qualified HV Electrical Contractor.

Where any HV cable is to be cut, altered or moved, the Contractor shall arrange for a suitably qualified and licensed HV Contractor to test and mark the cable to ensure that it is the correct cable, and that it is not 'live' before work commences.

Any new transformer installed must be set to have 230V potential between the phase and neutral terminals.

Mark all transformers with their kVA rating and owner (local electricity distributor) on the external casing. Label all outgoing ways with their destination building/load above the LV terminals in permanently fixed traffolyte.

18.6 Low Voltage

Provide a LV site main switchboard (SMSB) with each new transformer. The SMSB and consumer mains shall be rated to match the rating of the transformer. All LV distribution shall originate from the SMSB. The SMSB and building MSB may be combined if it is unlikely that there will be other substantial loads connected to the SMSB outside of the building. Balance loads across phases.

Rising mains are not acceptable. All switchboards shall be supplied via dedicated sub-mains cabling. Provide dual socket outlets in all locations that call for general purpose outlets (GPOs), unless nominated otherwise.

GPOs shall be 'Clipsal C2000' or approved equal with ID covers. The colour of the GPO face plates shall be white except in body protected areas, where the requirements of AS3003 take precedence. Rocker switches shall be colour coded as follows:

- Blue for GPOs connected to a UPS-backed supply.
- Red for GPOs connected to a generator-backed supply.
- Green for cleaner's outlet (except in body protected areas, where beige faceplate is required).
- White for all other GPOs.

All outlets shall be fitted with typed or traffolyte labels indicating the circuit number and distribution board of origin e.g. DB.2-CB.12. Traffolyte labels on an outdoor rated mounting tape shall be provided for any GPO which has no ID window.

Special purpose outlets shall be 'Clipsal 56 series' or approved equal.

Three-phase outlets shall be 'Clipsal' and shall have 5 round pins. These outlets shall be identified by means of circuit identification traffolyte labels strapped on the cable or on the outlet at a visible location.

Suspended GPOs shall be 'Clipsal SS15' or approved equal, complete with metal suspension chain. A hook shall be fitted at the end of the suspension chain to allow the GPO to be stowed at a higher level. Suspension chains must be fixed to a solid support surface such as a concrete slab soffit or steel beam. A 'Traffolyte' ID label must be installed on the outlets at a visible location or strapped on the suspension system. Retractable systems are discouraged as they are not durable and cause maintenance and safety issues.

Provide dedicated circuits for the following:

- Coffee machines.

- Microwaves.
- Dishwashers.
- Hot water units, including combined chilled/boiling water units.
- Starter sockets.
- Audio visual equipment (where multiple circuits are required, ensure all circuits are on the same phase).
- Sensitive analytical, measuring or monitoring equipment.
- Outlets and isolators rated for 15A or greater.

All outlets are double GPOs unless noted otherwise.

Provide a single GPO, for cleaner's use, at every 20m along all corridors, within each laboratory, seminar room, auditorium, lecture theatre and the like, at main stair landings and in any room preceding a room that is not accessed from the before mentioned rooms, excluding cupboards and minor storerooms. A GPO shall be provided outside toilets and each Telecommunications Equipment Room (TER) adjacent to the entry. These GPO's shall have a green rocker and white face plate, be mounted 300mm AFFL and shall be on a dedicated cleaner's circuit. Multiple cleaner's outlets may co-exist on the same circuit.

Electric hand driers must be provided with an isolator. This isolator shall be recessed into the wall at high level below or above the false ceiling line and shall be lockable.

Confirm the need for additional, higher rated external outlets outlets to serve food trucks, outdoor events and the like. Cabling to enter external outlets from below to eliminate water ingress issues. Label external GPOs with traffolyte labels fixed to the conduit with a durable strap. Recess external GPOs installed in concrete street furniture.

Floor boxes must only be specified for an island bench where it is not viable to drop electrical services from the ceiling to the table. All outlets within the floor box must have traffolyte ID labels fixed with flat point screws. Include screed box with all floor boxes and ensure make and model is suitable to reticulate Category 7A data cabling.

Provide emergency stops for power, gas and other services as required by the relevant standards and regulations in laboratories, commercial kitchens and other similarly hazardous spaces.

Position emergency stops adjacent to doors and away from light switches if possible. Stops shall be shrouded to prevent accidental activation.

Emergency stops shall only control services within the space in which the stop is located (the "zone"). One emergency stop shall not control multiple spaces. Emergency stops and their associated controls shall be supplied from the same switchboard that supplies the space.

Provide emergency stop reset buttons in common areas outside of the emergency stop zone, in a location that can be accessed by authorised staff without entering a plant room. If there are multiple

emergency stop zones in proximity, co-locate their reset buttons and controls into a single panel. Each emergency stop zone shall be provided with an individual audible alarm and a mute button.

Emergency stops and controls shall be installed on flush stainless-steel faceplates. Emergency stops shall come with engraved red text that outlines the operation of the button and the procedure users are to follow.

Design emergency stops to ensure they do not activate on voltage sag, brownout or other power quality event and only activate when the relevant button is pressed.

Where appropriate for the situation, soft wiring can be utilised to reticulate power to outlets at workstations. Soft wiring solutions shall be provided as part of the workstation package and only be supplied by reputable manufacturers.

18.7 Backup Power

When commencing new buildings or significant refurbishments, review the project scope and user requirements (if these have not been provided, request them from SCU) and nominate a backup power strategy based on one of the following:

- Provide no backup power.
- Provide UPS only.
- Provide UPS and generator. Size the generator to accommodate the loads agreed.
- Provide UPS and generator. Implement a load shedding system which operates in real time in response to actual demand to maximise connected load without overloading the generator capacity.
- Provide generator only, sizing as per options 3 or 4.

Discuss and agree the preferred strategy with SCU during the concept and schematic design phases. If strategy 1 or 5 has been agreed with SCU, the remainder of this Backup Power section is not relevant.

The following are guidelines only and should be used as the basis to start the design process. Each project will have unique requirements that do not fit neatly within the categories provided here. If in doubt, ask.

When strategies 2, 3 or 4 have been agreed with SCU to be implemented, the following equipment requires UPS-backed supply:

- Security equipment.
- Communications equipment (if directed by SCU Technology Services).
- BMS controllers.
- Refrigeration temperature monitoring systems.
- Gas detection systems in laboratories and similar spaces.
- Specific loads identified by users via the SD's as requiring UPS-backed supply (e.g. specific lab equipment).

- Power supplies to power quality meters and emergency stop systems.

Do not provide UPS-backed GPOs generally. UPS supply to user loads is only to be provided for specifically nominated equipment.

Review existing UPS capacity, where applicable, prior to adding any additional user loads to an existing UPS.

Where there is no existing UPS, provide a single building modular UPS to provide supply to the nominated loads. Provide infrastructure to reticulate the UPS-backed supply to all parts of the building via a UPS main distribution board, with no more than one UPS-backed distribution board per floor or as required to suit the loads.

Provide full external bypass to allow isolation of the UPS for maintenance without interrupting power to the loads.

The following is a general description of the levels of prioritisation that will be used if strategies 3, 4 or 5 are implemented.

Priority	Description	Typical Application
1	Very high importance	Fire and life safety equipment
2	High importance	UPS, equipment required for the building to operate for an extended period, sensitive or hazardous experimental
3	Moderate importance	Essential air conditioning and refrigeration plant, other research spaces
4	Low importance	Offices, teaching spaces
5	Very low importance	Balance of building loads

Once a strategy and prioritisation level to be included in the design has been agreed with SCU, review and classify the loads within the building to calculate the required generator capacity (UPS capacity to be calculated as per the previous section).

There are two ways by which electrical loads are assigned a level of prioritisation:

- By the type of equipment provided with back-up power (equipment-based prioritisation).
- By the type of space to be provided with back-up power (area-based prioritisation).

Equipment-based prioritisation will generally take precedence over area-based prioritisation (e.g. fume cupboard exhaust remains priority 1 equipment in priority 4 teaching laboratories).

Specific or unique equipment may require a higher priority than given here – confirm this with users.

Ensure that all associated building services with these spaces are also provided with the appropriate prioritisation of back-up power, to allow the space to be used as per business-as-usual arrangements while operating on generator. For example, ensure that you have considered the source of cooling or heating and that this is accommodated within the priority 2 back-up power requirements for a PC3 lab to ensure that air conditioning can be maintained while on generator-backed supply.

Unless advised otherwise, assume all generator systems are break-before-make and do not parallel with the grid. UPS should be used to bridge the gap between mains outage and generator starting for critical loads.

Provide fuel storage equivalent to 24 hours of runtime at 100% load. On-board storage is preferred but standalone storage should be used if a skid-mounted tank would increase the height of the generator controls above 2200mm AFFL.

If a building is operating in generator mode, in lieu of turning entire luminaires off. Ensure the minimum requirements of AS1680.0 are always met.

Implement load shedding for mechanical systems via contactors in the electrical distribution system, rather than via BMS, i.e. reticulate separate essential and non-essential supplies to MSSBs.

Utilise lift controllers to load shed lifts via a low-level interface. If two lifts are required to operate to cover all floors, ensure both lifts do not operate simultaneously.

When providing new main switchboards, provide facility to connect temporary generators, irrespective of whether a permanent generator is provided or not. Size connection to match building maximum demand and provide manual transfer switch at main switchboard. Provide facility to allow the connection of load banks to allow for the testing of permanently installed generators without interrupting supply to the building. Size connection to match building maximum demand and provide manual transfer switch at the main switchboard.

18.8 Switchboards

Switchboards to comply with AS 61439 and this includes MSBs, MDBs and DBs. Only Schneider or Terasaki brands of switchgear to be utilized and to be co-ordinated in use with the brand already in existence within a building's MSB or MDB. Further details are included in Appendix (A)

All switchboards, distribution boards and control panels shall be designed to be vermin proof. There shall be physical barriers between each 240 Volt section of the board, and each section shall be fitted with a hinged lockable door. Locks to the escutcheons shall be quarter turn slotted cam locks, and the outer doors shall have 'L' or swing handles and E keys. All doors shall be keyed alike with L-shape handles. More than 1 (one) handle is required for a door panel higher than 1,000mm.

External switchboards shall be rated for minimum IP54, constructed of minimum 2mm, grade 316 stainless-steel. Provide an anti-condensation heater, including power supply, for all external

switchboards. Where 'lift off' panels are required due to limited space, guide rods must be provided to assist mounting of the panels.

For the purpose of thermal scanning, the escutcheon must be designed to allow opening of the escutcheon without the need to turn off the main switch/breaker. Thermal imaging windows must be provided to allow safe and accurate scanning of every section rated for more than 630 amps in any switchboard. All switchboards shall be colour orange X15 (AS 2700) or RAL 2000 orange externally, and white internally.

All switchboards, distribution boards, control panels, tee-off boxes or any boxes containing electrical accessories must be installed in locations which allow access without the use of ladders or work platforms. All floor mounted switchboards must be provided with a steel plinth with a minimum height of 100mm. Bottom entry floor mounted switchboards must be designed to accommodate easy installation of a cable gland at the point of entry and easy terminations to the relevant busbars or functional units.

Provide access pits under and in front of the switchboard to allow for the connection of future cabling.

Every switch and protective device on every switchboard shall have a label noting the following:

- Name of load.
- Trip setting and frame rating of protective devices, or current rating for isolators and switches.
- Size, length, specification and current carrying capacity of the sub-mains cable to the load.

All labels shall be engraved black text on white traffolyte. For fire and life safety services, labels shall be engraved white text on red traffolyte. Labels shall be secured by means of flat point screws, nuts and washers. Gluing or the use of self-tapping screws is unacceptable. Labelling within the switchboards for relays, contactors etc. should be on standoff brackets. Seek advice from SCU for the naming conventions for switchboards. Label outgoing cables from MSB and MSSBs with traffolyte labels, secured with zip-ties.

The main switchboard shall be a Form 3b verified assembly, floor mounted, free standing and preferably modular construction. Provision shall be made to extend the main busbar systems in either direction. Switchboard components shall be Schneider or an SCU approved equal.

Switchboard workshop drawings must be submitted for review and approval by SCU and the consultant and include the following information for review:

- Plan view.
- Front and rear elevations.
- Sectional views showing segregation, busbar arrangements and module layouts.
- Single line diagram, including the size and current carrying rating of each section of busbar.
- Schedule of equipment, including make and model for all items.

The switchboard builder must also produce relevant verification documents to demonstrate that the proposed MSB complies with the current version of AS 61439. These documents shall be included in the Operation and Maintenance Manual. The design of the MSB must include the provision to monitor, detect and release the energy generated by an arc fault in accordance with AS3000.

Where multiple transformers supply a single building, provide manually operated mechanical interlocks to allow the building to operate on a single transformer.

Provide inspection windows to allow thermal imaging scan of all functional unit termination points rated 630 amps or higher.

A vertical busbar arrangement is required to maximise cooling of the busbars by convection.

Main switchboards shall have at least 25% spare capacity in physical connection space. Provide a variety of different frame sizes for future connections and ensure busbars are suitably rated.

The MSB shall be supplied with a label noting:

- Switchboard name.
- Test certificate number.
- Date of manufacture.
- IP rating.
- Origin, size and current rating of consumer mains.
- Recommended information as specified in AS 61439.1.

Non-fading laminated A3 size prints of the 'As Constructed' line diagram schematic drawings of the main switchboard and the electrical power reticulation to the building shall be provided in the Main Switch Room. These drawings shall be ring bound into a plastic folder and placed in a suitable wall mounted rack holder. The main Switchboard line diagram must include the size, rating, and the length of all incoming and outgoing cable and the rating, model and manufacturer of all switchgear.

Complete an arc flash analysis to NENS09 for all new main switchboards. Submit analysis to SCU for review. Provide signage indicating the appropriate level of PPE for the calculated arc flashes based on door closed and door open configurations.

The design of distribution boards shall be verified to AS 61439. Provide minimum Form 2 separation with a chassis rated for minimum 250A per phase.

For pole quantities, provide:

- 100% spare capacity on all distribution boards in science buildings.
- 75% spare capacity in other academic (research or learning) buildings.
- 50% spare capacity in non-academic (e.g. corporate services) buildings Spare capacity of pole quantities is measured at practical completion.

Distribution boards shall be provided to serve areas of heavy load concentration (e.g. workshops) and each laboratory. Locate distribution boards to be accessible for maintenance purposes without having to access the space itself.

All light and power circuits are to be loaded to less than 75% of their rated capacity.

All distribution boards shall be sized to allow for all incoming mains and outgoing cables and the positioning of Transformers, Terminal Blocks and Contactors such that cable to these items is completed in a neat and tidy manner.

All distribution boards shall be supplied with a label noting:

- Switchboard name.
- Test certificate number.
- Date of manufacture.
- IP rating.
- Origin, size and current rating of consumer mains.
- Recommended information as specified in AS 61439.1.

Circuit schedules shall be typed and shall be provided at all switchboard positions. Schedules shall be secured in purpose made clear PVC covered holders. Circuit schedules shall indicate the room numbers or area served by the circuit. The schedule should also show where the Board is fed from, and type and length of cable used to feed the board.

An electronic copy, Word or Excel format, of the circuit schedules shall be included in the 'As Constructed' documentation.

An A1 size non-fading laminated single line circuit diagram shall be provided for each DB and shall be hung on the internal face of the board door using an eye lid mechanism. If an updated circuit legend is required, the old sheet must be marked as superseded and left on site, behind the new sheet, for future reference.

Local protection devices RCBO's/MCB's to final sub-circuits shall be Schneider or an SCU approved equal. If a refurbishment project results in more than 35% of the circuits on an existing switchboard being replaced or modified, then all lighting and power circuits on that switchboard shall be fitted with RCBO's if they are not currently installed to the level required by the current edition of the AS3000 Wiring Rules. Where existing Eaton Quicklag, Heinaman or NHP Safe-T circuit breakers are installed, replace with a new Schneider or SCU approved switchboard fitted with RCBO's of the same make.

All neutrals, earths and active cables shall be number ferruled to correspond to the circuit breaker number. All circuit breakers shall be numbered consecutively on the fascia from top to bottom on the left-hand side then top to bottom on the right-hand side; and also on the circuit breaker mounting bracket for ease of identification once the fascia has been removed.

All active cables entering circuit protection devices shall be installed as per manufacture's recommendations. All control wiring shall be number ferruled with numbers as indicated on as constructed drawings.

Neutral and earth bars shall have the same number of terminations as there are circuit protection device positions, and be provided with two grub screws per terminal. Multi-joining of earths and neutrals into one joint prior to termination shall not be acceptable unless they are screened cable earthing. Screw type cable connections shall not be permitted within switchboards and distribution boards.

Please refer to Appendix A (Switchboards) for further details.

18.9 Telecommunications Equipment Room (TER)

Coordinate design and any special requirements with SCU Technology Services. Refer to Data & Telecommunications Design Specifications

18.10 Metering

The Contractor shall provide for KWHR Meters on all Distribution Panels equal to Crompton Instruments, Integra 1630 with BACnet/IP Output. All installations are to be in liaison with the SCU preferred BMS provider. Separate metering is required to each Building.

All meters need to be attached to the Building Management System (BMS) – refer to section 14.15.

18.11 Power Quality

Each main switchboard must be provisioned for the connection of power factor correction (PFC), harmonic filtering and/or voltage regulation devices.

Where not supplied by the building UPS or if UPS power is of insufficient quality, sensitive equipment which has specific power quality requirements must be supplied with a power quality device. Any such specific requirement must be discussed with the equipment user. If directed to provide as part of the works, the PFC should be sized to achieve a minimum 0.95 power factor when the building is fully operational.

If directed to provide as part of the works, install power quality devices to achieve a THD value of less than 5%. The device must be able to provide the compensation for these mentioned parameters within less than 5ms.

If directed to provide as part of the works, a voltage regulator should be installed to maintain a voltage fluctuation of less than 2% from the nominal voltage of 230V.

18.12 Cabling

Power and lighting cable shall not be less than 2.5mm², stranded copper conductors. Cabling should be sized to suit the frame size of the proposed circuit protection device, not the trip setting.

Field control wiring for extra low voltage (less than 32 V AC./110 V DC.) shall be not less than 2.5mm² stranded copper. Control wiring within switch board can be 1.5mm², but once these control cables leave the board they are to be 2.5mm², and leave via a terminal block.

Communications/Data cable used for RS-485 applications must be BELDEN 9841 or an exact electrical equivalent.

Junction boxes with identification labels shall only be used after written approval from the Superintendent. Cable exposed to sunlight in external locations must be UV rated.

Cable Entries to switchboards or equipment via gland plates or through panels shall be made using circular, orange-sheathed, cable and suitable compression glands. Double insulated flat cable may be used if entering through ducts or conduits. Non-magnetic gland plates and penetration cover plates shall be used when the cable rating exceeds 100 amps.

Data/control cabling originating external to the building shall be fitted with an appropriately selected surge diverter to protect the electronic device from damage.

Provide zinc anneal cable trays for internal applications, minimum 1.25mm thickness with minimum 30% perforated hole area.

Cable trays in external applications or otherwise exposed to the weather shall be fully galvanised and corrosion resistant.

All external cable trays shall be provided with ventilated and removable top hat cover sections to protect the entire length of the visible cabling. Covering sections should not allow the ingress of a tool that would allow vandalism to sever cabling.

