



University of the South Pacific

Estates & Infrastructure
DESIGN STANDARDS AND GUIDELINES

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Modifications and Approvals

Version	Issue Date	Modification Clause(s)	Comment	Approved By
E1A1	03/04/14	Relabel QUT to USP	QUT addition adopted without amendments	Mervyn Lepper
2	03/03/25	USP Design Standard and Guidelines		Mervyn Lepper

1 Introduction

The USP Design Standards and Guidelines (DSG) describes building design and construction practices, technical standards, specifications and principles to be followed, as well as defining the internal USP procedures to be followed where design and construction may need to differ from these stated requirements.

1.1 Purpose of DSG for Consultants and Contractors

The DSG collates the detailed requirements for the design and construction of USP projects for the understanding and use of Consultants and Contractors.

This document forms a part of all design and/or construction projects and is in addition to the project specific 'Scope of Work'. All contracts must specify the Edition and Amendments of the DSG pertaining to the project.

1.2 Review Process

This latest version of the DSG is available on the Estates and Infrastructure Services homepage: [Design Standard and Guideline](#)

1.3 Reasons for having standards

These standards are set for reasons including:

- ☐ Controlling building and environment aesthetics
- ☐ Establishing and maintaining safe and healthy working and learning environment
- ☐ Minimising risks to environment and promoting sustainable practices
- ☐ Providing equity in the physical environment
- ☐ Minimising life cycle costs
- ☐ Savings gained through bulk purchasing

1.4 Document Layout

Part	Description	Section(s)
Introduction	General	Section 1
Part 1	Architectural	Section 2 to 20
Part 2	Building Services	Section 21 to 33
Part 3	External Design	Section 34 & 35
Part 4	Documentation Requirements	Section 36

Consultants and Contractors (where applicable) are required to comply with all relevant parts of the document, not only the specific sub sections.

1.5 Legal Requirements

A key function of the USP DSG is to uphold our legal obligations and commitments.

It is the responsibility of the Consultant and/or Contractor to ensure all legal requirements, standards and obligations pertaining to building design and/or construction of a facility are diligently met when undertaking work for USP. Refer to [Section 17 Workplace Health and Safety](#). If there is conflict between the DSG 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 Responsible USP Officers must occur. Refer to Table in this section.

Where any standards are quoted, reference shall always be made to the most recent edition.

1.6 Definitions

Principal

For all University projects the Principal shall be USP through the Director, Estate & infrastructure Services.

Construction Authority

The Construction Authority for all University projects shall be the Estate & infrastructure Services.

Superintendent

Unless nominated otherwise, the Superintendent shall be the USP Project Manager.

Design Coordinator

Generally, communications with the University, requests for approvals etc., shall be addressed to the University's Design Coordinator in the first instance. The Design Coordinator shall arrange for subsequent internal approvals as required. (Refer PPK. for Roles & Responsibilities)

Definition of 'Approved'

Wherever the word approved or approved by USP are used, they shall mean approval by the Approval process detailed in Section 1.7

1.7 Requests for Variation from Current DSG standards or specifications

Requests for Variation from Current DSG standards or specifications

All requests for deviations from current DSG shall adhere to the following process.

Final Approval

Final approval for departure from existing DSG standards will be reviewed and agreed to by the Director Estates and Infrastructure Services prior to the calling of construction tenders. Approvals for non-compliances required post tender will follow the same process.

DSG Standard Review

All approvals information will be forwarded to the Manager Design for consideration in future DSG amendments.

Precedents

Where there is a difference between the current DSG standard and the BCA, AS or other standard, the standard which provides the highest standard of risk mitigation shall take precedence.

1.8 Certificate of Compliance with DSG

A completed “Certification of Compliance” must be completed for all projects.

A request for approval of the variation must be made to the USP Project Coordinator. Relevant *Responsible USP Officers* will be consulted.

A recommendation for approval must be obtained from the Manager Design.

Table of Responsible USP Officers for non-compliance recommendation and reviews

Sect. #	DSG Section name	USP Position
1	Introduction	Manager Design
2	Planning Controls	Director E&I
3	Architectural Design	Manager Design
4	External Walls and Windows	Manager Design
5	Internal Walls	Manager Design
6	Floors	Manager Design
7	Ceilings	Manager Design
8	Roofs	Manager Design
9	Furniture and Fittings	Manager Design
10	Doors, Hardware and Locks	Manager Design
11	Building Security	Manager Security Services
12	Structural design	Manager Design
14	Acoustics	Manager Design
15	Painting	Manager Design
16	Access for PWD	Manager DRC
17	Workplace Health and Safety	Manager OHS
18	Signage	Manager Assets
19	Teaching Spaces	Manager Assets
20	Laboratories	Manager Design
21	Videoconference Facilities	Director ITS
22	Audio Visual	Director ITS
23	Air Conditioning and Ventilation	Manager Contract & Admin
24	Water Supply etc.	Manager Contract & Admin
25	Other Piped Services	Manager Contract & Admin

26	Electrical Services	Manager Contract & Admin
27	Data & Communications	Director ITS
28	Lifts	Manager Contract & Admin
29	Fire Services	Manager OHS
30	Fume Exhausts and fume Cupboards	Manager Design
31	Building Management System	Manager Contract & Admin
32	Colour schedules for Plant and Equipment	Manager Contract & Admin
33	Roads Footpaths and Car parks	Manager Contract & Admin
34	Landscape	Manager Contract & Admin
35	Documentation	Manager Assets

2 Planning Controls

2.1 Development Controls

Master Plans/Development Plans

Master Plans and Development Plans are in place for each USP location and must be referenced as the basis for determining development parameters for any USP site. Master/Development plans must be complied with unless amendments are agreed to in writing by USP. USP Master/Development Plans can be found in the link provided below.

<https://www.usp.ac.fj/estates-infrastructure/campus-property-information/>

Local Authority

All developments within all USP properties must comply with the local Town Planning Acts and any standard requirements of the Town/City Councils or relevant local authorities.

Design Principles

The following Design Principles must be considered and incorporated in all designs for any developments within USP lands.



Heritage Sites

Modifications to USP's Heritage sites must follow the guidelines of local relevant Government Departments. Development Applications for heritage sites should be made to the relevant Government Department as required prior to the start of any works on site.

2.2 Legislation Controls

All work shall be designed and constructed to comply with statutory requirements including, any Building Acts, local

Building Codes, Local Government Ordinances, Fire Safety Acts, Anti-Discrimination Legislation, Environmental Protection Legislation and the Workplace 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.

2.3 USP Planning Controls

Space Management

The University views Space as a resource, the same as financial allocations in the form of annual budgets. As a resource, University Space is limited and is an essential component for Academic Units and Sections to meet their strategic objectives. To ensure that the University manages its spaces across all campuses in a manner that is equitable, efficient and effective in line with recognized best practice. It sets the principles for the allocation, utilization and management of university space. Therefore, any changes to any space within USP, including any new development must comply with USP's Space Management Policy. As required by the policy, all new developments shall require a Space Application Form endorsed by the DVC RC & E&I. The Space Management Policy and Procedures can be found in the link provided below.

<https://policylib.usp.ac.fj/form.categorydetails.php?id=2>

Building Maintenance

To ensure that the University buildings and properties, their systems and equipment, provide a safe, reliable and secure environment that is:

- fit for purpose and addresses maintenance-related risks, complies with standards for learning, teaching, research and working set by the University
- compliant with current legislation and follows a systematic process to address maintenance needs.

All planning for the maintenance related works to any university owned or leased property (subject to the terms of lease agreements) must comply with the USP Building Maintenance Policy and Procedure. The Building Maintenance Policy and Procedures can be found in the link provided below.

<https://policylib.usp.ac.fj/form.categorydetails.php?id=2>

Capital Building Projects

To ensure key capital project objectives are achieved. These include but are not limited to controlling risks, achieving value for money, satisfying funding requirements and ensuring compliance with statutory and regulatory requirements. All Capital Building Projects must comply with the USP Capital Building Projects Policy & Procedure. The Capital Building Projects Policy & Procedure can be found in the link provided below.

<https://policylib.usp.ac.fj/form.categorydetails.php?id=2>

Review Process

All USP Design Documentation (Building & Property) must undergo review and attain sign off from the following USP departments (where applicable) prior to the finalization of the Design.

- OHS Department
- Disability Resource Centre
- ITS Department
- Security Department
- Client/End User
- Estates & Infrastructure Department

Approvals

All USP Design Documentation (Building & Property) before being submitted for Tender must attain following final approvals from the below persons:

- Design Manager
- Director Estates & Infrastructure

Flexibility

Buildings shall be designed to be as flexible as possible internally to facilitate future changes in function and configuration. Load bearing walls shall be minimized and restricted to areas such as the building core for stairwells, lift shaft and toilets. All other internal walls and partitions shall be non-load bearing. Building services must be designed to be easily accessed and expanded and to allow for future flexibility.

Disability Resource Center

The key role of the Disability Resource Center (DRC) is to develop an organizational culture that values diversity and equal opportunity. The DRC will advise on matters of access. The regulatory requirements for persons with disabilities must be considered and where particular needs are identified in the briefing process, the University's Disability Resource Center must also be consulted.

The University recognizes that people with limited mobility face additional barriers to access to buildings and facilities. It is reasonable that people with disabilities be able to make their way around with a similar degree of ease and safety as experienced by other campus users. It is recognized that in making buildings and facilities accessible to people with disabilities others will also benefit. The University has adopted a Disability Inclusiveness policy which recognizes its social and legal obligations to provide an accessible and inclusive environment for people with disabilities. Designers are to have regard for the requirements of the Policy when planning and designing buildings. For USP's Disability Inclusiveness Policy, refer to the link provided below:

<http://policylib.usp.ac.fj/form.search.php?search=disability>

3 Architectural Design

3.1 General

In this section the requirement for the Functional Design Brief and a number of architectural design issues are outlined. Space standards, requirements for additional spaces and target building efficiencies are given.

3.2 Functional Design Brief (FDB)

For all project's a Design Brief is to be prepared by the Design Coordinator in consultation with the Assets Team. The Design Brief must be approved by the Design Manager and submitted to the CAD Technicians prior to the development of Concept plans.

The Design Brief must incorporate the project specific requirements of the USP stakeholders and be revised or updated if there are changes to the project

3.3 Contents of Functional Design Brief (FDB)

The following list outlines the general requirements per project. Select what is required and discuss exclusions with USP.

- Project Number and Name
- Introduction
- Background Data
 - USP context
 - include Master Plan
- Project Scope
- Project Development Considerations
 - Environmental requirements
 - Procurement Method
 - Geotechnical and Drainage Requirements
 - Critical Outside Agency Involvement
 - Right-of-Way Requirements
 - Utility Relocation Requirements
 - Traffic Requirements
 - Seasonal Considerations
 - Design Criteria
- Budget
- Locality Map
- Typical Section
- Schedule/ Timeline
- Other requirements

Design Brief Considerations for:**a. Laboratory Design**

Laboratory design require particular care. The designer must be fully conversant with applicable legislative requirements. Further, in this process, they must ensure that they clearly understand day- to-day operations, weekly events, monthly, quarterly or annual activities, integrally-stepped procedures, presence or absence of aids, student demand and class requirements (volumes and multiplications), apparatus effects, legal chemical storage requirements and those of good practice (e.g. decanting facilities for flammable goods and the requirement of AS2982:2010 that no flammables or volatile chemicals be stored in secondary or tertiary undergraduate teaching laboratories). [Section 20 Special Requirements for Laboratories](#) deals with these issues in more detail.

b. Ecologically Sustainable Development (ESD)

For each new project and for major refurbishment projects a detailed describing the project objectives responding to ecologically sustainable development (ESD) considerations must be prepared. This should address such issues as climatic-responsive design, long-term operating performance and life cycle cost assessment, energy efficiency strategies, building materials selection, use of renewable, and energy content of materials, storm water reuse and recyclability of components.

c. Fire Engineering Design (FED)

A Fire Engineering Design (FED) shall be established by the designers at the "Concept Development" stage, to investigate and evaluate all Fire Safety measures and systems proposed for the building to ensure that all the required criteria are met. In the development of the FED, liaise with the USP Services Team. Refer also [Section 30 Fire Services](#).

3.4 Safe Design Principles

Safe design identifies hazards and ways to control associated risks, and then incorporates this knowledge into the design of end products, to eliminate or reduce harm to people exposed to the products. Safe design can be considered in the design of:

- buildings and structures
- facilities
- hardware
- work systems
- equipment
- workplace layout and configuration

Safe design can apply to the design of the initial concept, use and serviceability, through to decommissioning or disposal of the end product. For designers, this will mean making choices about how the end product:

- is built, including what materials are used in its construction
- will be used
- will be maintained
- should be disposed of

While safe design has many benefits, there are also specific occupational health and safety (OHS) legal duties relating to safe design of buildings and structures, and plant (eg machinery and equipment).

A safe design approach should include processes to:

- 1 Identify hazards**
Identify the hazards relating to all stages of the product – such as hazardous manual handling or violence and aggression.
- 2 Assess the risk**
Assess the likelihood of the hazard causing harm to people.
- 3 Eliminate or control the risk**
Implement effective control measures to eliminate the risk, or if this is not possible, reduce the risk of harm to an acceptable level. For example, overhead tracking, noise reduction, machine guarding.
- 4 Review**
Review the effectiveness of the controls to ensure they are working to reduce the risk to an acceptable level.

Safe design is most effective when all stakeholders are consulted and contribute to the end product, facility or environment.

Identifying the hazard and eliminating the risk early in the design process is not only the most effective way to reduce the risk of harm, but is often easier and cheaper than making changes later when the hazards become risks in the workplace. Safe design can save money, improve workflow, and reduce time lost from injury and illness, in turn improving:

- profitability
- employee wellbeing
- usability of the facility or product
- workforce productivity
- Business Continuity

Safe design can also encourage innovative ways to deal with hazards.

Responsibility for safe design rests with groups or individuals who control or oversee design functions, including:

- architects, designers or draftspersons
- persons who may make design decisions during any of the lifecycle phases, such as engineers, manufacturers, suppliers, installers, builders, developers and project managers
- anyone who may alter the design
- designers of building services
- designers of fixed plant, such as electrical systems
- purchasers of the end product

3.5 Building Legibility

Design consideration must be given early in the design process to the legibility of the building and, in particular, the ready visual identification of entry/access points. While this is partly in response to Crime Prevention Through Environmental Design (CPTED) considerations, it also relates to the convenience of users and effective way-finding on each campus.

Allowance should be made in the design of the external entry facade of the building for the installation of any major signs in conformity with USP graphic standards - Please refer to [Section 18 Signage](#)

3.6 Solar Control

The orientation and positioning of new buildings must be such that solar control is facilitated, natural lighting to the interior maximised and views from the building are considered.

Particular care should be taken to screen against solar heat gain and glare on the faces of buildings and to avoid problems for adjacent buildings by reflections. The preferred solution is through appropriate shading of external glazing. Refer [Section 4 External Walls and Windows](#).

Sun shading and screening shall be included in the building design and provided by features such as slab projections, overhangs, fins and blades etc., of low maintenance materials. Windows on western facing facades are to be avoided, and eastern facing windows shall be minimised. Windows on the northern facade shall be designed such that the summer sun is excluded, but advantage can be taken of the winter sun. All external doorways, entrances and porches shall have protection from weather, except where precluded by building legislation. Excessive glare from summer and winter sun is to be avoided or controlled. Reflective glass shall not be used, except in exceptional circumstances and only with the express approval of USP.

3.7 Natural Light

Perimeter rooms are not to block the transmission of natural light into interior corridors or other spaces. Daylight may be borrowed through the use of glazed walls or windows. Glazed walls must be clear glass unless approved by the Director of Property & Facilities.

3.8 Wind around Buildings

For an individual building or groups of buildings, designers need to be aware of the problems of wind turbulence and wind-tunnelling, particularly at the Gardens Point site. (Wind tunnel tests have been carried out for buildings along the freeway, and reports of these tests are available for information.)

Site wind patterns are generally defined in the Site Master Plans and must be assessed as part of the design.

3.9 Lighting and Finishes

The energy efficiency requirements of Section J of the BCA must be considered during the design stage. The reflectance values of finishes must be determined early in the design phase as the lighting system designer requires this information to determine a lighting design that does not compromise the level of illumination of the working environments or safety of other areas.

Minimum reflectance values:

- 3.9.1 0.8 for ceilings
- 3.9.2 0.6 for walls
- 3.9.3 0.4 for floors

The reflectance schedule along with a draft colour and finishes schedule must be presented to USP prior to calling tenders and an updated schedule included in the As Constructed documentation. The building certifier also requires this information as part of the assessment for building certification.

3.10 Acoustic Control

The anticipated ambient noise level should be determined and recognised in establishing types of partition and subdivision walls.

External ambient noise from traffic, aircraft and other buildings should be considered in determining details and materials of external facades, windows, roofs and the like.

Requirements are detailed in [Section 14 Acoustic](#).

Internal noise from plant room, hydraulic services (e.g. sewer, stormwater) pipes and air-conditioning systems must be considered in determining the overall design.

3.11 Crime Prevention through Environmental Design

CPTED Principles

All buildings, car parks, walkways, bicycle paths and their immediate environs shall be designed to incorporate Crime Prevention through Environmental Design (CPTED) concepts and strategies to achieve a positive working and learning environment whilst reducing the opportunity for crimes against University property, staff and students.

In general terms, CPTED is a process which reduces the incidence and fear of crime through the effective design and use of the built environment. The application of CPTED concepts and strategies in the design of buildings has direct benefit to the University by reducing losses through theft and vandalism, and enhancing the personal safety of staff and students.

Designers shall familiarise themselves with the application of CPTED concepts and strategies or engage the services of a specialist consultant to ensure that their designs meet the intent of these Guidelines. The "Queensland CPTED Guidelines" are publicly available via the Queensland Police Service web site. It is essential that designers clearly define the behavioural objectives for a given space and ensure that the design and use of that space supports those objectives.

The following design factors shall be given specific attention:

Lighting

See [Section 14 Acoustic](#) and [Section 11 Security](#)

Sightlines

The inability to see what is ahead because of sharp corners, walls, topographical features, landscaping, shrubs or columns is a serious impediment to feeling and being safe. These same features provide concealment for crimes such as assault, robbery, burglary, vandalism and graffiti. Designers shall maximise "visual permeability" and opportunities for "natural surveillance" and avoid "blind" corners, especially on stairs, in corridors, and in the location of toilets. All rooms should have glass panels from corridors to increase security and windows should be used to increase observation of external areas.

Entrapment Spots

Entrapment spots are small, confined areas, adjacent or near frequently used routes. They are typically shielded on three sides by opaque barriers such as walls or vegetation. For example, dark recessed entrances, loading docks, gaps in vegetation along paths, toilet airlocks, small courtyards or certain architectural features may create entrapment spots. Entrapment spots are to be avoided either through design, such as maze entry systems in toilets, or by restricting access to the space by using hardware such as grilles. Where an entrapment spot is unavoidable, it shall be lit to a minimum of 30 lux and brought to the attention of USP.

Isolation

Isolated placement of facilities such as toilets, public telephones, car parks, bus stops, pedestrian paths and tunnels, after-hours computer and science laboratories, libraries, etc. can increase fear on the part of the users and the opportunities for crime. Designers shall give careful consideration to mitigating the sense of isolation by using techniques such as incorporating windows to overlook pedestrian routes and locating the

above mentioned facilities off high circulation areas where opportunities for "natural surveillance" are enhanced. Toilets shall not be located within isolated corridors or adjacent to a fire exit.

Loitering

Designers shall avoid locating toilets or bathrooms adjacent to public telephones, external seating, vending machines, notice-boards, or any other item which may legitimise loitering in the vicinity of the toilet.

Transitional Space and Signage

The ability to easily navigate the university campus reduces confusion and enhances confidence on the part of students, staff and particularly visitors. Designers shall incorporate techniques such as landscaping, changes in texture and/or colour, placement of furniture, etc. to aid with "legibility" of the site and clearly define the transition from public to semi-public to semi-private to private space. Where signs are used, their meaning shall be clear and unambiguous, and they shall be strategically located at entrances and near the intersections of corridors and paths. Please refer to [Section 18 Signage](#)

The successful application of CPTED concepts requires designers to consider not only the proposed building and the activity which it supports, but also its relationship to neighbouring buildings and activities whether on or adjacent to the campus. Protective security measures shall be integrated with CPTED strategies, where appropriate, to further reduce crime risks and enhance personal safety.

Access to toilets

Access to toilets for people attending after-hours must be provided. The Security of the people, the logistics of unlocking doors or swipe card access and the path of travel must be considered.

3.12 Circulation

Foyers and Corridors

Foyer size and width of corridors shall be chosen to allow for high level use periods.

Vertical Transport

Vertical transport shall be provided in the design of all multi-level buildings. Lifts shall conform to all the relevant Codes and requirements for persons with disabilities.

External ramps as a means of interconnecting floors are not an acceptable alternative to providing a lift.

Stairs

Stairs shall be designed to conform to the requirements of the BCA and other relevant Codes. In general, treads should be not less than 280mm, and risers should not exceed 180mm and must be consistently dimensioned throughout each flight. Stairs shall have a non-slip surface, be readily cleanable, and have a 50mm strip of contrasting colour on nosings.

Fire Stairs

Fire Stairs may, in some instances, be approved for use as communication stairs for the day-to-day functioning of the building. The needs for the security of persons and property, and of maintaining the integrity of fire safety systems, must be weighed against the convenience of users and economic considerations (constructional and operational).

The use of fire stairs as communicating stairs shall be expressly approved during the FDB process by USP. When such use is approved, door hold-open devices or clear viewing panels are to be incorporated.

Where fire stairs are approved to be used for intercommunication between floors, and not solely for escape, the standard of finish in these stairs must be equivalent to adjacent public areas.

Refer also to [Section 30 Fire Services](#)

3.13 Identification of Campus, Building, Level, Room and Project

Campus Names & Abbreviations

The Property & Facilities Director will advise of approval of all new campus names and their two digit letter abbreviations. For example; Gardens Point campus = GP, Kelvin Grove Campus = KG, etc.

Building Names

USP Council has delegated authority to the Vice-Chancellor to approve the naming of University buildings.¹

Building Unique Numbers

All buildings (owned and leased) will have a unique building number, consisting of the campus abbreviation and a three digit number, for example **KG-158**. This number will be assigned by the Manager, Infrastructure Systems & Information based on the information in the Archibus Space Management system. All records for that building will be filed against that unique building number.

When a building is demolished the unique building number is retired. A new building in the same place will get a new unique building number.

When a leased building is vacated the unique building number is retired with the leased building.

Building Block Numbers

Historically all buildings of any size, in a campus, had a block letter assigned to it, that related to the discipline taught in the building. Due to limited letters in the alphabet and the number of buildings per campus, this is not possible anymore.

- 3.13.1 All significant buildings will have a unique alpha building letter that relate to that campus. For example KG-S block. But some limitations apply:
 - 3.13.1.1 If the building is owned by USP the alpha letter will be placed on the building entrance and it will be displayed on the campus maps.
 - 3.13.1.2 If the building is not owned, but significant then the alpha letter will be assigned to the building on all maps, but the alpha letter will not be placed on the building.
- 3.13.2 Where related buildings are located together in a cluster, a unique but common alpha letter and individual number combination will be assigned, like Z1, Z2, Z3, etc. The same limitations apply as follow:
 - 3.13.2.1 If the building is owned by USP the alpha letter and number will be placed on the building entrance and it will be displayed on the campus maps.

¹ QUT Manual of Policies and Procedures, Chapter H, Section 3.3.1

3.13.2 If the building is not owned, but significant then the alpha letter and number will be assigned to the building on all maps, but the alpha letter and number will not be placed on the building.

The alpha and cluster letter/numbers will be assigned by the Manager, Infrastructure Systems & Information.

Building Levels

Building floor numbering is determined as per the *USP Wayfinding Signage Manual*.²

Room Numbers

All room numbers must be assigned by the USP, Infrastructure Systems & Information Unit.

The Principal Consultant must email to fm_records@USP.edu.au the architectural design floor plans (in AutoCAD format) and room type descriptions to Property & Facilities, Infrastructure Systems & Information (ISI) Unit, wherever a project will cause a building floor plan to change or a new floor plan to be created.