Cable trays, ladders and ducts shall be colour banded (300mm width) at a maximum of three metre intervals, and at each change of direction and either side of any partition or barrier. Trays and ladders shall have the following colour coding throughout the entire installation:

- Orange X15 - for power, lighting and mechanical electrical cabling.
- White - for telecommunication and data services.
- Signal Red R13 - for fire services.

Where cable containment systems are painted, attach a label indicating the type of service (e.g. power, ELV, communications) for ease of identification.

Conduits installed below ground for low or high voltage services shall be orange. Small conduits above ground shall be grey/white for painting. Large conduits above ground shall be orange and provided a protective metal hat section, suitably painted/powder coated to blend with the surrounding wall

colour. Conduit saddles shall be of the stand-off type i.e. full saddle with spacer in exposed areas or on painted walls. Half saddles are not acceptable.

All cable trays, ladders and ducts shall have 50% spare carrying capacity. All cable ladders or ducts leaving switchboards or load centres shall have 100% spare capacity up to the ceiling space.

All services supports shall meet the requirements of AS1170.4 Seismic restraints. Prior to the installation of these services, a form 15 design certificate from an Engineer and associated design documentation must be provided to the satisfaction of the Building Certifier certifying that the Mechanical, Electrical, Hydraulic and Sprinkler systems comply with AS1170.4.' All cables shall be installed in the ceiling of the floor they serve.

Install all consumer mains, sub-mains and other major cabling, on cable trays in ceiling spaces and on ceiling ladders where rising in cupboards in trefoil formation. Do not install major cabling runs over offices or other enclosed spaces.

Where cables are not run on ladders and trays, every cable shall be supported clear of the ceiling grid or framing using 'Unicon' or approved equal push-in clips or tied to a catenary wire. The spacing of clips and ties shall not exceed manufacturer's recommendations. Adhesive fixed clips are not permitted.

Where the number of final sub-circuit cables running parallel in the ceiling space exceeds six, a catenary must be used for support. Where the number of final sub-circuit cables running parallel in the ceiling space exceeds twenty-four, a cable tray must be used for support.

Where cables are run in conduits, any connection between rigid and flexible conduit shall use an appropriate adaptor and not be adhesive or silicon joined. Conduits cast in slabs shall be 35mm min. dia. and their location shall be properly surveyed and clearly shown on the 'As Constructed' drawings.

The laying of cable on top of the ceiling tiles or lining, or tying cables to ceiling grid, cable tray or duct support hangers is not permitted. All electrical accessories such as junction boxes, battery packs, control gear and lighting power sockets must also be supported clear of the ceiling grid or framing.

Power circuits within partitions or wall cavities shall be installed vertically from the ceiling space to the outlet or connection position. Outlets within 1000mm of each other may be connected horizontally, providing the total horizontal route between successive outlets shall not exceed 1m. Cables shall not be installed diagonally.

Where cables are installed within concealed areas or horizontally within partitions, they shall be installed within conduit so they can be withdrawn, and so that sufficient segregation can be afforded if a new service requires installation.

Where cables are installed through existing sealed penetrations, the barrier material shall be reinstated to meet the original rating or requirement. Where cable duct is used, provide three channel, aluminium duct. Select finish to suit architectural requirements. Install ducting above desk level.

Where island rooms exist, these shall be provided with a minimum of 2 x 32mm spare conduits for future installation of additional power from the relevant distribution board.

18.13 Emergency Evacuation Lighting

All emergency lights and exit signs shall be single-point and self-contained, suitable for use with an automated testing and monitoring system. Emergency lights will generally be unmaintained and exit signs and emergency battens will generally be maintained.

Install emergency lighting in all areas required by the NCC, AS2293 and where the sudden loss of lighting could pose a safety risk (e.g. laboratories, toilets, etc).

All EEL shall be LED with Lithium Nanophosphate (L10) battery technology and are compatible with 915 MHz radio frequency.

All new emergency and exit lighting shall be monitored by the Zoneworks Hive System that is integrated into the SCU Building Management System

When working in existing buildings, refer to SCU for details of existing monitoring systems.

Where monitoring systems are already in use in a building, existing fittings must be replaced with Hive L10 fittings, and the contractor must liaise with Clevertronics or SCU Property Services about commissioning and adding fittings or controllers to the Zoneworks Hive monitored system.

Where required, the contractor shall engage the incumbent maintenance contractor to undertake works to modify existing monitoring systems in conjunction with the supplier and provide all required information.

Each luminaire shall have visible ID labels on the fitting for maintenance identification purposes. The ID for 'Clevertronics Hive' shall indicate the SCU assigned SPU identification system. The contractor will be required to supply in excel format the fittings MAC Address/Building No./Hive Controller (or group)

No./Floor Level/Room No./DB No. & Circuit No. A layout of the installation in PDF or DWG format locating the fitting and MAC address No. is also to be supplied prior to commissioning. SCU Property Services or Clevertronics will then allocate the fittings assigned SPU ID and commission the system to the Hive network. The contractor will then be responsible for allocating the SPU ID number to each field fitting.

Emergency Evacuation Lighting System shall have a minimum ten (10) year replacement warranty at the time of installation.

Prior to practical completion of refurbishment projects, a full test of the building system shall be carried out as per AS2293 standards (minimum 2-hour discharge test) including a comparison of the previous and new test results to confirm that the installation and commissioning of the modified system have been undertaken correctly, and that all parts of the building is functioning as required.

18.14 Lighting Protection

Lightning protection shall be provided to a building, if recommended, using the risk assessment criteria specified by AS 1768. Provide a copy of the risk assessment to SCU for review, irrespective of whether a system is recommended by the assessment or not.

Test points shall be provided at the lowest level of the building.

Provide surge protection at switchboard for all cabling installed external to the building (incoming or final sub-circuit). Provide Novaris, Erico, Dehn or approved equal.

18.15 Underground Electrical Services

All underground electrical services shall be laid in sand with 75mm below and 150mm above and to sides.

Trenches shall be backfilled only with selected fill and compacted in layers not exceeding 200 mm to a relative density of 90%. The minimum cover shall be not less than 600mm to the top of conduit. Concrete cover to conduits at a lesser depth will be allowed only with the written approval of the Superintendent.

Cable schedule, cable single line diagram, cable route with burial depth and pit & pipe verification checklist must be included in the as constructed documentation.

The minimum size of underground conduit shall be 25mm diameter. All underground conduits >80mm diameter must be fitted with a bell mouth at pit entries to assist with future work. All penetration to building fabrics must be designed to avoid water ingress to the building, and all conduits must be sealed at both ends to avoid vermin and water ingress. All spare in-ground conduits shall be fitted with a 2.5mm² TPI cable or a draw wire.

All underground cable shall be double insulated cable, no less than 2.5mm². Jointing of underground cables is not preferred, but if a joint cannot be avoided, it may only be done with the written consent from the Superintendent; be done in a cable pit with an IP68 rated jointing kit and be suspended at 200mm (at least) above the bottom of the pit.

Traffolyte ID labels must be provided (cable-tied to a cable or conduit) to every cable run in a pit to identify the cable (i.e. Consumer Main to N23).

Maximum distance between pits on underground cable runs shall be sixty (60) metres. All pits shall have their lids marked with a recessed brass plate indicating the service installed and the route from the pit.

Where available, drain the lowest pit in the conduit and pit network to a nearby storm water drain, including a back-flow prevention valve. If there is no adjacent storm water line available, a 2m x 2m gravel pit must be provided under each pit with a grating suitably sized to drain the water into the pit.

All underground pits must be cleaned out prior to practical completion to remove construction debris.

Brass marker plates with lettering no less than 10mm high shall be installed on the building external wall at entry/exit points, at kerbs and road crossings and any changes in direction. The plate shall be installed flush and fixed by a mechanical fixing. Plates must include an arrow showing the direction of the cable run. In unpaved areas, the marker shall be set in a concrete pad not less than 300 x 300 x 200mm deep.

18.16 Testing

All faults detected during mandatory testing shall be immediately rectified and retested at no additional cost to SCU.

On all projects, the Main Switchboard, distribution boards and load centres installed or modified within the project shall be checked using a Thermoscan infrared scanning unit, or equivalent, during the defects liability period by the Contractor at a time of maximum demand to check for faulty connections.

All test results shall be recorded and provided to the Superintendent on completion of testing.

At the conclusion of commissioning and testing, SCU reserves the right to witness the testing of systems to verify operation is as per documentation and the DG&P. Liaise with SCU for witness testing requirements in good time prior to the commencement of commissioning.

Any defects found shall be made good prior to the issue of a Certificate of Final Completion and a complete report, together with thermal photographs shall be provided on completion.

18.17 Product Substitution

Where a product substitution is proposed for any specific electrical system/item nominated, a comprehensive engineering assessment report shall be produced for each item by the project Consultant to demonstrate product equivalence. The reports must assess all aspects of the electrical system/item and be supported with test certification, performance calculations and modelling, plus all other supporting documents for both the original and proposed substitute items of equipment.

18.18 Plant and Equipment

As part of the building manual, a fully populated schedule of maintainable electrical equipment supplied in this project must be provided in electronic format (combination of PDF, DWG, RVT and DOC file formats only).

18.19 Warranty

All major electrical components such as MSB's, HV equipment, power quality equipment, generators and associated control systems must have a two (2) year manufacturers and installation warranty. A warranty document for each major equipment must be supplied as part of building manual.

18.20 Renewable Energy Systems

The renewable energy system installation and associated services shall be designed, supplied, installed, tested and maintained to the requirements of the following standards:

- Clean Energy Council Install and Supervise Guidelines for Accredited Installers.
- AS/NZS 5033 - Installation and safety requirements for photovoltaic (PV) arrays.
- AS/NZS 1768 - Lightning Protection.
- AS/NZS 1170.2 - Wind Loads.
- AS/NZS 4777.1 - Grid Connections of Energy Systems via Inverters.
- Local Electricity Distributor Approved Grid Protection Relays.
- Local Electricity Distributor Standard for Low Voltage Embedded Generation Connections or Standards; for High Voltage Embedded Generation Connections.

Where multiple inverters are installed, they must be fitted with isolators to enable quick and safe inverter replacement. Installation of a custom-built inverter is not acceptable. Inverters shall be installed in a location that will allow safe and easy future maintenance access.

All renewable energy generation systems must be designed, installed and commissioned in a way that will allow the system plus the derived data to be displayed for educational purposes.

Inverter communications port shall conform to the Sunspec protocol, and at a minimum, shall have the ability to for the following to be remotely set:

- Real power output.
- Power factor/VAR's.
- Inverter grid protection device (AC output relay).

Inverters shall have the ability to be remotely read by the University's Fronius system and the following registers:

- Voltage (AC).
- Current (AC).
- Real power (AC).
- KVA (AC).
- KVAr (AC).
- Power factor.

- Voltage for DC each input.
- Current for DC each input.
- Error messages.
- Inverter temperature.

The inverters shall be able to actively change the output power to match the load at the network coupling point.

The inverter output at the PV-DB shall be metered by an NMI pattern approved meter and shall have Modbus communications.

The inverters shall have a minimum 98% uptime guarantee. The inverter is to be certified compliant to AS/NZS 4777.2:2020 The inverter shall have a warranty of 10 years or more.

Inverters shall be installed in plant rooms, however if this is not practicable, installation is preferred to be undercover.

Any shaded panels shall have an optimiser. This includes any panel that over time may become shaded due to growing trees. Optimisers on all panels are preferred to maximise the output per panel and for record- keeping purposes.

All PV strings shall be able to be monitored for voltage and current output. This can be done via the inverter if each string is separately fed into the inverter and can be measured.

PV Strings should not be paralleled at the array.

Solar panel performance shall not degrade faster than what is stated on the solar panel datasheet. The solar panels must have a minimum product warranty of 12 years and a performance warranty of 25 years.

Durability requirements shall be in accordance with AS 4312, AS 5033 and other relevant Australian Standards.

Solar panels shall have an expiry date on the Clean Energy Council website of no early than 12 months from the installation date. Provision of all Operational and Maintenance Manuals at handover.

19.0 Security Systems and Services

All the requirements of this Section are Mandatory

19.1 Generally

In addition to the requirements of Crime Prevention Through Environmental Design (CPTED) as outlined in Section 2 Planning & Design Controls, there are specific systems required to secure the University's buildings and carparks against unauthorised access.

All Security Systems and Services shall be designed, installed, commissioned and maintained in accordance with the Building Code of Australia (BCA) and the relevant Australian Standards to achieve the most suitable security solution for each project.

The security requirements for each project will need to be clarified with SCU. It is the general policy of the University to have the cabling infrastructure for the security system provided by an approved and certified builder. The installation and commissioning of the security system, (including cameras) are coordinated separately by SCU.

A list of preferred Security Contractors is available from SCU on request.

Master keying of locks is covered in Section 9 Doors & Hardware.

19.2 Electronic Access Control System (EAC)

Electronic Access Control systems shall be as set out on the SD's, however the final EAC system for the building shall be determined during design development in consultation with SCU.

An interfaced solution of Gallagher and Salto access control is to be installed in accordance with specifications and through nominated contractors. A list of nominated sub-contractors can be obtained from SCU.

All Controllers installed in new buildings or refurbishments are to have 30% minimum spare capacity for future expansion.

19.3 Electronic Mortice Locks

Electronic mortice locks shall be as set out in the SD's to meet the following requirements:
Electronic Mortice Lock – Single Side

Lockwood 3572/3582

- Fail secure.
- Gallagher T15 reader (Mifare black).

- Electromagnetic Hold Open Device (powered by door lock power supply) with wall mounted momentary release button marked "Door Release". Where appropriate use KABA 9000FSSIL Slide Arm Electronic Hold Open Door closer, KABA 9000 series (no mechanical hold open feature).
- Free egress. Mortice lock fitted with internal door release switch and be free handle exit (Do not use standalone door release buttons).
- Key Override Monitoring (KOM) alarm enabled generating an alarm in Gallagher Command Centre.
- Door Open Too Long (DOTL) alarm enabled generating an alarm in Gallagher Command Centre and emitting a tone at the door via a stand-alone OPTICAL/ACOUSTIC INDICATOR which is to be activated by its own output from the controller. (# S7102 AI673 OPTICAL/ACOUSTIC INDICATOR ARITECH as supplied by Direct Alarm Supplies.) Wired back to controllers in location specified by SCU.
- Bi-Lock Cylinder ("AZ01" Lismore, "STE" Gold Coast – Ballina Locksmiths).
- On 3572 use KABA 600 Series, with 25 lever, Satin Chrome.
- On 3582 use KABA 600 Series, with 25 lever, Satin Chrome.
- If double door both leaves must be monitored.
- Doors designated to be Salto Update Points will be marked "A (SUP)."

All external doors to be configured fail secure (power to unlock). Internal doors to be configured fail safe (power to lock). For Aluminum Doors use:

Lockwood, 3582ELAM4LSC, Slim line mortice lock, 23mm back set, fail safe, monitored including KOM. For Timber Doors use: Lockwood, 3570ELM0SC, mortice lock Fail safe/secure selectable, fully monitored including KOM, Satin Chrome, or KABA equivalent.

Electronic Mortice Lock – Dual-side

Lockwood 3572/3582

- Fail secure*.
- Gallagher T15 reader (Mifare black) on both sides of door. (Do not use standalone door release buttons).
- Door closer, KABA 9000 series (no mechanical hold open feature)
- Fixed handle both sides.
- Key Override Monitoring (KOM) alarm enabled generating an alarm in Gallagher Command Centre.
- Emergency Break Glass Unit (BGU) on the internal/egress side. (TROJAN EM REX Call Point, Break Glass Emergency Exit Switch, #EXIT1000);
- BGU must generate an alarm in Gallagher Command Centre and the BGU itself shall emit a tone at the door.
- Bi-Lock Cylinder both sides ("AZ01" Lismore, "STE" Gold Coast – Ballina Locksmiths);

- Door Open Too Long (DOTL) alarm enabled generating an alarm in Gallagher Command Centre and emitting a tone at the door via a stand-alone OPTICAL/ACOUSTIC INDICATOR which is to be activated by its own output from the controller. (# S7102 AI673 OPTICAL/ACOUSTIC INDICATOR).
- ARITECH as supplied by Direct Alarm Supplies). Wired back to controllers in location specified by SCU;
- On 3572 use KABA 600 Series, with 25 lever, Satin Chrome.
- On 3582 use KABA 600 Series, with 25 lever, Satin Chrome.
- If double door both leaves must be monitored.
- Doors designated to be Salto Update Points will be marked "C (SUP)".

All external doors to be configured fail secure (power to unlock). Internal doors to be configured fail safe (power to lock). For Aluminium Doors use:

- Lockwood, 3582ELAM4LSC, Slim line mortice lock, 23mm back set, fail safe, monitored including KOM.
- Timber Doors use: Lockwood, 3570ELM0SC, mortice lock Fail safe/secure selectable, fully monitored including KOM, Satin Chrome, or KABA equivalent.

19.4 Closed Circuit Television (CCTV) System

All CCTV systems installed shall achieve the following standard objectives:

- Provision of high-resolution colour CCD cameras and Digital Video Recording (DVR).
- Be capable of continuous operation and not require manual activation during or before an incident to commence recording.
- Be able to record high quality pictures of every person who comes in through the view of a camera in the system. High quality pictures shall mean that individuals passing through the view of a camera in the system may be easily identified from those pictures.
- Provide general coverage of all the areas as indicated by the fields of view marked on the security system plan for the building / area or as specified by CLF Security & Control Systems Manager.
- Storage capacity to be minimum of 30 days.

All cabling is to be performed as per the relevant Australian Standard and relevant Sections of these Design Guidelines & Procedures.

Exact locations of equipment shall be determined on site to provide effective security, in consultation with SCU. The installer shall not select new locations for the equipment.

19.5 Help Phones

To be located as nominated on Electrical Services Plans (1500 off FFL). Jacques IP Help Phone:

- Wall mounted, single button, self-testing, vandal resistant, (VSL-351QS+) with flush mount back box for in wall mounting (FWE-14), or, Surface mount back box, 316 type stainless steel (SWE- 4).
- If mounting location requires a Jacques IP Bollard Mounting, single button, self-testing, vandal resistant, (VSL-341) can be used.

Phones shall be mounted 1200 mm above finished surface level. The Contractor shall provide all necessary cabling to the nominated locations in accordance with the requirements of the SCU Technology Services team.

19.6 Duress Points

Fixed duress alarms and pendants are to be located in areas determined by SCU. Duress Button Fixed Under Desk:

- Stainless Steel.
- Fixed under desk.
- Manufacturer Part Number: PADP2.
- Available from Direct Alarm Supplies (DAS).
- DAS Part Number: S3710.

Duress Pendants:

Inovonics EN1223D Dual Button Pendant Transmitters. Corresponding receivers providing saturation of designated area.

20.0 Landscaping

20.1 Generally

Materials and workmanship shall be in accordance with the relevant Australian Standards AS 4419 - Soils for Landscaping and Garden Use.

20.2 Red Imported Fire Ants (RIFA)

Any materials sourced or originating from a current Red Imported Fire Ant (RIFA) treatment Zone is to be assured, certified or guaranteed in writing to be visually free of RIFA by the material supplier. Refer to Section 4 Project Preliminaries for the full requirements associated with RIFA.