All As-Constructed drawings and equipment schedules must only display the USP assigned room numbers!

Project Number

The USP project number starts with the USP Work Request number followed by the building code. If the project is across two to five buildings, a separate project number will be issued for each building. Separate drawing sheets/files are required per building. These numbers are essential to our archive search system and must be obtained at the start of each project and included on all items of project documentation. Project numbers are to be obtained from the Project Coordinator.

3.14 Design Principles and Space Standards

The following design principles and space standards should be referenced by consultants and end users when undertaking projects at USP. These standards should be used as a guideline and may in some instances need to be modified to suit particular applications and circumstances. Regulatory requirements and intent under Workplace Health and Safety and other relevant legislations shall be complied with as a minimum.

Implementation of Work Space Planning at USP

In planning new work space layouts the University's Project Coordinators in conjunction with the consultants and end users will advise on the design. The proposed office layout must comply with the principles outlined in this standard and with the **Work Space Planning Policy**³ (Refer Section 1.2.4 of the *University Manual of Policy and Procedures*).

In exceptional circumstances variations of +/- 15% may be permissible (e.g. where extant physical or structural constraints or functional need dictates). In such circumstances the Director FM will make the final determination of the nature and format of the planned areas. Any plans that do not comply with this policy must be approved by the Director FM.

² Refer to Section 18, Signage and Appendix 18.2 Wayfinding Signage Manual, Issue C, Dated 15.11.2012

³ Refer The University Manual of Policy and Procedures, Chapter H, Section 1.2.4, Work space planning policy

Work Space Planning Policy

The *Work Space Planning Policy* has been adopted by USP based on a balanced consideration of end user needs with sustainable environmental and financial management practices. Under the *Work Space Planning Policy*, University staff will generally be accommodated within a flexible and open work space comprised of a variety of individual and shared work zones. Flexible, open work spaces with a variety of activity based work zones enable the University to:

- 3.14.1 Foster greater collaboration and exchange of knowledge between staff, students and other University stakeholders
- 3.14.2 Provide a greater level of amenity and choice to all staff in the workplace
- 3.14.3 Support a diverse range of end user functional requirements
- 3.14.4 Provide more flexible and efficient space that can readily respond to organisational churn
- 3.14.5 Reduce organisational costs and excess material wastage

Work Space Design Principles

The following design principles underpin USP's Work Space Planning Policy and should be referenced by consultants and end users to design sustainable work spaces that encourage collaboration and organisational transparency and that support end user functional requirements:

Principle 1 Openness & Transparency

Design open work spaces that encourage organisational transparency, maximise natural light and provide an appropriate level of amenity for all occupants:

- 3.14.6 Limit the extent of "enclosed built fitout" (partitions extending to the ceiling) and optimise open, flexible work zones. The extent of "enclosed built fitout" will be assessed on a project by project basis but should generally be limited to a maximum of 20% of the total modified area. Any variation to this limit will be subject to endorsement by the Director FM
- 3.14.7 Locate "enclosed built fitout" to areas either adjacent to the building's core or away from the building's perimeter
- 3.14.8 Use the building's perimeter for open, flexible work spaces to maximise natural light and outlook
- 3.14.9 Maximise the use of glazing on "enclosed built fitout"

Principle 2 Function & Variety

Provide a variety of individual and shared work zones that support end user functional requirements and that support collaboration and knowledge sharing. Such work zones may include:

- 3.14.10 Open plan, individual work points
- 3.14.11 Informal breakout areas
- 3.14.12 Meeting carrels and quiet zones
- 3.14.13 Team tables
- 3.14.14 Multi-purpose meeting and project rooms
- 3.14.15 Enclosed offices (Refer Section 3.15 Enclosed Office Fitout and Workstation Services)
- 3.14.16 Shared storage and utility hubs

When planning these work zones, key end user functional requirements that should be considered include (but are not limited to):

- 3.14.17 Effective consultation with students and other USP stakeholders
- 3.14.18 Quiet/focused individual tasks
- 3.14.19 Storage for a range of resources and artefacts

3.14.20 Adequate and appropriate levels of security and access for staff, students and other University stakeholders

Other design considerations may include:

- 3.14.21 Relationships between functions and how that translates to the layout of offices, workstations, other support facilities and equipment
 - 3.14.22 Planning requirements for links to adjacent buildings
 - 3.14.23 Collocation of dual functions for spaces not occupied full time
- 3.14.24 Zoning functions to avoid disruption due to conflicting acoustic and functional requirements. For example adequately segregating noisy functions (e.g. common facilities, kitchen, and resource areas) from quieter non-related functions. A key consideration in this regard is allowing for effective engagement with students and other University stakeholders while avoiding disruption to other end user functions
- 3.14.25 Providing spaces that address a range of end user privacy requirements (acoustic and visual). Whilst privacy may be required for some functions, open interaction is desired for others
 - 3.14.26 Providing ease of mobility and circulation
- 3.14.27 Providing a variety of support spaces which complement and supplement end user requirements. It is important to plan for adequate support space such as meeting rooms, storage, common utility facilities (printers, photocopying etc.), filing space, common library
- 3.14.28 Reviewing occupational ergonomics

Principle 3 Flexibility & Efficiency

Consider future flexibility and efficiency during the design stages to ensure the space can easily be modified and to reduce the cost of organisational churn:

- 3.14.29 Plan work spaces in functional zones
- 3.14.30 Plan for consistency with the base building (including the building's structural grid and mullions)
- 3.14.31 Design layouts based on modular space standards (particularly with respect to "enclosed built fitout")
 - 3.14.32 Provide sufficient flexibility to support organisational and physical re-configuration
 - 3.14.33 Provide sufficient flexibility to adapt to new technologies and new ways of working
 - 3.14.34 Incorporate multi-purpose zones
 - 3.14.35 Avoid use of built-in joinery
- 3.14.36 Design fitouts as separate elements that can easily be connected and disconnected for the purposes of reconfiguration, replacement and upgrade

Principle 4 Sustainability

Procurement:

Contracting and design of workspaces, furniture and fittings should be based on the elements of sustainable procurement which include the following:

- 3.14.37 Meeting the users' needs (functional, fit for purpose)
- 3.14.38 Delivering long term 'value for money' by considering whole-of-life costs
- 3.14.39 Maximising social and economic benefits
- 3.14.40 Avoiding adverse impacts to the environment and human health
- 3.14.41 Referencing independent, sustainable purchasing guides for fitouts and furniture

Environment:

Design for environmental sustainability by considering the following:

- 3.14.42 Materials and fittings selection
- 3.14.43 Reduce material use
- 3.14.44 Minimise embodied energy
- 3.14.45 Reuse furniture and fittings
- 3.14.46 Use recycled content
- 3.14.47 Consider whole-of-life environmental impacts and management

Indoor environment

- 3.14.48 Reduce adverse impact of design and materials on indoor air quality
- 3.14.49 Optimise use of natural light and ventilation for users comfort

Shared conveniences

- 3.14.50 Provide centralised waste receptacles
- 3.14.51 Include adequate recycling facilities with intuitive design and/or signs to encourage recycling
- 3.14.52 Allow for central printing stations with controls to minimise ink, paper and energy use
- 3.14.53 Provide water stations for filling glasses or larger water bottles

Space Allocation

The following space standards are to be used to determine the schedule of areas for work space projects being undertaken at USP:

Where a work space area accommodates 10 or more FTE, a gross space allocation of up to 14m² UFA/FTE will be provided. Where the group size is less than 10 FTE, a reduction to 10m² UFA/FTE (gross) or less may be proposed dependant on the availability of other support facilities and approval from the Director FM.

Note that UFA includes “enclosed built fitout” (partitions extending to the ceiling for rooms such as offices, meeting rooms, tea or lunch rooms, secure storage rooms, etc.) and “open plan areas” (such as workstations, breakout and informal meeting spaces, waiting areas, secondary circulation, shared storage, printing/resource areas etc.). UFA excludes toilets, stairs, lifts, plant rooms, data centres and primary circulation.

The extent of “enclosed built fitout” (partitions extending to the ceiling) will be assessed on a project by project basis but should generally be limited to a maximum of 20% of the total project area. Limiting the extent of “enclosed built fitout” serves to optimise an open and flexible work space. Any variation to this limit will be subject to endorsement by the Director FM.

a) Enclosed Offices

Enclosed offices will only be provided where there is a demonstrable functional requirement. An example of a functional requirement is where the majority of an officer’s time is spent in completely confidential work (such as staff counselling) and access to a shared meeting room is not appropriate.

Where there is a demonstrable functional need supported by a recommendation from the Executive Dean of Faculty/Head of Division, a standard enclosed office of 11m² may be provided in accordance with Section

- 3.15 *Enclosed Office Fitout and Workstation Services* and subject to endorsement by the Director FM in consultation with the Vice-Chancellor, USP.

b) Storage

USP recognises the importance of providing adequate storage for both academic and professional staff. Where possible, staff should maximise the use of digital storage options provided by USP. As a supplement to digital storage, new workspace projects will address the provision of adequate physical storage through a range of personal and shared design solutions. These design solutions include:

- Personal storage located at individual workstations and in enclosed offices
- Shared, team storage/libraries located in areas adjacent to team clusters
- Shared facility and resource hubs located throughout the total work space
- Shared secure storage located where appropriate

Building Efficiency

Building efficiency, (UFA/GFA x 100) calculated in accordance with the definitions published by TEFMA (which are based on NPWC definitions), shall be not less than the following:

Science type	65%
Humanities type	70%
Library	80%
Administration	70%

Teaching Space

All new and refurbished general teaching rooms must have a minimum of 2m²/student. This applies to all general teaching rooms at USP including all seminar rooms and tutorial rooms. Other teaching spaces, such as lecture theatres, computer rooms and specialist studios, must be sized so that they are fit for purpose.

All teaching rooms and student facilities must allow for access by students and staff with disabilities. This requires wheel chair access to all facilities and impacts on the space requirements. Refer also [Section 16 Circulation & Access for People with Disabilities](#) and [Section 19 Teaching Spaces](#).

- Classrooms 2m² per person
- Lecture room/theatre, including bio-box from 150 to 600 seats 1m²/seat plus 30 m² to 75 m² dependent on layout and to accommodate bio-box.
- Computer Laboratories 3-3.5m²/station
- Computer Room/V lab style 4m²/station
- Science Laboratories 4m²/student

The size required will depend on the layout required for teaching and the need to provide access for People with disabilities.

Library Space

For major projects, particularly if the building is off Campus the Library must be consulted for space requirements for the delivery of their services.

Reading space including associated passageways 2.5 m²/place

Open access book stacks including gangways and aisles 2.2m²/double sided 900mm shelving unit Compactus storage areas including aisles per volumes 1m²/360 book volumes

Note even where a library is not part of the brief there may be a need to provide additional library services, see item below "Library Services"

Space Reporting Requirement

For all Major Projects an areas schedule must be provided at the completion of the sketch design stage. This is used by the Maintenance and Cleaning sections in their forward planning. The schedule is to have GFA, UFA and a breakdown of non-usable areas. The format is to be agreed with USP.

3.15 Enclosed Office Fitout and Services

This section should be referenced by consultants and University end users in conjunction with *Section 3.14 Design Principles and Space Standards*

Enclosed Offices Partitions

Generally enclosed offices will be formed with floor to ceiling partitions as follows:

- Partitions to the front and sides of an enclosed office are to maximise the use of full height glazing.
- The front partition will be fully glazed with no blinds, film or un-authorised signage.
- The side partitions will be predominantly glazed allowing for a component of the partition to be solid to accommodate building services where necessary.
- Glazing to side partitions should generally be free from blinds, film or un-authorised signage except where an office is adjacent to a meeting, conference or training room. In this instance a plain, translucent film may be applied to the shared partition (between 450mm and 1850mm above the floor) to provide a level of visual privacy but maintain transfer of light.

Doors

- Where possible, doors to enclosed offices should be avoided
- Where there is a requirement for a door, a full height, glazed sliding or hinged door should be used
- Doors are to be free from blinds, film or un-authorised signage

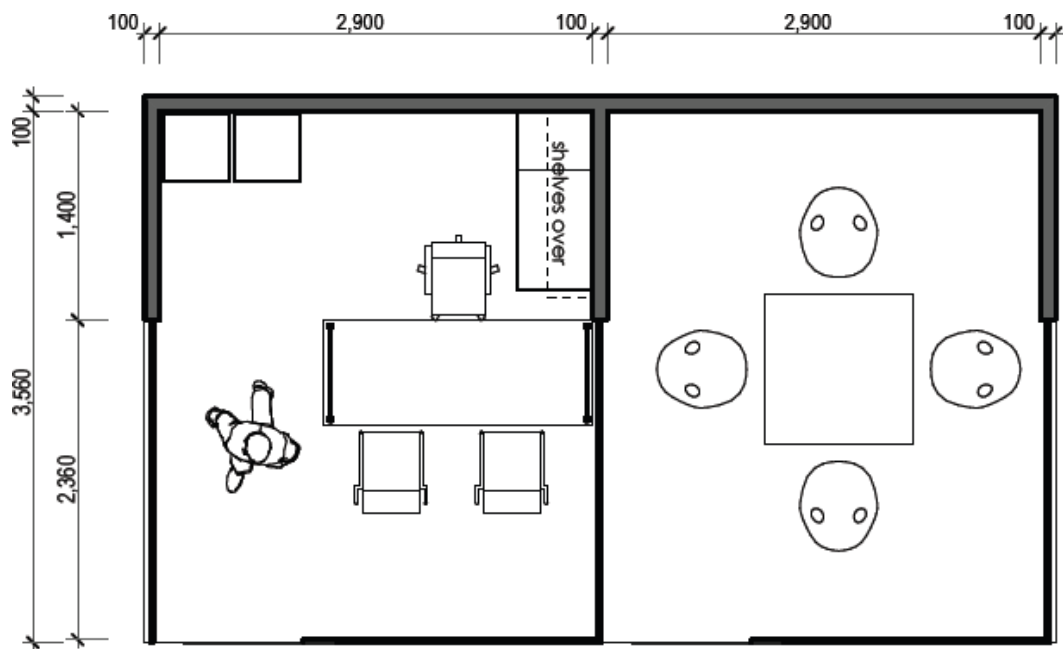
Furniture

- Refer *Section 9.12 Office Furniture*.

Services

- For enclosed offices provide 4 double GPO and 2 data outlets
- For workstations in open work space areas provide a minimum of 2 double GPOs, a telephone outlet, and 2 data outlets.

Indicative layouts demonstrating fitout components for a standard 11m² enclosed office are provided on the following pages.

Option A - Indicative fitout for a standard 11m² enclosed office adjacent to an 11m² meeting room

Maximum use of glazing to front and side partitions.

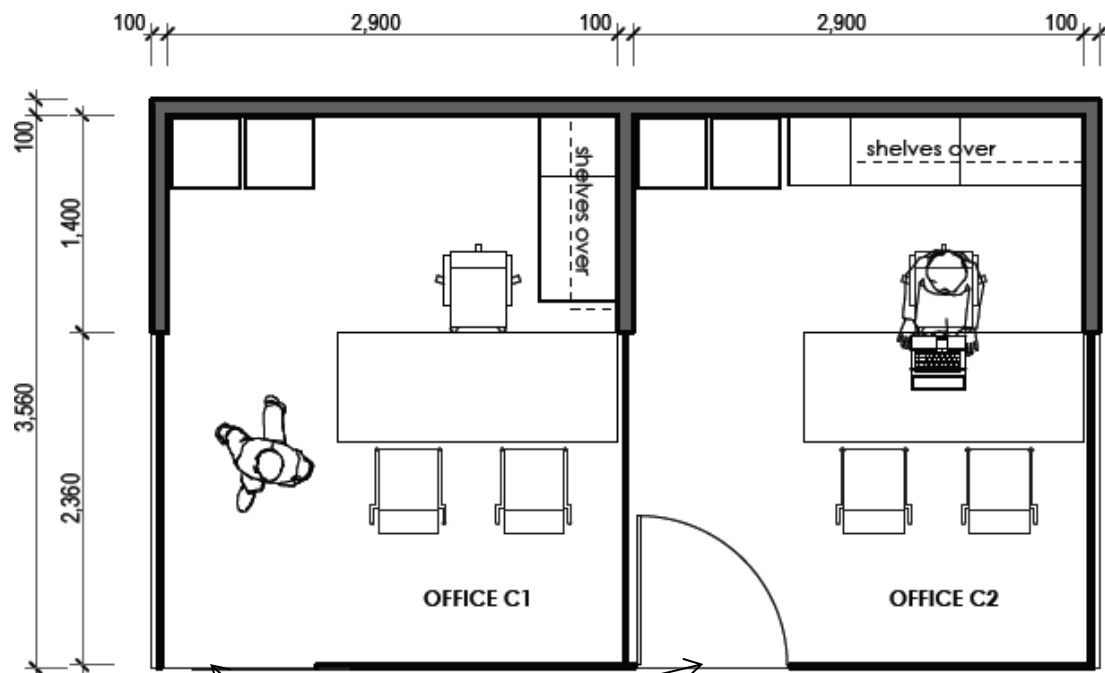
No film or unauthorised signage

Component of partition solid to accommodate services

Plain, translucent film to glazed, shared partition between office and meeting



Option B - Indicative fitout for a standard 11m² enclosed office adjacent to an 11m² enclosed office



Use of glazed door (hinged or sliding).

Component of partition solid to accommodate services

No film or signage to glazing of shared partition

Maximum use of glazing to front and side partitions. No film or unauthorised signage



3.16 Workplace Amenities

Workplace amenities requirements are defined in WH & S Act and Regulations. Changes to legislation in January 2005 now specify requirements for the provision of:

- First aid facilities, Toilets, Hand washing facilities, Drinking water, Dining facilities, Dressing Rooms, Showers, Lighting, Ventilation, Work area spaces and airspace.
- These Regulations align WH & S Amenity requirements with the BCA and QDC for design and construction of buildings or workplaces. However, the intent of the WH & S Regulations may require minor variations in some areas, to achieve health and safety performance outcomes.

3.17 Service Space Requirements

Refer also to each section in Part 2

Cleaners' Rooms

Cleaners' rooms are to be located on each floor and shall be a minimum of 3m² in area. Each cleaner's room shall contain a cleaners' sink with tiled splashback and shall be connected to hot and cold water. The floor shall be finished with non-slip vinyl with coved skirtings. Adjustable shelving (4 linear meters) to be provided. Doors must open out.

Shower Facilities

Provide in each new building a minimum of either one combined Unisex/PWD shower or one each separate male and female shower facilities. Each facility to have hot and cold water, closable doors, benches, shower screens, hooks, mirror, and shelves. The facilities should be located at or near ground level. Where the facilities provided also serve PWD requirements, the requirements of [Section 16 Circulation & Access for People with Disabilities](#) apply. Review with USP on the need for additional showers.

Bike Storage and ventilated wet-gear Storage

Per major project, discuss the need for lockable bicycle storage with USP and for the provision of a secure drying area and locker area for sporting gear.

Gardeners/Building Maintenance Store

A room of 10m² (minimum) in area should be provided at ground level with external access in each building. The room shall have one GPO at a height of one metre and a cleaner's sink with 20mm cold water hose cock. The external door shall have a clear opening width of one metre and shall be outward or upward opening. Provide appropriate storage for flammable liquids, chemicals and the like, which may include the need for proprietary cabinets.

Valve Room

One major service duct riser shall be accessible from outside the building at ground level in which all main services isolation valves, meters, RPZD and the like shall be located.

Service and Storage Areas

Particular care is to be taken in the design of these areas to provide convenient access to industrial waste bins and other rubbish containers while at the same time providing suitable visual screening. Adequate provision is to be made for the secure and ventilated storage of gas bottles where required.

Plant Rooms, Communication rooms, Specialist Service Rooms and Service Risers

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.

Sufficient unencumbered space around fixed plant shall be provided to enable safe access to all parts of the facility or equipment and allow for special activities such as refuelling.

Vending Machines

Consideration shall be given in the design of public external spaces adjoining 24 hour access facilities such as lecture theatres, libraries, or commercial buildings on University campuses for the installation by others of vending machines. Allowance should be made for lighting, power, water supply and drainage to sewer. Vending machines shall only be located in areas approved by USP and in all cases must be aesthetically integrated into the space.

Library Services

For major projects, particularly if the building is off Campus the Library (TILS representative) must be consulted for space requirements for the delivery of their services.

4 External Walls and Windows

4.1 General

This section should be read in conjunction with:

- 4.1.1 [Section 2 Planning Controls](#)
- 4.1.2 [Section 7 Ceilings and Ceiling Finishes](#)
- 4.1.3 [Section 11 Security](#)
- 4.1.4 [Section 27 Electrical Services](#)
- 4.1.5 [Section 12 Structural Design](#)

4.2 Materials

External walls shall be of brick, concrete or full height glazing. Concrete masonry shall be standard grey, but feature bands or panels may be introduced using white or off-white or other colour approved by USP. Concrete may be off-form, board finish or shuttered finish, or have aggregates exposed by light sand blasting. Pre-cast concrete panels in similar colours may also be used. The minimum quality of visible concrete finish shall be equal to or better than Class 2 Formwork, Type B colour control. Split-face concrete blocks are generally not to be used, except for design detail.

At Gardens Point, the external walls may be of brick in a brown colour, with contrasting dark banding.

On all sites the use of pre-finished metal-faced sandwich panel and metal/composite cladding systems may be considered with USP approval.

Factory pre-finished CFC cladding may be considered for approval by USP.

Concrete masonry is discouraged but may be considered for approval by USP FM Operations

Paint finish to minimal external areas is acceptable - colour and type of paint is to be to the approval of USP FM Operations.

4.3 Finishes

As-constructed finishes that minimise future maintenance shall be the designer's highest priority. Paint finishes to external walls may be acceptable but ease of maintenance, particularly ease of access, must be thoroughly considered and require approval by USP FM Operations before paint to external walls may be used. All materials shall be selected for their likely availability and colour consistency over a 15-year building period.

All materials and finishes shall be approved by USP. For Steel work see [Section 11 Security](#) and [Section 12 Structural Design](#) requirements for corrosion protection requirements.

4.4 Colours

In certain areas it may be useful to introduce specific colour schemes to highlight features such as School entrances or roof mounted equipment. All colour schemes are to be approved by USP FM.

4.5 Construction & Design

Buildings with in-situ concrete external walls shall be designed with particular care and consideration given to the avoidance of possible future effects of shrinkage and cracking leading to corrosion of reinforcement and eventual spalling of concrete. Any such designs will be critically examined and structural guarantees will be required.

Energy Efficiency

The Solar Absorptance Value of the gross wall areas should be taken into account regarding the overall thermal capacity building design to minimise energy use and provide improved thermal comfort conditions. ABCB Section J refers.

Control Joints

External walls to buildings shall be designed with particular care and consideration given to the effects of shrinkage and cracking, with appropriately sealed control joints that suit the construction materials.

Facade Staining and Brick Jointing

Facade staining (efflorescence, mould, mildew) shall be avoided by careful design and detailing to shed water clear off the building, clear of lower projections and clear of pathways. Wall/ parapet capping shall be designed to ensure facade staining is avoided, by including protection such as flashings or capping to the top surface to eliminate water entering walls and cavities at this point and having the surface angled to allow run-off.

Mortar joints to face brick shall be ironed to a half round radius, struck flush or other joint profile which will not collect surface debris. For similar reasons, raked joints and level sill surfaces are not permitted.

Signage

Allowance should be made in the design of the external entry facade of the building for the installation of the building identification. Refer [Section 18 Signage](#).

4.6 Eaves Linings

Eaves linings (external soffits) shall be of pre-finished material adequately fixed and sealed against the ingress of moisture, dust and the like which may lead to corrosion. For buildings of low-rise construction, fibre cement such as DECORVENT sheeting may be used.

4.7 Windows

Open able Window Design

Open ability is to be provided for ventilation purposes in non-air-conditioned spaces. Pivot hinge windows can open outwards or inwards. Outward opening pivot windows should not be used in locations in proximity to pedestrian circulation areas.

For purposes of design, Terrain Category 2.5 shall be used as a minimum. All openable windows, irrespective of level, shall be factory fitted with window locks which comply with the requirements of [Section 10 Doors](#). Louvre windows shall not be used, except in special USP approved applications.

The design of the walls at windows and doors shall ensure that the cavities between the inner and outer walls are suitably flashed and the cavities are closed with the wall material and not aluminium angles.

Not less than 30% of windows shall be open able to achieve ventilation in cases of air-conditioning failures, and ventilating smoke/hazardous fumes. Every room and every bay of windows on the perimeter must have at least one open able window. Windows to toilet areas shall be provided with obscure glass.

Finishes

All aluminium shall be either anodised or powder coated.

Anodising: The minimum thickness of anodising shall be not less than 20 microns.

Powder coating: Powder coat shall be of a quality commensurate with the application and shall be equivalent to Duratec X15, Super Durable Polyester or better.

Warranty: to achieve a manufacturer's warranty for film integrity and for colour of a minimum of ten years. (Where bright colours are used, FLUOROSE TFP may be required to achieve warranty requirements.)

All exposed screw fixings, rivets, cut edges and the like, shall be of stainless steel or other non-corrosive material compatible with the frames and coloured to match

Solar Control

A high level of sun shading and screening shall be included in the building design and provided by features such as slab projections, overhangs, fins and blades.

The use of high performance solar or coloured glass is acceptable in areas where heat and glare may be a problem. Applied reflective film to glass and highly reflective glasses shall not be used.

Windows on western and eastern facing facades are generally to be minimised or sufficient shading provided to control radiated heat. Northern glass shall be adequately shaded for summer sun. All external doorways, entrances and porches shall have protection from weather. Sun control devices should not hinder window cleaning or cause a wind noise problem. Where appropriate, advantage should be taken of sun control devices for the provision of window cleaning facilities.

Particular care shall be taken to avoid glare through windows as a result of direct or indirect sunlight and reflections from paving, roads, roofs or adjacent buildings. The use of internal louvered blinds or curtains should not be a substitute for adequate external solar control devices.

Window Cleaning

All external surfaces of glass must be easily accessible for cleaning from pedestrian areas, by Elevating Work Platform or twin rope access. Details shall be submitted for approval to USP FM Operations.

Sealants

Sealants shall be selected to be appropriate for their application and shall be colour matched to the finished surface. Install sealant systems in accordance with manufacturer's instructions including the use of primers and suitably-sized backing rods where required.

4.8 External Corner Protection

Provide approved and appropriate bollard protection to all external areas of buildings liable to vehicular damage.

4.9 External Stairs and landings

All external stairs and landings over two floors in height must be designed to prevent self harm from jumping. Designs must be sympathetic to the fabric of the building and the surrounding built environment, and must be approved by Director Property & Facilities.

5 Internal Walls, Partitions and Finishes

5.1 Wall & Partition Types

Buildings must be designed to be as flexible as possible internally. Load bearing walls must be minimised and restricted to areas such as the building core for stairwells, lift shafts and toilets.

All other internal walls and partitions must be non-load bearing and able to be readily removed and altered at minimum cost. Building interiors shall be designed to provide maximum flexibility for future modifications or change in use.

Partitions and internal walls shall be 13mm painted plaster board on stud wall preferably metal, installed to manufacturer's recommendations. Plasterboard level of finish to AS/NZS 2589:2017 shall be a minimum of Level 4. In specialised high quality areas, Level 5 may be required.

Plasterboard fixed to masonry walls to be installed using 28mm metal furring channel.

Finish, trim, floor and wall construction in dietary and food preparation areas shall be free of spaces that can harbour rodents and insects.

5.2 Materials

1.2.1 Wall Finish in Corridors

The finish to stud framed walls in corridors subject to impact by trolleys or high use by students shall be fibre cement board or equal to a height of 1200mm. The cement board shall be 10mm thick, with recessed edges and finished flush using perforated paper reinforcing tape. The junction of the top of the cement board and the finish above shall be finished with an appropriate trim.

1.2.2 Operable Walls

The use of operable walls is not favoured. Obtain approval for the use of all operable walls from the Estates and Infrastructure. Operable walls shall be a system equal or better to Hufcore and have an acoustic rating equal to the other walls of the room. Refer also to Section 3.7 Acoustic Control.

Structural support of the tracking is to be oversized to prevent sagging, distortion and movement. Consideration is to be given to health and safety risks in the client operation of the wall (e.g. pinch points, manual handling).

1.2.3 Glazed Partition Walls

The framing to glazed partition walls incorporating doors and door frames that provide the point of security to a suite of offices or similar must be a 100x45mm minimum aluminium partition framing system.

Glazed walling systems may be used in areas where there are no acoustic requirements as shall comply with AS1288 and AS/NZS 2208 as applicable. Use appropriate safety decals to ensure adequate visibility to users.

1.2.4 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 finish. Adequate control and expansion joints shall

be provided to prevent cracking due to building structure settlement.

Finish, trim, floor and wall construction in dietary and food preparation areas shall be free of spaces that can harbour rodents and insects.

Partitions to the perimeters of plant rooms, service areas, risers and the like may be concrete masonry, as required by the application.

5.3 Acoustics

All internal walls and partitions must be designed in accordance with the requirements of Section 14 Acoustic. Partitions requiring to be insulated with 'Dacron' natural wool batts and/or double sheeted on one or both sides as necessary to achieve the sound transmission loss between spaces.

Details of intersection of partitions and external windows shall ensure sound insulation is maintained at that intersection equivalent to that of the remainder of the partition.

Partitions may extend from floor slab to underside of the slab above, when the partition is required to have a sound rating of weighted sound reduction index (Rw) 41 or higher.

5.4 Fire-rated Partitions

Particular attention shall be paid to fire-rated partitions to ensure that any penetrations comply with manufacturer's recommendations for tested systems. Refer to Section 30 fire services.

5.5 Skirtings

1.5.1 Vinyl Skirting

Black vinyl skirting's of 75mm height and be provided to all internal partitions irrespective of type, except where metal skirting duct is used, where walls are tiled, or where other floor finishes are turned up walls.

100 mm hardboard skirting's may be used in refurbishment works where appropriate and approved by Estates and Infrastructure. Painted skirting's are required to have approvals from the Design Manager.

1.5.2 Aluminium skirtings

Ducted skirtings shall be 150 x 50mm 3 channel aluminium, black powder coat finish.

5.6 Toilet & Shower Areas

Walls in toilet and shower areas, must be finished with first quality ceramic tiles from floor to ceiling. Tiling must be designed and installed in accordance with the current Australian Standard on Ceramic Tiles

Partition walls to toilets must be a proprietary brand cubicle system with a high gloss finish and be supported 200 mm clear of the floor on stainless steel feet. All other fixing brackets, including acorn nuts, must be stainless steel.

600 x 300 wall tiles to be white and shall be glazed or semi-glazed with grouting in a white colour. With black 300 x 300 black border tiles.

Refer also to Section 10 for Toilet Doors and Lock

5.7 Toilet Partitioning

Toilet Partitions

Toilet cubicle partitioning shall be HARDICOLOR (or similar) washroom partitioning systems.

HARDICOLOR system shall comprise polyurethane grey painted 18mm HARDIPANEL Compressed fibre cement sheet dividers, front blades and doors with either aluminium track floor fixing to blade or double stainless steel pedestal with aluminium extrusion head-section, horizontal sheet joint and wall junction trim.

Wet Area Partitions

For wet areas such as showers, partitions shall be compressed fibre cement sheet construction, toilet partitioning systems finished with paint finish.

Toilet & Shower Partition Hardware

Stainless steel toilet partition hardware comprising lift-off gravity hinges, slotted indicator, bolt and staple and coat hook buffer, all bolt through with SS acorn head nuts and bolts. Special provisions are required for PWD applications - refer [Section 16 Circulation](#).

Finishes

All internal paint systems are to be in accordance with [Section 15 Painting](#). Generally, all internal walls, including plant room walls, are to be painted.

Services

Nopiped services shall be chased into walls. General infrastructure services reticulations are to be located in service ducts, accessible through lockable doors.

Sealants

Sealants shall be selected to be appropriate for their application, shall be colour matched to the finished surface, and installed in accordance with manufacturer's instructions including the use of primers and suitably-sized backing rods where required. All control and expansion joints are to be caulked with approved sealant.

5.8 Other Wet Areas

Where sink units, cleaners' sinks or hand basins are specified, a tile splashback must be provided. The splashback shall extend 600mm minimum above the fixture, to the bottom edge of the fixture and 200mm past wide each. All substrate material must be water resistant.

5.9 Chair Rails

Provide a chair rail of 200mm x 12mm in select grade and selected species (hard to scratch e.g. spotted gum), (nominally 750mm above the floor to top but height should match the chairs in the room) finished in clear polyurethane, laminate finish, or proprietary vinyl-coated chair railing to all plasterboard walls of seminar rooms, tutorial rooms, video conferencing rooms, computer rooms, open learning areas, meeting rooms and lunch rooms, screw fixed to wall studs with recessed screw heads and matching plugs.

5.10 Handrails

Lecture Theatre

Provide a 50mm diameter stainless steel handrail to the side and rear walls of all tiered lecture theatres where aisles exist. Height above floor and projection from wall face shall be in accordance with the requirements of AS 1428.

Internal General Access Stairs

Internal general access stairs shall have stainless steel handrails to one or both sides as required to and comply with the National Building Codes or Building Codes of Australia.

Fire Isolated Stairs

Fire isolated stairs which are not general access stairs, shall have hot dipped galvanised steel handrails (not painted) to one or both sides to comply with the National Building Codes or Building Codes of Australia.

5.11 Services

Services are to be located in service ducts easily accessible through lockable doors. Proposed routes of service pipes are to be approved by Estates and Infrastructure. To allow future planning changes. **Piped** services are not to be built into partitions and internal walls without prior approval by Estates and Infrastructure. Refer to Section XX

5.12 Sealants

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

5.13 Expansion Joint

All control and expansion joints are to be caulked with approved sealants to prevent water penetration.

5.14 Painting

Refer to **Section 15 for painting.**

6 Floors and Floor Finishes

6.1 Design

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 course of the building's life. Refer [Section 12 Structural Design](#). All floors are to be finished within a maximum tolerance of +/- 3mm in a 3000mm straight edge.

6.2 Finished Floor Surface

General

The selection of floor finishes is very important. It has direct impact on safety (students, staff and visitors) and has potential legal implications if not correctly addressed (e.g. Workers Compensation, Tort Law etc.) A "duty of care" exists where professionals are involved in the selection of products (e.g. architects, interior designers) and responsibility must be undertaken.

Designers shall incorporate the principles & requirements established in AS/NZ Standards and WH & S legislation, to reduce the risk of persons slipping on pedestrian surfaces.

Slip Resistance characteristics shall not be judged by the 'R' rating alone, but must include the Classification of Pedestrian Surface according to Wet Pendulum Test to establish the contribution to the floor surface to the risk of slipping when wet.

All flooring shall comply with the Introductory Guide HB 197:1999 published by CSIRO and Standards Australia, for slip resistance.

Considerations during selection must include:

- 6.2.1 Functional needs
- 6.2.2 Cleaning and maintenance
- 6.2.3 Structural
- 6.2.4 Footwear standards likely to be worn by students & staff
- 6.2.5 Quantitative evaluations and classification information available for each type of surface from the manufacturer, and where not available from the manufacturer must be gained by independent scientific assessment E.G. Wet Slip Resistance by Stanley Skid Resistance Tester (pendulum) from a NATA accredited tester.

All flooring to building entry points and areas where it is reasonable to expect wet occurrences, are to have a classification of contribution to the risk of slipping when wet of Low (W) or very low (V) in accordance with AS/NZS 4586. Note, it is considered 'reasonable' to expect that persons entering a building whilst it is raining, will continue into the building dripping water from umbrellas, bags, backpacks, clothing, shoes etc. for a distance of at least 25 metres. It is usual practice within the University for staff and students to carry their umbrella/bag/backpack to their lecture/workplace and not to leave such items at building entries. At entries having a high pedestrian rate a floor surface with a 'V' category is preferred.

6.3 Termite Control

Anti-termite treatment shall be provided to all buildings. Depending on the application, either chemical or physical barriers in conformity with AS3660 may be employed, using the criteria used in AS3660.3 to determine the most appropriate system. In new buildings the preference is for the use of non-chemical barriers. In existing buildings, the presence of chemical barriers may necessitate the retention of the chemical method of subterranean termite control.

All tree roots which have been exposed during excavation, tree stumps, logs and timber shall be removed from the building site as described in the Brief for the building.

All workmanship and materials shall conform to the requirements of the relevant Standard. Where chemical barriers and/or termiticides are used, all necessary safety precautions and legal obligations shall be met, to protect on site personnel during installation and building occupants from uncontrolled exposure

An MSDS for chemical termite substances must also be provided to USP.

The Contractor shall provide the Superintendent with a Certificate of Installation in accordance with AS 3660.1 Appendix A, from the installer of the termite management system.

This certificate is to be submitted to USP and as a minimum include the following:

- 6.3.1 Detail of termite prevention work undertaken, including a diagram where appropriate indicating location of and materials and chemicals used
- 6.3.2 Areas of building protected against termite entry
- 6.3.3 Any limitations of the procedures for termite protection which may be due to the design of the building.

Stainless steel mesh barriers which comply with the requirements of [Section 6 Floors and Floor Finishes](#) of AS3660.1 are to be used to provide protection against termite entry. Stainless steel mesh barriers shall also be used between the slab edge and the wall, and across wall cavities in masonry wall structures. The use of chemically impregnated barrier systems shall not be used without the specific approval of Estates & Infrastructure

Timber used in construction should be of a type of naturally termite-resistant timbers per AS3660.

6.4 Membranes

All ground slabs shall have, as a minimum, a membrane equivalent to 300 microns Fortecon IR3 (Impact Resistance Grade No.3).

Where required by the application, floors and walls shall be fully tanked using an approved proprietary waterproofing membrane system. These installations shall be detailed and installed strictly in accordance with manufacturer's recommendations in an installation which shall be warranted in terms of both materials and workmanship. In certain applications the water testing of the completed installation may be appropriate.

6.5 Floor Finishes

Carpet

UNIVERSITY STANDARD	
Alternative 1	Interface carpet tiles 500 x 500 Patterned Dark Grey colour with underlay
Alternative 2	100% wool to 90% wool/10% nylon carpet PVC Rug, Kasbah Grey Colour or selected from manufacture's standard colour, with underlay. Commercial grade; Minimum of 10-12 years service life and warranty; low flammability rating; suitable for continuous use subject to office castor chairs; Stain proof; Easy to clean and with Sound acoustic properties.
Alternative 3	TBC

Other Carpet Tiles may be considered for approval by USP FM Operations Section. Note, brand and style should be verified as being a type that the manufacturer will accept return of at end of life for recycling at no charge to USP.

Installation: direct stick method. Note, adhesive should be a No-VOC or Low-VOC type. Where manufacturers specification calls for a particular adhesive that isn't no or low VOC details of the proposed adhesive is to be provided to the USP Project Coordinator for approval prior to work commencing.

In high traffic areas, (such as libraries, primary thoroughfares) the use of Carpet tiles may especially be required or warranted. Determine requirement in such cases with the USP Project Coordinator.

Carpet shall not be used in wet areas or around cold water drinking fountains to prevent or inhibit mould growth. Provide an area of non-slip sheet vinyl or tiled flooring with a minimum plan distance from the drinking fountain of 1m.

Foyers of buildings or other similar areas, where water may be tracked inside on rainy days, should allow for adequate drainage and slip resistant surfaces. See Section - Door mats

For alternate solutions seek approval from USP.

Vinyl / Linoleum Sheet adhered Floor Coverings

UNIVERSITY STANDARD

Alternative 1	TBC after confirmation from Management on usage
Alternative 2	

Alternative 3	

Sheet floor coverings shall have welded joints and be fixed to floor using adhesives in accordance with the manufacturer's instructions. The flooring shall be either coved up all walls, plinths and service pipes to a height of 100/150mm or fitted with black PVC skirting - refer [Section 5 Internal Walls](#).

Approved anti-static vinyl shall be installed in any areas subject to static electricity discharge such as data rooms, bio-boxes and other specialised areas.

Any alternatives must be by approval only and should be of a type that does not need to be sealed or stripped of sealers, only swept and mopped to maintain cleanliness and good appearance.

Rubber Sheet adhered Floor Coverings

May be considered & must be accepted for use by the USP FM Project Coordinator.

Ceramic Tiles & Quarry Tiles

UNIVERSITY STANDARD	
Alternative 1	Matt Black 600 × 600mm Ceramic Tiles manufactured by NIRO
Alternative 2	Matt Dark Grey 600 × 600mm Ceramic Tiles manufactured by NIRO
Alternative 3	Equivalent to above, by approval USP Manager Design . Note Section 6.2 regarding required 'V' or 'W' slip coefficient of friction.

Ceramic tiles shall be used on floors of all toilet areas and showers including air-locks and, where required, in fire-rated passageways and general use stairs. Install tiles using flexible thin-bed adhesives suited to the applications.

Particular care should be given in the selection of tiles to ensure slip resistance and serviceability. Porous unglazed tiles are not to be used in any new installation.

All tiles shall comply with the following criteria:

PHYSICAL PROPERTIES	STANDARD	VALUES
Surface qualities	ISO 10545-2	Length and width +/- 0.6%
Warpage of edges + or - 0.5%		
Thickness + or - 0.5%		
Wedging + or - 0.6%		
Flatness + or - 0.5%		
Water Absorption	ISO 10545-3	0.5%

Modulus of Rupture	ISO 10545-4	27 N/mm ²
Deep Abrasion	ISO 10545-6	205 mm ²
Coefficient of Linear or Thermal Expansion	ISO 10545-8	90 K-1
Resistance to Thermal Shock	ISO 10545-9	No visible defects
Moisture Expansion	ISO 10545-10	0.05%
Crazing Resistance	ISO 10545-11	No visible defects
Chemical Resistance	ISO 10545-13	No visible defects
Resistance to Stains	ISO 10545-14	No visible defects

Ceramic tiles shall be used on floors of all toilet areas and showers including air-locks and general use stairs. Floor tiles to toilet and shower areas shall be anti-slip with dark grout (**black** or similar) and shall finish level with adjacent finishes. Floor tiles to toilet and shower areas shall be minimum **300mm × 300mm** unglazed or semi-glazed.

Any existing installations of porous unglazed tiles shall be replaced or cleaned and re-sealed as part of any refurbishment works, and tested to ensure a suitable slip resistance result is achieved.

All tile layouts shall be approved by **Design Manager**

Stairs and Fire-isolated Passageways

Quarry or ceramic tiles to fire-rated passageways and stairs including stair treads and risers shall be unglazed, shall be non-slip to suit the application with tread riser and nosing tile of a contrasting colour and matching grout. Tiled stair landings shall have a matching skirting tile ½ tile high or minimum 100mm high. Appropriate caulked expansion joints shall be provided as required, including the junction of tiles floors with walls, installed in accordance with manufacturer's recommendations.

Colour selection for visual contrast shall comply with AS 1428.1 for stair tread nosings.

Stair tread nosings shall be Latham; heavy duty, slip resistant metal extrusion and purpose made for the application. Stair nosings on masonry stairs shall be recessed so that the top of the nosing is flush with the tread.

Stair tread nosings in tiered theatres shall be Latham with luminescent infill to front two bars and remaining bars sparkling black infill.

For alternate solutions seek approval from USP **Design Manager**

6.6 Joints

Joints of dissimilar floor finishes shall be achieved using brass angles or strips set into the slab and fixed with epoxy cement.

6.7 Door Mats

Door mats shall be provided at normal access doors at ground level to the building on the inside of the door. Mats shall be formed by inserting into general carpet at doorways by overlaying and double cutting door mat carpet adhesive fixed to floor.

Door mat carpet shall be Autex "Indoor/Outdoor" "Widetrack", "Images" Autex "Decord" sheet carpet or Interface Flor "Entry Level" Barrier Matting 500 x 500mm adhesive fixed as recommended by manufacturer.

Door mat extent: at least the width of the door opening x minimum 3m inside the door. Door mats must not pose trip hazards.

For alternate solutions seek approval from USP **Design Manager**

6.8 Lift

Generally apply non slip vinyl flooring to lifts in accordance with [Section 5 Internal Walls](#). Carpet or Pirelli rubber flooring with low relief studs may be approved by USP in special circumstances. Ceramic Tiles shall not be used in lift cars.

6.9 Sealants

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

6.10 Underlay

Underlay as substrates to a floor finish over, for example, existing timber floors, shall be submitted for approval, and shall only be installed used in accordance with the manufacturer's instructions.

6.11 Toilet & Shower Areas, Plant Rooms

As these areas have the likelihood of being hosed down during cleaning, all toilet areas including airlocks and disabled toilets shall be deemed wet areas and are to be waterproofed to satisfy the requirements of AS 3740 for Category 1 wet areas. All wet areas are to have installed an approved impervious flooring using either copper or stainless steel tray, fibreglass reinforced acrylic membrane or purpose built base or flooring. The preferred design detail is a 50mm set-down floor slab to achieve a continuous floor level without thresholds at doorways. The set-down area is overlaid with the waterproofing membrane system and cementations screed laid to falls. The membrane should turn up at the perimeter onto the fibre cement

wall lining substrate - refer [Section 5 Internal Walls](#). Refer to the James Hardie Bathroom Construction Fixing Manual and AS3740 Appendices A and B for indicative details.

Plant rooms having any water services (including chilled or condenser water) and or air handling units shall be bunted and tanked to cater for maintenance in changing out valves, cleaning coils etc.

6.12 Access Floors

Access floors where required by the Space Forms shall be a "Unistrut MK.25A" gridless system as required for the room function. A 150 high flat black PVC is skirting to be used.

7 Ceilings and Ceiling Finishes

7.1 Suspended Ceilings

Suspended Ceilings shall generally be provided in all occupied areas in buildings, except where the Space Form specifies otherwise. Office spaces shall preferably have suspended ceilings to ensure ceiling services are concealed.

7.2 Ceiling Types

Open Ceilings should be considered as a viable design option in consideration of sustainability, decreasing costs and allowing for service access.

Where provided ceiling systems shall generally be a two-way grid of exposed T-bars with 1200x600mm 'Rondo' or similar approved module. Wall angles shall be of the shadow line type except where the ceiling's fire rating dictates otherwise. Ceiling tiles shall be either Armstrong RH99 (also described as HumiGuard Plus) fine fissured square edge or equivalent mineral fibre suitable for both air-conditioned and non-air-conditioned or in wet areas, vinyl-faced fibre cement. The acoustic properties of the tiles shall be considered in relation to the acoustic requirements of the space(s). Lightweight vinyl faced fibreglass tiles shall not be used. Additional acoustic provision such as sections of acoustic blanket on ceilings over ceiling height partitions may be required for satisfactory acoustic performance. Refer [Section 14 Acoustic](#).

Ceiling Access

Wherever access is required to the ceiling to service or remove equipment, the ceiling shall be designed for easy removal including removal of tee-bars.

7.3 Flush Plasterboard Ceilings

Flush plasterboard shall be avoided unless required for specific applications such as Physical Containment (PC) Laboratories, food preparation or medical operating requirements.

Use for aesthetic reasons in feature applications such as Reception areas is subject to the approval of the Estates & Infrastructure

Flush plasterboard ceilings shall be installed on a fully concealed system equal to the 'Rondo' system, comprising top cross rails and furring channels at centers in accordance with the manufacturer's printed instructions to suit the application, and 5mm diameter galvanized rod rigid hangers.

The spacing and arrangement of the hangers shall in all cases be designed to carry the weight of the ceiling, light fittings etc. in accordance with the manufacturer's printed instructions. The use of spring clips on hangers to ceilings other than tile ceilings is prohibited.

Wall angles may be either shadow line type or coves depending on application.

Ceiling Access

Provide access openings to facilitate ready access to above-ceiling services; size and locate access openings to suit access requirements. Locations, quantity and sizes of access openings are subject to the approval of the Estates & Infrastructure.