20.3 Water Supply to Hosecocks, Drinking Fountains and Irrigation Systems

All external hose cocks and drinking fountains are serviced by a separate valved water supply from the building Valve Room.

20.4 Landscape Drainage

Surface Drainage – All surface water shall be collected in grated sumps. Each sump shall incorporate a silt trap and be of sufficient capacity to drain the area under all conditions, taking into consideration, extreme weather events which may compromise the efficiency of the system.

Subsoil Drainage - Provide at least one 100mm diameter slotted subsoil drain to service each 10m² of garden/lawn. All drains shall be enclosed in a geofabric sock and laid in a trench in the subsoil with a 150mm gravel surround. Where connected to the stormwater drainage system, a vertical air gap must exist between the end of the drain and the obvert of the storm water pipe.

Where drainage is installed under paved areas, rigid PVC shall be used. The outfall of drainage from courtyards is to discharge into planted landscapes where possible.

The high end of all drainage lines is to be turned up to provide a flushing point with concrete surround and shall be fitted with a bolted trap screw. The final level for the capped end shall be 75mm above mulching or set flush with turf. An Id tag is to be installed in concrete surround of the flushing point identifying it as stormwater.

Planter Boxes - All planter boxes and planter beds within paved areas shall be properly drained, using gravel and filter fabric.

Where boxes or beds are to be planted with trees, ensure that the possible intrusion of roots into the subsoil/stormwater drainage system is prevented utilising root barriers where plant roots may cause damage to surrounding infrastructure.

20.5 Topsoil & Planting Soil

Material - All soil for grassing and planting shall comply with AS 4419 and generally be an approved friable sandy loam with a sand content of between 50% and 70% by volume and a humus content of between 5% and 10% by volume. The pH shall be 6.0 to 7.0. All soil shall be free from stones, weeds, sticks and rubbish.

Subsoil Preparation – Before placing soil, the subsoil shall be properly prepared by ripping, cultivating and removing unwanted materials including any necessary treatment of acid or alkali content.

Cultivate the sub grade of all garden areas prior to placement of soil, if compacted, by ripping to a minimum depth of 400mm to loosen the compacted ground. Do not disturb services or existing tree roots. If necessary, cultivate these areas by hand.

Placing – Soil shall be spread on the prepared subsoil including mixing in any required fertiliser and making allowance to achieve minimum soil depths after light compaction.

Soil Depth For Gardens and Turfed Areas - A minimum depth of 300mm of topsoil is required for garden beds and a minimum depth of 100mm topsoil for turfed or seeded areas.

Soil Depth for Planter Boxes and Beds within Paved Areas - A minimum depth of 1 metre of topsoil is required for planter boxes and beds.

20.6 Turf

Turf shall be of an approved species of good quality and free from weeds.

The area to receive turf shall be lightly consolidated after preparation to avoid settlement and be graded to an even slope. Topsoil shall be spread over the area so that grass finishes level with adjoining paving and kerbs. Turf shall be laid along the contours with the joints staggered. The turfed surface shall be lightly and evenly top dressed with sandy loam or sand to fill any depressions. Turf shall be well and regularly watered after laying. All turfed areas are to be irrigated with a system designed to suit the turf zone for efficient watering.

20.7 Planting

A Plant Species List for all campuses is available from the University. Preference shall be given to the use of native, drought tolerant plants which do not require regular watering.

Plants shall be sun-hardened nursery stock, grown in appropriate media, and free from weeds.

If there is doubt about adequate drainage, the holes need to be water-tested prior to planting to ensure proper drainage.

Partly fill holes with soil containing blood and bone or other organic fertilizer at the manufacturer's rate, incorporate well, and cover with 25-50mm of fertiliser-free soil.

Water all plants before and immediately after planting.

20.8 Garden Mulch

Mulch shall be free from soil, weed growth and green material or other matter. Mulch may be of the following types:

- Timber Chips - Derived from trees and vegetation removed from the site during site clearing and stockpiled on the campus.
- Pine Bark Mulch - Medium grade with minimum bark size of 20mm square and maximum of 75mm square.
- Hoop Pine Bark Mulch - For use on steep slopes to the approval of CLF.
- Riverstone Mulch - Smooth, washed river stones in sizes varying from 100mm to 25mm to a minimum depth of 150mm.
- Gravel Mulch-Washed River gravel of 30mm maximum (unless a larger size stone is required) size to a minimum depth of 75mm. Use in external areas (other than under buildings) shall be avoided.

Generally, mulch is to be placed to a minimum depth of 75mm unless noted otherwise and in all cases shall finish flush with edge retainer or adjoining surfaces. Black plastic is not to be used below mulch. The selection of the garden mulch type is to be approved by SCU.

20.9 Irrigation System Generally

- Where irrigation systems are required, the irrigation controller shall be a Toro Sentinel Irrigation Controller (or of equivalent specifications and functions), with the number of stations required to be determined by the irrigation system designer and will be compatible with the Universities existing system. The Contractor shall supply an irrigation plan before the commencement of the landscaping.
- Garden beds and turfed areas shall not be irrigated unless instructed by the Superintendent. Water for irrigation shall only be taken from the rainwater storage tank provided for the building or University dam supply.
- Where water used for irrigation is extracted from the ponds at the Lismore Campus, SCU shall be consulted prior to design approval.
- The landscape contract must include for the supply, installation, testing and commissioning of all the equipment necessary for the completion of the works described or inferred in the tender specification and drawings.

20.10 Landscape Furniture

The selection of landscape furniture including seats, bins, bollards, lighting, fencing and signs is to be to the approval of SCU. In all cases, consideration is to be given to matching existing adjacent furniture or that which is generally adopted for use on the particular campus.

Drinking fountains in external landscaped areas shall be aluminium fountains with selected powdercoat finish. Fountains shall be securely fixed to concrete slabs or pad footing in accordance with the manufacturer's instructions, and wastewater disposal shall be to the approval of SCU.

20.11 The Landscape Maintenance Period

For new construction, the Landscape Maintenance period shall commence from the date of Practical Completion of the Works and shall extend for a period of twelve (12) months. Maintenance of landscape works to include watering, mowing, pruning, weeding, fertilising, pest and disease control, replacement of dead or missing plants and the like for grassed and garden areas.

Any replacement plants shall be of a size and maturity which matches those in the landscaping at the time of replacement.

For refurbishment or minor works, post practical completion maintenance will be determined on a project basis by SCU.

16.17 Vegetation Protection

Vegetation (including trees and ground flora) identified for retention is to be appropriately protected from construction impacts, events and activities that may negatively impact them, including compacting the surface around trees, disturbing tree roots or damage to the trunk or limbs from overhead machinery.

Where vegetation is within a works zone or may be affected by building works, the Superintendent must be consulted regarding the appropriate steps for protection or removal.

21.0 Signage

The requirements of this Section are Mandatory.

21.1 Generally

The University has adopted a new suite of standard signs to be used across all its campuses. All sign types are illustrated in the SCU Signage and Wayfinding Strategy.

There shall be no departures from the design and use of the signage types, colours and graphics nominated in the Strategy. Any proposal to depart from the requirements must be submitted to SCU for consideration and approval.

22.2 Responsibilities of Design Consultants for Signage

Unless otherwise advised by SCU, the project Architect is responsible for the preparation of documentation required for the procurement and installation of all project signage, both internal and external, which shall be included in the tender documents.

The text to be included on each sign type will be provided to the architect by the University following consultation with and input from the user groups.

22.3 Statutory Signage

All statutory signage required for a project shall be provided as part of the Contract Works. The project Architect in conjunction with the other design consultants is responsible to determine all statutory signage requirements in accordance with the NCC BCA, Australian Standards or relevant legislation.

Statutory signage also includes all hazard identification and safety signage associated with laboratories and other specialist areas. These requirements shall be confirmed with the relevant user groups and University's WHS team.

22.4 Braille and Tactile Signage

Braille and tactile signage shall be provided in accordance with the requirements of the NCC BCA and the recommendations of the Access Consultant. Braille and tactile elements are a mandatory requirement for the following signage types:

- Internal room identification.
- Facility entrance identification.
- Public directory information.

22.5 Tenancy and External Agency Signage

Signage for commercial tenancies and external agencies will normally be the responsibility of the tenant/operator, subject to the approval of SCU.

22.0 Loose Furniture and Equipment

23.1 Generally

Furniture (e.g., chairs, seats, workstations, tables etc.) is generally suitable for 'heavy duty commercial' use, with a minimum warranty of five (5) years. Furniture is to conform to all codes above for strength and durability.

The Head Consultant or Contractor shall prepare a furniture layout drawing including the colours and finishes for presentation to SCU. A current listing of preferred workstation furniture is detailed in 23.8.

All new furniture must be considered for:

- Meeting or exceeding the Australian Industry Fire Index standard requirements.
- Whole of life cycle costs.
- Sustainability constructed and/or recycled.
- Ease of cleaning.
- Flexibility and reuse ability.
- Sourced locally and/or Australian-made.
- Ability to be disassembled and reassembled as needed.

23.2 Specialist Furniture

In some areas (e.g. executive areas, areas requiring a corporate image, Research Centres, Learning Centres, Laboratories, Cafes etc.) 'specialist' furniture, other than that described on the web page may be required. Selections are to be approved by SCU.

23.3 Furniture Suppliers

Furniture shall be purchased only from suppliers approved by SCU. For any other suppliers, competitive quoting procedures will apply. Current acceptable suppliers and suppliers previously used by the University can be provided upon request.

23.4 Timber Furniture Requirements

- Timber furniture includes items manufactured from timber or melamine veneered MDF board and metal, such as office workstations, mobile drawer units, tables, trolleys. etc.
- MDF board used in furniture items shall be 'E Zero' board, and the selection of all materials used shall comply with the requirements of Section 2.11 Sustainability Principles.
- Furniture shall generally be finished in white melamine with matching 2mm ABS edging.
- All workstations will be supplied with 1600mm electronic sit-to-stand with installed curved privacy screens.

23.5 Chairs

- Chairs selected for general use must be available for a minimum of five years so replacements can be purchased.
- All office task chairs and chairs used for computers are to be fully ergonomic gas lift chairs on castors with a minimum (7) year warranty period and 135kg weight rating. Office task chairs shall have adjustable backs and seat and back tilt. Chairs with adjustable lumbar support to backs, adjustable arms and large seats and backs will be supplied to individuals if required (requirement to be confirmed by SCU).
- Chairs, including fabrics, will generally be suitable for 'heavy-duty commercial' use. Ergonomic task chairs will have a 'Furntech/AFDI' Level 6 certificate of assessment.
- Upholstery fabrics shall be selected to disguise stains therefore light colours are to be avoided. Patterns and/or textures are preferable. Preference is to be given to fabrics where the fibre is produced from a recyclable or renewable resource. Acceptable fabrics are nominated in the 'Furniture Standards' on the CLF web page.
- Chair arms are not to be fabric upholstered.

23.6 External Furniture



- External furniture may be loose if the area is secured; otherwise, it shall be fixed. External furniture shall generally be limited to tables and chairs or benches.
- Chairs shall be anodised aluminium or UV-stable polypropylene and shall be self-draining. Tabletops shall be resistant to water, heat, abrasion, cigarette burn and UV light.
- Framing to tables and chairs shall be welded and not screw-fixed.

23.7 Metal Furniture


- Metal furniture shall comprise filing cabinets (2, 3 or 4 drawer), storage cupboards, shelving units or lockers.
- All metal furniture shall have a powder coat finish with a minimum five (5) year warranty for both furniture and finish.

23.8 Workstation Furniture Schedule

Description	Indicative Image
<p>Altea Pro Electric Height Adjustable Straight Workstation</p> <p>Dual motor</p> <p>3-stage column lift</p> <p>Height range 637 - 1280mm (with 25mm top)</p> <p>140kg load capacity</p> <p>Speed 38mm/s</p> <p>Anti-collision function</p> <p>Noise level <40dB</p> <p>Handset LED display</p> <p>3 button memory</p> <p>CE,RoHS,cTUVus certified</p> <p>BIFMA certification</p> <p>Warranty 20 year frame / 5 year electrics Frame finish - White powdercoat</p> <p>Top - 25mm white melamine with scallop Sizes -</p> <p>1500 x 750 and 1800 x 750</p>	

<p>Cable Basket</p> <p>Single tier</p> <p>No outlets</p> <p>(for cable management purposes only) Sizes - 1250mm 1550mm</p>	
<p>Altea Pro Electric Height Adjustable Back to Back Workstation</p> <p>Dual motor (per user)</p> <p>3-stage column lift</p> <p>Height range 637 - 1280mm (with 25mm top)</p> <p>140kg load capacity (per user)</p> <p>Speed 38mm/s</p> <p>Anti-collision function</p> <p>Noise level <40dB</p> <p>Handset LED display</p> <p>3 button memory</p> <p>CE,RoHS,cTUVus certified</p>	



<p>BIFMA certification</p> <p>Warranty 20 year frame / 5 year electrics Frame finish - White powdercoat</p> <p>Top - 25mm white melamine with scallop Sizes -</p> <p>1500 x 750</p> <p>1800 x 750</p> <p>(per user)</p> <p>* Includes shared cable tray *</p>	
<p>Metal Modesty Panel</p> <p>Perforated design</p> <p>Powdercoat finish</p> <p>White Sizes 1590 x 300</p> <p>1290 x 300</p>	
<p>Mobile Caddy</p> <p>2 drawers + 1 file drawer</p> <p>Tambour door with 2 shelf levels</p> <p>570mm H x 1050mm W x 460mm D</p>	



Fully lockable (master key series)

Available LHS or RHS

Flush front on mobile ped side

On castors

Ball bearing runners

10 year warranty

Finish - White powdercoat



Mobile Pedestal

Flush front design

5th wheel for added stability

Lockable

2 Standard + 1 File Drawer

- 390W x 520D x 600Hmm

Pen tray

Powdercoat finish

5 Year Warranty

Finish - White powdercoat





Team Air Task Chair

Australian made

135kg weight rating

Heavy duty mechanism

Independent back tilt

Independent seat tilt

Standard molded foam seat

Anti-bacterial / anti-microbial foam

Mesh back in black

Height adjustable lumbar

Back tilt tension control

Moulded foam seat

AFRDI level 6 severe commercial use

GECA certified

10 year warranty

Seat upholstered in - Black stretch water resistant fabric





Vicinity™ Desk Screen

A curated collection of Flat or pressed finished options

Delivers excellent acoustic performance

Semi-permanent—easy to move as required

Customisable with pressed screen finish

Available in eight classic designs

100% polyester (PET)

Pinnable surface

Durable and easily maintained

No capping required

Carbon neutral

Made locally

Sophisticated colour palette

Clamps die-cast zinc

Includes desk clamps (non-destructive fixing) Design - Nook

Finish - Range of colours to choose from Sizes -

1500 x 400 x 400 x 600 high





1800 x 400 x 400 x 600 high

Vicinity™ Desk Screen

A curated collection of Flat or pressed finished options

Delivers excellent acoustic performance

Semi-permanent—easy to move as required

Customisable with pressed screen finish

Available in eight classic designs

100% polyester (PET)

Pinnable surface

Durable and easily maintained

No capping required

Carbon neutral

Made locally

Sophisticated colour palette





Clamps die-cast zinc

Includes desk clamps (non-destructive fixing) Design - Haven

Finish - Range of colours to choose from Sizes -

1500 x 750 x 600 high

1800 x 750 x 600 high



Vicinity™ Desk Screen

A curated collection of Flat or pressed finished options

Delivers excellent acoustic performance

Semi-permanent—easy to move as required

Customisable with pressed screen finish

Available in eight classic designs

100% polyester (PET)

Pinnable surface

Durable and easily maintained

No capping required





Carbon neutral

Made locally

Sophisticated colour palette

Clamps die-cast zinc

Includes desk clamps (non-destructive fixing) Design - Hedge

Finish - Range of colours to choose from Sizes -

1500 long x 600 high

1800 long x 600 high





Aquarius 69480 Manual Soap Dispenser

Made from ABS plastic

Keyless easy-to-load refills.

Great for use in all bathrooms mounted on the wall to keep cleansers close and easy to use

Compatible for use with dispenser refills (sold separately): SOAP1250, SOAP1252, SOAP6342, SOAP6331, SOAP6332, SOAP6333.

White





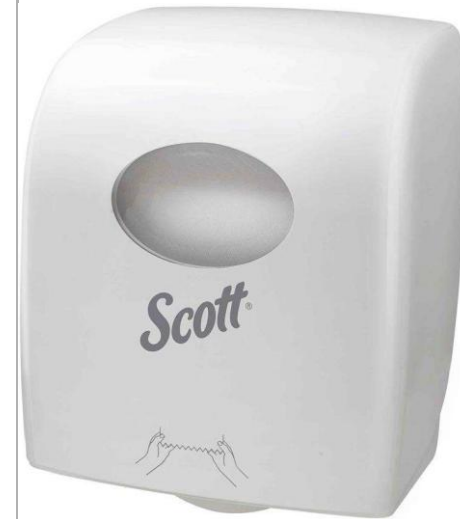
Scott Hand Towel Dispenser 7957

- 324 (H) x 297 (W) x 192 (D) mm

Certified by HACCP International

White

Compatible refills: TOWL4190





Aquarius Toilet Roll Dispenser Jumbo

The high capacity double roll system reduces janitorial maintenance and is lockable which deters pilferage. Easy to mount on the wall of the cubicle and can be refilled simply.

Jumbo rolls

White

To suit TISS5748 & TISS5749.



23.0 Documentation and Post Construction Requirements

All the requirements of this Section are Mandatory.

24.1 Generally

This Section deals with the University's requirements with respect to the provision of 'As Constructed' drawings, Maintenance Manuals and Survey information; and for the performance of preventative maintenance during the Defects Liability Period. The Consultancy appointment and SCU's Project requirements identify the project specific responsibilities for as constructed drawings and maintenance manuals.

24.2 Preventative Maintenance

All SCU Contracts require the performance of regular preventive maintenance and servicing of the works during the Defects Liability Period. Such maintenance shall be in accordance with the manufacturer's instructions and the requirements of the Workplace Health and Safety Act, Standards or other applicable regulations, legislation or codes of practice. With respect to any mechanical or electrical services, fire alarms, fire services, fire pumps, hydraulic services, hydraulic systems, lifts etc. maintenance shall be carried out not less frequently than monthly.

At least one month prior to achieving Practical Completion, the Contractor shall prepare and provide a Program to the Superintendent, which indicates all Preventative and Statutory Maintenance work to be undertaken during the Defects Liability period; including nominating the company/person who will undertake the maintenance work and the time frame (month/year) on which it will be carried out.

A written report including copies of Logbooks and maintenance records shall be provided to the Superintendent immediately after each monthly service is performed. The report shall detail all work done, defects identified and repaired, and general comments on overall performance.

The Certificate of Final Completion will not be issued until such time as all preventive and statutory maintenance requirements have been completed, including the final service at the end of the defects liability period, and all Log Books and maintenance records have been provided to the Superintendent.

24.3 Guarantees & Warranties

The Contractor must provide guarantees, test and similar certificates as specified under the various trades as soon as reasonably possible after the granting of Practical Completion, and before the issue of the Certificate of Final Completion. The Contractor must ensure that such guarantees and certificates have been effectively transferred or issued to SCU, so that thereafter, the Guarantor must be directly responsible to SCU commencing from the date of Practical Completion.