Non-fire rated access openings shall be approved proprietary type of solid MDF, metal or similar construction with flush set perimeter frames, minimum size 600 x 600mm. The access panel should hinge down on opening with budget type latch operated by square head key securing panel in closed position. Unless access panel is permanently fixed to perimeter frame, provide safety chain to restrain in event of hinge failure.

Fire rated access openings shall provide a similar appearance but with the required fire-resistance

Ceiling Access should be well coordinated and located strategically on ceilings.

7.4 Ceiling Fixtures

Where fixtures or fittings such as light fittings, speakers, thermal alarms and the like are to be mounted on the ceiling tiles, approved timber backing pieces shall be provided which must span the full width of the tile to provide bearing on the ceiling grid. Timber backers are not to be bonded to tiles.

7.5 Unacceptable Ceiling Systems

Ceilings comprising metal or timber slats generally shall not be used.

7.6 Plant Room Ceilings

All plant room ceilings shall be painted for light reflectance and to ensure that the surface finish is satisfactory.

7.7 Ceiling Height and Ceiling Space

In general, the minimum acceptable ceiling height throughout university buildings shall be not less than 2400 mm. The minimum clearance in the ceiling space to the underside of the slab or roof structure over shall be not less than 400mm.

If fixed ceilings are required for specific areas, written approval must be obtained from the Estates & Infrastructure. Any internal fixed ceiling shall be of 10mm plasterboard.

7.8 Identification of Concealed Services

Refer specific Sections dealing with services, however as a minimum discreet signage shall be provided to indicate locations of VAV, duct heaters, fire dampers, & valves for all piped services. Where an access hatch is provided place labels on hatch, otherwise if in a grid ceiling place on grid t-bar.

8 Roofs

Refer also [Section 3 Architectural Design](#)

8.1 General

Care shall be taken in the design and specifications of roofs to avoid rain penetration and in strong winds. Pitched roofs shall be used in preference to flat roof systems. All roof spaces shall have permanent, fixed, adequate access; be provided with catwalks and be sufficiently lit to enable the roof space to be traversed without danger 24 hours a day. Light colored roofing and cladding should be utilized to minimize heat absorption. Refer to Design Standards Structural and Civil Section 4 for additional requirements for design of structural elements. There shall be close collaboration and coordination with USP's Estates & Infrastructure (Design team) prior to the preparation of design documentation for any roof construction, upgrade or maintenance works to ensure effective compliance to this design guideline.

Visual Amenity

By design, roofs adjacent to and overlooked by windows shall be avoided, if possible, to minimize glare problems. Where unavoidable, protect windows to minimize glare. Metal fascia's shall not be used on flat roofs of new buildings. The visible edge of roof sheeting shall be avoided.

Roof Safety

The issue of roof design for safe access both during construction and for maintenance purposes must be considered during the design phase and designers must design roofs and structures which minimize the risk of falling during both the construction phase and during ongoing maintenance activities. See also 8.13..

8.2 Roof Types

Pitched Roofs

Minimum roof pitches shall be avoided. Roof pitches of less than 3 degrees are not acceptable.

Design and installation of metal deck roofs shall comply with AS1562.1; roof design shall include for roof maintenance traffic loads of 1.8kN. Provide safety mesh complying with AS/NZS 4389.

8.3 Roof Materials

Generally, roofing sheets for all USP buildings shall be **0.48mm BMT Colorbond** profiled steel fixed in accordance with manufacturer's written instructions.

Where the purlin spacings are more than 700mm, Multi-Span 905 Color bond Ultra roofing material shall be used.

Roof Thatching

Synthetic thatching materials shall be used in preference to natural thatching materials for roofs of any USP Bure/Fale/Farea.

8.4 Roof Flashings

Roof flashings generally shall be designed to minimise the use of sealants and shall be fabricated and installed in accordance with the roof deck manufacturer's recommendations. The plumbing designer shall design and specify flashings necessary for roofing penetrations. Flashings, cappings etc associated with the roofing shall be 0.55mm BMT, prefinished to match the decking. All fixing types are to be as recommended by the roof deck manufacturer. In no instance shall plastic tap in fixings shall be used on any exposed section of roofing. All caulking and rivets shall match the colour of the roof and flashings.

Roof installations shall be designed to be vermin and bird proof.

Where the ends of the roof sheeting are clearly visible above the eaves gutter, install a Colorbond angle to match the roof colour with the vertical leg positioned downwards and the other leg fixed to the top of the rib, spaced to allow water run-off.

Flashings to penetrations for roof access hatches, skylights 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.

"Decktite" flashings are acceptable for penetrations. Where flashings abut walls, a double 'K' flashing (two piece) flashing is required.

8.5 Gutters Generally

Consideration shall be given in the design and location of gutters to the problems of leaf accumulation. Box gutters should generally be avoided in new work, and in any case must be approved by the USP project manager. Eaves gutters should be used and be of a self cleaning design. Over sized gutters should be considered. Gutter sizing shall be sized in accordance with AS 3500.3.3.

Chain Gutters

Chain gutters may be used where the roof overhang of a building is exceedingly high and cannot accommodate the use of a downpipe.

Gutter and Valley Material

All eaves gutters and valleys shall be of type 304 minimum 0.9mm stainless steel fabricated to ensure that joints are not subject to crevice corrosion.

Gutter Grades

Gutter Grades shall be nominated on the plans. Minimum uniform fall for eaves gutters - 1 in 500. Minimum fall for box gutters, where approved, shall be 1 in 200.

Gutter Expansion Joints

Continuous lengths of gutter shall have expansion joints as stated in AS 2180. Expansion joints shall comprise stop ends with a saddle over flashing.

Gutter and Downpipe Sizing

Flooding frequency shall be decided for each project after considering the damage flooding would cause. Generally the following flooding frequency shall be adopted:

Box gutter (if permitted)	1 in 100 years
Eaves gutter	1 in 20 years
Minimum size	300mm wide (clear of roof material x 100mm deep with free board of 50mm)
Sumps	Sumps shall be designed at box gutter outlets (if permitted)

All gutters shall have adequate fall to outlets. Suitable-sized overflows are to be provided to all gutters. All sizing shall be in accordance with AS 3500 Part 3.3.

8.6 Rain Water Heads

Where necessary, rain water heads shall be in type 304 stainless steel, and shall include overflow spitters. Rainwater heads shall be sealed at the top with a removable lid and may be polished.

8.7 Overflows and Spitters

Overflows shall be provided to all roofs and gutters at gutter sumps and at rainwater heads as a safeguard against flooding caused by downpipe or drain blockages. Overflows are to discharge clear of building lines and pedestrian bridges or paths. Discharge from overflows shall be No.4 polished 304 stainless steel and be visible. Horizontal outlets shall discharge 150mm from the face of the building. The hydraulic capacity of an overflow shall be not less than the design flow for the associated gutter outlet. Where spitters are used they are to be 304 stainless steel. Overflows are to be sized to AS 3500.3.3.

8.8 Leaf & Hail Guards

Leaf and hail guards shall be provided on all sumps. Material shall be stainless steel. All guards shall be removable. Guards shall project above the top of the sump not less than half the depth of the gutter.

8.9 Gutter Guards

On any installations utilising domestic-sized quad style gutters, proprietary plastic mesh gutter guards of approved type shall be fitted along the entire lengths of the gutter.

8.10 Downpipes

Downpipes are to be sized to AS 3500.3.3 with 100mm diameter minimum. All exposed downpipes shall generally be constructed of 304 1.6mm stainless steel with all joints welded or spiral welded tube. Tested U.P.V.C. will be considered as an alternative for particular applications.

All downpipe brackets shall be of stainless steel or stand off extruded aluminium brackets.

Generally, downpipes shall not be built into walls; however, where approved for internal use they must be readily accessible for maintenance purposes. Minimise bends in downpipes. Where offsets are required, angles shall not exceed 45 degrees.

Downpipes shall be disconnected at ground level by means of a stormwater sump over which the downpipe discharges. Do not build in downpipes with underground drainage.

All downpipes and all gutters shall be hydrostatically tested and certified by the installer to the maximum head possible.

8.11 Sound Insulation and Condensation

Insulation shall be provided to any internal downpipe where water noise may create an acoustic problem.

Where condensation on the exterior surface of downpipes is likely to occur and cause nuisance, consideration shall be given to insulating downpipes.

8.12 Roof Access

Roof Access

Provide safe roof access from a service area or through room or by means of an internally openable roof hatch or door into the Roof Safety Zone i.e.: a minimum of 3 metres from the edge of the roof where possible. A permanent (hot dipped galvanised) steel stair ladder should be provided where necessary, preferably located in a plant room or a separately enclosed space. A fixed or semi fixed roof ladder (hot dipped galvanised) shall also be provided at changes in roof levels. All ladders are to be constructed to Australian Standard 1657. Roof walkways with handrails shall be provided to access all equipment on roofs and be approved aluminium construction as manufactured by Juralco or equal approved. Restrict entry to

roof access areas or rooms by provision of locked door with keys available only to authorised maintenance persons. Refer [Section 10 - Doors, Hardware and Locks](#).

Roof Equipment & Plant

Positioning of rooftop plant or equipment must be inside the Roof Safety Zone where practicable, to eliminate or minimise the need for plant maintenance or other staff to access or work within 3 metres of the roof edge.

Roof Insulation

To the whole of the roof area, unless otherwise agreed,, provide as a minimum 55mm (R1.5) fibre composite blanket bonded to a reflective foil laminate equal to Bradford Anticon laid over galvanised roof safety mesh support (such as ARC AW1 MZ) to comply with AS2423 and fixed on top of the purlin.

Compatibility of Materials

Compatibility of materials used for roofing, flashings, guttering and the like must be considered in the architectural detailing.

8.13 Roof Accessories

All plumbing and associated pipework, mechanical fans, cowls and the like on or projecting above roofs shall be finished to match the roof colour, however all metal framing shall be hot dipped galvanised after fabrication and be left unpainted.

8.14 Roof Safety System

Where required for maintenance, cleaning and the like, provide a "Latchway System fall restraint system where work or access is needed outside of a roof safety zone.

Roof Safety system shall include the appropriate combinations of components including horizontal safety cable, anchorage points or other as approved by USP. An installation plan must be provided by the designer /installer for USP approval prior to installation.

The installation shall comply with the relevant Australian Standards and meet the performance requirements of WH & S Regulations on fall prevention. The installer shall supply Engineering Design Safety and Installation certificates and final plans to USP.

All above information about new roof safety systems shall be provided by the Project Manager or Co-ordinator to USP for record keeping purposes and to enable programmed maintenance testing of roof safety systems to be initiated.

Refer also 8.1.2. The USP Roof Safety Management Plan evaluates hazards of existing roofs and should be referenced/applied to any existing building works and, where relevant, to new work.

9 Furniture and Fittings

9.1 General

All University furniture, furnishings and fittings should be purchased in accordance with the ~~Estates~~ Property & Facilities guidelines located on the web at:

http://www.fmd.USP.edu.au/campus_services/furniture/

In the design and selection of furniture and fittings consider the requirements of people with disabilities. Refer to [Section 16 Circulation](#) for further details.

9.2 Whiteboards and Pinboards

Whiteboards and Pinboards of a fixed type and those of sliding, rotating or special nature which generally occur in large lecture theatres shall be installed as part of the building project. Special requirements are set out in space description forms or will be determined in conjunction with USP.

The following are generally applicable:

Area	Description
Offices	Whiteboard 1200mm x 900mm with pen rail
	Boards mounted outside office - TBD
	Pinboard 1200mm x 900mm
Teaching Rooms	Whiteboards and pinboards as required - refer Section 19 Teaching Spaces
Laboratories	Whiteboards and pinboards as required - refer Section 20 Special Requirements for Laboratories
Common & Meeting Rooms	Establish the board requirements for the particular project.

Boards generally shall have aluminium edge frames with concealed, secure fixings. Mounting to stud framed walls shall match that for shelving as described in Section 8 (Roofs).3.

Whiteboards shall be sandwich panel of white vitreous porcelain on 13mm caneite core with galvanised steel backing sheet and aluminium edge trim.

Pinboards generally shall be 6mm Krommenie on 8mm particle board with aluminium edge trim. Pinboards constructed as fabric-wrapped (fabric similar to "Front Runner") glued to 13mm Caneite and screw fixed to wall and capped with proprietary metal screw caps may be acceptable in refurbishment works where necessary to match existing.

9.3 Fixtures to General Offices

Departmental/School Offices may require, near to the Enquiry Counter, a provision for receipt of mail, messages and the like for each staff member, and provision for receipt of student assignments. Typically

these pigeonhole units are built into walls for dual-side access and are not free standing. Open pigeonhole units for placing of messages to students marked alphabetically 'A-Z' may be required by some Faculties.

The design brief shall establish these requirements including size, configuration and locking.

9.4 Shelves

Particular requirements for shelves throughout the building shall be determined in the development of the Brief and documented on a room by room basis.

Wall shelving shall be fully adjustable using white "U-rect-it" components. Keyhole stripping shall be fixed to walls and partitions at 600mm max centres into studs with screws or "Ramset Hollow Wall" or "Hilti Cavity" anchors. "Wall Mate" fixings to wall linings and plastic inserts to screws are not acceptable. Shelving shall be Formex "Mist Grey" or "Seal Grey" (or equivalent colours) melamine finished 25mm medium density fibreboard (Craftwood or equivalent) with T-mould tap-in PVC edging all round, colour to selection, 300mm wide unless otherwise required.

9.5 Directory Boards & Room Names

All directory boards and direction systems inclusive of room numbers and names are provided within the building project and in accordance with the requirements of [Section 18 Signage](#)

Lobbies and similar entry spaces should be designed to accommodate directory boards.

9.6 Official Notice Boards & General Notice Boards

Please refer to [Section 18 Signage](#)

9.7 Toilet Fittings

Toilet Airlocks or Wash Basin Areas

Provide in each space:

- 9.7.1 Vanity bench unit with full width mirror minimum 800mm wide above tiled splashback
- 9.7.2 Electric hand dryer, push button operated. Installation: one dryer for each three basins or less
- 9.7.3 GPO adjacent mirror.
- 9.7.4 Paper towel dispensers are only to be installed at request of client and in consultation with Cleaning Manager. Product is Kimberley Clarke (roll towel dispenser) product code KC4941, white in colour. From Hanleys, 21 Yarraman Place, Virginia, QLD 4014. Ph.: 32162711 fax 32162722.
- 9.7.5 Soap dispenser, wall mounted shall be Campbell Cleaning Technologies, Dermaflo CB166221.5LT ph. 07-37103200 32 Perlvale St Darra QLD. Installation: one dispenser for each three basins or less. Locate such that soap cannot drip onto the floor.

Toilet Cubicle

Provide in each cubicle:

- 9.7.6 Toilet roll holder dispensers shall be Jumbo-roll from Queensland Tissue Products A.B.C D-500. PWD accessible toilets shall have standard Bradley Model 5241 Double Roll Tissue Holder.
- 9.7.7 Coat hook (c.p.), 1 No, to back of door
- 9.7.8 Sanitary napkin disposal units are not required to be installed, but each female or unisex cubicle shall be sufficiently sized to accommodate a unit 300wx220dx850h and not obstruct the patron's space.
- 9.7.9 Provide small shelf for handbag/papers

Unisex Toilet for People with Disabilities

Provide in each facility:

- 9.7.10 Vanity Bench and Grab rails
- 9.7.11 Electric hand dryer, push button operated. Installation: one dryer for each facility or Hygenex 00020 White paper dispenser supplied by Carter Holt Harvey.
- 9.7.12 Wall mounted mirror (Bradley No. 740-1836 or equivalent) positioned as per AS1428.
- 9.7.13 Bradley Model 5241 Double Roll Tissue Holder.
- 9.7.14 Coat hook (c.p.), 2 No, door mounted
- 9.7.15 Wall mounted J & D MacDonald folding baby change table (Main building entrance level only, one per building)
- 9.7.16 Allow space for sanitary napkin disposal units

Shower Cubicle

Provide in each cubicle:

- 9.7.17 Built-in soap holder
- 9.7.18 Coat hook (c.p.), 2 No, door mounted
- 9.7.19 Fixed seat/bench for changing purposes
- 9.7.20 Sliding shower screen door.

Shower for People with Disabilities

Provide in each facility:

- 9.7.21 Folding seat in cubicle
- 9.7.22 Grabrail(s)
- 9.7.23 Fixed shower head with diverter to detachable head
- 9.7.24 Shower head support grabrail and detachable portable shower head
- 9.7.25 Built-in soap holder
- 9.7.26 Coat hook (c.p.), 2 No, door mounted
- 9.7.27 Commercial-quality shower curtain and heavy duty stainless steel rail
- 9.7.28 These facilities will usually be combined with a PWD unisex toilet.

Note: There is a concern regarding the risk of bacterial growth in permanently installed flexible shower hoses serving a portable shower head. The detachable shower head will be held by the Disabilities Officer and provided when the user need arises.

9.8 Chilled Water Drinking Fountains

Allow in the building project the supply and installation of ZIP brand dual (adult/PWD) accessible chilled water drinking fountains (with the option of a cup filler gooseneck) at the rate of one installation to each floor level.

9.9 Built-in Furniture

Built-in furniture should not be used in office areas. This is to assist with future reuse and flexibility of space. Specific approval must be sought for any built-in furniture and designers must ensure that all access requirements are considered in the design.

All built-in furniture, cupboards and laboratory benches shall be supplied as part of the building project. Where applicable, details to match existing shall be determined in conjunction with USP. Generally, all built-in furniture shall be finished in laminated or timber veneer finish. Furniture must not preclude access to the windows for cleaning or access to installed services and outlets.

9.10 Moving Aisle Storage

Moving aisle storage when specified in space description forms may be Compactus, Conserv-an-aisle or similar and shall be supplied and installed as part of the building project. Refer also [Section 12 Structural Design](#) regarding compactus floor loadings.

9.11 Furniture & Equipment provided by USP

Generally all items of loose furniture will be included as a separate item in the overall project budget. Where applicable, items must match existing furniture.

This includes, but is not limited to:

- 9.11.1 Workstations
- 9.11.2 Desks
- 9.11.3 Returns
- 9.11.4 Book cases
- 9.11.5 Filing Cabinets
- 9.11.6 Refrigerators (should be frost free to avoid leaks)
- 9.11.7 Stationery Cupboards
- 9.11.8 Lockers
- 9.11.9 Waste Paper Bins
- 9.11.10 Tables (all types)
- 9.11.11 Chairs (all types) - All chairs to take a minimum 80Kg, and at least 25% of seats to be large. This applies also to tablet arm chairs.
- 9.11.12 Lateral Filing Units
- 9.11.13 Screens (office)
- 9.11.14 Drafting Stations

- 9.11.15 Storage Units (all types)
- 9.11.16 Dishwashers (RW)
- 9.11.17 Stoves

Equipment such as computers, printers, appliances, cutlery/crockery will generally be provided separately.

9.12 Office Furniture

The following loose furniture will be provided as part of the fitout for a “standard” enclosed office:

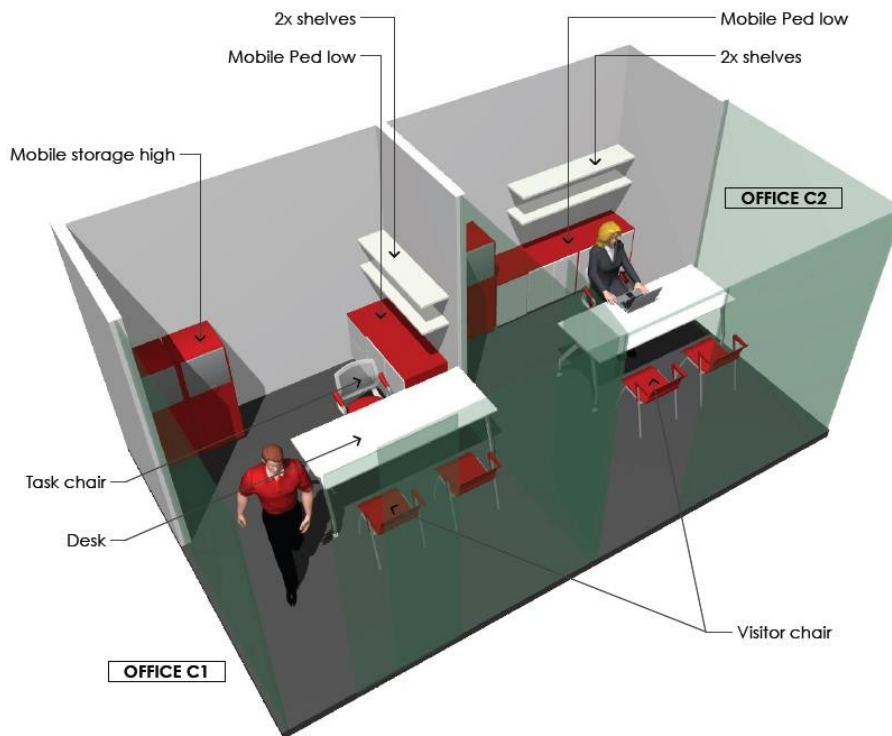
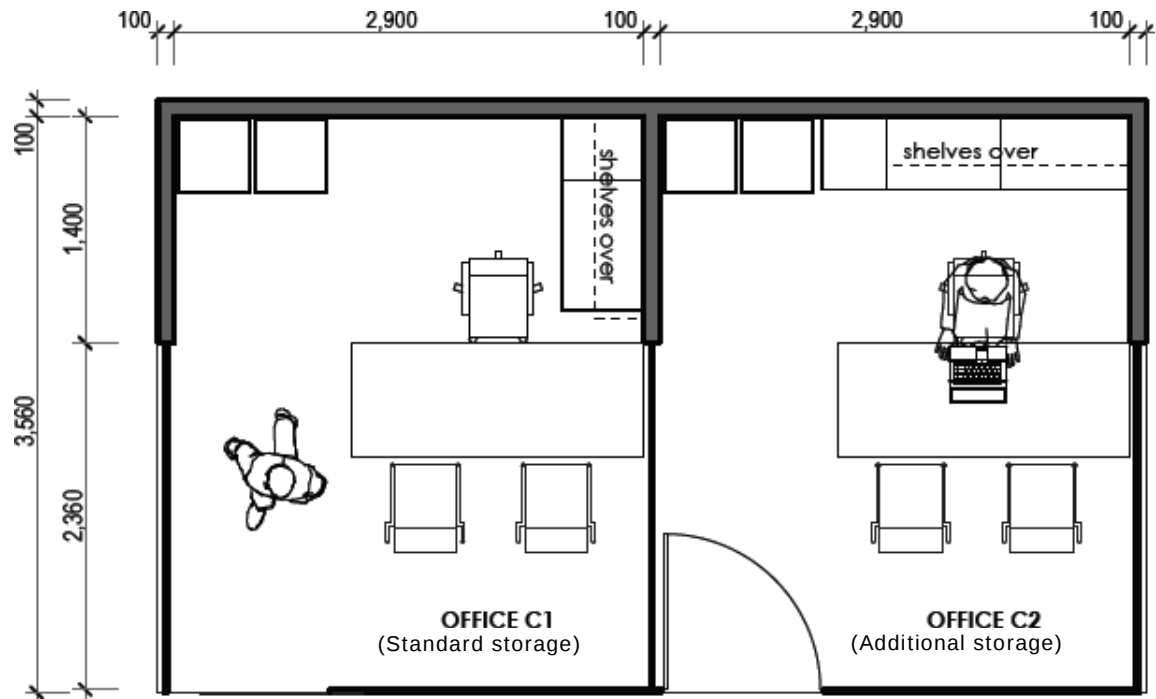
- 9.12.1 1 x Workstation
- 9.12.2 1 x Mobile Pedestal (under-bench)
- 9.12.3 1 x Ergonomic office chair
- 9.12.4 x Visitor’s chair
- 9.12.5 4.5 lineal metres of shelving/storage (predominantly standalone and/or mobile with minimal fixed shelving). Additional storage (up to a maximum of 7 lineal metres) may be provided where there is a demonstrable need. Personal storage will be further supplemented by secure shared storage and facility hubs throughout the work space.

All furniture should be free standing and/or mobile. No fixed joinery is to be provided.

All workstations are to be ergonomically designed according to AS4443, AS4442 and AS3590.2. Monitors to have, or be on adjustable pedestals and adjustable chairs are to be provided. If workstations are required to have adjustable keyboards, the keyboard is to be a minimum of 700mm wide to accommodate both keyboard and mouse.

Indicative furniture layouts for a standard 11m² enclosed office are provided on the following page.

Indicative furniture layouts for a standard 11m² Enclosed Office:



9.13 Blinds

All external windows shall have blinds unless agreed in writing with USP. All blinds shall be of the Silent Gliss Sidewinder Roller Blind System 4210 type only. Curtains, horizontal venetians and vertical blinds are generally prohibited. All blinds, where required, shall be supplied and fitted as part of the project. Provision shall be made for adequate battens, pelmets and the like to provide secure fixing. The need for blinds shall be minimised through use of passive solar means. Blinds may be provided for low (early and late solar angles) sun penetration control, glare control, or for visual privacy. Particular care should be taken to prevent glare and sun penetration around edges of vertical drapes and glare through drape fabric.

In teaching areas, meeting rooms and other rooms requiring black-out capability, blinds/curtains fabric shall be 'block-out' type.

9.14 Projection Screens

Projection Screens for slides, overhead projection or film shall be provided as set out in [Section 19 Teaching Spaces](#). The size and location requirements will be determined in conjunction with USP.

9.15 Door Stops

[Refer Section 10.21 \(Door Stops\).](#)

9.16 Cabin Hooks

[Refer Section 9 \(Furniture and Fittings\).](#)

9.17 Accessories & Fittings

Cupboards etc.

Hinges may be stainless steel butt or piano or each to suit the particular design. Fully concealed hinges shall be BLUM all metal construction or equivalent to suit application.

Door Handles and Drawer Pulls must be Satin chrome plated brass "D" handles, 110mm long.

9.18 Locks

Cupboard door locks shall be L&F camlocks or equivalent type complete with flange to conceal hole in door or drawer. Key alike where banks of doors are used.

9.19 Catches

Lincoln Sentry 851 or equivalent nylon double roller catches as required.

9.20 Drawer Slides

For normal use applications, BLUM230M (30Kg capacity) or equivalent, epoxy-coated steel runner with nylon rollers;

For heavy duty applications (file drawers and the like), Lincoln Sentry 5712 full extension side fix (45Kg capacity) or equivalent, cold rolled steel rails with nylon rollers and steel ball bearings.

9.21 Rubbish Bins for External Use

The preferred design is a low maintenance enclosure of a wheelie bin with a roof to prevent birds removing rubbish. Provide the type below or submit alternative for approval by USP.

240 Litre Bin

WBEMJ240 with powder coated precious silver pearl aluminium roof and frame with black body parts (SULO240LMRI1075)

Note: Where this 240 litre doesn't fit a 120 litre can be purchased.

120 Litre Bin

WBEMJ120 with powder coated precious silver pearl aluminium roof and frame with black body parts (SULO120LNZ@940)

Note: The Sulo information is the size of wheelie bins it needs to fit in it.

9.22 External Ashtrays

The preferred model is the Large Butt-Out bin (590mm in height 152mm in diameter) in stainless steel (Butt- Out Australia Pty Ltd).

9.23 Towel-rails to Kitchenettes

Towel rails to be installed in kitchens and kitchenettes for tea towels. Allow space for 1 to 3 towels depending on the number of users of the facility.

10 Doors, Hardware and Locks

10.1 Doors Generally

Construction and assembly of doors shall comply with applicable Australian Standards. Glazing in doors shall comply with AS 1288 and AS/NZS 2208 as applicable.

Double action swing and pivot doors shall not be used.

10.2 Entrance Doors

The design of building entrance doors is subject to the written approval of the Associate Director, Capital Works, or delegated authority.

Sliding doorsets are preferred for all main automatic exit/entry doors. Automatic sliding doors shall be DORMA BWN EZY-FITEL301 Series with chain drive or technically equivalent and approved by USP with a class 3 duty cyclorating in accordance with AS 4085, with electric opening sliding door system, Fail Safe integrated with the EAC Cardax system and fire alarm with an automatic reset and BWN electric motor locking system and battery backup. However, it must also comply with the ability to be manually locked and remain secure in the event of a power outage lasting several days.

Automatic sliding doors shall not be the frameless glass type. Framed automatic sliding glass doors shall be glazed with Veridian 14.28mm JailSafe glass.

Electromagnetic locks and Double action swing entrance doors shall not be used with entrance doors.

At least one external doorset to each building should be fitted with an automatic opening and closing device. This door or doors shall also be linked into the Electronic Access Control system. (Refer to Section 11.13 for details of Electronic Access Control systems).

10.3 Fire Doors

Fire doors shall comply with AS 1905.1 and generally shall be paint finished. Minimum thickness: 45mm.

Minimum frame metal thickness: 1.4mm. Frame materials: [refer Door Frames 10.8](#)

Construction shall include edge stripping as for [External Doors 10.5](#).

Fire doors, where exposed to weather, shall be faced both sides with 0.9mm 304 No 4 stainless steel sheet, adhesive fixed. Edge finish with mitred channel fabricated of matching sheet (nom 20mm x door width) with stainless steel countersunk screw fixing into door edge, all round and lapping over stainless steel facings.

Provide glazed viewing panel to each door (except where electromagnetic hold-open devices are fitted) and provide signage required under the BCA. Glazing to viewing panel shall be not less than 6.38mm thick laminated glass. Viewing panel size shall be nominally 600h x 100w, located within 200mm of the opening door stile and with the bottom edge at 1000mm AFFL.

Fire Doors must be installed and certified by a "qualified person" as defined by the Queensland Fire Contractors Board and as licensed by the BSA. Provide certification of compliance in Operating Manual - refer [Section 40 Documentation](#).

Maintenance of fire doors shall be specified in accordance with AS 1851.7. (This is relevant to Defects Liability).

10.4 Smoke Doors

Where required, smoke doors may be or either solid timber ([10.7 External and Internal Aluminium-framed Glazed Doors](#)) or aluminium framed and glazed construction ([10.6 External Timber Doors](#)) and shall satisfy the requirements of the BCA (Specification C3.4). If fitted with hold-open devices ([10.18 Electro Magnetic Hold-Open Devices](#)), a selector for sequencing closing must also be fitted ([10.19 Selectors](#)). Fit Raven smoke seals appropriate to the application ([10.24 Security Door Viewer](#)).

10.5 External Doors

Provide a suitable head flashing to external doors, where it is exposed to weather.

If glazed doors are used, they shall comply with the requirements for Entrance Doors ([10.2 Entrance Doors](#)).

All hinged external doors shall open in the direction of egress and have a "Pull" sign on the outside and "Push" on the inside. Double doors should be signed on the normally opening leaf only.

10.6 External Timber Doors

All timber external doors shall be blockboard solid core construction to AS 2688, external grade and sheathed with 4mm A bond select grade ply. Edge strips shall be 12mm silky oak or hardwood all round, butt jointed, top and bottom installed first. The adhesive to the edge strips and the ply to the door carcass shall be Type A bond i.e. waterproof glue not water resistant. Timber doors shall be painted with gloss enamel (alkyd) system. Paint extent shall include top and bottom edges. Paint colour selection for external applications shall be such that door manufacturers' warranties are not voided.

10.7 External and Internal Aluminium-framed Glazed Doors

External and internal doors shall be aluminium unless noted otherwise, with mid rail not less than 200mm wide glazed with safety glass. Aluminium finish may be either anodise or powdercoat.

Anodising shall not be less than 20 microns anodise to both doors and frames.

Powdercoat shall be of a quality commensurate with the application and shall be equivalent to DULUX Duratec (Line Number 900) or better. Warranty: to achieve a manufacturer's warranty for film integrity and for colour of a minimum of ten years. (Where bright colours are used, Duratec LX or Fluoraset FP may be required to achieve warranty requirements.)

Aluminium doors larger than standard size must have accompanying hinges, closers and the like designed to prevent movement and misalignment. Preference shall be given for one single door leaf with side light. The top rail of aluminium doors shall be of a size to fit the door closer.

Where Cardax EAC/electric locks are fitted, the door midrail will be used for cable access.

10.8 Internal Timber Doors

All timber internal doors shall be blockboard solid core construction to AS 2688, not less than 40mm thick and sheeted with 4mm A bond select grade ply. Edge strips shall be 12mm hoop pine all round, butt jointed, top and bottom installed first. The adhesive to the edge strips and the ply to the door carcass shall be Type A bond i.e. waterproof glue not water resistant. Timber doors shall be painted with gloss enamel (alkyd) system. Paint extent shall include top and bottom edges.

Door sizes shall generally be of a standard size not less than 2040 x 870, unless nominated otherwise or required to be larger for particular purposes or to meet statutory requirements.

Doors generally shall have a glazed viewing panel with not less than 6.38mm thick laminated glass. Viewing Panel size shall be nominally 600h x 150w, located within 200mm of the opening door stile and with the bottom edge at 1000mm AFFL. Viewing panels to laboratory doors shall comply with the requirements of AS/NZS 2982.1. Refer also [Section 20 Special Requirements for Laboratories](#).

All plant rooms, seminar, laboratory and other doors as required by the Space Description Form shall be minimum one leaf construction 1020mm wide and shall open outwards taking care not to swing across paths of travel. Doors to cleaners' rooms, service ducts and small storage cupboards shall also open outwards.

In new buildings, air grilles shall be installed only in toilet and air lock doors, and if the extruded aluminium type, shall be fixed with concealed screw fixings on the inside. The use of door grilles in refurbishment work projects will be permitted with the approval of the Manager, Capital Works, USP.

Note: Disabled toilet doors are not to have an air grille in the door.

Doors to sanitary compartments for people with disabilities shall comply with AS 1428.1 and shall open outward. Refer also [10.20 Kick Plates](#).

10.9 Door Frames

Door frames should be steel or equivalent, of a solid, robust, construction, resistant to bowing when lateral force is fire or sound-rating requirements.

Minimum frame metal thickness is 1.1mm.

Factory finish:

- 10.9.1 Internal Locations will be Zinc anneal
- 10.9.2 All external doors will be Galva bond

Door frames shall be sufficiently rigid to avoid distortion by the door weight or the twisting action of the door closer.

10.10 Keying System

All keying is to use the "Specific University Abloy Protec Profile" under the University Master Key system. The keying schedule is to be agreed with the University's Security Systems Officer. Key coding will be determined by the Security Systems Officer and John Barnes & Co. (Qld) Pty Ltd. The number of individual keys to be issued will be determined by the Security Systems Officer in consultation with the building occupants, and in accordance with the University's policy on Key Issue and Control, prior to issue.

Only master keying shall be used. Maison keying will not be approved.

Construction cylinders will be used during construction of any new buildings or alteration works.

Keys will be stamped with the University crest and with a sequential key number approved by the Security Manager.

At practical completion of the construction and before handover to the University, the construction cylinders shall be removed and replaced with barrels and keys to the following University Restricted series: All campuses are Abloy Protec profile No NA77EE

Keying will be provided for the following:

Each building or building group as identified in the University master keying plan managed by USP Security.

Maintenance, including the following sub groups:

- 10.10.1 Electrical distribution boards,
- 10.10.2 High voltage rooms and sub-stations,
- 10.10.3 Plant rooms,
- 10.10.4 Data communication boards,
- 10.10.5 Plant alarm panels

Security, including a single key for:

- 10.10.6 Alarm system cabinets,
- 10.10.7 Electronic access control cabinets, and
- 10.10.8 Key cabinets.

10.11 Locks

Except where otherwise scheduled:

- 10.11.1 All doors shall have mechanical locks/latches installed.
- 10.11.2 Mechanical locks/latches shall be Lockwood 3570 dead latching series.

- 10.11.3 Locks shall be mounted such that the strike is 1000mm above finished floor level except the indicator bolt to toilet entry doors where fitted.
- 10.11.4 No locks are to be mounted in the bottom rails of doors.
- 10.11.5 All locks shall have "W" type cams where possible to prevent over 90° key rotation and are not to employ anti-lock out (kick off) function.
- 10.11.6 Where the mortice lock requires a dead-latch function, ensure that the appropriate strike plate is fitted and installed correctly. Refer [10.27 Striker Plates](#).
- 10.11.7 Dead bolting locks, Lockwood 3540 series locks shall only be used with written approval of the Security Manager.
- 10.11.8 Electric locks shall be Lockwood 3570 series in most instances or 3580 series narrow style, where limited space is available.
- 10.11.9 Where the Cardax installation is swipe in - entry reader only, the locks are to be fail secure. Connection to the building Fire Alarm System will be dependent on specific application. As a general rule the designated Cardax controlled building front entry door shall be swipe in - entry reader only in order that it may fail secure. All other building external entry perimeter doors are to be reed switch monitored.
- 10.11.10 Where the Cardax installation is swipe in - entry reader / swipe out - exit reader, the lock shall be "Fail Safe" and connected to the building Fire Alarm System for fire exit release. These "Fail Safe" locks are to have key override on both sides of the door.
- 10.11.11 Where electronic locks are installed, any required card readers shall be located so as to be accessible to people with disabilities, not closer than 1000mm from the arc of the hinged door, not within 500mm of an internal corner and preferably on the latch side of the door. Card readers shall be located between 900mm and 1300mm above the finished floor level.
- 10.11.12 Where electronic locking is required, the Lockwood 3570 Series Electric Mortice Dead latches are to be used in most instances. In some circumstances, electromagnetic locks may be used with the approval of the University Security Manager, however, drop bolts, electric strikes and shear locks are not to be used, refer [Section 11 Building Security](#)

10.12 Lock Applications for Individual Doors

Locks and lock furniture shall be LOCKWOOD manufactured by Ogden Industries, unless otherwise noted. Furniture finish shall be SCP.

Where Lockwood 1801-70/1905-70 handles are specified Kaba 600 series with 25 lever may also be utilised.

Application	Type
Stairs Locking	3572W-SP3572-5250 with 1801-70/1905-70
Stairs Ground Floor Exists	3572X with 1801-70/1905-70
Lecture & Seminar Rooms	3572W-SP3572-5250 with 1801-70/1905-70
Offices	3572WT cylinder and cam with SP3570 - 5250 adaptor and 1801-70/1904-70 furniture
Duct Doors (non-fire rated)	211 Nightlatch
Duct doors (fire rated)	EFCO507
Mortice Privacy Latch to PWD	Lockwood lock LW3574EA SC with furniture LW1814/70SC and

Toilet	LW1939/70SC
Non Locking Door	Passage 3574 with 1805-70/1907-70
Sub Stations & Specified Areas	Lock 3572X with 1801-70/1905-70
Aluminium Glazed Entry (hinged)	3572X with 3570-2402/2452 Hold Back Cylinder to inside with 1800/1907-70
Small Roller Shutter	PL330N padlock keyed to ABLOY Protec
Larger Roller Doors	Perimeter wall roller shutter doors to be secured at the bottom of both sides with padlocks from the Abloy Protec range and/or electric key switched motorised doors
Electric Key Switched	'LOCK IT WELL" switches, as per application with ABLOY Protec profile
Electronic Access Controlled Locks	See Section 11 Building Security
Display Cases (high security)	ABLOY Protec
Window Locks	LOCKWOOD 780/880 or equivalent all keyed alike, or an approved 'allen key" type, depending on application. Refer to Section 4 External Walls and Windows .
Toilet Partition Furniture	Refer to Section 5 Internal Walls, Partitions and Finishes

10.13 Door Closers

Provide surface mounted door closers to residential bedrooms, entrance doors, external doors, lecture theatre doors and doors to all teaching spaces, internal offices, toilets, air-locks, fire-doors and plant rooms. Door closers shall generally be provided to the perimeters of all air-conditioned spaces. Hold-open function closers shall be provided to all teaching spaces, except those opening to non-air-conditioned space. Provide delay action control closers where directed for disabled access.

Overhead surface-mounted type	DORMA TS93B EN1 – 5 pull side mount DORMA TS93G EN1 – 5 push side mount DORMA TS93GSRRF – Hold open unit/pair of doors
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packers to keep the arm of the door closer clear of the seal. In all cases screws are not to penetrate glazing beads on acoustic seals.

NB: All outward opening doors shall have “G” Bodies and inward opening doors shall have “B” Bodies.

Where the security systems installed require doors to be automatically closed, ensure that the appropriate door closer types are fitted. (ex Lab user discussion)

Prior to Practical Completion (and when mechanical systems are fully operational and balanced), door closers shall be adjusted so that spring strength is adjusted to lowest optimal setting for satisfactory closing action.

10.14 Hinges

Hinges generally shall be TRIO 304 grade satin stainless steel, fixed pin butt hinges, Cat. No. T717525FPSS or T710025FPSS. Hinges shall be left unpainted. All screw fixings shall be stainless steel.

Generally all door frames shall have a minimum of three hinges per leaf with the middle hinge approximately 200mm below the top hinge. Doors with closers are to have a double hinge at the top.

Application	Type
Fire and External Doors	Three (3) per leaf 100 x 100 x 2.5mm
Internal Doors	Three (3) per leaf 100 x 75 x 2.5mm
External Doors	Can be either of above depending on door swing required
Aluminium Doors	Stainless steel ball-bearing interfold type, stainless steel screw- fixed to frames and jambs
Heavy / Acoustic Doors	Three (3) per leaf 100 x 100 x 2.5mm stainless steel bearing hinge TRIO Cat. No. T710025FPSSB
Extended Hinges	TRIO "Super" series wide throw butt hinges, as required.

10.15 Hinge Bolts

2 x Duo hinge bolts HBW to suit doors 38mm thick (Where required, high security applications only)

10.16 Bolts

Application	Type
Barrel Bolts	DALCO 1751 x 150mm with floor ferrules
Flush Bolts (Standard 2040 door height aluminium framed glazed doors only - except where acoustic seals fitted)	EFCO 841 x 150mm
Automatic Flush Bolts (two pairs of fire doors)	LOCKWOOD FOH00149
Fire Bolt (two pairs of fire doors)	LOCKWOOD 8530 - 102
Skeleton Bolts (Door ht 2100 and over)	DALCO 1801 x 200mm to 600mm as required

10.17 Panic Bars

DORMA AD7000 Series ("bar" type).

10.18 Electro Magnetic Hold-Open Devices

Electromagnetic hold-open devices as required shall be DORMA type, be provided to all fire doors in high traffic areas which shall be activated by the Building Fire Alarm System and mounted at 1800mm above finished floor level near the leading edge of the door.

10.19 Selectors

LOCKWOOD A3000x230mm Fit to door pairs which are fitted with electromagnetic hold-open devices.

10.20 Kick Plates

Kick plates are required in the following locations: toilet doors, teaching spaces, circulation spaces and stairs (where no hold-open provision is provided) and plant rooms.

Kick plates shall be 150mm high x nominal full door width, 0.9mm thick 304 No 4 satin stainless steel, glued and screw fixed with stainless steel raised head screws to both sides of each door.

Where timber doors are subject to excessive damage from trolleys or similar impacts, and to doors to sanitary compartments for people with disabilities (PWD), the stainless steel kick plates shall extend to a height of 600mm above the floor level. Verify requirement for door protection with respect to trolleys with the Project Manager, USP.

Ensure that kickplates and fixings are so manufactured and installed to provide smooth surfaces and edges, with no sharp edges or protrusions.

10.21 Door Stops

To any door where the door may strike a wall, provide a aluminium and rubber door stop, floor (LOCKWOOD A250SC) /or wall (LOCKWOOD A350SC) mounted, in a position that will allow full access clear of door furniture.

10.22 Coat Hooks

Provide a coat hook on the inside of every office door.

10.23 Cabin Hooks & Eyes

Cabin Hooks shall be provided, as required, to doors without door closers. Fitting shall be EMRO 144 stainless steel or equivalent.

10.24 Security Door Viewer

Where no glazed viewing panel is fitted, doors to lecture theatres, computer rooms, seminar rooms, meeting rooms and other specialist spaces shall be fitted with a security door viewer (LOCKWOOD 160), mounted inside out and 1500mm above the finished floor level.

10.25 Acoustic & Smoke Seals

Provide RAVEN or LORIENT door seals, selected to suit the particular application.

Where acoustic seals are required to the bottom edge of a door leaf, the seal shall be surface mounted type and not rebated into the face of the door, and threshold fitted across opening.

10.26 Push Plates & Pull Handles (toilets & airlocks)

Provide on 1.6mm satin stainless steel push plate (150mm w x 500mm h) fixed with countersunk stainless steel screws. To pull side, fit EFCO 136 SCP 200mm "D" handle mounted 100mm above lowest edge of plate. Mount plate to opening edge of door with lowest edge 900mm AFFL. Provide engraved "PULL" to push plates with pull handles. Refer [Section 18 Signage](#) for details of text size, location and colour of infill.

10.27 Strike Shield (Blocker) Plates

External building perimeter fire exit doors and external building perimeter plant room doors to be fitted with BOYD SS092 or equivalent brushed stainless steel, concealed fix blocker plates covering access to lock tongue and striker plate.

10.28 Striker Plates

Dead latch striker plates are to be used for mortice dead latches. Correct hanging of the doors is critical for the proper functioning of the lock. All striker plates are to be installed in accordance with the manufacturer's instructions. Welded striker plates are not acceptable. Verify after installation that the required dead latching function has been met.

10.29 Roller Doors

Only quality Commercial grade roller doors and roller shutters are to be used. Motorised Roller Door Operators should be considered against functionality and manual handling perspectives.

11 Building Security

Section 11 of the USP Design Standards and Guidelines (DSG) addresses Building Security. It has been masked from general distribution and public view for security reasons.

This control measure does not diminish, limit or remove the obligation on the Project Coordinator and Project to fully comply with the requirements of this section.

If you require a copy of Section 11 please contact: Isimeli Uluilakeba, USP Chief Security Officer, on (679) 992 6663 or email isimeli.uluilakeba@usp.ac.fj

12 Structural Design

12.1 Standards

The current Australian standards shall be complied with except where a higher standard is called for in this document.

12.2 Preamble

Durability & Flexibility

It is expected that University buildings will have a life of well in excess of 50 years and the structural elements should have a high level of durability particularly with regard to resistance to:

- 12.2.1 Deterioration and corrosion due to weathering and environmental effects.
- 12.2.2 Other factors which may increase long term maintenance
- 12.2.3 Flexibility for potential changes in occupancy loadings.
- 12.2.4 Provision for the installation of penetrations in floors and walls for future service penetrations.

Written agreement is to be sought from the University on the extent of flexibility for changes of occupancy and the extent of provision for future penetrations in floors and walls proposed by the structural consultant (at the commencement of each project).

Serviceability

The structural elements are to provide a high level of serviceability for users. Vertical and lateral deflections shall not be perceivable to users under normal conditions of occupancy.

Design Loads

The following information must be noted in tabular form on the structural drawings approved for construction:

- 12.2.5 Design superimposed dead loads
- 12.2.6 Design live loads including special areas such as compactus storage
- 12.2.7 Design wind loads
- 12.2.8 Design bearing pressures for foundation material.

Load Bearing Walls

The use of internal load bearing walls is to be avoided where possible. All load bearing walls are to be clearly noted on the structural drawings. The use of load bearing clay masonry walls is prohibited.

Dimensions and Member Sizes

The dimensions and sizes of a structural member are to be noted on the drawings.

Heavy Loadings

Areas of floor designed to support heavy loads e.g. from compactus storage or equipment shall be noted and shaded on the structural floor plans.

12.3 Geographical Investigation

General

A Geotechnical investigation and report shall be mandatory for all new buildings. The investigation shall be comprehensive and shall take account of all factors which could affect the design and serviceability of the building.

Flood Levels

The Geotechnical investigation shall address all issues relating to the effects of a flood on building foundations, fill platforms and road works where these items are below the 1974 flood level. Also refer back to section 3.4.

12.4 Design Loads for Floors

General

Superimposed dead loads and live loads for floors shall generally be in accordance with AS 1170.1 for the proposed use or uses of the building. Some flexibility for future changes in occupancy should be considered and discussed with USP. Refer to [Section 2 Planning Controls](#).