24.4 Operating & Maintenance Manuals

Operating and Maintenance (O&M) manuals shall cover all aspects of the work undertaken in the project. All Manuals shall have a Cover page providing the key project information as required by Standard Drawing. Each Manual shall have a Contents page properly structured into Sections and indexed with page numbers. The manuals shall be submitted to the Superintendent in electronic format, and they shall be grouped into a single PDF file for each discipline corresponding to the list provided on Standard Drawing. The PDF file shall be fully searchable and bookmarked according to the section index.

The O&M manuals shall include but not be limited to the following:

- A general description of the scope of the project.
- A list of all design consultants employed on the project whether by SCU or the Contractor.
- Details of all suppliers and subcontractors supplying goods or services to the project.
- Finishes and colour identification schedules.
- Operating instructions and technical schedules for all equipment and plant installed as component parts of the project.
- Maintenance instructions including time schedules.
- Control system and electrical layout plans complete with terminal numbers corresponding to wiring ferrules, with cross referencing as necessary.
- Testing and commissioning dates, set points, flow rates, timer settings etc. including all testing evidence certificates.
- An asset list of all maintainable equipment
- All warranties and guarantees and
- All statutory certificates and approvals.

All collated information inserted into the document must be clear digital copies. Poorly scanned documents and screen clips of information will not be accepted.

24.5 'As Constructed' Drawings

Prior to Practical Completion, a proposed Schedule of 'As Constructed Drawings' shall be submitted for approval by the Superintendent. The Schedule shall comprise a full list of 'As Constructed' drawings for the project, with all key information on the drawing noted and including the corresponding electronic drawing file name for each drawing.

Failure to provide 'As Constructed' drawings in accordance with the Schedule, will result in the Superintendent withholding funds from progress payments sufficient to cover the cost of preparing the documents by other means.

Where drawings are sourced from Subcontractors e.g. shop drawings, for 'As Constructed' drawings, the Consultant and Contractor shall check to ensure that these drawings comply fully with these

Design Guidelines & Procedures and reflect the as built works, before submitting them to the Superintendent.

The 'As Constructed' drawings shall clearly describe all works carried out in the Contract showing both concealed and exposed items, be fully dimensioned and contain at least the following information:

- All equipment and system identification.
- All regulating and measuring devices in the system.
- Final accepted values of commissioning data (for example, air and/or water flow quantities, voltage/current, signal strength etc.).
- Final settings of all regulating devices and
- Major equipment maintenance/servicing access clearance requirements.

The scope of 'As Constructed Drawings' shall include as a minimum the following drawings provided:

Discipline	Minimum Content of Drawings
General site information	All in-ground services reticulation and external installation including electrical, lighting, fire hydrants, sewerage, water, stormwater, chilled water, gases, communications and data. Connection details to existing infrastructure and invert levels of gravity fall pipework.
	Site & Building location
Architectural	All floor plans and partition layout plans
	All reflected ceiling plans
	Building Sections and elevations
	Construction details
	Furniture layouts
	Finishes and joinery drawings
	Roof plans
Structural	Design criteria, framing plans & structural details
Civil	Road and pathway work, road related signage



	Sections & details
	Storm water
Survey	Survey plans, permanent survey points & contours
Electrical	Exact location and route of underground cables/conduits
	Power & communications system layout and schematics
	Switchboard & distribution board details
	Lighting layout including emergency lighting and exit signs
	Lightning prevention and earthing system
Security	Security system layout and schematics
Air Conditioning	Air conditioning system ductwork/pipework layout and schematics
	Ventilation systems
	Fume cupboard installation
	Plant room and riser details, sections
	Control system, BMS wiring schematics and switchboard details



Discipline	Minimum Content of Drawings
Mechanical	Refrigeration system/cold rooms
	Compressed air, vacuum and gases
Lift	Lifts and hoisting equipment installation
Fire services	Water reticulation including fire hydrants and sprinkler
	Automatic fire detection and alarm system including zone diagrams
	Hydrant and hose reel coverage drawings
	Hydrant and Sprinkler test drains
	Block Plans – with Fire hydrant and Sprinkler required duties, flows current relevant Australian Standard and building classifications noted.
	Fire collar and pipework wrapping penetration plan
Hydraulics	Sanitary plumbing and drainage layout and schematics
	Storm water
	Water supply layout and schematics
	Gas services (non-medical/laboratory)
Landscaping	Furniture items
	Hard landscaping
	Soft landscaping
Irrigation	Piping system layout and schematics
Signage	Sign location plan including type
	Structural engineers' drawings for construction of major signs including footings etc.
	Electrical power supply drawings and installed electrical lighting equipment for illuminated signs

24.6 Building Services Plans of Altered Existing Buildings

Where a Consultant undertakes design services for a major alteration/refurbishment project, the Consultant will be required to add to their drawings, all existing building services of the Building level or levels to be altered/refurbished, in CAD format, where the existing services have not previously been documented in that format.

If the existing building services to the altered/refurbished Building level or levels have been documented in CAD format and are in the possession of CLF, copies of the relevant files will be provided to assist the Consultant.

The building services files are to be:

- Communications, Electrical and Fire detection.
- Hydraulics.
- Mechanical.

The relevant electronic files of architectural floor plan of the Building level or levels will be supplied in AutoCAD format for reference upon request. The CMWM is to be notified of any discrepancies found in the floor plan.

24.7 Site Surveys

Consultants and Contractors shall arrange a site inspection with the CMWM to confirm any existing site services details and to verify the accuracy of any available drawings.

In the case of refurbishment projects, Consultants shall carry out a detailed review of existing building services, and compile a photographic record of the existing installation to help define the scope of demolition; to identify which services and accessories need to be relocated, and to identify any major obstacles relevant to coordination of the new design.

A written record shall also be made of the following:

- Location and heights of all existing plant, equipment and services accessories, including notations as to whether or not they are to remain, be demolished or relocated.
- All mechanical, light and power switchboards.
- All infrastructure plant and reticulation which requires assessment as to its suitability to support the proposed new use of the building or designated spaces.

The Consultant or Contractor shall assess any existing code non-conformances or infrastructure deficiencies and communicate details of same to the CMWM. Copies of all records shall be made available to SCU.

24.8 Practical Completion

The Certificate of Practical Completion will be issued by the Contractor.

The Certificate will not be issued until such time as all systems have been properly commissioned and are fully operational, inspections have been completed and passed by the relevant authority, and a 'Certificate of Classification Occupancy' has been issued by the appointed Building Surveyor.

Prior to issue of the Certificate, SCU will carry out comprehensive inspections of the works. These inspections will not commence until such time as all Consultants have completed their inspections and necessary rectification has been carried out. No less than two (2) weeks should be allowed for SCU inspections and tests. The outcome of these inspections will in no way absolve the Consultant or Contractor from any subsequent problems or defects that may become apparent as part of the new works.

APPENDIX (A)

SOUTHERN CROSS UNIVERSITY (SCU) SWITCHBOARDS GENERAL

This Appendix is a complementary document to the SCU 'Design Control Document' and provides additional information in relation to the procurement of switchboards for the SCU Campuses

Detailed information can be found the in the NATSPEC Worksections:-

- 0941 – Switchboards Proprietary
- 0942 – Custom-Built
- 0943 – Switchboard Components

NATSPEC update their Worksections in April and October of each year, so ensure the current version is being utilised for your project. A yearly subscription fee applies for this service

The information in the SPECIFIC section below, concentrates on planning issues to be taken into consideration when designing for both new and replacement switchboards

This document has an emphasis on the replacement of existing switchboards as opposed to desk-top studies for new projects

SPECIFIC

Site Inspections

Designers should ensure a site inspection is undertaken when replacing an existing switchboard. If possible obtain from site records the existing electrical 'connectivity' between switchboards in the building of interest, all the way back to the Main Switchboard (MSB) which may be in the building of interest or another building.

Measure the room or cupboard size in which the switchboard is located

Note the switchgear brand in the switchboard and the upstream switchboard for grading purposes

Note how cables enter and leave the switchboard enclosure

Note – if possible the cable size of the incoming mains or possibly check the lug size – for internal inspections obtain the services of the SCU nominated electrician or electrical contractor

Is the board in a cupboard in a fire egress path, as that cupboard will need to be non-combustible and provided with Smoke Seals?

Consider if the board needs to have a cover if installed within a lockable cupboard already

Note the details on the circuit schedule and if complete

Note any circuit breakers which are OFF and check if any wiring connected

Has the switchboard any Emergency Lighting test facility, or is it required? Check if SCU have utilised a computer-monitored system of emergency lights in that building

Have the emergency lighting circuits been labelled as such with WARNING labels about isolation

Does the switchboard have a manufacturer's label

Are there currently lighting controls installed on the switchboard and what do they control?

Are there submains originating from this board to serve other boards – if so, note details

How many circuit breaker poles on the switchboard and how many spares?

Note the size of the main switch if any installed. If installed this is often a proprietary size and not an indication of the capacity of the submain supply entering the board

Does the switchboard have a Hybrid Chassis with a mix of 18mm and 27mm wide circuit breakers

Does the board have Surge Divertors – if so, note the type

Check clearances in front of the switchboard to confirm if it complies with the clearances nominated in AS/NZS 3000 (current version)

Design Considerations

Review the site findings prior to preparing documents for procurement of the new switchboard

This section summarizes consideration related to MSBs and MDBs/DBs

Main Switchboards (MSBs)

The main switchboard, as its name implies, is the first switchboard encountered once the supply from the street or substation is connected to the site buildings. The main switchboard is sized to suit the initial and predicted future loads and is required to have a single main switch or fuse – called the SPD (Service Protection Device), to protect, as well as isolate the installation, from the external network in the street.

Main switchboards range in size from the wall-mounted domestic style enclosures, to large self-standing enclosures – often many meters in length and standing around 2100mm high.

Main switchboards are required to have not only a current rating for the anticipated loads, but also a fault rating for any fault which could occur internally within the board or downstream in the network on the customer's site.

Where the load is less than 400 Amps/Phase the fault level capacity of the main switchboard shall be a minimum 25 kA (refer to Service and Installation Rules of NSW) – Section (1.17.4).

Where the load is likely to exceed 400 Amps/Phase, the Supply Authority should be consulted for their advice on the fault level to be designed for.

It is important to provide suitable accommodation for a main switchboard, as it has to operate 24/7 without failure and this is assisted by cupboards or rooms, which minimise the ingress of dust and moisture as well as keeping the temperature to within the switchgear rating (usually 40 degrees Celsius), but 25 – 30 degrees is suggested as a sensible target environment.

Main switchboards are required to have adequate clearance in front of them and AS/NZS 3000 – Cl. 2.10.2, Figs (2.19 – 2.24)) covers various situations (diagrammatically) showing the requirements. Once switchboards reach a certain length and current rating, they are required to have (2) means of egress from the accommodation in which they are housed (refer Section – 2.10.2.2) of AS/NZS 3000. Sometimes the limited space available in front of switchboards, necessitates the use of lift-off covers in lieu of swing doors

The access doors to the main switchroom are also required to be a minimum of 2m high, and 900mm wide (both clear dimensions), as per Cl. 2.10.1.2 (c) (iv)

Switchboards are required to comply with the requirements of AS/NZS 61439 (Previously AS/NZS 3439), as regards construction. This standard also addresses the various ‘Forms’ of switchboard.

In addition to the above aspects, the IP (Ingress Protection) rating of a switchboard should be nominated in the design (especially if to be located outdoors, where a minimum IP54, should be utilised) and the type of enclosure, whether to be powder-coated sheet steel, or for more hostile environments, the use of Stainless Steel (316) or Marine Grade Aluminium may need to be considered.

External switchboards – especially in ‘alpine’ areas (where low temperatures may be experienced), may require the use of ‘anti-condensation’ heaters, to heat-up the interior of the switchboard, to minimise moisture build-up on switchgear components. This device is utilised in conjunction with a thermostat. Sizing of the anti-condensation heater should be based on 20 watts/m² of anticipated switchboard (total external area – including top), but normally the switchboard firms will make the assessment, when the requirement for this item is specified in the design documents. Other equipment which may also be installed in the main switchboard includes:-

- Metering (Revenue type) and if PV (Solar) is or will be connected, then Bi-Directional metering
- Private metering (to achieve BCA – Section – J9 compliance)
- Internal Distribution board (for local power and lighting circuits)
- Power Monitoring devices to monitor a range of electrical parameters
- Contactors for switching loads
- ATS – Auto Transfer Switch – associated with Standby Generator
- PFC CT – for Power Factor Correction Sensing
- Surge Diverters to restrict external surges from travelling into the customer’s site

Often the designer has to make some assessment of the accommodation required for a main switchboard, early in the Concept/Scheme Design Phase – this can be assessed from:-

- Experience
- Previous projects with similar requirements
- Preliminary issue of a Single Line Diagram to a switchboard firm, for preliminary assessment. Some firms are very accommodating with these requests as they are potential projects for them

The single line diagram is the method used to convey to the ESC (Electrical Sub-Contractor) and the switchboard firm, the requirements for the main switchboard for a project and by definition, only shows the intent of the design, using single lines, vs each phase and neutral (for simplicity). To avoid confusion with any single phase loads, which may be required – phase lines are used on the single line diagram to indicate the number of phase required at any one point.

Cable entry into and out of the main switchboard also needs to be considered by the designer - if all connections are to be via the bottom of the enclosure, then consideration of a pit underneath the main switchboard, with access covers in front, may be required, to assist with future services which may need to connect to the switchboard.

If metering is to be provided in a separate metering panel to the main switchboard, utilise dashed outlines to convey this as well as the 'limit' of the proposed MSB, to avoid any confusion for the contractor and switchboard builder

Documents to include submission of drawings from the switchboard firm to the designer, to confirm all the requirements of the design documents have been addressed

Main Distribution/Distribution Boards

Main Distribution Boards are often 'created' from previous MSBs, where the current rating, circuit breaker quantities required etc cannot be met any longer due to a variety of growth issues, so where possible a new MSB is introduced to supplement the need

Distribution Boards are required in larger installations, where multiple buildings or multi-level buildings are involved. They avoid long sub-circuits for lighting and power equipment and provide a more convenient isolation point for additions and alterations.

Distribution boards are described by the 'number of poles' they contain, which is just a way of referring to the maximum number of single pole circuit breakers which can be installed in the switchboard.

Distribution boards should be incorporated where the circuits of an area are likely to exceed 30m from an existing or other new board – this has its background, mainly in Vd (Voltage Drop) compliance.

Most projects utilise 'proprietary' distribution boards, which means they can be purchased, off-the-shelf, from catalogue information provided by the switchboard firms. Proprietary switchboards are available from NHP, Schneider

By reference to the catalogues produced by these firms, information on sizes, IP rating, fault rating, poles sizes available, colours, busbar rating, hybrid arrangements etc, can be obtained, to assist designers in documenting their requirements for their project.

It is important to specify spare capacity in distribution boards, over and above the circuit requirements for the specific project – where number of circuits is less than 36, a 50% spare capacity is recommended and this could be reduced to 25% in excess of this quantity.

Distribution Boards and their switchgear, also need to have a suitable fault rating, but with extensive use of 'cascading' features with the major brands of switchgear these days, it is easy to check from catalogue information what the enhanced fault level capability of a circuit breaker will be, with the

knowledge of the upstream circuit breaker on the main switchboard. However, quick reference tables are available in the main switchgear catalogues which give guidance on the fault level at a switchboard, based on the kA level at the board of origin and the cable type and distance to the distribution board of interest, so that the fault level for the switchboard itself can be assessed (the Schneider Catalogue has this information) Most distribution boards are tested to at least 20kA, for 0.1 sec, which is normally sufficient time for the upstream circuit breaker to trip.

For Mechanical Services, usually a dedicated switchboard is provided under that trade contract, as often controls, starters etc. need to be accommodated, which are not readily accommodated in proprietary general purpose load centres. Often the mechanical consultant will request the fault level at his board, so utilise the quick calculation tables in the switchgear firms catalogue for this purpose

APPENDIX B



Project: Southern Cross University
Company:

Revision Number: 1
Issue Date: 19/03/2026

Revision History

Revision	Date	Prepared By	Status	Comments
1	18/09/2024	Zygan Pitcairn	-	

1. Introduction

i. Preamble

Southern Cross University(SCU) currently has an existing site wide building management system. This proposal aims to enhance user experience through seamlessly integrating additions and upgrades to the mechanical equipment on site.

The current system, Niagara, offers essential features such as secure device connectivity and data normalisation, enabling the acquisition and utilization of operational data from various silos at device and equipment levels. Niagara's control engine empowers users not only to monitor data flows but also to develop logic sequences for control program, providing Padua College enhanced interoperability, operational efficiency and adaptability to future technological advancements.

2. AC Standalone Unit

i. AC Requirements / Support

The air conditioning units installed must be reverse cycle to accommodate cooling and heating functionalities with the capabilities of operating within the outdoor summer and winter design conditions for Brisbane Queensland. The selected air conditioning units shall be in line with what is currently installed at SCU and be supported by reputable manufacturers that provide readily available services, support and parts in Australia. Documentation of installation and maintenance procedures shall be provided upon project completion.

ii. Interface Requirements

The standalone split system shall be integrated into the building management system (BMS) through a high-level interface (HLI) to ensure connection the existing Building Management System on site. High Level Interface (HLI) is the preferred connection method to equip the facility management team with the ability to set setpoint, modes, start/stop control, temperature readings and accurate alarm data. The preferred connection method shall be BACnet/Modbus over IP or Modbus/BACnet over two wire comms. If low level control is only available unit shall be capable of start/stop control, run status and fault status of unit.

iii. Integration Requirements

The selected unit shall facilitate seamless integration to the SCU BMS "NeoView" and SCU BMS LAN. This project includes the requirement to ensure adequate points and device licenses are available on the BMS and to purchase additional if necessary to support the new mechanical plant. The BMS graphics, including alarming and ancillary functions, must be updated to reflect the new installation, ensuring accurate monitoring and control capabilities.

Local lockout capability should be provided to stop local control. If no local control station is provided, an out-of-hours button with run LED must be included to enable extended operation of the air conditioner for an additional 90 minutes beyond regular hours.

All BMS modifications and tasks must be discussed and completed by Nexo Controls. Please contact Zygan Pitcairn at zygan@nexocontrols.com or call 0432 064 490.

iv. Controller / Peripheral Requirements

Where control functionality cannot be completed through direct connection of the unit to SCU network, all control hardware, gateways, panels and peripheral equipment are to be supplied to meet the interface requirements.

v. Compliance

Compliance with current Australian standards (e.g., AS/NZS 3823.1.x) is mandatory.

vi. Installation

Installation of the air conditioning units shall be performed by qualified and licensed technicians, adhering to manufacturer guidelines, Australian standards, and building codes. Proper positioning of units is required to ensure optimal airflow and distribution within the space that it serves.