Compactus Storage

Provision shall be made for compactus storage as follows:

In locations specifically nominated in the brief,

In all general office and administration areas in locations to be agreed with USP,

The size of the compactus shelving and the weight of materials to be stored shall be confirmed with USP.

Library Stack Areas

The design live load for library stack areas shall be 6 kn/m² for a maximum shelf height of 2.3 metres.

Special Use Areas

Design floor loads for special use areas shall be determined on an ad hoc basis in consultation with the USP.

12.5 Reinforced Concrete Members

Durability

All reinforced concrete members shall be designed to satisfy the requirements for durability in Section 4 of AS 3600. All members in above ground exterior environments at the Gardens Point, Kelvin Grove and Carseldine Campuses shall as a minimum requirement satisfy the provisions for Exposure Classification B1.

Control of Cracking

Satisfy all the requirements in Section 8, 9 & 11 of AS 3600 for control of cracking in reinforced concrete members to a moderate level.

Floor Slabs – General

The floor slab system shall be cost effective, serviceable and provide flexibility for installation of future service penetrations. Refer also to [Section 2 Planning Controls](#)

Floor Slabs – Post Tensioning and Precast Floor Systems

Approval must be obtained from USP prior to the adoption of a post tensioned or precast concrete system for floor slab and beam construction. If a post tensioned floor system is used, as-constructed drawings showing the exact location of tendons shall be provided to the USP. The location of tendons shall be accurately and clearly marked on the slab soffits.

Thermal resistance (R-values) of the floor is to be $>1.0 \text{ m}^2 \text{ K/W}$.

Slip Joints

Provide adequate slip joints between suspended concrete slabs and beams and the top of masonry supporting walls which are not connected to the slabs or beams with reinforcing bars.

Walls

Walls 12m in length or more must have a full height movement control joint. Where possible the joint should be placed immediately adjacent window or door openings and must be weatherproof.

12.6 Structural Steelwork

Corrosion Protection

All structural steelwork and connections exposed to the atmosphere or located in external masonry walls or wall cavities shall as a minimum requirement be prepared and hot dip galvanised in entirety in accordance with AS4680. Cutting and welding on-site is not allowed without permission of USP. "Zinc stick" and cold galvanizing do not constitute acceptable practice without USP approval.

12.7 Timber & Steel Framing

Steel framing is preferred over timber framing in order to achieve construction utilising termite resistant materials (Refer 'termites' [Section 6.3 - Floors and Floor Finishes](#)).

13 Not Used

14 Acoustics

14.1 Regulatory Requirements

Authority and code requirements relevant to acoustic considerations with respect to University developments include:

- 14.1.1 EPA Environmental Protection Policy (Noise) 1997
- 14.1.2 EPA Environmental Protection Amendment Regulation No 2 1999
- 14.1.3 BCC Planning Policies
- 14.1.4 Current Australian Standards including AS 1035, AS 1045, AS 1296, AS 2021, AS 2822, AS 2436, AS 3671, AS 1191, AS/ANZ 1935, AS 2253 and AS 3671.
- 14.1.5 WH&S Act & relevant regulations

14.2 Scope of Acoustic Considerations

In the design of new buildings, or in the refurbishment of existing facilities, acoustic considerations may include:

- 14.2.1 External noise intrusion
- 14.2.2 Noise generated within the building due to building services
- 14.2.3 Noise emissions from the building as they affect adjoining buildings or residents
- 14.2.4 Noise interactions between spaces and consequent privacy considerations
- 14.2.5 Acoustic quality of spaces such as speech intelligibility
- 14.2.6 Special acoustic requirements such as sound or video recording
- 14.2.7 The acoustic limitations of existing building fabric when undertaking refurbishment works

14.3 External Noise Intrusion

Typical noise sources include:

- 14.3.1 Traffic noise (road, rail and/or aircraft sources)
- 14.3.2 Equipment associated with adjacent buildings and industrial activities
- 14.3.3 These types of intrusive noise can be classified as either:
- 14.3.4 Steady or pseudo-steady
 - 14.3.5 Transient (e.g. aircraft fly

over) These types of noise can be quantified

as:

- 14.3.6 Steady noise is measured as the equivalent continuous measurement: LAeq.
- 14.3.7 Transient noise is measured as the level exceeded for 1 percent of the time: LA01.

Criteria apply over any one hour period during applicable hours (for University activities: 8am to 9pm).

Limits of acceptable noise intrusion are listed below in **Table 14.1**.

Room Type	L _{Aeq}	L _{A01}
OT5, OT6 (individual) office, OT7 (shared office)	37dBA	45dBA
OT1 to OT4 Senior staff (individual) office	37dBA	45dBA
Administrative/clerical office (open space), post graduate student areas	37dBA	50dBA
Counselling Office	37dBA	45dBA
Teaching Room	37dBA	45dBA
Lecture Theatre	32dBA	40dBA
Library	40dBA	50dBA
Video-conferencing Room	32dBA	40dBA
Corridors, Lobbies	45dBA	55dBA

14.4 Noise Emissions

Noise emissions can arise from building services or the functional activities of the space. This category includes noise generated by associated activities (e.g. delivery vehicles to a loading dock).

Noise of this type may impact on other buildings on or off campus.

The acoustic characteristics of potentially affected adjoining buildings will need to be taken into account to determine acceptable noise emissions from the proposed new building and its associated noise source(s).

Criteria for campus buildings: refer **Table 14.1**.

Criteria for adjoining (off-site) buildings and facilities: refer applicable statutory requirements.

14.5 Building Services

These include noise sources such as fans, motors and pumps etc. The noise can be transferred to internal useable spaces by two mechanisms:

- 14.5.1 Air-borne noise transmission
- 14.5.2 Structure-borne noise transmission

Both mechanisms of transmission must be considered in the design, by the provision of appropriate sound insulation and structural isolation.

Plant noise can commonly consist of pronounced tonal components which add to the annoyance. Wherever such tones exist, the measured noise level shall be penalised by 5 dBA upward adjustment (Adj).

Noise from building services shall not exceed the following values: **Table 14.2.**

Room Type	LAeq Adj
OT5, OT6 (individual) office, OT7 (shared office)	37dBA
OT1 to OT4 Senior staff (individual) office	37dBA
Administrative/clerical office (open space), post graduate student areas	37dBA
Counselling Office	37dBA
Teaching Room	37dBA
Lecture Theatre	32dBA
Library	40dBA
Video-conferencing Room	32dBA
Corridors, Lobbies	45dBA

The intention is to achieve a balance between the noise generated by building services and the noise intruding from outside. Hence the limits specified in table 14.1 and 14.2 have the same value for the L_{aeq} parameter.

In a situation where there is no significant intruding noise, then the values in Table 14.2 can be increased. The combined ambient noise level L_{aeq} from external sources and from building services must not exceed the Adj criteria in table 14.2 by more than 3dBA.

14.6 Noise Interaction between Spaces

The privacy achieved between two adjoining spaces depends on a number of parameters, as described in AS 2282. For University buildings, the requirements can be simplified to two parameters:

- 14.6.1 The sound reduction between the spaces (Dntw)
- 14.6.2 The ambient noise of the receiving space (dBA)

The sound reduction is quantified by the weighted standardised level difference (Dntw). The ambient noise is quantified as the equivalent A-weighted sound pressure level (L_{aeq}).

The summation of the sound reduction and the ambient noise level in the receiving space gives the Privacy Rating:

$$PR = Dntw + dBA$$

The noise **reduction** between two spaces primary depends on the acoustical performance of the dividing partition, generally expressed as the Weighted Sound Reduction Index (R_w). Apart from the partition selections, there numerous other factors which influence noise reduction including:

- 14.6.3 Noise flanking paths via common ceiling voids, air-conditioning, ductwork and the like

- 14.6.4 Noise leakage at services penetrations and unsealed gaps at window mullions, at partition headsets.
- 14.6.5 Weaker elements incorporated into the partition such as doors, windows, glazed highlights, glass fins etc.
- 14.6.6 Poor workmanship and departures from the documented design
- 14.6.7 The amount of sound absorption in the receiving space

The Designer shall account for these various factors in the selection of particular design detail and in the supervision of the installation. At best, the numerical value of the D_{ntw} could be expected to be 3 points lower than the R_w rating as tested in a laboratory.

The **ambient noise** within a building can vary considerably throughout the day as a result of changing activities inside and external to the building, or resulting from changes in solar load affecting the operation of variable volume air-conditioning systems. Different parts of the building will also affect the ambient noise. For example, location remote from plantrooms will generally have lower plant noise levels. Some of the new forms of air-conditioning such as the chilled beam system have inherently low noise generation.

The ambient noise levels specified in Table 14.1 represent the maximum permissible levels. There is no comparable specification for a minimum level. When assigning an ambient noise level for use in a privacy calculation, the Designer shall take due account of the lowest ambient noise levels which are likely to occur in each situation.

Room Type	OT5, OT6, OT7	OT1 to OT4	Ad Min	Counselling	Teaching Room	Lecture Theatre	Library	Video Conf Room	Corridor
OT5, OT6 (individual) office, OT7 (shared office)	80	85	80	90	90	90	90	90	70
OT1 to OT4 Senior staff (individual) office	85	85	85	90	90	90	90	90	90
Administrative/clerical office (open space), post graduate student areas	80	85	-	90	90	90	90	90	-
Counselling Office	90	90	90	90	90	90	90	90	80
Teaching Room	90	90	90	90	90	90	90	90	75
Lecture Theatre	90	90	90	90	90	90	90	90	80
Library	90	90	90	90	90	90	90	90	-
Video-conferencing Room	90	90	90	90	90	90	90	90	80
Corridors	70	70	-	80	75	80	-	80	-

14.7 Acoustic Qualities of a Space

There are a large number of acoustical parameters used to define and describe the acoustical qualities of a space. The most common is the measurement of reverberation time: R_T , measured in seconds (sec).

R_T for various spaces shall not be greater than those defined by **Table 14.4**:

Room Type	RT
OT5, OT6 (individual) office, OT7 (shared office)	0.6 to 0.8 sec
OT1 to OT4 Senior staff (individual) office	0.6 to 0.8 sec
Administrative/clerical office (open space), post graduate student areas	0.6 to 0.8 sec
Counselling Office	0.6 to 0.8 sec
Teaching Room	0.6 to 0.8 sec
Lecture Theatre	0.6 to 1.0 sec
Library	0.4 to 0.6 sec
Video-conferencing Room	0.3 to 0.7 sec
Corridors	0.6 to 0.8 sec

Other considerations include:

- 14.7.1 Rear wall echoes in lecture theatres
- 14.7.2 Standing wave or room modes in recording or practice studios
- 14.7.3 Flutter echo in performance spaces

These acoustical issues must be evaluated and addressed on a project-specific basis using a specialist acoustic consultant as required.

14.8 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 AS2436 is required.

Particular considerations include:

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

14.9 Minor Works Projects

For minor works projects where no specialised acoustic considerations are expected to apply (as designated by the USP Project Manager), a USP document (AC000 003 00A) "Designated Minor Works Standard Acoustic Details"⁴ will be provided for guidance on acoustic requirements.

⁴ Appendix - 14 – Designated Minor Works, Standard Acoustic Details, Dated 1 Oct. 2002

15 Painting

15.1 General

Scope:

This section of the Standards describes the University's painting & surface finish requirements.

Considerations:

Provide coating systems to substrates as follows and as scheduled

- 15.1.1 Consistent in colour, gloss level, texture, and dry film thickness
- 15.1.2 Free of runs, sags, blisters, or other discontinuities
- 15.1.3 Paint systems fully opaque
- Clear finishes at the level of transparency consistent with the product fully adhered
- 15.1.4 Resistant to expected impacts and damage from expected use
- 15.1.5 Resistant to environmental degradation with the manufacturers stated life span
- 15.1.6 Minimise the impact on the quality of indoor atmospheric health by using a low or no Volatile Organic Chemicals (VOCs) product where possible
- 15.1.7 Minimise heat absorption and temperature in the surrounding area (e.g. by using highly reflective or low heat absorbing paint)
- 15.1.8 Minimise impact on the environment through responsible manufacture and using lower amounts of oil, titanium dioxide and other chemicals potentially damaging to the environment
- 15.1.9 Environmentally responsible methods are to be used consistent with those promoted by GreenPainters® and standards organisations listed below.

APAS and other Standards

All paint types or protective coating systems specified in project paint systems shall conform to the appropriate APAS specification. <http://www.apas.gov.au/>

Where the building is subject to Green Star® accreditation stringent compliance is required to the conditions of Green Building Council of Australia specifications for paints and substances used. Registers of paints and substances used must be kept and submitted to relevant parties. (See Green Building Council of Australia : <http://www.gbca.org.au>)

Low VOC and environmentally friendly products are accredited and/or assessed by Good Environmental Choice Australia <http://www.geca.org.au> and Ecospecifier <http://www.ecospecifier.com.au>.

APAS is administered by CSIRO's Manufacturing & Infrastructure Technology Division [CMIT]. APAS tests and certifies paints and coatings to ensure they meet stringent performance specifications. The basis of the APAS scheme is The APAS List of Approved Products containing more than 2000 approved paint and related products. It is a comprehensive guide for specifiers. Paint products are approved against these specifications and are to be produced only in APAS approved manufacturing plants.

APAS is active in environmental and occupational health and safety, including setting limits for volatile organic compounds (VOCs) in paints and coatings. A recent reduction strategy sets VOC limits reduction

targets for the paint manufacturing industry on environmental air quality by 2011. See section 1.1.3 - Green Paint Selection

APAS has withdrawn approval for many products containing lead, chromates and other toxic ingredients over the years and specifiers should monitor paints or coatings approval status.

All paint types or protective coating systems specified in project paint systems shall conform to the appropriate APAS specification. <http://www.apas.gov.au/>

Standards

The following Australian / New Zealand standards are referred to in this section for compliance where appropriate:
|AS 1530|Methods for fire tests on building materials, components and structures.

AS/NZS 1580	Paints and related materials - Methods of test
AS 1627	Metal finishing - Preparation and pre-treatment of surfaces
AS 1851.7	Fire Doors
AS/NZS 2310	Glossary of paint and painting terms.
AS/NZS 2311	Guide to the painting of buildings
AS/NZS 2312	Guide to the protection of iron and steel against exterior atmospheric corrosion.
AS 2700	Colours for general purposes.
AS 3750	Guide to Properties of Paints for Buildings - Introduction and list of Guides
AS 3750	Paints for Steel Structures - Introduction & List of Standards
AS 4025	Paints for Equipment [including ships]
AS 4049	Paints and related materials - Pavement marking
HB 73.1	Handbook of Australian Paint Standards [General]

Paint Selection

Preference shall be given to selection of paint that complies with the APAS program to reduce Volatile Organic Compounds [VOCs] in Australian manufactured paints.

VOCs negatively impact on indoor air quality through emissions during application, during and after curing. These emissions may impact on individual health and well being, including personal allergic reactions, aggravation of pre-existing medical conditions e.g.: asthma.

Manufacturers provide current information of aspects of their paints and other building/surface preparation products. Low i.e. less than ten percent Volatile Organic Compounds (VOCs) or no VOCs are required. Ecospecifier and Good Environmental Choice Australia have information on a range of environmental attributes including potentially hazardous ingredients of products they have assessed.

Submission

The proposed brand(s) of paints and paint lines in the tender shall be specified in accordance with the University Paint system. [See Section 15.5](#)

- 15.1.10 The Contractor or specifier shall provide, on a representative portion of substrate(s), 1 m² samples of each of the total coating systems which meet the specified requirements for colour, gloss and texture as per the University paint system.
- 15.1.11 The physical and chemical properties of proposed paints or coating systems shall be assessed against AS/NZS 1580 and any other above relevant standard for technical & functional suitability.
- 15.1.12 Paints shall not be a Schedule 1 or 3 paint within the meaning of the Uniform Paint Standard [UPS], which forms part of the Standard for the Uniform Scheduling of Medicines and Poisons [SUSMP] and which is issued by the National Health and Medical Research Council [NHMRC]. <http://www.tga.gov.au/ndpsc/paintgui.pdf>
- 15.1.13 Paints classified as either Schedule 1 or 3 shall not be used in human contact areas or applications as prohibited by UPS e.g.: roofs or surfaces to be used for the collection or storage of potable water. Refer to <http://www.anztpa.org>
- 15.1.14 High performance paints - submit the manufacturers' specifications for each system using two-pack or other high performance paint.

Health, Safety & Environment - MSDS

Provide a Material Safety Data Sheet (MSDS) for each proposed paint or paint line as part of the submission.

A full set of MSDS for final paint system shall be provided to and held by the Contractor on site during construction and must be available for inspection by USP Superintendent or client upon request.

Health Risk Management

Careful assessment must be taken in the planning of painting jobs, of the impact on indoor air quality, [including readiness of HVAC systems to adequately ventilate areas] and the potential effects on University staff in remaining in occupied areas during painting, or when moving them into newly painted work areas. Strong odours and off gassing of curing paint surfaces may induce health symptoms such as asthma, sensitivity or headaches in some individuals.

Appropriate precautions must be taken in planning to remove or protect persons from paint product vapours or preparation dusts.

These include but are not limited to:

- 15.1.15 Careful selection and assessment of safer paint products to minimise potential health effects. [Select Low VOC paints where available].
- 15.1.16 Painting tasks scheduled - out of hours
- 15.1.17 Relocation of staff for duration of project [larger projects].
- 15.1.18 Alter working arrangements for known sensitised or allergic individuals e.g. work from home, other non-affected area.
- 15.1.19 Ensure all paint containers remain sealed and when brushes are soaking.
- 15.1.20 Clean up any spills promptly to reduce vapour load in indoor environments.
- 15.1.21 Remove doors or other movable structures to external open air spaces to paint and cure before reinstalling or rehanging if possible.

- 15.1.22 Ensure paint vapours and preparation dusts do not enter HVAC systems or adjacent buildings - tradespersons to locate painting activities away from air intake areas and natural building airflow corridors e.g. automatic doors.
- 15.1.23 Empty drying paint cans shall be resealed and with other paint debris, removed from the site immediately upon completion of the painting session to avoid paint vapours accumulating in indoor spaces.

Environment Care

Contractors shall practice water saving work techniques wherever possible.

This may include:

- 15.1.24 Minimise wash out of rollers by storing overnight in clean plastic bags or specially designed roller covers to continue use
- 15.1.25 Store brushes in a bucket of water overnight, spin water out next day and continue use
- 15.1.26 Paint or paint waste shall not be put down stormwater drains or sewers. Small amounts of unwanted paint should be brushed out on newspaper, allowed to dry, and then placed in normal waste
- 15.1.27 Larger projects should use a paint waste water recycling systems

Inspections

Contractor shall give the University project manager sufficient notice to allow inspections as required at the following work hold points:

- 15.1.28 Completion of preparation of surfaces
- 15.1.29 After application of prime or sealer coats
- 15.1.30 After application of undercoat
- 15.1.31 After application of each subsequent coat

Asbestos in Substrates

The University maintains an Asbestos register which lists the known or suspected locations of asbestos materials in existing buildings or structures. Contractors must consult this Register, prior to planning or undertaking surface preparation in existing University work areas or where the presence of asbestos is otherwise suspected.

No construction work shall proceed until the Superintendent confirms asbestos material is not present or has been properly removed and scientific testing confirms this state.

Work undertaken to remove asbestos material prior to painting must comply with the Qld WH & S Regulation 1997 and [National Code of Practice for Safe Removal of Asbestos.](#)

15.2 Paint Materials

Brands

Only first quality lines from approved manufacturers shall be used. Approved manufacturers are:

- 15.2.1 Dulux
- 15.2.2 Taubmans
- 15.2.3 Bristol
- 15.2.4 Wattyl
- 15.2.5 Resene

Sikkens Other APAS approved paint products may be considered for use, but only after documented agreement and full assessment by the University Project Manager for eco friendly, functional and technical suitability.

Containers of paint materials specified by APAS numbers shall be labelled as such by the manufacturer.

Materials

Contractors shall be informed that secondary or substituted brands/generic lines are not acceptable to USP. Paint brands or paint lines shall not be changed without documented approval of the Superintendent.

Paints and/or colours from different manufacturers shall not be combined in a paint system.

Colours shall be from manufacturers' standard range. Variation by tinting to the standard palette shall only be by the manufacturer or supplier unless otherwise approved.

Gloss Levels

'Flat', 'low-gloss', 'semi-gloss', 'gloss' and 'full-gloss' as per AS/NZS 2310 and AS/NZS 2311, or other relevant AS/NZ standard.

Primers, Sealers, Undercoats

Ensure that primers, sealers and undercoats are suitable for the substrate and compatible with the finish coat and each other.

Except for stains and other clear or translucent finishes each coating shall be of a noticeably different tint from the preceding coat.

15.3 Workmanship

Area Preparation

As per relevant sections AS/NZS 2311 and AS/NZS 2312

Ensure the work of all other trades is complete as far as is practicable within the area to be painted, except for installation of fittings, floor sanding and laying flooring materials, before commencing to paint.

Deliver paint containers to the site in the manufacturers labelled and unopened containers.

Painting shall not be done 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 10oC or more than 50oC, unless the paint is suitable and recommended for such conditions.

Before painting in any section of the project begins, ensure the area is cleaned out and protected against dust entry or sources of paint contamination.

Drop sheets and masking shall be specified and used to protect finished work or other surfaces liable to damage during painting. Any accessories or surfaces that are damaged directly or indirectly as a result of painting shall be repaired or replaced by the contractor. Cleaning of areas where paint has fallen should not allow the paint to enter drains, sewers or areas of natural drainage / waterways.

Special care must be taken in protecting items which remain in the area or which cannot be moved for the duration of the job e.g. computers, desks and furniture.

Paint shall be mixed and applied in accordance with the manufacturer's recommendations. Paint shall

not be mixed in areas or on surfaces liable to damage from spillage.

Door furniture, switch plates, light fittings, pin boards, whiteboards and shelving and the like shall be removed before painting, and replaced on completion.

15.3.1 Identifying fire door tags or barcodes on the stile of a fire door must not be removed or painted over at any time. There items must be painted around.

During preparation of surfaces, painting and inspection, light levels shall 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.

Putty or fillers may be stained to match the colour of the substrate.

The areas in which painting is to be done shall be adequately ventilated either through natural ventilation e.g. open windows, or use of functioning HVAC systems. In or near occupied areas, arrange for continued HVAC ventilation until painting is completed to aid in dilution and dispersal of paint odours and vapours. Refer section 1.1.5 - Health, Safety and Environment

Paint and related materials shall be stored and prepared in the area assigned by the project manager to comply with Qld Dangerous Goods Safety Management Act & Regulations 2001.

Precautions shall be taken to prevent fire and accumulation of solvent vapours through paint-soiled rags or empty drying containers or other waste. These shall be removed at the end of each day's work or stored in sealed metal containers.

Marks, paint spots and stains shall be cleaned off throughout the work area as soon as possible; maintaining and restoring damaged surfaces to their original condition.

Where necessary for aesthetic reasons, damaged paintwork or misses shall be touched up only with the paint batch used in the original application.

Equipment

Refer to relevant sections AS/NZS 2311 and AS/NZS 2312 where appropriate, and other related standards or WH & S legislation as applicable.

Painting equipment and ladders, planks and other plant shall be appropriate and properly maintained by the Contractor.

Conventional or airless spray equipment must be of an appropriate capacity so as to satisfactorily atomise the paint being applied. Spray equipment shall be fitted with the correct nozzle/tip assembly to avoid the need to thin paint beyond the maximum amount recommended by the manufacturer. The air supply shall be free from oil, water and other contaminant.

Wet Paint Notices shall be placed conspicuously and not removed until paint is dry, unless approval is given and access is restricted to all persons except painting staff.

Application

Refer to relevant sections AS/NZS 2311 and AS/NZS 2312 where appropriate, and other related standards as applicable.

Paint and related materials shall be applied in accordance with the manufacturer's recommendations. The application of thinned prime or seal coats, consistent with the paint manufacturer's recommendations, and which may be necessary on porous surfaces, or of any additional finishing coats necessary to achieve the required colour, opacity, texture or film thickness shall be at the contractor's expense.

The standard of workmanship with regard to final colour, gloss and texture shall match the sample areas specified.

15.4 Substrates

Substrate Preparation

Refer to relevant sections AS/NZS 2311 and AS/NZS 2312 where appropriate, and other related standards as applicable.

Substrates shall be properly prepared to receive the specified paint systems.

Preparation shall include, but not necessarily be limited to:

Clean down and remove oil, grease and loose foreign matter, including laitance, efflorescence, moss, lichen, dirt and corrosion products, in a manner which causes neither undue damage to the substrate nor damage to, or contamination of, the surroundings.

Mould and other fungal presence must be treated according to Australian Mould Guideline -AMG-2005 -1 by recommended mould remediation methods and by trained and accredited mould remediators in severe cases.

For glossy surfaces, adequately scuff and/or solvent or chemically etch as appropriate to provide satisfactory adhesion for subsequent paint coats. Opt only for substances free of hazardous and carcinogenic substances with as low a VOC content as possible.

Minimal amounts of recycled water only should be used where cleaning with water is required. Green cleaning products that do not contain potentially hazardous ingredients and are readily biodegradable should be used. (See those recommended by Good Environmental Choice Australia and Ecospecifier Australia). Excess suds and other materials generated such as paint scrapings, fines, residual paint and dirt likely should be collected and/or prevented from entering natural drainage, stormwater or sewer system. Any material suspected of containing hazardous substances (e.g., asbestos or lead) must be disposed of as regulated waste.

Fill cracks and holes with fillers, sealants or grouting cements as appropriate for the finishing system and substrate, and sand smooth. Again low VOC and non-hazardous products should be used.

Unless otherwise specified, ensure that surfaces are cured and dry before painting commences.

Apply the first coat of paint immediately after cleaning and before contamination of the substrate can occur. Where contamination of intermediate coats occurs, clean in accordance with the coating manufacturer's recommendations and to the Superintendent's approval, immediately prior to over-coating.

Moisture Content of Substrate

Refer to AS/NZS 2311 relevant section

At time of priming, test the substrate with a moisture meter if required.

Metal Surfaces Preparation

Refer to AS 1627, AS 4025 as appropriate to the requirements of the specification.

Iron and Steel Surfaces

Ensure removal of weld spatter, slag, burrs or any other objectionable surface irregularities.

a)	Degreasing: to AS 1627.1, by solvent or alkaline cleaning.
b)	Hand or power tool cleaning: to AS 1627.2 or .7 respectively. A final surface at least equal to preparation grade 'St2' of AS 1627.9 shall be specified.
c)	Abrasive blast cleaning: to AS 1627.4, to the class specified in the specified protective treatment. A surface roughness appropriate for the specified treatment shall be specified.

Masonry, Plaster and Cementitious Surfaces

a)	Concrete and Masonry: Before application to very smooth concrete, brick or masonry, specify acid etch, grind, or abrasive blast to the surface as appropriate to provide a suitable key for the subsequently applied coating and to remove laitance. Loose friable matter shall be removed before filling surface discontinuities.
b)	Set Plaster and Fibrous Plaster Surfaces: Solvent-borne paint or other impervious coatings shall not be applied if the moisture content at the surface, tested with a moisture meter, exceeds 12%.

Timber Surfaces

- 15.4.1 Large resinous knots and decayed areas shall be cut out and replaced with sound timber.
- 15.4.2 Remove any defective putty and punch nails.
- 15.4.3 For painted surfaces, spot prime small knots, cracks, open joints, holes and bare timber with specified wood primer.
- 15.4.4 Fill as necessary with polymeric fillers or oil-based putty, which in the case of clear or lightly pigmented finishes, shall match the substrate.
- 15.4.5 Use appropriate inert filler if the finish is a two-pack epoxy or polyurethane.
- 15.4.6 Dress surfaces shall be lightly sanded in the direction of the wood grain with appropriate grade 'free cut paper' and powdery deposits removed.
- 15.4.7 One coat of wood primer to the back of external fascia boards, timber door and window frames, bottoms of doors, associated trims and glazing beads shall be applied before fixing in position.

15.5 Paint Systems

All paint types or protective coating systems specified in project paint systems shall conform to the appropriate APAS specification. <http://www.apas.gov.au/>

Selected paint systems will be applied in accordance with the manufacturer's written specification.

16 Circulation and Access for People with Disabilities

16.1 General

Achieving equitable access requires understanding and applying all factors that can affect accessibility. The concept of Process of Access recognises the essential and sequential links between accessible information, transportation, public domains, outdoor areas, and the built environment. These guidelines define accessibility in the built environment in line with the definition found under Article 9 of the Convention on the Rights of Persons with Disabilities (CRPD), which means everyone should be able to: *‘Reach all places, use and work their way around the built environment without assistance’*.

In developing countries, this means accounting for local conditions and standards. It also means using appropriate and affordable materials and practices.

Access to the buildings and facilities under the control of the University, and provisions for people with disabilities, shall comply with the requirements of the relevant building legislation, in particular the National Building Codes or Building Codes of Australia (BCA). The BCA prescribes a minimum standard of provision to be in accordance with Australian Standard AS 1428.1:2009. Where appropriate, every effort should also be made to incorporate the requirements of AS 1428.2 - 1992. In addition, some aspects of AS 1428.4 noted herein and the Draft Access Code for Buildings may be required to be complied with. Should the Draft Access Code be adopted during the life of this document USP compliance will commence from the date of enactment. USP will make the final determination of the extent of non-statutory provision of facilities for people with disabilities to be provided within building projects. This decision will only be made following consultation with the University of the South Pacific (USP) Manager Disability and Resource Center (DRC) and the Manager Design, Estates and Infrastructure (E&I).

In the context of University facilities, work surfaces may mean, for example, office work desks, teaching room table accommodation, lecture theatre seating/accommodation or laboratory benching. Where work surfaces are provided for wheelchair users, dimensions shall be generally to those required under AS 1428.2 Clause 24. Refer [Section 19 Teaching Spaces](#).

Following the specific guidance under the four headings provided in this section will result in a secure and accessible environment within and between buildings and in outdoor environments. This will promote opportunities for greater mobility and result in increased social and economic independence.

This guidance is grouped under four design requirement headings:

- sensory, including tactile warnings, guide ways and information
- outdoor environments, including obstructions, signage, street furniture, pathways, kerb ramps, pedestrian crossings, and parking spaces.
- horizontal access, including doors, entrance areas and lobbies, corridors, handrails and railings, bathrooms and toilets
- vertical access, including ramps, lifts and stairs.

16.2 Sensory Accessibility

This section deals with sensory accessibility design requirements. Accessible information and communications is important for everyone, including people with low vision and blindness to navigate physical spaces. This involves a consistent and continuous guiding system that includes tactile:

- warnings
- guide ways
- information.

Lighting and good signage is an important aspect in providing a safe and secure environment, particularly for people with disability.

Communication within the environment is important. Adequate lighting allows for signage to be read. It is also necessary

to enable people who use sign language or visual cues in speech to see their communication partners. Emergency communication systems must have both auditory and visual cues.

16.1 Outdoor Environment

This section deals with the design requirements of accessible outdoor environments, including outdoor areas, open spaces and recreational areas. It covers obstructions, signage, outdoor furniture, pathways, kerb ramps, pedestrian crossings, and parking spaces.

16.3.1 Obstructions

Obstacles, protruding elements and anything else obstructing the path of travel should be removed or relocated.

This includes:

- overhanging obstructions, such as electric cables, light fixtures, signs and vegetation
- fixed objects on pathway surfaces, such as bollards, garbage bins, poles, trees and other outdoor furniture
- unfixed objects on pathway surfaces, such as A-frame signs, commercial street furniture, planting boxes
- spaces below ramps and stairs.

Ideally obstructions need to be relocated from pathway surfaces and outside the path of travel in a continuous line. The recommended minimum width for a clear path of travel is 900mm, with a minimum clear height of 2m.

Guidelines to consider:

If obstructions cannot be relocated this way, they need to be clearly detectable which means they must:

- be a vertical shape rising from the pathway surface
- be placed on a 100 mm raised platform where possible
- have tactile markings on the ground around the obstacle with a minimum 30% luminance contrast to surrounding surfaces.
- overhanging obstructions should be mounted at a minimum clear height of 2m
- fixed objects should be clearly identified with contrasting durable colour marking strips
- distance between bollards should be minimum of 1 m and have a regular vertical shape without protruding elements
- spaces below ramps and stairs should be blocked completely by protective rails, raised kerbs or marked with a tactile surface.

16.3.2. Signage

Signage includes direction signs, emergency and hazard warnings, information notice boards and location signs. It must be clear, easy to read and understand, properly lit at night, visible and well located.

Guidelines to consider:

- sign surfaces should prevent glare and be of durable weather-resistant material
- colours should contrast with the surrounding surface to avoid confusing people with low vision and blindness
- colour combinations should be red and green or yellow and blue to avoid confusing people with low vision and blindness
- letters should be sized in proportion to the reading distance
- International Symbol of Access symbol should be used where appropriate (for example, in parking and toilets for people with disability).

The height of characters in signs for varying viewing distances should be determined in accordance with Table 1:

Table 1:
Height of Letters

Required Viewing Distance (m)	Minimum Height of Letters (mm)
1.5	5
1.8	6
3.0	10
3.6	12

4.5	15
6.0	20
7.5	25
15.0	50
25.0	80
35.0	110
40.0	130
50.0	160

Note: Text height is based on the lower case of the words.

- All text consisting of single words or group of words, should begin with an upper-case letter and continue with lower case letters (sentence case)
- All text must be arranged with left alignment. Signs with a single word may be centre justified.

Graphical Symbols: -

The size of graphical symbols or pictographs should be based on the intended viewing distance and determined in accordance with Table 2.

Table 2:
Sizes of Symbols

Viewing Distance (m)	Size (mm)
Up to 7.0	60 × 60
7.0 to 18.0	100 × 100
Above 18.0	200 200 to 450 × 450

Note: Dimensions above refers to the minimum size of the Symbol of Access

Arrows must be located on the side of the sign to which they are pointing, that is, arrows pointing left must be on the left and arrows pointing right must be on the right.

Colour Contrast: -

All characters and graphical symbols must: -

- be glare free
- have colours and tones that contrast with the following background:
 - within the sign and
 - with the surrounding or substrate

Note:

- To enable a sign to be located on both light and dark backgrounds or for corporate signage where the colours cannot be changed, a contrasting border should be placed around the sign.
- The sign must not have any sharp edges and if fitted into a frame, the frame must not have any sharp edges.
- Illuminated clear glass or acrylic signs with coloured etched legends are not acceptable for legibility reasons.
- Signs indicating washrooms for different sexes should have clear and simple symbols or words, preferably with colour distinctions between male and female e.g., blue for male and pink for female.

Location and Height of Signs

- Signs should be located where they are clearly visible to people who are walking, standing, or seated.
- Signs to amenities must be mounted on the wall next to the latch-side of the door at a distance of 50mm to 100mm from the door jamb to the side of the sign, as shown on *Figure (i)*. They must **NOT** be mounted on the door as the sign might not be visible when the door is open. Where there is no wall space to the latch-side of the door including double-leaf doors, signs must be placed on the nearest adjacent wall.
- The centre line of the sign must be at a height of 1500mm above the floor level where they can be read equally by a standing person, or a person with visual impairment who needs to touch and read the tactile information on the sign.

- Where signs would not be visible in a crowded situation, they should be suspended from the ceiling or projected from walls at a height of at least 2000mm above the floor level. Suspended signs should be avoided as they are not within the field of vision for some persons with visual impairments.



Figure (i)

Refer AS 1428.1 Section 14 Acoustic and Section 18 Signage.
16.3.3 Outdoor Furniture

This section deals with outdoor furnitures which includes bus stops, fixed benches, garbage bins, lamp posts, planter boxes, sign boards, vending machines, and water fountains.

Commercial outdoor furniture includes A-frame signs, planter boxes, stalls, tables, unfixed chairs and vendor carts that are adjacent to travel paths. This type of furniture is usually privately owned by businesses or individuals.

Guidelines to consider:

- position to allow for hazard-free passage of all people
- install at regular intervals to provide sensory cues to those with low vision and blindness
- identify location with textural changes in footpath surfaces
- mount outlets and controls, vending machines and water fountains, 850mm to 1m above the ground to enable access and ease of use
- install seating at regular intervals (100m to 200m) and at prominent public facilities, such as bus stops, and washrooms, to enable rest opportunities
- install level seating areas outside main circulation pathways, including spaces for wheelchairs
- install adequate garbage bins to minimise dumping of rubbish that can obstruct pathways and increase pollution and hygiene hazards
- allow recesses (designated refuse areas) for unfixed rubbish containers, such as skips, so they are not informally located on the path of travel
- relocate commercial outdoor furniture outside the path of travel
- include in permits issued for commercial outdoor furniture the boundaries needed for clear paths of travel, such as required circulation paths adjacent to a restaurant area.

Drinking Fountain

Refer Section 9 Furniture and Fittings for the dual fountain type serving able bodied and PWD users. Install a gully trap adjacent to serve the unit. A pressure reduction valve shall be fitted to allow easier push button action.

At least one Accessible chilled water drinking fountain shall be provided wherever drinking fountains are provided.

16.3.4 Pathways

Pathways include paved and unpaved footpaths. They must be safe for all users, particularly people with low vision and blindness or mobility disability. **Hazardous** pathways are those that:

- are uneven and/or unpaved
- have holes
- are of poor quality
- are not wide enough
- have many steps and/or changes in level.

Guidelines to consider:

- clear of all obstructions
- seal or upgrade unpaved footpath surfaces, where possible, since these often become hazardous in adverse weather conditions
- construct slopes that do not exceed a gradient of 1:20
- for slopes that exceed 1:20, install ramps and allow for landings with minimum dimension of 1m x 1m every 9m, to enable rest opportunities
- use smooth, continuous, non-slip and even surfaces for all pathways
- install a guide strip comprising a tactile line in a colour that contrasts with the pavement for people with low vision and blindness
- install tactile tiling on pedestrian routes of travel, with a minimum 30% luminance contrast to adjacent surfaces
- place tactile tiling at pedestrian crossings and around obstructions that are difficult for people with low vision and blindness to detect
- avoid stepped kerbs or, if required, ensure they are between 70mm and 150mm high
- place drains, grating and manholes outside pedestrian pathways to avoid potential changes in pathway texture and height
- cover all drains, gratings and manholes for safety, ensuring covers are level with the path surface and have narrow grid patterns choose plant varieties carefully, avoiding, for example, thorny and poisonous plants and plants that drop seeds and leaves.

Footpaths should provide a continuous accessible path of travel to or within a building providing access to all facilities and should not incorporate barrier (e.g., step, stairway etc.) Footpaths shall comply with AS1428.1 – 2009 and subsequent amendments Tactile indicators should be incorporated as specified in AS1428.4.

16.3.5 Kerb Ramps

Kerb ramps can include a small ramp built into the footpath to ease passage to the street. These are especially helpful for people with disability but also for cyclists, pedestrians with baby carriages and other groups. Well-designed kerb ramps enable people to deal with the level changes between pathways and street or building entrances with minimal disruption.

Guidelines to consider:

- position out of the line of pedestrian flow
- install in accessible car parking areas, at drop-off zones at main building entrances, at pathways with high usage and at street intersections
- position away from places where water might accumulate
- allow minimum width of 1m and maximum slope of 1:10 (maximum 10mm lip where the kerb meets the lower pavement)
- choose construction material texture that distinguishes ramps from main paths
- choose construction material of a contrasting colour to guide pedestrians with low vision and blindness.

Pedestrian Crossing

Pedestrian crossings are also known as zebra crossings. They facilitate the safe and independent crossing of roads.

Guidelines to consider:

- use a colour that contrasts with the road and surrounding kerbs to avoid confusing people with low vision and blindness
- identify kerb ramps with tactile markings to alert pedestrians of potential hazards or danger in level changes and traffic
- install traffic control signals that have appropriately located push buttons, audible and visual signals and time intervals for people who cross slowly
- install guide strips leading pedestrians to traffic light push buttons, for security and guidance

- provide a coloured tactile marking strip on traffic islands
- raise crossings to the same level as the pathway so those using a wheelchair do not have to struggle with differences in height (raised crossings also act as speed bumps for approaching vehicles)
- introduce other traffic calming measures, such as speed bumps, to increase safe crossing for vulnerable groups.

16.3.7 Parking

Parking includes parking spaces and drop-off zones. Parking problems faced by people with disability include no or too few spaces, spaces that are not wide enough and/or spaces located too far from a main building entrance. Drop-off zone problems include no specified zones or poorly located zones.

Guidelines to consider in designing Parking Spaces:

- provide one disability-reserved parking space for every 50 general parking spaces, noting that some municipalities require more than this
- locate disability-reserved parking spaces no more than 50m from a main building entrance
- design parking spaces for people with disability that are a minimum width of 3.2m (preferably 3.6m) with an adjacent minimum 2.4m wide shared space for wheelchair transfers
- provide same-level access from disability-reserved parking spaces to kerb ramps and pedestrian pathways where possible.

Guidelines to consider in designing Drop-off Zones:

- design at a minimum 3.2m wide for ease of mobility and safety
- make parking spaces for people with disability wide enough to accommodate two cars
- provide at transport stops, such as bus stops
- position within 30m of accessible building entrances to reduce the need to travel long distances
- provide shelter with seating facilities for weather protection
- provide kerb ramps to negotiate changes in level from parks to footpaths
- provide clear signage to reduce potential for confusion
- provide tactile guide strips for improved security and safety
- consider installing bollards to define zones.

16.4 Horizontal Circulation

This section deals with horizontal accessibility design requirements. This covers building elements with horizontal access such as

- doors
- entrance areas and lobbies
- corridors
- handrails, and railings
- amenities.

16.4.1 Doors and Hardware

Accessible doors include doors a person can operate in a single motion with little effort. They should **NOT**:

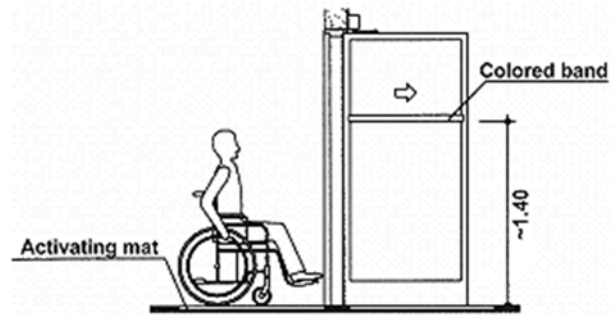
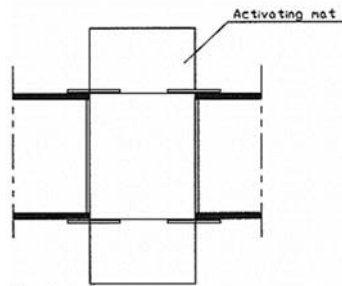
- be too narrow
- have incorrect hinging
- be heavy and hard to operate
- have an incorrect door swing direction.

Design Consideration (Accessibility for the Disabled – A Design Manual for a Barrier Free Environment – United Nations Enable)

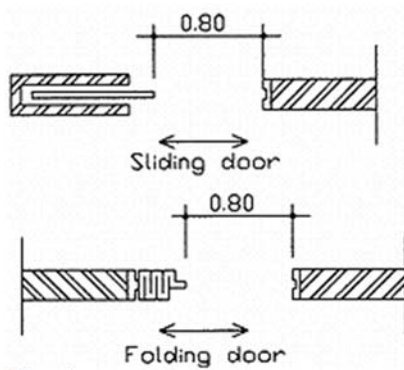
- Power-operated doors are the best for people with disabilities. The activator system should be automatic or placed within easy reach.
- An accessible door should have the following features: a sign, a door handle, an extra pull handle, glazing and a kick plate.

Door Types:-

- Automatic doors: - Can be of the sliding or swinging type. In general sliding doors are preferable to swinging doors (fig. 1) (fig. 2).



- Automatic doors are useful when traffic is heavy.
- Automatic doors should have an adequate opening interval. -Guard-rails can be installed near double-swinging doors to indicate a door-opening area and to prevent people from being hit by the door.
- Pivoted doors: - Pivoted doors should swing away from the direction of travel wherever possible.
- Sliding and folding doors: - Manual sliding and folding doors are recommended for narrow spaces not heavily used by the public



Door Closers suited to the application should be adjustable to the least closing force required. Ensure that closers are adjusted to the lightest closing force necessary for satisfactory operation. Two-way swing doors may be approved where appropriate.

Kick Plates on PWD Toilet Doors:

Provide stainless steel kickplates - refer [Section 10 Doors](#). Ensure door grilles are NOT provided in PWD doors.

Refer to [Section 10 – Doors, Hardware, and Locks](#) for details of PWD requirements for these spaces.

16.4.2 Entrance Areas and Lobbies

Entrance areas and lobbies should be accessible, easy to find, well-lit and supported with clear and consistent signage.

Guidelines to consider when designing Entrances: -

- make at least one entrance, preferably the main one, accessible by people using wheelchairs
- connect accessible pathways to accessible indoor and/or outdoor parking areas, drop-off areas, local public transit stops and public footpaths
- provide adequate covered space in front of entrances for shelter and protection from adverse weather conditions
- paint entrance doors in a colour that contrasts with surrounding surfaces
- provide lighting at entrances and along accessible pathways.

Guidelines to consider when designing Lobbies: -

- place reception desks in clear view of entrance doors
- make lobbies accessible for people using wheelchairs and provide enough space for wheelchair maneuvering
- construct counters 850mm $\pm$ 20mm high for ease of mobility and engagement with staff or communication items like telephones
- provide access to facilities such as mailboxes, public telephones and water fountains, with controls 850mm to 1.1m high
- provide public seating outside main circulation paths so people can engage socially, rest or wait
- choose furnishings of colours that contrast with the floor and surrounding walls for easy maneuverability
- provide at least 10% of seats with backs and armrests for adequate rest support.

16.4.3 Corridors: -

Corridors need to be well lit and unobstructed.

Guidelines to consider:

- make length of corridors as short as possible
- design changes of direction at 90 degrees
- allow for an unobstructed clear path of travel with a minimum width of 1.5m (preferably 1.8m), for ease of mobility and maneuverability with other pedestrians (low traffic corridors should be a minimum 1m width)
- provide appropriate resting facilities (The maximum distances people with mobility disability can walk without resting depends on factors such as slope and walking surface. Research reveals that only 20% of people with mobility disability who use mobility aids, such as walking sticks, can walk 180m without resting. It is also difficult for them to stand for more than 10 minutes at a time. Complying with the Universal design it is recommended to provide seating wherever people have to wait and along main circulation paths.)

16.4.4 Handrails and Railings: -

Handrails and railings need to be properly configured and installed at an accessible height.

Guidelines to consider:

Provide handrails around all accessible balconies, galleries, hazardous areas, platforms, ramps, roofs and stairs for safety, assistance and rest opportunities install handrails at a minimum height of between 800mm and 1m check that installation arrangements are in line with safety and accessibility guidelines.

16.4.5 Amenities

Toilets & Showers

Toilets and showers include those in any form of accommodation, places of employment and public buildings.

Guidelines to consider:

- provide an accessible bathroom and/or toilet on each floor
- provide unisex-accessible bathrooms in office buildings, which can be used by people with disability and their assistant companion if of the opposite sex (in some countries this might be culturally inappropriate, however)
- provide separate facilities for males and females in schools, where feasible
- provide at least one toilet cubicle designed for wheelchair access in school ablution blocks
- install doors that are a minimum 850mm clear width and preferably open out or slide
- provide sufficient space for people using wheelchairs or other assistive devices
- install easy-to-use amenities at a convenient height
- install adequate handrails and grab bars to assist people to and from a wheelchair and assist those with reduced strength
- provide security and privacy features so users can easily close and lock bathroom or toilet doors.
- install toilets to have a minimum dimension of 1.6m x 2.4m or 2.0m x 2.7m if a shower or bath is included (assuming an in-swinging door)
- locate toilets against the wall, diagonal from the entry door
- centerline toilets 450mm to 500mm from the wall
- firmly fix a grip rail next to the toilet, 800mm high
- install accessories, such as mirrors, soap dispensers, tissue holders and towel-rails, at 900mm to 1.1m high
- firmly fix washbasins to the wall at a height of between 800mm and 850mm, with the centerline at least 450mm from an adjacent wall
- fit single-lever mixer taps
- install showers instead of baths, where possible
- firmly fix showers 800mm high, with horizontal grab rails to two walls
- attach shower heads to flexible hoses and preferably a fixed slider fitting with vertical 800mm to 1.8m high grab rail
- install a drop down or removable seat in showers
- provide female hygiene facilities that are easily accessible
- provide at least one conventional cubicle in male and female toilets to help people with ambulant disability provide cubicles for people with disability that are 900 mm wide, with grab rails on both sides of the toilet and with the door opening out.