3. AC VRF Unit

i. AC Requirements / Support

The air conditioning units installed must be 3-pipe heat pump units (where connecting to existing, meet existing units functionality) to accommodate cooling and heating functionalities with the capabilities of operating within the outdoor summer and winter design conditions for Brisbane Queensland. The selected air conditioning units shall be in line with what is currently installed at SCU and be supported by reputable manufacturers that provide readily available services, support and parts in Australia. Documentation of installation and maintenance procedures shall be provided upon project completion.

i. Interface Requirements

A VRF unit shall be capable of connecting to the existing on VRF systems or form a new VRF system that is equipped with a central controller that allows for a High-Level Interface (HLI) connection. High Level Interface (HLI) is the preferred connection method to equip the facility management team with the ability to set setpoint, modes, start/stop control, temperature readings and accurate alarm data. The preferred connection method shall be BACnet/Modbus over IP or Modbus/BACnet over two wire comms.

ii. Integration Requirements

The selected unit shall facilitate seamless integration to the SCU BMS "NeoView" and SCU BMS LAN. This project includes the requirement to ensure adequate points and device licenses are available on the BMS and to purchase additional if necessary to support the new mechanical plant. The BMS graphics, including alarming and ancillary functions, must be updated to reflect the new installation, ensuring accurate monitoring and control capabilities.

Local lockout capability should be provided to stop local control. If no local control station is provided, an out-of-hours button with run LED must be included to enable extended operation of the air conditioner for an additional 90 minutes beyond regular hours.

All BMS modifications and tasks must be discussed and completed by Nexo Controls. Please contact Zygan Pitcairn at zygan@nexocontrols.com or call 0432 064 490.

iii. Controller / Peripheral Requirements

Where control functionality cannot be completed through direct connection of the unit to SCU network, all control hardware, gateways, panels and peripheral equipment are to be supplied to meet the interface requirements.

iv. Compliance

Compliance with current Australian standards (e.g., AS/NZS 3823.1.x) is mandatory.

v. Installation

Installation of the air conditioning units shall be performed by qualified and licensed technicians, adhering to manufacturer guidelines, Australian standards, and building codes. Proper positioning of units is required to ensure optimal airflow and distribution within the space that it serves.

4. Package Air Conditioner

i. AC Requirements / Support

The air conditioning units installed must be reverse cycle to accommodate cooling and heating functionalities with the capabilities of operating within the outdoor summer and winter design conditions for Brisbane Queensland. The selected air conditioning units shall be in line with what is currently installed at SCU and be supported by reputable manufacturers that provide readily available services, support and parts in Australia. Documentation of installation and maintenance procedures shall be provided upon project completion.

ii. Interface Requirements

The package air conditioner shall be integrated into the building management system (BMS) through a high-level interface (HLI) to ensure connection the existing Building Management System on site. High Level Interface (HLI) is the preferred connection method to equip the facility management team with the ability to set setpoint, modes, start/stop control, temperature readings and accurate alarm data. The preferred connection method shall be BACnet/Modbus over IP or Modbus/BACnet over two wire comms. If low level control is only available package unit shall be capable of start/stop control, run status, fault status, heating, cooling and any auxiliary controls in the unit to maintain temperature in the space it serves.

vi. Integration Requirements

The selected unit shall facilitate seamless integration to the SCU BMS "NeoView" and SCU BMS LAN. This project includes the requirement to ensure adequate points and device licenses are available on

the BMS and to purchase additional if necessary to support the new mechanical plant. The BMS graphics, including alarming and ancillary functions, must be updated to reflect the new installation, ensuring accurate monitoring and control capabilities.

Local lockout capability should be provided to stop local control. SCU to be consulted to determine if a local control station with temperature reading and setpoint adjustment is to be provided under the scope of works. If no local control station is provided, an out-of-hours button with run LED must be included to enable extended operation of the air conditioner for an additional 90 minutes beyond regular hours.

All BMS modifications and tasks must be discussed and completed by Nexo Controls. Please contact Zygan Pitcairn at zygan@nexocontrols.com or call 0432 064 490.

vii. Controller / Peripheral Requirements

Where control functionality cannot be completed through direct connection of the unit to SCU network, all control hardware, gateways, panels and peripheral equipment are to be supplied to meet the interface requirements.

viii. Compliance

Compliance with current Australian standards (e.g., AS/NZS 3823.1.x) is mandatory.

ix. Installation

Installation of the air conditioning units shall be performed by qualified and licensed technicians, adhering to manufacturer guidelines, Australian standards, and building codes. Proper positioning of units is required to ensure optimal airflow and distribution within the space that it serves.

5. Exhaust / Supply Fans

i. Fan Requirements / Support

The selected fans shall be supported by reputable manufacturers that provide readily available services, support and parts in Australia. Documentation of installation and maintenance procedures shall be provided upon project completion.

ii. Interface Requirements

If the exhaust or supply fan is an EC fan, it shall be integrated into the building management system (BMS) through a high-level interface (HLI). High Level Interface (HLI) is the preferred connection method to equip the facility management team with the ability to set setpoint, start/stop control and accurate alarm data. The preferred connection method shall be BACnet/Modbus over IP or Modbus/BACnet over two wire comms. If low level control is only available fan shall be capable of start/stop control, run status and fault status of fan at a minimum (dependent on Padua Colleges requirements if additional control is required).

i. Integration Requirements

The selected fan shall facilitate seamless integration to the SCU BMS "NeoView" and SCU BMS LAN. This project includes the requirement to ensure adequate points and device licenses are available on the BMS and to purchase additional if necessary to support the new mechanical plant. The BMS graphics, including alarming and ancillary functions, must be updated to reflect the new installation, ensuring accurate monitoring and control capabilities.

SCU are to be consulted to determine if a local control station is to be provided under the scope of works. If no local control / external link is provided, an out-of-hours button with run LED must be included to enable extended operation of the fan for an additional 90 minutes beyond regular hours.

All BMS modifications and tasks must be discussed and completed by Nexo Controls. Please contact Zygan Pitcairn at zygan@nexocontrols.com or call 0432 064 490.

ii. Controller / Peripheral Requirements

Where control functionality cannot be completed through direct connection of the fan to SCU network, all control hardware, gateways, panels and peripheral equipment are to be supplied to meet the interface requirements.

iii. Compliance

Compliance with current Australian standards is mandatory.

iv. Installation

Installation of the fans shall be performed by qualified and licensed technicians, adhering to manufacturer guidelines, Australian standards, and building codes. Proper positioning of fans is required to ensure correct airflow extraction or distribution within the space that it serves.

6. VSD's

i. Interface Requirements

HLI

MSTP/Ethernet

Run hours, power usage, accurate faults

Preference is BACnet

Preference to control via HLI

i. Integration Requirements

The selected equipment shall facilitate seamless integration to the BMS "NeoView" and BMS LAN. This project includes the requirement to ensure adequate points and device licenses are available on the BMS and to purchase additional if necessary to support the new mechanical plant. The BMS graphics, including alarming and ancillary functions, must be updated to reflect the new installation, ensuring accurate monitoring and control capabilities.

All BMS modifications and tasks must be discussed and completed by Nexo Controls. Please contact Zygan Pitcairn at zygan@nexocontrols.com or call 0432 064 490.

ii. Controller / Peripheral Requirements

Where control functionality cannot be completed through direct connection of the fan to SCU network, all control hardware, gateways, panels and peripheral equipment are to be supplied to meet the interface requirements.

7. Chillers

i. Interface Requirements

HLI

MSTP /Ethernet

Run hours, power usage, accurate faults

Preference is BACnet

Preference to control via HLI

i. Integration Requirements

The selected equipment shall facilitate seamless integration to the BMS "NeoView" and BMS LAN. This project includes the requirement to ensure adequate points and device licenses are available on the BMS and to purchase additional if necessary to support the new mechanical plant. The BMS graphics, including alarming and ancillary functions, must be updated to reflect the new installation, ensuring accurate monitoring and control capabilities.

All BMS modifications and tasks must be discussed and completed by Nexo Controls. Please contact Zygan Pitcairn at zygan@nexocontrols.com or call 0432 064 490.

ii. Controller / Peripheral Requirements

Where control functionality cannot be completed through direct connection of the fan to SCU network, all control hardware, gateways, panels and peripheral equipment are to be supplied to meet the interface requirements.

8. Power Meters

ii. Interface Requirements

HLI

MSPT/Ethernet

Volts, amps, kw, var, freq, etc.

Preference is BACnet

iii. Integration Requirements

The selected equipment shall facilitate seamless integration to the BMS "NeoView" and BMS LAN. This project includes the requirement to ensure adequate points and device licenses are available on the BMS and to purchase additional if necessary to support the new mechanical plant. The BMS graphics, including alarming and ancillary functions, must be updated to reflect the new installation, ensuring accurate monitoring and control capabilities.

All BMS modifications and tasks must be discussed and completed by Nexo Controls. Please contact Zygan Pitcairn at zygan@nexocontrols.com or call 0432 064 490.

iv. Controller / Peripheral Requirements

Where control functionality cannot be completed through direct connection of the fan to SCU network, all control hardware, gateways, panels and peripheral equipment are to be supplied to meet the interface requirements.

9. Water Meters

iii. Interface Requirements

HLI

MSPT/Ethernet

Pulse

Preference is HLI

v. Integration Requirements

The selected equipment shall facilitate seamless integration to the BMS "NeoView" and BMS LAN. This project includes the requirement to ensure adequate points and device licenses are available on the BMS and to purchase additional if necessary to support the new mechanical plant. The BMS graphics, including alarming and ancillary functions, must be updated to reflect the new installation, ensuring accurate monitoring and control capabilities.

All BMS modifications and tasks must be discussed and completed by Nexo Controls. Please contact Zygan Pitcairn at zygan@nexocontrols.com or call 0432 064 490.

vi. Controller / Peripheral Requirements

Where control functionality cannot be completed through direct connection of the fan to SCU network, all control hardware, gateways, panels and peripheral equipment are to be supplied to meet the interface requirements.

10. Solar Inverters

iv. Interface Requirements

HLI

MSPT/Ethernet

Preference is IP

vii. Integration Requirements

The selected equipment shall facilitate seamless integration to the BMS "NeoView" and BMS LAN. This project includes the requirement to ensure adequate points and device licenses are available on the BMS and to purchase additional if necessary to support the new mechanical plant. The BMS graphics, including alarming and ancillary functions, must be updated to reflect the new installation, ensuring accurate monitoring and control capabilities.

All BMS modifications and tasks must be discussed and completed by Nexo Controls. Please contact Zygan Pitcairn at zygan@nexocontrols.com or call 0432 064 490.

viii. Controller / Peripheral Requirements

Where control functionality cannot be completed through direct connection of the fan to SCU network, all control hardware, gateways, panels and peripheral equipment are to be supplied to meet the interface requirements.

11. Lighting Controls

v. Interface Requirements

HLI to lighting controllers

Low level controls

ix. Integration Requirements

The selected equipment shall facilitate seamless integration to the BMS "NeoView" and BMS LAN. This project includes the requirement to ensure adequate points and device licenses are available on the BMS and to purchase additional if necessary to support the new mechanical plant. The BMS graphics, including alarming and ancillary functions, must be updated to reflect the new installation, ensuring accurate monitoring and control capabilities.

All BMS modifications and tasks must be discussed and completed by Nexo Controls. Please contact Zygan Pitcairn at zygan@nexocontrols.com or call 0432 064 490.

x. Controller / Peripheral Requirements

Where control functionality cannot be completed through direct connection of the fan to SCU network, all control hardware, gateways, panels and peripheral equipment are to be supplied to meet the interface requirements.

12. Fire System

vi. Interface Requirements

Low level contact for each zone in fire (Note all fire shutdowns are done via electrical lockouts not through the BMS)

xi. Integration Requirements

The selected equipment shall facilitate seamless integration to the BMS "NeoView" and BMS LAN. This project includes the requirement to ensure adequate points and device licenses are available on the BMS and to purchase additional if necessary to support the new mechanical plant. The BMS graphics, including alarming and ancillary functions, must be updated to reflect the new installation, ensuring accurate monitoring and control capabilities.

All BMS modifications and tasks must be discussed and completed by Nexo Controls. Please contact Zygan Pitcairn at zygan@nexocontrols.com or call 0432 064 490.

xii. Controller / Peripheral Requirements

Where control functionality cannot be completed through direct connection of the fan to SCU network, all control hardware, gateways, panels and peripheral equipment are to be supplied to meet the interface requirements.

13. Others Systems (Such as water treatment)

vii. Interface Requirements

HMI

MSPT/Ethernet

Preference is IP

Contractor is to make points available to the BMS via their standard protocol preference is BACnet/Modbus

xiii. Integration Requirements

The selected equipment shall facilitate seamless integration to the BMS "NeoView" and BMS LAN. This project includes the requirement to ensure adequate points and device licenses are available on the BMS and to purchase additional if necessary to support the new mechanical plant. The BMS graphics, including alarming and ancillary functions, must be updated to reflect the new installation, ensuring accurate monitoring and control capabilities.

All BMS modifications and tasks must be discussed and completed by Nexo Controls. Please contact Zygan Pitcairn at zygan@nexocontrols.com or call 0432 064 490.

xiv. Controller / Peripheral Requirements

Where control functionality cannot be completed through direct connection of the fan to SCU network, all control hardware, gateways, panels and peripheral equipment are to be supplied to meet the interface requirements.

APPENDIX C

Data & Telecommunications Design Specifications

Produced By:	Senior Manager, Infrastructure Platforms
Revision	20
Date:	17th June 2024

1. Introduction

1.1 Overview

The following specifications details the supply and installation requirements for the communications network at Southern Cross University. These standards are to be applied to all copper cabling, fibre optic cabling, wireless and Communication Rooms within all Southern Cross University campuses and buildings, regardless of their intended use.

The intention of this specification is to provide the comprehensive source of information and guidance for those involved with cabling installations within the University's buildings and grounds and also to SCU's regional campuses.

Adherence to these recommendations within the University will lead to opportunities for cost saving both during construction and throughout the life of the buildings.

It shall be mandatory that these specifications be adhered to stringently by all installers of voice and data communications related work on all Southern Cross University campuses.

Variation from these specifications can only occur with consultation and approval from Chief Technology Officer, Technology Services.

This specification has been prepared on behalf of the Chief Technology Officer, Technology Services Directorate, Southern Cross University, Military Road, Lismore.

1.2 Related Documentation and Standards

1.2.1 Approved Manufacturers Cabling Systems

SCU will only accept equipment and cabling systems from the following approved manufacturers:

- Molex

All structured cabling at SCU campuses should be installed with Molex cabling, to maintain the current Molex cabling manufacturer's warranty.

All structured cabling systems shall be installed by a contractor who is certified to design, install and warrant Molex systems plus provide a manufacturer's warranty to SCU for a minimum of 25 years. The manufacturer will assume sole responsibility for warranty claims.

Any individual contractor or employee, performing termination or testing must be fully certified and have fully completed all training requirements of the manufacturer's warranty program without exception.

A manufacturer's warranty certificate to be provided to SCU before payment.

In order to maintain optimum performance, the complete cabling system from end to end must be Molex product including all patch cables.

Installation companies who wish to apply for the above warranty must have a Molex Business Associate ticket on the Customer Support Portal (or equivalent) where:

1. The relationship type is “Certified Installer”, and
2. The ticket is in a valid status at the time of installation.

Documentation for Warranty purposes

The As-Built documentation must be uploaded to the warranty ticket on the CSP site of the Cabling Vendor and can be in PDF or native AutoCAD DWG format. At minimum, it should include:

- a) A map showing the location of all work area outlets, consolidation points, and Multi User Telecommunications Outlet Assembly (MUTOA), and Telecommunications Room locations
- b) Cabinet layout
 - These can be neatly hand drawn (a photo or photocopy of evacuation drawings for commercial buildings is a good base), or Visio or CAD drawings.
 - You must show the location of each WAO and their ID
 - You must show the location of each TR and their ID
 - Cabinet naming details should be clearly identified
 - You must show the position of each Patch Panel and its ID
 - Location of new outlets if additional are added, should be clearly identifiable

We receive many questions about why we require the exact cabinet layout at the time of warranty submissions. Reasons are as follows:

- Risk mitigation – not only for the Cabling Vendor, but also you (the Installer), and most importantly, the Southern Cross University.
 - The better and more accurate the documentation is, the faster we can manage a warranty claim which is of essence to the Southern Cross University. This may also cover the Southern Cross University against inaccurate records...
 - This may identify the movement of the panel by a third party which unfortunately would void a Molex Connected Enterprise Solutions Warranty. The Permanent Link must remain permanent...
- Recording changes to an existing site.
 - By listing what has been added to any panel, it is known which panels were worked on during the additional works.
 - Can identify new panels to be covered without affecting the warranty on existing panels.
- Having a photo on file of the front and rear could also provide evidence of the installation quality
 - Again, this reference material would be available if there was a warranty claim in the future.

1. POWER OVER ETHERNET (POE)

Find below the additional requirements for PoE Applications:

1. When testing, you must ensure to include tests for DC Loop Resistance and DC Resistance Unbalance (between pairs and within a pair). Failure to enable these tests will result in this warranty not being eligible for specific PoE Application Assurance warranty.
2. For PoE Type 3 / Class 5 and above applications, we require Cat 6A cabling to be used on new installations.
3. As per the ISO/IEC TS 29125:2017, SA TS 29125:2019 (Technical Specification) and the TIA TSB-184-A:2017 (Telecommunications Systems Bulletin) recommendations, there should be no more than 24 cables per cable bundle. If your intended application is PoE Type 3 / Class 5 or above, then this becomes a Molex requirement for Warranty purposes.
4. As per the ISO/IEC TS 29125:2017 and SA TS 29125:2019 recommendations, the maximum temperature rise between the center of the cable bundle and the outer edge must be no more than 10°C / 50°F.
5. As per the Standards referred to above, appropriate spacing between cable bundles for ventilation and heat dissipation is highly recommended due to the impact of heat rise on the cables (mainly at levels above 60W). Therefore, Molex Connected Enterprise Solutions will not consider installations using loose lay cabling runs where PoE applications need to be supported and warranted. Avoid tight cable bundles.
6. When conduits are used, a maximum fill of 40% is recommended as opposed to the standard 60% where PoE applications are not considered

This is not an exhaustive list, and all of the requirements are documented in the PoE Implementation Guide in the Technical Bulletins section of the CSP (<https://csp.molex.com/intranet/documents/24216/156952>) and will be checked by the Cabling Vendor at the time of Warranty processing.

Except where explicitly varied by this specification, all cabling to be supplied and/or installed under this specification shall meet, at a minimum, the following standards and specifications (and all related standards, addendums, appendices and specifications):

1.2.2 Relevant Australian and International Standards

Standard/Specification or Technical Bulletin Number	Description
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ARPANSA Protection Publication No. 3	Radiation Series	Maximum Exposure Levels to Radiofrequency Fields – 3 kHz to 300 GHz
AS/NZS CISPR 22		Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement
AS 1269		Occupational noise management
AS 1485		Safety and health in workrooms of educational institutions
AS 2107		Acoustics – Recommended design sound levels and reverberation times for building interiors
AS/NZS 2211.2		Laser safety – Safety of optical fibre communications systems
AS 2834		Computer accommodation
AS/NZS 2053		Conduits and Fittings for Electrical Installations
AS/NZS 2648		Underground Marking Tape
AS 2834:1995		Computer Accommodation
AS 3000:2000		Electrical installations (known as the Australian / New Zealand Wiring Rules)
AS/NZS 3080:2003 Superseded by AS 11801.1:2019 and AS 11801.1:2019 Amd 1:2022		Telecommunications Installations – Integrated Telecommunications Cabling Systems for Commercial Premises <small>AS 11801.1, in conjunction with AS 11801.2, supersedes AS/NZS 3080:2013, <i>Information technology—Generic cabling for customer premises (ISO/IEC 11801:2011, MOD)</i> AS 11801.1, in conjunction with AS 11801.3, supersedes AS/NZS ISO/IEC 24702:2007, <i>Telecommunications installations – Generic cabling – Industrial premises</i> AS 11801.1, in conjunction with AS 11801.4, supersedes AS/NZS ISO/IEC 15018:2005, <i>Information technology—Generic cabling for homes</i> AS 11801.1, in conjunction with AS 11801.5, supersedes AS/NZ ISO/IEC 24764:2012, <i>Generic cabling systems for data centres</i></small>
AS/NZS 3084:2003 Superseded by AS/NZS 3084:2017		Telecommunications Pathways and Spaces for Commercial Buildings.
AS/NZS 3085.1:2004		Telecommunications Installations Administration of Communication Cabling System - Part 1: Basic Requirements



Superseded by AS 3085.1:2022	
AS/NZS 3087.1:2003 Superseded by AS/NZS IEC 61935.1:2012 (now withdrawn)	Telecommunications Installations - Generic Cabling Systems – Specification for the testing of balanced communications cabling
AS/NZS 3087.2:2003 Seems like this one was superseded as well	Telecommunications installations - Generic cabling systems – Specification for the testing of patch cords in accordance with AS/NZS 3080
AS 3260	Safety of Information Technology Equipment including Electrical Business Equipment
AS 3548	Electrical Interference – Limits and Methods of Measurements of Information Technology Equipment
AS/NZS 4117	Surge protection devices for telecommunication applications
AS/NZS 4251.1	Electromagnetic compatibility (EMC) – Generic emission standard Part 1: Residential, commercial and light industry
HB 29:2000	Communications Cabling Manual, Module 2
ISO/IEC-60297 Part 1 and Part 2	Dimensions of mechanical structures of the 482.6mm (19in) series
ISO/IEC-11801 Precisely AS/NZS 11801.1:2019 and AS 11801.2:2019	Information Technology – Generic cabling for customer premises.
IEEE 802.3	Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications
IEEE 802.3af :2003 IEEE 802.3at: 2009 IEEE 802.3bt:2018	Power over Ethernet standard. Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications—Amendment Data Terminal

	Equipment (DTE) Power via Media Dependent Interface (MDI)																																																							
	<table border="1"> <thead> <tr> <th colspan="2">TYPE 1</th> <th colspan="2">TYPE 2</th> <th colspan="2">TYPE 3</th> <th colspan="2">TYPE 4</th> <th>PoH</th> <th>UPoE</th> <th>UPoE+</th> </tr> </thead> <tbody> <tr> <td>Class 1 4 W</td> <td>Class 2 7 W</td> <td>Class 3 15.4 W</td> <td>Class 4 30 W</td> <td>Class 5 45 W</td> <td>Class 6 60 W</td> <td>Class 7 75 W</td> <td>Class 8 90 W</td> <td>100W</td> <td>Proprietary 60W</td> <td>Proprietary 90W</td> </tr> <tr> <td colspan="4">350mA</td> <td colspan="2">600mA</td> <td colspan="2">960mA</td> <td>1000mA</td> <td>600mA</td> <td>960mA</td> </tr> <tr> <td colspan="4">2 PAIRS ENERGIZED</td> <td colspan="7">4 PAIRS ENERGIZED</td> </tr> <tr> <td colspan="2">IEEE 802.3af</td> <td colspan="2">IEEE 802.3at</td> <td colspan="4">IEEE 802.3bt</td> <td>Proprietary</td> <td colspan="2">Proprietary</td> </tr> </tbody> </table>	TYPE 1		TYPE 2		TYPE 3		TYPE 4		PoH	UPoE	UPoE+	Class 1 4 W	Class 2 7 W	Class 3 15.4 W	Class 4 30 W	Class 5 45 W	Class 6 60 W	Class 7 75 W	Class 8 90 W	100W	Proprietary 60W	Proprietary 90W	350mA				600mA		960mA		1000mA	600mA	960mA	2 PAIRS ENERGIZED				4 PAIRS ENERGIZED							IEEE 802.3af		IEEE 802.3at		IEEE 802.3bt				Proprietary	Proprietary	
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TIA/EIA-568-B.3 Superseded by ANSI/TIA-568.3-E:2022	Optical Fibre Cabling Components Standards																																																							
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(inactive)	Additional Horizontal Cabling Practices for Open Offices																																																							
TIA/EIA-606 Superseded by ANSI/TIA-606-D:2021	Administration Standard for the Telecom. Infrastructure of Commercial Buildings																																																							
TIA-EIA-607 Superseded by ANSI/TIA-607-D:2019	Commercial Building Grounding/Bonding Requirements																																																							
TSB-162-B:2021	Telecommunications Cabling Guidelines for Wireless Access Points																																																							
TSB-184-A:2017	Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling																																																							

ACA/ACIF Technical Standards and Codes

The work covered by the Specification shall comply with the following AS/ACIF Standards.

Standard/Specification or Technical Bulletin Number	Description
AS/ACIF S008:2011	Requirements for customer cabling products



Superseded by AS/CA S008:2020	
AS/ACIF S009:2006 Superseded by AS/CA S009:2020	Installation requirements for customer cabling (Wiring Rules)

1.3 Workplace Health & Safety Compliance

Southern Cross University has introduced an on-line induction system (ELMO) which all contractors/Service Providers are required to undertake prior to commencing work on Southern Cross University properties. Upon completion of the on-line program, the contractor staff member is to print the contractor induction certificate, sign both the top and bottom sections and to provide original to SCU Security staff or Facilities staff to be co-signed. The following link http://www.elearn.com.au/scu_contractor/ takes you directly to the induction site. Please use the following username & password:

- Username: scu

Password: contractor

All work shall comply with the Southern Cross University Workplace Health & Safety procedures for contractors.

2. General Cabling Requirements

2.1 General

Since the University cabling system may provide connectivity to the public carrier's network, the following requirements are mandatory.

Personnel installing any cabling work (voice or data) are required to comply with the licensing requirements as detailed in Australian Communications Authority (ACA) Technical Standard 010. In addition, all installation works shall be 100% site supervised by personnel currently registered with the ACA or ACA authorised registrar as holding a cabling provider Open License together with additional accreditation indicating completion of endorsed courses in the areas of testing, commissioning, installation and correct work practices relevant to the performance standards of the various elements of the particular cabling system.

All components and cable shall have ACA approval under Technical Standard 008, and be listed in the AUSTEL CCL. The vendor of the components and cable shall provide the appropriate AUSTEL permit number. The installer is responsible for ensuring that cabling products are identified in accordance with Technical Standard 008.

The installation shall be carried out in accordance with AUSTEL Technical Standard 009.

2.2 Redundant Cabling

The Contractor shall be responsible for the following when replacing existing cables;

- The end to end removal of all redundant cabling as a result of a building or room refurbishment. This includes any cabling disconnected and not required, any old cabling left in walls, access poles, workstation partitions, on cable trays, or in (wall and floor) ducting.

- The removal of any underground cable made redundant by the running of a new replacement underground cable.
- The removal of the cabling is to be from either the patch panel to outlet, from distribution frame to outlet or in the case of underground cable termination point to termination point at both ends.

In all cases records are to be rewritten to reflect the changes.

A list of outlets made redundant due to refurbishment is to be created and provided to TS as part of the 'as built' information by the Contractor to ensure accurate updating of TS records.

Existing labelling of redundant outlets shall be replaced with blank labels at both ends to show that the removed cable is no longer in existence.

Any conflict with these standards will be resolved by the Director, Technology Services, or his representatives(s).

3. Documentation/Drawings

A complete set of hard and soft copy, "to scale" floor-plans, showing:

- work area outlet positions and numbering scheme,
- cable pathways including:
 - horizontal pathways in ceilings,
 - under floors,
 - otherwise concealed pathways, and
 - floor distribution locations.

Schematics will also be provided for riser and campus backbone cabling, showing:

- cable types,
- core counts,
- conduits size,
- pits,
- connection pathways between Floor Distributors,
- Building Distributors, and
- Campus Distributors.

A bill of materials, showing product descriptions, part numbers and quantities shall be provided for future reference (upgrades and servicing). The bill of materials shall be provided in A4 hard copy and PDF format at a minimum and MS Word or Excel document in the latest format.

A full set of 4 pair copper and fibre test results shall be provided digitally as a PDF and in the relevant native cable test format (e.g .flv for Fluke testers).

All documentation should be provided in a suitable format to be used by system administrators for fault-finding, moves, adds, and changes. Copies of floor plans should be provided in a laminated A4 or A3 format for each Floor Distributor location, with master copies for the Campus/Building

Distributor location. Riser diagrams should also be laminated (A4 or A3) for the Central Distribution location.

Record books to suit the installed cross connect system shall be supplied. All specified hard jumpering are to be recorded in the record books.

All documentation and test results shall be forwarded to the Network & Communications Manager. Note the payment may be delayed until documentation and test results are received and reviewed for accuracy and completeness.

Testers used must:

- a) Be listed on the Molex Connected Enterprise Solutions Approved Testers List. Note that this may be updated at any time and the most recent version can always be found under the “Useful Warranty Information” section on the main Molex CSP Home Page.
- b) Testers MUST be under valid calibration, and that calibration must be carried out by the tester manufacturer or authorized third party, and in accordance with the manufacturer's recommendations for frequency (usually annually).
- c) Have the latest Firmware applied
- d) Be used in conjunction with the correct adapters (also calibrated) according to the tests performed

Test Results must:

- a) NOT contain any FAIL, or FAIL* results
- b) NOT contain duplicate results for a given link
- c) NOT contain any PASS* results
- d) NOT contain multiple results with identical date & time stamps for the same individual tester
- e) Have the correct NVP specified as per the cable specification (the NVP is also printed on the cable)
- f) NOT have negative NEXT values

If recertified (RC) test results are submitted, we also require the original unaltered non-RC test results for comparison. These will be considered strictly on a case-by-case basis and acceptance will be entirely at the discretion of the Southern Cross University.

Negative NEXT values are not accepted.

Standards recommend the minimum length for a Permanent Link is 15m, or 15m between the Patch Panel and a Consolidation Point. We may consider down to 10m Permanent Links, but only if they

exhibit positive NEXT values. Accepting these shorter links for warranty purposes is entirely at the sole discretion of the cabling Vendor.

Certified Installers applying for the above warranty need to ensure conformance to the following:

1. Must submit a correctly completed warranty application via the Molex CSP
2. Must have acknowledged and answered YES to both Installer Declarations (A & B) within the Molex warranty application form (or equivalent)
3. Have submitted all accompanying documentation:
 - a) Test Results must be provided in the native tester format, tested in accordance with the requirements specified in the IEC and ANSI/TIA Standards, and the tester used must be specified in the Vendor List of Approved Testers, which may be found on the CSP (<https://csp.molex.com/intranet/documents/24216/145940>)

All copper links MUST be tested to Permanent Link test settings using the appropriate adapters. Likewise, when MPTL connectors are used, the appropriate Patch Cord adapters MUST also be used.

Permanent Link testing is mandatory.

The lengths of installed Permanent Links seen in the test results must be less than or equal to its specified maximum length for the applicable Category.

- b) As-Built documentation.
4. Test Result dates must not be:
 - a) Prior to the Installation Date specified within the warranty ticket
 - b) More than 6 months after the Site Installation Date.
 - c) More than 6 months before the date of warranty application.

We recommend if working on a large site that is taking longer than 6 months, to break it into smaller logical "chunks" and apply for each separately. You can specify on the warranty ticket that it is part of a larger overall project/site.

All testing shall be completed on the installed Permanent Link (Cabinet to Faceplate), testing to ISO 11801 Class EA (Cat 6A) (PL2) Permanent Link test requirements, or to match the performance of the installed cable, this shall include:

- Insertion Loss (Formally called Attenuation)
- Near End Crosstalk (NEXT)
- Power Sum NEXT (PSNEXT)

- Return Loss (RL)
- Attenuation to Crosstalk Ratio at the Near End (ACR-N)
- Power Sum ACR-N (PSACR-N)
- Attenuation to Crosstalk Ratio at the Far End (ACR-F) (Formally called ELFEXT)
- Power Sum ACR-F (PSACR-F)
- Wiremap
- DC Loop Resistance
- DC Resistance within a Pair
- DC Resistance between Pairs
- Propagation Delay
- Delay Skew

Additional Fiber testing requirements:

- Fiber testing must be conducted using an Optical Loss Test Set (OLTS) as per Tier 1 requirement in the standards.
- The correct approved Fiber Optic test “referencing method” is used (1-Jumper Method, unless stated otherwise).
- Fiber testing is conducted in both directions and at both wavelengths.

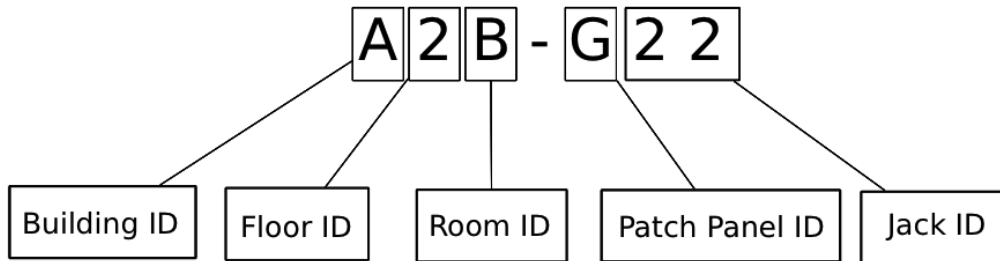
Testers used must:

- e) Be listed on the Molex Connected Enterprise Solutions Approved Testers List. Note that this may be updated at any time and the most recent version can always be found under the “Useful Warranty Information” section on the main CSP Home Page.
- f) Testers MUST be under valid calibration, and that calibration must be carried out by the tester manufacturer or authorized third party, and in accordance with the manufacturer's recommendations for frequency (usually annually).
- g) Have the latest Firmware applied
- h) Be used in conjunction with the correct adapters (also calibrated) according to the tests performed

4. Identification of Terminations and Outlets

All terminations to wall outlets shall be identified and labelled as per SCU. specifications using securely fixed laminated labels, white with black lettering. Lettering shall be a minimum 4mm upper case in height. Patch panels used in the frame in the communications room shall be correctly labelled in accordance with campus standards.

SCU Data Cabling Labelling Standard - Work area wall outlets



Note All characters should be uppercase. The following alphabetical characters should **NOT** be used I,O,S.

Alphabetic sequence after Z is reached should proceed AA,AB,AC etc...

Building ID	Alphabetic character.
Floor ID	Numeric character representing the floor on which the comms room is located.
Room ID	Alphabetic character representing either the comms room or rack where the jack is terminated. If there is only one comms room on the floor then this character represents the rack ID.
Patch Panel ID	Alphabetic character identifying the patch panel.
Jack ID	Numeric character identifying the jack on the patch panel.

IMPORTANT NOTE: Planning and assessment of cabling in support of remote powering (PoE) is essential.




Three Remote Powering Categories have been defined by International and European Standards.

For Category RP1, attachment of the remote powering equipment at a distributor is controlled such that the average current for all conductors served by the distributor is not greater than 212mA (Ic-average). And with RP1, no planning or installation practices are required, but documentation and administrative controls during both the attachment of a PSE or a PD and any subsequent extensions of the cabling are required.




For Category RP2, the same average current is restricted to a specified value between 212mA and 500mA (Ic-average). Then, the same RP1 constraints apply to Category RP2.

And finally, for Category RP3, attachment of a PSE or a PD at a distributor is unrestricted subject to the limit of $I_c < 500\text{mA}$. But of course, good upfront planning is required, together with documentation and administrative controls during subsequent extensions of the cabling.

For each Cabinet and Patch Panel, a label shall indicate the Remote Power category. Below are some examples:

<p>INSTALLATION CATEGORY</p> <h1 style="margin: 0;">RP1</h1>		<p>YOUR DESIGN ALLOWS FOR AN INSTALLATION CATEGORY OF RP1 NO AUTHORIZED ATTACHMENT OF REMOTE POWERING EQUIPMENT</p> <p>Attachment of the remote powering equipment at a distributor is controlled such that the average current for all conductors served by the distributor ($I_{L-average}$) is not greater than 212 mA</p>
<p>INSTALLATION CATEGORY</p> <h1 style="margin: 0;">RP2</h1>		<p>YOUR DESIGN ALLOWS FOR AN INSTALLATION CATEGORY OF RP2 NO AUTHORIZED ATTACHMENT OF REMOTE POWERING EQUIPMENT</p> <p>Attachment of the remote powering equipment at a distributor is controlled such that the average current for all conductors served by the distributor ($I_{L-average}$) is restricted to a specified value between 212 mA and 500 mA</p>
<p>INSTALLATION CATEGORY</p> <h1 style="margin: 0;">RP3</h1>		<p>YOUR DESIGN ALLOWS FOR AN INSTALLATION CATEGORY OF RP3 AUTHORIZED ATTACHMENT OF REMOTE POWERING EQUIPMENT</p> <p>Attachment of the remote powering equipment at a distributor is unrestricted subject to the limit of $I_L \leq 500$ mA Planning and installation practices of the above-mentioned Standards are still required</p>



<p>INSTALLATION CATEGORY</p> <h1 style="margin: 0;">RP1</h1>  <p>EN 50174-2:2018 ISO/IEC 14763-2:2019 AS/NZS 14763.2:2020</p>	<p>INSTALLATION CATEGORY</p> <h1 style="margin: 0;">RP2</h1>  <p>EN 50174-2:2018 ISO/IEC 14763-2:2019 AS/NZS 14763.2:2020</p>	<p>INSTALLATION CATEGORY</p> <h1 style="margin: 0;">RP3</h1>  <p>EN 50174-2:2018 ISO/IEC 14763-2:2019 AS/NZS 14763.2:2020</p>
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IMPORTANT: To find out the Remote Category of the Permanent Links attached to the Patch Panels, Installers shall download the Molex PoE Calculator from the Molex Customer Support Portal. This tool shall be used upfront, at the design stage, to ensure the desired category is achieved once the installation is completed.

A copy of the results (PDF Print from the PoE Calculator) shall also be attached to the Warranty Documentation, should a Molex PoE Application Assurance be required.

Southern Cross University shall only accept Permanent links of the RP3 Category.

5. Inspection, Testing & Commissioning of Cabling

5.1 General Issues

All works shall be inspected and tested as required by Section 1.2 and Section 2. of this specification prior to commissioning.

No pipe work, fixtures or equipment shall be concealed or covered before they have been inspected by the University or its Agents.

Twenty-four (24) hours minimum notice shall be given prior to the carrying out of tests.

All tests shall be carried out to the applicable Standards, Act or Authority requirements notwithstanding the following minimum requirements:

- All defects shall be remedied immediately and the tests reapplied.
- Tests shall be repeated if necessary to the satisfaction of the Authorities having jurisdiction.

5.2 Fibre Optic Testing and Documentation

All cables shall be tested and documented as follows:

- Power loss measurements made at wavelengths of 850nm and 1,300nm for OM3/4 50/125 fibres. The optical fibre PIL test results will be included in a table, spreadsheet or other similar presentation format indicating the calculated Power Insertion Loss (PIL), the tested PIL and a pass/fail scenario.
- The summary tables from the test equipment are not acceptable as the Pass/Fail criteria is not the calculated PIL.
- OTDR (Optical Time Domain Reflectometer) measurements made at a wavelength of 1,300nm for cables longer than 100m.

The acceptance criterion for all test results shall be the maximum cable attenuation as given in the manufactures data, plus 0.5dB per LC connector as per AS3080.

All optical fibre test results shall be documented and on completion supplied to the University. These results shall include OTDR traces, cable length and end to end power loss measurements at 850nm and 1,300nm. Appropriate reader software and user guides are to be supplied with the electronic results. All measurements are to be presented in the metric system.

Fibre terminations shall be clearly labelled as per the SCU building identification code.

5.3 Horizontal/Vertical Cable Installation Testing & Documentation (where applicable)

The necessary skilled and competent personnel together with all equipment, and accessories required to test and commission the works shall be provided.

The installation shall be tested progressively as construction progresses and then finally on completion to ensure that the installation complies and operates correctly under normal conditions. All testing and commissioning shall be carefully pre-planned and scheduled in order that it is fully coordinated with other relevant trades and shall be carried out in a safe and efficient manner with a minimum of inconvenience to all concerned.

The cable installers shall supply documentary evidence that the transmission characteristics of the twisted pair cable and the transmission performance requirements of the connecting hardware (connectors, patch panels, outlets and patch leads), conform to the Category 6A specifications and the caliber of the twisted pair cabling will be ISO/IEC 11801 Class EA (EIA/TIA Cat 6A). In addition to testing the "In-link" performance parameters detailed in A.1 above, Alien Crosstalk testing or "Between-link" testing shall be carried out in accordance with Section 4.7 of ANSI/TIA-1152. Alien crosstalk testing includes the PS ANEXT and PS AACR-F (Power sum alien attenuation-to-crosstalk ratio from the far end) performance parameters. The standards refer to the link-under-test for Alien Crosstalk as the *disturbed* link.

All Category 6A cable testing shall be carried out using a Fluke DSX series cable tester with 100% of all installed links to be tested for full compliance with the TIA Category 6A PERMANENT LINK parameters in accordance with the field test specifications defined in ANSI/TIA-568-C.2 "*Commercial Balanced Twisted-Pair Telecommunications Cabling and Components Standard*". The Fluke Tester must have been factory calibrated within the last 12 months.

Current Firmware & Standards revision applicable to the tester shall be confirmed with FLUKE prior to the commencement of testing

Multipair cable (25pr, 50pr, 100pr) shall be tested for polarity and continuity only.

All tests' procedures used and results obtained for both works and site tests shall be submitted in the form of a written "Test Report".

The installation shall be tested to the satisfaction of the University, prior to the acceptance of the installation.

Following testing by the Contractor, a random sample of 20% of outlets on each floor shall be fully tested in the presence of the University representative. If any fault is found then the test shall be aborted, the entire floor shall be retested and again acceptance tested. All costs including fees for retesting shall be borne by the Contractor.

6. Cabling Components

The University telecommunications cabling system will consist of the following components unless otherwise specified:

6.1 Fibre Interbuilding Cable

Existing University campus infrastructure is installed using 62.5/125 micrometer for multimode (MM) and 9/125 micrometer for singlemode (SM).

All future installations shall follow the existing Infrastructure and will use 50/125 OM4 for multimode and 9/125 OS1a for singlemode.

6.1.1. Optical fibre core quantities

It is recommended that the optical fibre cable shall be installed with 12 core OM4 and 12 core singlemode or greater between any two buildings.

6.1.2. Optical fibre connectors

The existing University Campus infrastructure is installed using a combination of SC and ST connectors. All new installations shall use LC connectors for both OS1a and OM4 cable.

. A protective cover or cable management is to be fitted to the front of the panel for the protection of the optical fibre leads.

6.1.3. Optical fibre patch cords

OS1a: YELLOW

OM4: AQUA

6.2 Copper Interbuilding Cable

Copper cable installed between building for the purpose of providing voice services across the campus and connecting these services to the Public Carrier's network shall conform to ACA regulations (as described in Section 1.2 and 2. of this specification) with respect to materials, installation and administration.

Any conflict with these standards will be resolved by the Director, Technology Services, or his representatives(s).

6.3 Horizontal Cabling

Horizontal cabling specifications as detailed in this document shall apply to both voice and data systems.

The horizontal cable includes the cable, the wall outlet for terminating the cable into the work area and the patch panel for terminating the cable in the Communications Cabinet/Cupboard.

Horizontal cabling shall emanate from the IDF within the Communications Cabinet/Cupboard and propagate out in a star manner to each RJ45 telecommunications/data outlet. Each RJ45 outlet shall have connected to it a 4 pair cable.

Standard staff work areas will have two data outlets only.

Standard student work areas where a computer is provided will have a single outlet only.

Standard digital signage work areas will have two data outlets per screen.

All outlets are to be angled shuttered outlets. The shutter mechanism must form part of the faceplate or connector, be internal and spring loaded.

Where traditional voice services are being installed, voice and data outlets shall be included on the one face plate, with a blue socket for the voice outlet.

Data outlets for indoor Wireless Access Points (WAP's) are to be a double outlet.

6.4 Backbone/Vertical Riser Cabling

Includes all riser cables which terminate at the Main Distribution Rack (MDF-Building) and subsequently transverse up or down to each Intermediate Distribution Frame (IDF) and terminate.

Normal precautions regarding cable runs to minimise noise induction, as defined in the documentation listed in Section 1.2 of this specification, shall be adhered to.

6.5 Communications Cabinet/Cupboard

An enclosure where the backbone cable is terminated and patched to the horizontal cabling system. This enclosure may also house the MDF-Building terminations and some active telecommunications or data networking equipment.) Patching may also be provided to connect the horizontal cables to the telecommunications/data equipment.

6.6 Main Distribution Frame (MDF-Site)

The element in the cabling system that provides the first level of connection between the Interbuilding Cabling and the Public Carrier's lead in cable or the SCU central communications interface. This will probably be located in the "Pizza Hut" for voice cabling and the Lismore Data Centre, B2.35 for data cabling on the Lismore campus.

6.7 Main Distribution Frame (MDF-Building)

The element in the cabling system that provides the first level of connection between the interbuilding Cable and the building's Backbone Cable.

6.8 Intermediate Distribution Frame (IDF)

The element(s) in the cabling system that provides additional interconnection beyond the Main Distribution Frame (MDF-Building). Usually provided on floor by floor basis and housed within a Communications Cabinet/Cupboard.

7. Horizontal Cabling Installation

7.1 General

Horizontal cable, connectors and installation for both voice and data services shall comply with the minimum requirements of Category 6A/Class EA specifications as detailed in AS3080, (inactive) and (inactive).

The cable termination scheme shall be the T568A. (Refer AS/NZS 3080 : 2002 Appendix ZA).

For new buildings or any additional cabling in existing campus buildings, Category 6A patch panels with shuttered outlets should be used. Angled shuttered outlets will also be used in offices.

If ten or more cables run in ceiling space in parallel, a cable tray must be used unless otherwise specified by Technology Services representative in writing. The cable tray shall be installed no less than 150mm from the underside of any slab or cable tray carrying other services, and no less than 300mm from any roofing material unless varied in writing by a Technology Services representative.

Cable ladders and trays shall:

- be connected to electrical safety earth using 4 mm² cable coloured green/yellow fitted with cable lugs and have a continuous earth throughout
- be fabricated from galvanised steel or aluminium sections

- be fitted with manufacturers standard accessories, bends, risers, splices, etc
- be free from sharp edges or corners
- be provided with rolled or folded sides of at least 35mm high
- have factory made perforations and slots prior to galvanising in lieu of drilling for suspensions or fixings
- be fixed to steel brackets and hangers to provide a rigid fixing
- be fixed such that there is sufficient air space between the structure and the tray enabling natural air circulation to occur and for cable access
- be installed parallel or at right angles to the building structure and planning grids
- have facilities for longitudinal expansion at splice joints, including continuity or earth connection
- incorporate sun screens where exposed to sunlight

Supports shall be:

- designed for a safety factor of 2:1
- spaced to co-ordinate with the building structure and other services
- cantilever, or L, type brackets for ceiling mount tray
- unistrut supports for floor and vertical mount tray

Cable ladders shall:

- have rungs at 300 mm, maximum, centres.
- be used where cable loadings exceed 75 kg per metre.
- have capacity to withstand the following loading with a safety factor of 1.5 and a maximum deflection of 15 mm between supports;
- be light duty with support capacity of 120 kg/metre having support spans at 3 metre intervals for ladder up to 300 mm wide.
- be medium duty with support capacity of 180 kg/m having support spans at 3 metre intervals for ladder up to 600 mm wide.

Ladder trays shall:

- consist of rungs of perforated steel
- be supported such that the maximum deflection between adjacent supports does not exceed 10 mm
- when fully loaded to the ultimate capacity provided with a 2:1 safety factor
- be sized so that they are loaded a maximum 80% of their width capacity including spaces between cables for derating purposes without undue bunching

Cable trays shall be:

- fabricated from perforated sheet steel electro zinc plated with 50%, minimum, of its surface area open for air circulation
- supported such that the maximum deflection between adjacent supports does not exceed 10 mm
- when fully loaded to the ultimate capacity provided with a 2:1 safety factor

- sized so that they are loaded a maximum 80% of their width capacity including spaces between cables for derating purposes without undue bunching
- high sided type for cable loads in excess of 20 kg per metre

From the cable tray system, cables shall be supported clear of the ceiling structure by 'Unicon' clips as approved by Technology Services at maximum intervals of 1.2m, or by Catenary wire and be extended to the top of the service columns or partition wall and down to the workstation location. No more than five cables will be allowed in one 'Unicon' clip.

Where cables enter the Telecommunications Equipment Room (TER) above the racks, large bend radius cable ladders shall be used to facilitate the dropping off of cables into racks.

All cables shall be tied to cable tray or other cable routing systems using velcro. The use of cable ties to fasten bundles of cables is prohibited.

Cable hangers shall only be used in circumstances where it is not possible to install cable trays, ladders, or conduits. Written approval must be obtained from Technology Services prior to the installation and use of cable hangers.

Cable hangers should provide strain relief and route cables so that the bend radius conforms to AS/NZS 3084 standards. A maximum of 10, four pair cables or equivalent is allowed to run through a cable hanger, which should be placed in every 500mm of a cable run.

For installations where catenary support is existing the catenary must be strung directly under the slab or supported from the slab via hanging chains or rods and approved by the project manager prior to use. Catenaries if used should not support more cables than permitted per manufacturer specifications with support for the catenary wire being no more than two (2) metres apart.

Category 6A cable shall NOT be pulled such that more than 11kg strain is exerted. All cabling should be concealed wherever possible and run in ceiling voids, wall partitions and modular furniture panels. Where it is not possible to run the cabling in such concealed places Panduit TG70 raceway (60% fill rate) or Molex, ADC Krone equivalent duct is to be used.

All major vertical and horizontal trunk-cabling pathways shall be easily accessible for their entire length, by way of removable panels and ceiling tiles.

Cabling that is to be concealed in ceiling voids, plaster walls and other areas not accessible after building works are finished, shall be run in conduits utilizing sweep bend radius (with a draw wire installed) or using other means to be agreed to in consultation with Project Manager. This is to ensure that future cabling can be run to the same areas when needed without opening finished building works. Where cabling is exposed, plastic conduit shall be used as protection for cables. Outlet faceplates, raceway and conduit that is visible within a room, is to match the existing outlet faceplates. Raceway and conduit used shall be painted a similar colour if necessary, using paint suitable for the type of duct used, for example vinyl paint for plastic duct.

Cables shall be supported clear of the ceiling structure by approved cabling support systems. Under no circumstances shall cables be laid on ceiling tiles, attached to a ceiling support, or other services.

Cables shall be installed in such a manner that adequate spacing is provided for fixing and for heat dissipation.

Cables shall be kept at a safe distance from items liable to become hot. The distance shall be consistent with the maximum temperature possible and the cable type. Cables shall at no point make direct contact with such items. Where cable pathways cross a heat source, the heat source and/or the cable pathway should be thermally shielded.

All catenaries shall be earthed as required by AS/NZS 3000 and cable ties used to support cables on the catenary wire shall be Velcro ties spaced no more than 300mm apart.

Cable on trays if used, shall be tied no more than 600mm apart when the cable is on top of the tray, 300mm apart if cable is suspended under a tray. All vertical cable shall be tied to the riser tray/ladder, with care taken to avoid cinching. Riser tie-offs shall not be placed further than 500mm apart.

The minimum separation between the fixed telecommunications cabling and parallel runs greater than 3 metres of low voltage (240V) fixed electrical cabling shall be at least 300mm for performance and noise reduction reasons. Separation from other electrically noisy environments such as power distribution mains, sub-mains, fluorescent light fittings and halogen down light transformers shall be 300mm.

The data and voice communications outlets shall be cabled back to a modular patch panel in the telecommunications closet. The voice backbone cables should be fitted off on 25 or 50 port patch panel to the 19" rack it. See section 10.2 for sample rack layouts.

Cables run parallel to electrical cables shall be separated as detailed in Table 1.

TABLE 1

Circuit Rating (kVA)	Unshielded Power Cables (mm)	Shielded Power Cables (mm)
< = 1	300	25
> 1 < = 2	450	50
> 2 < = 5	600	150
> 5	1,500	300

(Extract from AS2834, applies to a nominal Phase to Phase voltage of < = 480 volts. These distances have been recommended to minimise interference as distinct from those distances listed at TS 009 and AS3000 which refer to safety isolation.)

Cables shall be adequately separated from sources of electromagnetic interference.

Bending radii shall not be less than the manufacturer's recommendation and in any case shall be not less than six times overall cable diameter.

7.2 Cable Routing

All distribution cabling shall emanate from patch panels and be routed to nominated work stations and outlets through ceiling space, risers, skirting duct and workstation partition duct where specified. Cable lengths shall be kept to a minimum.

Horizontal cabling shall be supported on floor to ceiling cable tray within riser shafts.

Cable tray where specified shall be installed and earthed as detailed in AUSTEL TS 009.

7.3 Cabling installed in Three Channel Skirting Duct

Where skirting duct is specified, three channel ducting of a type consistent with the Moduline CFC/35150 Series shall be supplied and installed. Other types of skirting duct shall be approved by the University. Standard dimensions shall be 35mm depth x 150mm height with the centre channel height measuring no less than 50mm to provide an adequate outlet fit-off zone for data, telephone and power outlets.

Telecommunications or data cabling installed in the skirting duct shall be routed via the dedicated cable chamber i.e. the upper channel. Electrical cables shall be installed in the lower channel.

Telecommunications and electrical outlets shall be installed in the centre channel, in which case the dividing metal between the channels shall be notched to allow cable access to the centre channel.

Where cables are terminated in the skirting duct, neat penetrations shall be made in a section of the duct cover and the connectors clipped into place and the duct cover neatly replaced. Mounting kits are available from the supplier for this purpose. Sufficient cable shall be provided for later removal of the termination for servicing.

Where cables pass behind a termination in the duct, the installer shall ensure no strain is placed upon the termination cable.

The cable shall at all times be shielded from cabling of other services in the duct.

7.4 Workstation Partition Ducting

Where workstation partitioned ducting is specified, RJ45 outlets shall be clipped directly into ducting cover plates. The cabling contractor shall provide punch outs for connectors. Care to be taken to ensure correct bend radius at termination points.

Cabling shall be run in the data and voice section of workstation partition ducts, ensuring cables are screened from other services cabling in these ducts.

Face plates to match all other accessories at positions where required.

7.5 Termination Equipment and Components

All twisted pair cabling shall be terminated using insulation displacement techniques. The outer sheath of the cable shall not be removed any further than necessary to ensure each pair is twisted as closely as possible to the termination point. The maximum length for data cabling where practicable shall not exceed 13mm.

Patch panels and telecommunications outlets shall be Category 6A RJ45 type and shall comply with AS3080 specifications. All outlets are to be shuttered.

7.6 Patch Cables (if applicable)

All twisted pair cables shall be multi strand twisted pair cables of the same characteristics as specified for the horizontal cable, terminated at each end using RJ45 connectors.

The length of the patch cable shall not be excessive and suitable for neat looming through jumper rings installed in the Telecommunications Cabinet/Cupboard to ensure that no strain is applied to the patch panel, connector or patch cable.

8. Backbone/Vertical Riser Cabling

8.1 riser subsystem

The riser subsystem is the main cable route between floors within a building. The riser subsystem is only to be used for the through passage of cables. No cables shall be terminated in telecommunications risers.

Telecommunications risers shall run the vertical height of the building and shall be used for routing all horizontal cables back to the telecommunications equipment room.

A telecommunications riser shall be located within 5 metres of each comms equipment room.

The minimum size of the riser shall be 1000mm wide x 500mm deep.

The telecommunications riser shall be accessible on each floor by way of door 900mm wide x 2000mm high.

Cable ladders shall run the entire height of the riser and feed the horizontal cable trays in the telecommunications equipment room.

No communications equipment is to be mounted or terminated in a riser.

9. Inter-Building Cabling Installation

9.1 Fibre Cable

9.1.1 General

The existing University campus infrastructure is installed using a 62.5/125micrometer for multimode (MM) and 9/125 micrometer for singlemode (SM).

It is recommended that all future installations will use OM4 for multimode and OS1a for singlemode.

All new buildings will be connected to the main campus control room via 2 optic fibre cables run via diverse routes from the comms cupboard in the new building.

9.1.2 Cable Specification

Cable specification shall comply with (Superseded by AS 11801.1:2019 and AS 11801.1:2019 Amd 1:2022)

The minimum intra building fibre cable **should** contain 12 core OM4 and 12 core OS1a.

All new installation to new buildings shall have TWO building entry points from different directions.

All new building will have 2 diverse fibre cable run back to the campus data centre.

Connectors to be used when terminating the fibres shall be, LC for OS1a and OM4.

9.1.3 Installation

Fibre optic and copper cables between buildings shall be installed in underground conduits in accordance with ACA regulations for external underground installations. Fibre is to be laid in a white

PVC conduit of not less than 100 mm internal diameter. Draw wires and locator wires are to be installed in all new conduits.

The draw wire is to be fit for purpose and non metallic.

The locator wire is to be a 4mm square copper wire. The colour is to be violet or other. It is **not** to be coloured red, black, blue or white.

There is to be a 2m service loop located in each pit. The service loop is to be accessible to allow attachment of signal injection equipment. If a copper telephone cable is being installed through out the length of the conduit the locator wire is not required.

The University will specify the location and type of access covers or pits required to facilitate ease of installation. Where access pits are required, underground conduits shall enter and leave at opposite ends of the pit in a straight line. Under no circumstances shall underground conduits enter or leave the sides of the access pit thereby requiring cables to intersect existing services or deviate from a straight run.

Optic fibre cables will be labeled in each pit it goes through with " Optical Fibre - Caution " also the building it comes from and goes to as well as a contact phone number for `TS with a label no less than 3cm*2.5cm that is self-laminating wrap around

Minimum bend radius (as installed) - not less than 10 x outside diameter of cable or the manufacturer's specification, whichever is the greater.

During installation the pulling force shall not exceed the manufacturer's specified maximum.

Cable slack shall be provided as follows:

Within pits -2 metres minimum

At a termination location - 2 metres minimum

Within a termination enclosure - 0.5 metre minimum

NB: the manufacturer's minimum bend radius specification shall not be exceeded in any of the above locations.

All fibre cable terminations shall be made in SCU approved wall or rack mount enclosures. When using rack mount enclosures a patch cord protector shall be included in the installation.

All cable installations are to include suitable patch cables as part of the installation. Patch cable length and termination type is to be determined by SCU.

All locations of the cable run that may be accessed by service personnel are to be fitted with a *Laser hazard-warning* label.

SCU is to be consulted with respect to all cable route variations or route clarification.

9.1.4 Fibre Optic Terminations

Fibre optic cable termination should either be fusion spliced or pre-terminated. Pre-terminated cables are preferred for intra-building connectivity and fusion spliced for inter-building connectivity, however variation from this recommendation can be determined on a case-by-case basis.

Fusion Splicing

Termination of all fibre optic cables shall be performed by fusion splicing a pre-terminated pigtail onto the optical fibre cable in an approved termination enclosure.

All optical fibres shall be protected within the termination enclosure between the cable and splice cassette using a suitable PTEE sleeving over the 250um buffered fibres. Sufficient excess cable should be coiled up in the splice cassette to allow for future re-termination of the cable by fusion splicing. At least one (1) metre of excess fibre shall be coiled up in the splice cassette.

All fusion splices shall have a heat shrink splices protector installed over the completed splice. These splice protectors and the excess fibre must be neatly coiled in the enclosure splice cassette ensuring that the cable minimum bend radius is not exceeded.

Fusion splicing equipment must perform active alignment of the optical fibres prior to splicing using the automatic direct core monitoring profile alignment technique. The fusion splicing equipment should give an average loss less than 0.05dB with identical multimode fibres.

All fibre cables shall have a two-meter service loop at each end of the cable run; this may be stored in the back of the cabinet. Where there is not sufficient space the slack may be stored either under the raised floor or overhead whichever is applicable.

9.1.5 Fibre Optic Termination Enclosures

Enclosures shall be 24 ports or more depends on the fibre count, rack mount fibre optic enclosures that manage and protect optical fibre terminations and splices. The enclosures shall be modular and accept modules of any connector type. The enclosures mount to EIA standard 19" or 23" racks or enclosures, include multiple cable entry points, include fibre optic cable routing accessory kits, and include port and panel identification labels. 24 port versions include a slide out drawer for front access to all terminations. Angled connectors are preferred to assist in the reduction of bending the optical fibre leads. A protective cover or cable management is to be fitted to the front of the panel for the protection of the optical fibre leads.

OS1a Cables & Connectors

All leads and internal grade cable will be "YELLOW".

All connectors (on leads and patch panels) will be "BLUE".

OM3/4 Cables & Connectors

All OM3/4 leads and internal grade cable will be "AQUA".

All connectors (on leads and patch panels) will be "BEIGE".

Fibre patch leads shall be duplex with removable clips to facilitate polarity changes as required.;

Other enclosures which do not conform to these requirements shall not be approved by the University.

9.2 Copper Cabling

Copper underground cable for voice services shall be installed between the MDF - Site and the MDF - Building unless otherwise specified. The backbone cable shall be Austel / ACA approved voice grade or Category 3 type UTP cable. The minimum wire diameter shall be 0.40mm and 100 pair cables should be used where practical.

All copper interbuilding cabling for voice services shall be terminated in Krone IDC blocks and mounting frames.

In lightning prone areas Over Voltage (Arrestor) devices should be installed on all Inter-Building and Intra-Building cables to protect the telephone services.

All terminations and cables shall be documented.

10. Communications Cabinets

10.1 General

Communications cabinets shall be completely assembled, installed and terminated as specified and indicated in the brief. All communications cabinet installations are to reviewed and approved by Director, Technology Services or nominated representatives.

The use of wall mounted cabinets is discouraged. Usage of wall mounted cabinets will be subject to discussions and prior approval of the Director, Technology Services or nominated representatives.

B&R enclosures Ausrack style of racks are preferred

Equipment cabinets shall comprise of an epoxy powder coated steel cabinet. All cabinets shall:

- 45RU x 800 wide x 1000 deep,
- front and rear lockable, perspex or high flow ventilated doors, depending upon application.
- comply to ACMA standards and regulations,
- be electrically earthed,
- be such that all doors shall close with all patch leads and cables associated with the housed equipment in the cabinet,
- be provided with suitable clearance to ensure that the closure of the door shall not interfere with any device within the enclosure,
- have all joints welded with continuous seam welds which have been ground flush after fabrication. Spot welds are unacceptable,
- be of unitary folded and welded construction fabricated from minimum 2 mm bright mild steel framework and 1.6 mm thick for panels,
- be provided with removal panels, escutcheon plates and covers at the front,
- have cover plates folded so that all edges of the sheet are concealed,

- contain cable entries, sized to suit the cables specified and positioned to suit the site conditions
- be fitted with approved means of supporting all cabling with bushed holes between compartments
- have 50 mm, minimum, wiring space on any side where terminations are made, the wiring space being increased to suit the quantities and types of cables entering and leaving the equipment rack
- be provided with internal cable trays for the entire height, a minimum 150 mm wide each side
- be provided with a power rail with at least 6 outlets
- be provided with a set of fifty captive nuts and M6 Phillips fixing screws

Ferrous metal shall be free from rust, corrosion, grease and scale, be painted using at least one coat of rust inhibiting self-etching primer an undercoat of zinc enriched paint and two coats of epoxy powder coat paint

Equipment cabinet clearance shall be as follows:

- front access 1500 mm clearance,
- single side access 1000 mm clearance.

If multiple racks are installed in a bayed configuration, at a minimum 200mm cable zones are to be used between racks and 100mm cable zones at each end.

Minimum Configuration:

- 1 x 45 RU cabinet 600w x 1100d
- 2 x 100mm cable zones
- 2 x sides
- 2 x high flow perforated door or Perspex door (depending on room conditions)
- 2 x 150mm cable tray
- 2 x 8 way vertical PDU
- 1 x 1RU horizontal cable manager
- 1 x 2RU horizontal cable manager

10.2 Sample rack layouts

384 ports all patched	
45	Fibre Enclosure
44	Fibre Enclosure
43	Blank
42	Copper - Telephony
41	Copper - Telephony
40	Blank
39	24 x Data
38	24 x Data
37	24 x Data
36	24 x Data
35	24 x Data
34	24 x Data
33	24 x Data
32	24 x Data
31	24 x Data
30	24 x Data
29	24 x Data
28	24 x Data
27	24 x Data
26	24 x Data
25	24 x Data
24	24 x Data
23	Blank
22	Blank
21	Switch
20	Blank
19	Switch
18	Blank
17	Switch
16	Blank
15	Switch
14	Blank
13	Switch
12	Blank
11	Switch
10	Blank
9	Switch
8	Blank
7	Switch
6	Blank
5	UPS
4	UPS
3	UPS
2	UPS
1	UPS

384 Ports - All patched	
45	Fibre Enclosure
44	Fibre Enclosure
43	Blank
42	Copper - Telephony
41	Copper - Telephony
40	Blank
39	24 x Data
38	Switch
37	24 x Data
36	24 x Data
35	Switch
34	24 x Data
33	24 x Data
32	Switch
31	24 x Data
30	24 x Data
29	Switch
28	24 x Data
27	24 x Data
26	Switch
25	24 x Data
24	24 x Data
23	Switch
22	24 x Data
21	24 x Data
20	Switch
19	24 x Data
18	24 x Data
17	Switch
16	24 x Data
15	
14	
13	
12	
11	
10	
9	
8	
7	
6	
5	UPS
4	UPS
3	UPS
2	UPS
1	UPS

11. Power Requirements

11.1 UPS-Uninterruptable Power Supply For Buildings

Buildings containing more than one Telecommunications Equipment Room shall be supplied by a centralised UPS system. The system installed shall be Invensys Energy Systems(POWER WARE).The minimum system required for a building installation shall be a minimum of 20kVA UPS with a backup battery time of 2 hours and shall support the expansion of battery capacity to increase runtime. All UPS installation should be installed with a bypass manual switch. All UPS shall have these features in them or better:

- Efficiency Optimiser UPS
- Advanced Battery Management
- Advanced Communication capabilities for management via the university network
- DC Expert
- Online Double Conversion UPS

All communication rooms within the building shall be wired with at least 2 X 15 amp captive GPO's from the UPS sub board.

11.2 UPS-Uninterruptable Power Supply For Communication Cupboards

In a building that has only one communications cupboard, the minimum UPS specification will be 3kVA UPS equivalent to APC SURTD3000XLI fitted with Network monitoring card AP9631. All UPS installation should be installed with a bypass manual switch. All UPS shall have these features in them or better:

- Efficiency Optimiser UPS
- Advanced Battery Management
- Advanced Communication capabilities for management via the university network
- DC Expert
- Online Double Conversion UPS

All communication rooms within the building shall be wired with at least 2 X 15 amp captive GPO's from the UPS sub board.

12. Telecommunications Equipment Rooms

12.1 General

Each communications room or cupboard shall have:-

- Communication Room: the minimum space for a communication room (for 3 x Racks) is 6 x 4m or 24m².
- Communication Cupboard: the minimum space a telecommunication cupboard (for 1 x Rack) is 600mm(L) x 600mm(W) x 900mm(H), also known as 18RU cabinet.
- A communications room rack details is as specifications in section 10 – Communications Cupboards.
- Extra comms cupboards will be required in a building where the horizontal pathway distance exceeds 90mtrs.
- All comms rooms should be vented or air-conditioned such that internal temperatures do not exceed 22 degrees Celsius.
- A minimum of 6 power outlets to be installed in each rack in a rack mounted power strip.
- Each rack to be supplied by a dedicated 15amp circuit from a separate circuit breaker.
- Each comms cupboard shall have a minimum of two double GPO power points.
- A 2RU horizontal cable management panel similar to Panduit NCMHF2 is to be installed between every 2 data/phone outlet patch panels and a vertical cable management system
- All surfaces in comms cupboard to be sealed to minimize dust. Finishes should be in a light color to enhance lighting.
- Entry to comms cupboard to be dust proof.
- Each comms cupboard will have adequate artificial lighting. Minimum 2x40W fluorescent lights.
- A technical earth to be provided in each comms cupboard
- The earth must conform to the relevant Australian building codes.
- Sealing of Openings – The Contractor shall carry out the following sealing of openings associated with cabling installation;

- Effectively seal all openings, made or provided, in or through building walls, floors,
- ceilings, and other fixtures after cable reticulation to ensure that the integrity of the
- barrier penetrated is maintained.
- Effectively seal all cable duct openings above ground level, and all cable entries into
- trenches or buildings to prevent the ingress of moisture and the entry of rodents and fire where applicable.
- Ensure that all spare conduit and cable entries into Comms Cupboards are effectively plugged and sealed to prevent the ingress of moisture, entry of rodents or fire penetration.
- Ensure that all openings through roofs and external walls are made weatherproof. Where necessary, this will include the installation of flashing and/or rainhoods to prevent the entry of driving rain, seepage, etc.
- Ensure all fire rated sealing shall be done in accordance with the requirements of the
- Manager Facilities.
- Material Colours - All exposed materials shall be of a colour, which is consistent with the surrounding decor and shall be approved by the Manager Facilities.
- Painting and Corrosion - The Contractor shall be responsible for corrosion protection and the painting of all brackets, supports, cable ladders weathershields, etc. being supplied and/or installed. The Contractor shall also be responsible for the restoration of any damaged paintwork on equipment and accessories to the supplier's finish, or to a matching finish approved in writing by the Manager Facilities.
- No water pipes, water sprinklers, high voltage or power supply cables shall be installed within the equipment room
- The room shall not be located where it is exposed to vibration due to vehicles or machinery.
- Front and rear access to all enclosures and racks shall be provided. If the core equipment room can be secured, the preference is to utilise 4-post racks.
- There is to be a communications outlet in the room at one metre above the floor level. A wall phone is to be supplied for this location as part of the project.
- All Comms spaces are to be secured with lockable doors. Access provisions are to be either:
- Current TS key system for Communications Spaces, or
- Electronically scanned access-card system to provide access audit trail.
- The number of communications equipment rooms required in new buildings is directly related to the number of floors in the building and the building length. The length of the building is the distance between the farthest extremes of the building along the path of the proposed cable trays on any single floor.
- Where more than one Comms room is required, the rooms shall be connected to each other via easily accessible cable trays.
- Appropriate portable fire extinguishers, in accordance with local fire regulations, shall be provided, and maintained within the equipment room. They shall be located as close as practicable to the entry/exit.
- The following table indicates the minimum number of Comms rooms.

Number of floors	Building length	Number and location of equipment rooms
1	<160m	1 room centrally located on the ground floor
1	>160m and <240m	2 rooms, located equidistant along the ground floor
1	>240m and <320m	2 rooms on the ground floor, each located 80m from opposite extremes of the building.
2	<140m	1 room centrally located on the ground floor
2	>140m and <210M	2 rooms, located equidistant along the ground floor
2	>210 and <280m	2 rooms on the ground floor, each located 70m from opposite extremes of the building.
3	<140m	1 room, centrally located on the second floor
3	>140m and <210m	2 rooms, located equidistant along the second floor
3	>210m and <280m	2 rooms on the second floor, each located 70m from opposite extremes of the building
4	<120m	room, centrally located on the second floor
4	>120m and <180m	2 rooms, located equidistant along the second floor
4	>180m and <240m	2 rooms on the second floor, each located 60m from opposite extremes of the building.
5	<120m	1 room, centrally located on the third floor
5	>120 and <180m	2 rooms, located equidistant along the third floor
5	>180m and <240m	2 rooms on the third floor, each located 60m from opposite extremes of the building
6	<100m	1 room, centrally located on the third floor

6	>100m and <150m	2 rooms, located equidistant along the third floor
6	>150m and <200m	2 rooms on the third floor, each located 50m from opposite extremes of the building
7	<100m	1 room, centrally located on the third floor
7	>100m and <150m	2 rooms, located equidistant along the third floor
7	>150m and <200m	2 rooms on the third floor, each located 50m from opposite extremes of the building
Other	Other	To be determined by TS

Any building work done in a Comms cupboard must be done in a way that minimizes dust. Any drilling will require a dust extraction system connected to a vacuum cleaner.

In a new Comms Room or Cupboard, after the cabling work is completed, the room should be “microscrubbed” using a recognized specialist IT cleaning company before any active equipment is installed.

13 Conduit and Pits

13.1. Cable pits

- Communications pits should be at locations no greater than 70 meters apart or at any change of direction
- Communications pits should be located so that they are permanently unobstructed
- All major backbone pathways should be connected by 3 X 100mm conduits
- Each building should be connected to external pits from different sides of the building via 2 X 100mm conduits each to provide redundant fibre paths
- Pit Size: Pits shall be at least 600 x 300 x 600mm deep, unless otherwise specified.

The completed pit installation must include a 150mm x 150mm concrete collar around the pit, finishing flush with the ground and top of the pit.

- 100mm yellow metal guard posts must be installed on diagonally opposite corners finishing 1.2 meters above the ground. The posts must be set 600mm below ground into a 200mm bore with concrete.

- Manhole Construction: Walls and bottom shall be rendered brickwork, 75mm thick concrete moulded. Incorporate an additive to render or concrete to prevent the ingress of water.
- Plastic pits: Plastic pits can be used in grassed and foot pass way areas only. They are not used on roadways.
- The word “COMMS” or “COMMUNICATIONS” shall be moulded into the lid where used for communications. Lids shall be of a lockable design.
- The pits shall be bedded with a minimum of 100mm gravel aggregate.
- Drainage holes: Provide each pit with a drain hole in the base, positioned to drain into a drainage pit.
- Drainage pits: Provide a drainage pit filled with rubble, graded away from each cable pit for 2000mm. The minimum size of the drainage pit shall be 300mm wide by 300mm deep.
- All new underground conduits shall be WHITE in colour and be installed in compliance with AUSTEL/ACA Technical Standard TS009
- All conduits shall be installed with a 3mm nylon draw cord. The draw cord must be replaced with any new cable drawn in.
- Optic fibre cables will be labeled in each pit it goes through with " Optical Fibre - Caution " also the building it comes from and goes to as well as a contact phone number for TS with a label no less than 3cm*2.5cm that is self laminating wrap around

13.2. Trenching

- Requirement: Excavation plans must be submitted to the Manager Facilities prior to excavation.
- Roadways: Do not excavate roadways and driveways. These areas are to be under bored. Locate other services before proceeding with trenching. Locations of existing services can be obtained from the Manager Facilities.
- Specification references: Protection of persons and property - preliminaries, service trenches - groundwork and excavation in public areas groundwork.
- Existing surfaces: Saw cut existing concrete or bitumen surfaces in a straight-line to a depth of 75mm before excavation is commenced. Lift and store paving slabs for later reinstatement.
- Excavation: After excavation, clear trenches of sharp projections. Installation depth must be referred to Manager Facilities when rock is encountered in the excavation.
- Reinstatement the surface to the match existing. Approval must be obtained from appropriate authorities prior to excavations beyond site boundaries.

13.3. Cable in trenches

- Draw cords: All conduits shall be installed with a 3mm nylon draw cord.
- Sand: Provide clean sand around cables and conduits installed underground. The sand is to be flooded with water floors installation to achieve maximum compaction levels.

- Underground roadways: Under roadways and areas subject to traffic movement, install cables in a duct or conduit extending to not less than 1m on either side of the sealed surface or trafficable area and encase in concrete having a minimum cover thickness of 100mm.
- Sealing ducts conduits: Seal the buried entries to ducts and conduits with a pliable AND non-setting waterproof compound. Seal spare ducts or conduits immediately after installation and seal the others after the cable installation.

13.4. Backfilling trenches

- Garden areas: Backfill the top 150mm of the trench with topsoil.
- Lawn areas: Re-loam the top 150mm and resow trenches passing through existing lawns.
- Excess soil: Remove from the site unless otherwise directed.
- Existing assets: Reinststate existing surfaces and assets distributed or removed as a result of the excavation of trenching.
- Concrete surfaces: Reinststate concrete surfaces to the original level using approved reinforcing steel, keyed to the existing and laid to prevent reinstated concrete from subsiding and cracking.
- Bitumen surfaces: For existing bitumen surfaces, camber the reinstated surface so that the edges are flush and the centre is 10mm above the existing pavement. Fill the top 150mm below the bitumen surface with mechanically compacted finely crushed gravel. Prime coat the existing bitumen edges of the trench with bitumen prior to laying 75mm minimum of hot pre-mix bitumen to the finished cambered surface. If it can be shown that the pre-mix is not available, cold pre-mix will be accepted.

14 Wireless (WIFI)

14.1. Wireless Access Points CABling

- Wireless Access Point Cabling: The deployment of wireless access point (WAP) cabling must be carried out in consultation with Technology Services - Infrastructure Platforms team. The placement of WAPs must be documented on the building plans and provide to the IP Team prior to installation to ensure the locations are compatible with the SCU Wireless Service.

14.2. Wireless Devices and Building Structures

- Any building management system must use wired network connections and not WIFI so they don't conflict / interfere with the SCU Wifi Service.
- Any client wifi solutions must use the SCU authentication method and be tested by the IP Team before they are purchased. Otherwise they will not be able to be connected to the SCU Network.
- Workstation structures such as Pods, must be designed and constructed with material that does not disrupt or inhibit SCU WIFI signals.