Tap Fittings:

Provide CP Caroma Care Nordic basin mixer with 160mm extended lever option or Hansa Prado basin mixer with 160mm extended lever option or equivalent to be approved by Manager Design, E&I.

Hand Basin and Cantilever Bench:

Provide semi-recessed fitting Caroma Laser Basin with D251 heavy duty bracket with waste tie, Caroma Care Integra 500 wall basin with shroud, to provide free access space under for wheelchair as per AS1428.1.

WC Pan and Cistern:

Provide Caroma Care Pan (ref 8.02.4) OR Caroma Care Pan Concealed Trap (ref 8.02.3) with Sovereign 2000 cistern with Caroma Care Pushbutton option (Code 405067) large easy push down dual flush buttons.

Mirror:

Provide clear anodised aluminium framed upright mirror 1000 x 450mm and mounted 850 - 900mm above floor. (AS1428.1 10.4.1)

Switches:

Provide Clipsal Prestige (P2000) series type with large toggle switches in disabled access toilets.

The following requirements, including any additional to AS1428.1, shall be satisfied: Toilets and Showers. Refer Section` 9 Furniture and Fittings (Toilet Fixtures) for details of PWD requirements for these spaces.

16.5 Vertical Circulation

This section deals with vertical accessibility, which covers building elements enabling people to negotiate changes in level and reach upper floors in the built environment. Vertical accessibility components that make for an accessible environment and comply with universal design principles are covered in this section, including:

- multi-level building provisions
- avoiding unnecessary level changes
- installing ramps
- installing lifts
- installing emergency stairs.

16.5.1 Multi-level Building Provisions

People with disability are entitled to non-discrimination and should be able to access all floors of a building on an equal basis to people without disability. The CRPD, Article 2 Definitions, encourages progressive implementation of accessibility and notes the issue of 'reasonable accommodation'. For existing buildings undergoing refurbishment, reasonable access to all areas and floors should be the aim, with access to ground floor and public spaces as the minimum. For new buildings, access to all services, facilities and levels should be incorporated into the design, such as the use of ramps to reach areas above ground level.

16.5.2 Avoiding unnecessary level changes

In general, avoiding unnecessary level changes is most desirable. Floors without gaps or changes in levels are the most effective and cost-efficient way to prevent vertical accessibility barriers.

Guidelines to consider:

- design or alter existing structures to avoid level changes, particularly at entrances
- avoid high thresholds that can obstruct the continuous path of travel
- minimise gaps between surfaces, such as at footpaths and transportation platforms.

16.5.3 Installing Ramps

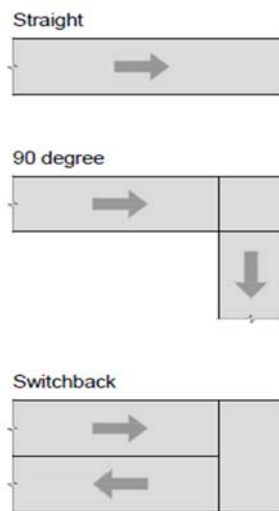
Ramps can provide barrier-free access into buildings and between floor levels. Compared with the option of installing a lift,

internal and external ramps between floors can be inexpensive. Lifts to upper floors should only be considered where maintenance funding and technical capacity are available.

Guidelines to consider:

- provide ramps when stairs obstruct the free passage of pedestrians and people with disability
- provide at least one accessible entrance to a public building, preferably the principal entrance
- locate ramps immediately adjacent to entrances, lobbies and stairs
- calculate sufficient space for ramps and landings to provide appropriate slope and include rest and passing areas
- for existing buildings where re-design or refurbishment is proposed, provide reasonable access to all ground floor services and facilities
- for designs of new single and multi-level buildings, access to all services and facilities should be addressed and incorporated into any design, which could include upper floor access by way of a ramp.

Figure ii: Three basic ramp configurations



Guidelines to consider:

- **Slope:** 1:20 is the recommended minimum for a non-assisted person in a wheelchair. The slope can be increased to 1:14 where the wheelchair user is assisted. Greater than 1:12 is considered a hazard.
- **Width:** Varies according to use, configuration, and slope, but the minimum is 1m.
- **Landings:** Provide at least every 9m, at every change of direction and at the top and bottom of every ramp. Landing width should be a minimum 1m and clear from obstructions.
- **Handrails:** Provide on both sides and along the full length of every ramp, 900mm to 1m high, returning at ends or turning down to minimise injuries. Handrails should extend for a distance of minimum 300mm at the top and bottom of ramps. For ramps wider than 3m, an intermediate rail could be installed.

Surface and tactile markings:

Surface material needs to be hard, non-slip and easy to maintain. Adequate drainage needs to be provided and ramp edges protected by a solid raised kerb. To alert people with low vision and blindness, tactile indicators at least 600mm wide should be placed at the top and bottom of ramps, with minimum 30% luminance contrast to adjacent surfaces. A colour contrasting textual marking strip, at least 600mm wide, should be placed at the top and bottom of ramps.

The maximum gradient for ramps exceeding 1200mm in length shall be 1:14. Refer Figure 1 in AS1428.1. Tactile ground surface indicators should be installed in accordance with AS.1428.4 See summary of specifications for walkways, ramps and landings at Table C in AS1428.1 – 2009.

16.5.4 Installing Lifts

The best way to provide people who have limited mobility with access to upper floors in a multi-storey building is with an accessible standard lift. However lifts are expensive, require a reliable electricity supply, regular and relatively high-cost maintenance and can be a safety hazard when electricity supply is variable.

Guidelines to consider when installing lifts:

- ensure dimension of lift enables easy access by a person in a wheelchair
- install a handrail on at least two sides
- position the control panel so it is easily accessible and can be easily viewed
- install door re-opening activators, audio-visual signals and floor audio announcements
- install a non-skid floor
- select a door colour that contrasts with the colour of the walls, floor and the landing area in front of lift doors

- provide minimum lift floor space of 1.4m x 1.6m
- provide controls positioned 850mm to 1.2m high
- install Braille and tactile signage at the appropriate height.

Lifts where provided shall comply with AS 1735.12 and, AS 1428.2 The BCA and, USP's DS&G for Lifts. For all new buildings, Lift car is to be of a minimum size as stipulated in AS 1428.2 1992 section 6.2 'Circulation space for 180° wheelchair turn' - 2070mm x 1540mm measured in accordance with AS 1735.12 – Section 2. Refurbished lift car sizes shall be considered on a case-by-case basis by E&I, Manager Design in consultation with USP, DRC Manager, Stakeholders and Consultants.

All new lifts and lift car refurbishments are to be provided with handrails to all sides and rear wall of cars. Consult AS 1735.12 re effect of fitting handrails on floor size. Handrails are to be satin finish and are to have a 30% contrast with background to which they are affixed.

Three dimensional door sensors are to be provided where practicable.

16.5.5 Installing Stairs

Stairs should provide safe access into buildings and between levels within buildings for all users. This is particularly important for those with low vision and blindness, as well as those with mobility disability. Poor staircase design is a common problem in many buildings in developing countries and it can lead to injuries.

Staircase design complying with universal design

Steps

- All steps in one flight should be uniform.
- Steps should be 150mm to 180mm high and not less than 280mm deep.
- Open riser staircases should not be used as they pose a risk.
- Angled risers are preferred to nosing, but if nosings are used they should be rounded and not project more than 40mm.
- Nosing should have permanent colour contrasts to facilitate ease of use for people with low vision and blindness.
- Stair covering should be slip-resistant, firmly fixed and easy to maintain.
- Landings should be provided at least every 15 steps to assist people who cannot manage long staircases.
- Each landing should be at least 1.2m long.
- Clear width of stairways should be at least 1m, preferably 1.5m allowing for easy two-way traffic.
- Handrails should be provided on both sides of a flight of stairs and on each side of landings.
- With wider stairs, intermediate handrails should be installed.
- Handrails should be positioned between 800mm and 1m above floor finish.
- Handrails must extend a minimum of 300mm beyond top and bottom steps, turning to the wall.
- Handrails should be supported on brackets that do not obstruct continuous hand contact with the handrail. Tactile marking
- Tactile warning strips should be provided at the top and bottom of stairs and at intermediate landings, to alert
- People with low vision and blindness to the location of the stairs.
- A textural marking strip is essential and should be at least 600 mm deep, extending over the full width of the stairs.
- To provide orientation for people with low vision, the marking strip should be in a colour that contrasts with the surrounding surface. Lighting
- Staircases should be well lit during the day and at night when in use, with a preferred level of lighting between 150 Lux and 200 Lux.

16.5.6 Emergency Stairs

Most people with disability are unable to access stairs in an emergency when lifts are not operating. Universal design helps practitioners address this important need.

Guidelines to consider:

- consult local and fire control authorities, Disabled People's Organisations, and people with a range of disability to determine emergency needs
- provide a rescue assistance area or standby space with direct access to an Emergency Exit where people can temporarily and safely await further instructions or assistance during emergency evacuation
- provide a rescue assistance area or standby space at each floor landing of Emergency Exit stairs or balconies in case of external stairs.

16.6 Teaching Facilities

16.6.1 Flexible Teaching and Learning Classrooms

A flexible classroom arrangement provides a wide range of opportunities for teachers and students to respond to class requirements. This supports a positive learning environment, noting that implementation of good design layout and universal design principles does not need to cost a lot of money.

Guidelines to consider:

- provide chairs of various heights, to match desk heights
- provide sufficient space for opportunities to arrange or re-arrange furniture and for people to move around the classroom, including those using wheelchairs
- design square or near square rooms, which are more functional and flexible than rectangular rooms and which reduce distances between users
- install blackboards and/or whiteboards, which are excellent teaching aids and give good contrast
- fix storage furniture and shelves along walls as a safety precaution
- install a lockable cupboard in which to keep materials and specialised learning equipment
- provide at least two exit doors if capacity in teaching and assembly spaces is above 50 people, for safety and evacuation
- avoid fully glazed doors which are hazardous, especially for students with low vision and blindness

16.6.2 Lecture Theatres, Lecture Rooms, Seminar/Tutorial Rooms and Computer Laboratories:-

Adjustable height, non-fixed seat workstations to be provided at a ratio as proscribed in the Draft Access Code for Buildings - Clause D3.9. Also refer Section 19 Teaching Spaces.

Minimum workstation size - nominally 1200mm by 800mm. Workstation are to be easily recognisable with “height adjustable” signage in the room. Refer Section 19 Teaching Spaces.

16.6.3 Science Laboratories:

- Each new science laboratory is to be provided with a minimum of one adjustable height workbench, complete with a full complement of services provided to ambulant workbenches in the proposed laboratory.
- Where sinks and wash hand basins are provided at least one is to be accessible to wheelchairs.
- Where safety showers and eyewash stations are provided at least one is to be accessible to wheelchairs.
- Where fume cupboards, biohazard/laminar flow cabinets or other specialty equipment are provided in new laboratory fit outs at least one of each is to be made accessible, or as agreed with the Manager DRC.

Refer to Section 20 Special requirements for Laboratories.

16.7 Audio Visual Facilities

Hearing Augmentation - Listening Systems

All new projects in which rooms are fitted with amplified Public Address systems, an approved hearing augmentation system shall be included. Such rooms shall include teaching spaces, computer and science laboratories. Student centres and other major faculty reception areas should be fitted with an approved hearing augmentationsystem

The standard hearing augmentation system for use at USP is the Williams WIR TX75 PRO infrared emitter, to be used in conjunction with Williams WIR RX22-4N infrared receiver and neck loop, or equivalent approved model.

Signage indicating the presence of hearing systems should be displayed in the prescribed manner.

Refer AS1428.2. (Clause 21) See Section 23 AV Standards for Classrooms and Lecture Theatres. Also refer Draft Access Code for Buildings Clause D3.7

16.8 Furniture Design and Selection

Furniture should be well-designed and well-built, so it is appropriate for all students, including those with disability.

Guidelines to consider:

- design and construct furniture to fit the user and maximise physical comfort

- construct all furniture so it is strong and stable to prevent easy tilting
- select furniture with rounded edges to prevent injuries
- provide at least one station with a top at suitable height for working while seated in multipurpose rooms, science rooms, other specialty rooms and workshops
- provide a few adjustable tables or tables of various heights suited to those in a wheelchair, which can be easily moved to teaching spaces

16.8.1 Kitchens

All kitchen facilities including tea preparation areas provided for student use shall be accessible. Accessible sink and work surfaces in staff kitchen facilities shall be considered on a case-by-case basis. Sinks and surfaces must comply with AS4299:1995.

Where tables are provided in public, student or staff common dining areas, at least one of accessible height is to be provided.

16.8.2 Reception Counters

The design of reception counters must be considered from an access point of view and designs must be approved by USP Manager Design of E&I and Manager DRC.

16.9 Lighting

Visual comfort is essential for quality learning. It is especially important for people with hearing disability and intellectual disability, as well as those with low vision and blindness. Proper lighting makes it easier for students to read blackboards and see other teaching aids. It also enables them to see teachers' faces and lips and the faces of other students.

Visual comfort involves balancing natural and artificial lighting, paying attention to colour schemes, and installing light points and ceiling fans in the correct position, for maximum benefit. It also involves positioning signage so it can be easily seen.

Guidelines to consider:

- ensure adequate natural light can enter classrooms and other essential rooms, particularly where power is not available
- provide a uniform light level, avoiding high contrasts and shadow areas
- locate light points over working benches and position to prevent children from working in their own shadow, especially at work benches installed along walls
- paint internal walls and ceilings a light shade, such as beige, to reflect light uniformly around the room
- avoid dark floor finishes, which means using lighter colours and finishes to make it easier to observe changes in floor surfaces and avoid obstacles
- use matt finishes to avoid glare on blackboards and working surfaces
- install electric lights on the ceiling in a uniform pattern
- recess electric lights and cover with a protection mesh to prevent accidental breakages
- use diffusers, shields or hoods on lights to prevent breakage and avoid bright spots in the vision field
- install low-consumption compact fluorescent lamps with reflectors
- select colour schemes carefully with a preference for pastel shades, which provide visual comfort
- follow manufacturer specifications with artificial lights to achieve the best distribution of light and light levels, noting that the recommended light level for educational activities is a minimum 540 lux⁵⁵
- install on external pathways and in internal corridors uniform lighting, at a minimum light level of 200 lux

Illumination levels should be uniform and comply with the requirements for illumination as set out in:

- AS 1680.1:2006 Interior and workplace lighting
- AS 1680.0:1998 - Interior lighting - Safe movement
- AS 1680.2.3 - 1994 - Educational and Training Facilities,
- And other relevant sections

The Standard does not seek to provide specific recommendation for levels of illumination suitable for people with disabilities. Particular consideration should be given to ensure that lighting meets the requirements for uniformity, task area illumination, colour, glare, contrast and unwanted reflections. The use of downlights and spotlights may present difficulties for people with vision impairment.

Any lighting controls connected to the USP data network are required to be connected to a light control LAN approved by ITS. Any variation to the approved LAN will need approval from the USP, Director IT Services.

16.10 Glass in Buildings

Glazing in buildings where the BCA requires access for people with disabilities, should be marked in accordance with AS 1428.1.7.5

See also AS 1228-2006 Glass in buildings - selection and installation Section 5.19

Making Glass Visible (Manifestation)

Manifestation is a treatment that can be applied to glass windows, doors, partitions and any other large expanses of clear glass, in order to make the glass visible, preventing injury through collisions. It can also help enhance privacy and can be decorative. Manifestation is typically created from a frosted film applied at specified locations on clear glass to make it more easy to detect.

Building regulations requirement: Manifestation of glazing, states that:

Transparent glazing with which people are likely to come into contact while moving around in or about the building, shall incorporate features which make it apparent.

Approved document for Protection from falling, collision and impact, suggests that this requirement will be satisfied by including permanent means of indicating the presence of large uninterrupted areas of transparent glazing, and provides further details, requiring that either:

They are clearly defined with **glass manifestation** on the glass at two levels; between 850-1,000 mm and 1,400-1,600 mm above the floor, contrasting visually with the background seen through the glass (both inside and out) in all lighting conditions. Manifestation takes the form of logo or sign at least 150 mm high (repeated if on a glazed screen), or a decorative feature such as broken lines or continuous bands, at least 50 mm high.

17 Workplace Health and Safety

17.1 Introduction

The following legislative documents and associated subordinate legislations are referred to in this section for compliance as a minimum, where appropriate:

- 17.1.1 Local WH&S Act & WH & S Regulations
- 17.1.2 Local Dangerous Goods Safety Management Act & Regulations
- 17.1.3 Local Building and Construction Industry (Portable Long Service Leave) Act
- 17.1.4 Local Electrical Safety Act & Regulations
- 17.1.5 Local Environmental Protection Act & Environmental Protection Policies and Regulations (various)
- 17.1.6 Radiation Safety Act & Regulations

17.2 Principal Contractor

The Contractor shall be appointed as the Principal Contractor within the meaning of the Workplace Health and Safety legislation for any projects involving Prescribed Activities (at any value) or Construction with estimated contract value **being signed as approved Contract Sum**

Principal Contractor duties include:

. Signage identifying principal contractor

. Preparation of Work Health & Safety (WHS) management plan (includes site rule

a. Duty to inform all persons of plan before they commence

b. Duty to review – must remain up to date

c. Must obtain SAFE WORK METHOD STATEMENTS (SWMS) before high-risk construction work commence

d. Put in place arrangements for ensuring compliance with specified requirements such as Facilities & Amenities

e. Manage risk associated with construction materials and waste, plant, traffic, and essential services.

17.3 Liability for Penalties & Costs

Payment of all penalties, costs and expenses incurred in respect to offences and alleged offences committed under applicable legislation including Workplace Health and Safety; Electrical Safety, Dangerous Goods Safety Management; and other applicable statutes, are to be met by the Contractor.

Payment must be made to the appropriate statutory authority.

17.4 Notification of building & construction work & payment of fees

Where building and construction work value is estimated at \$80,000 or more, the Principal shall ensure that **Local** WH & S are notified with the filing of approved forms and payment of appropriate fees as per **Local** WH & S Regulation

Construction Health Environment Safety & Security (HESS) Plans

The Principal Contractor must ensure that:

- 17.4.1 A Construction Health Environment Safety Plan HESS Plan is provided to the Principal as per the WH&S Regulations (sl60) USPOHS policy and regulations and which addresses in particular, risks that may impact on University working environment
- 17.4.2 Appropriate Work method statements or procedures are received and maintained for all High Risk Construction Work activities to be undertaken by any Contractor as per the Local WH & S Regulation
- 17.4.3 Construction HESS & Plans and Work Method Statements are updated as required throughout the project, that information is disseminated, and appropriate records are kept.
- 17.4.4 Contractors are expected to comply with all rules, regulations & best management practices applicable to the Construction Site. Also ensuring that sub-contractors do the same
- 17.4.5 Contractor designated site supervisors and safety staff shall monitor daily attendance and conduct safety checks and briefing to staff on site
- 17.4.6 The contractor shall ensure that housekeeping and tidiness of the worksite is maintained all times
- 17.4.7 The Contractor shall inform the USP Project Supervisor on any extension of working hours and weekends within the worksite at least 48 hours prior to the day of work.

These records must be available within 24 hours upon request by the Principal.

17.5 Workplace Health & Safety Officer for Construction Site

The Principal Contractor must appoint an accredited Workplace Health and Safety (WH&S) Officer prior to work commencing, in accordance with **Local** Workplace Health and Safety Act. Where appointed, the Principal and appropriate USP personnel must also be informed of the appointed person.

For Construction Site, Contractor is to ensure the following:

- Site safety barriers, fences, bollards & signages are placed around the work site
- The Contractor staff should ensure PPEs are always worn by workers at the worksite area

Contractors shall not remove any USP Property from any campus unless USP Assets Disposal form has been provided and given to the USP Security office beforehand.

Contractors shall ensure their workers do not engage in criminal activities whilst at work on campus and shall refer such cases to Police for investigation

The contractor should ensure that they follow all road rules, and fines may apply as per the contract.

17.6 Incident Reporting and Records

An incident record must be maintained by Contractors for all incidents that occur in connection with a project. An appropriate level of investigation must be conducted by the Principal Contractor for any incident that occurs on the construction work site.

The principal's representative shall be notified **the Campus Director** within 24 hours of any site incidents and a record must be available within 24 hours upon request by the Principal.

Contractors shall ensure that all injuries & incidents occurring within designated work site are to be reported to USP Project Supervisor immediately.

The Contractor is responsible for providing First Aid Kit (FAK), medical treatments of their staff or sub-contractors or public injured at their site to health facilities. Also to ensure that they nominate their first aiders once they are awarded the projects. The names will be given to the person responsible for the site once they commence with the projects.

Contractors are responsible for reporting workplace injuries to relevant governments authorities as per the current workman compensation acts and regulations.

The contractor must ensure that they nominate their Emergency Wardens once they are awarded the projects. The names will be given to the person responsible for the site during OHS induction

Incident records must also be tabled at each Project management site meeting.

17.7 Notifiable Incidents

The Principal Contractor must ensure that all Notifiable incidents on the work site are reported to the **CAMPUS DIRECTOR or OHS Committee within a very prescribed time frame**

The **SeSpvio** shall also be notified the Principal Contractor of all such incidents as soon as practical..

In the instance of a Notifiable incident, the Principal's nominated representative shall ensure that the USP Health and Safety officer, USP Procurement officer, is also advised of the occurrence as soon as practical, for information purposes and trend analysis.

The Principal Contractor is to provide a copy of the Incident Notification and incident investigation to the principal as soon as practical.

The contractor shall be responsible for their work site 24/7 security arrangements to secure their property, vehicles and assets against theft and damages.

Also, to provide USP Chief Security officer with an updated ID photos of all their workers and vehicle license numbers engaged in works on campus to facilitate their passes into campus.

17.8 USP Specific Information and Induction

The Principal shall provide the Contractor with workplace health and safety information specific to The University of the South Pacific (USP) and work activities that may impact on the project

This USP site safety induction provides relevant information for all contractors and s available at USP Property & Facilities website <http://www.fmd.USP.edu.au/>.

On Notifiable Construction sites, the Principal Contractor and key representatives must ensure that they are aware of this information.

A copy of the signed contractor induction checklist should be emailed back to USP representatives. The contractor is to ensure all their staff and sub-contractors attend the induction before mobilizing the site. It is the responsibilities of the contractor to induct new staff who join the site crew thereafter using materials provided by the USP team

ALL other Contractors and all their personnel and subcontractors, shall attend or complete the USP induction, before commencement of work at any USP campus.

Records will be maintained by the Principal.

Design of Buildings and Structures Designers of buildings or structures works must observe their specific legal obligations under the **Local** WH & S Act.

Local Safe Design Principle shall be applied for all new building or structure projects, refurbishments, service works, external works etc.

The key principles are:

- 17.8.1 Persons with control - persons who make decisions affecting the design of buildings, facilities or processes are best able to promote health and safety at the source
- 17.8.2 Product Lifecycle - safe design applies to every stage in the lifecycle from conception through to disposal - eliminating hazards or minimizing risks as early in the lifecycle as possible.
- 17.8.3 Systematic Risk Management - the application of hazard identification, risk assessment and risk control processes to achieve safe design.
- 17.8.4 Safe Design Knowledge and Capability -- should be either demonstrated or acquired by persons with control over the design.
- 17.8.5 Information Transfer - effective communication and documentation of design and risk control information between all persons involved in the phases of the lifecycle is essential for the safe design approach.

In particular safe access for maintenance must be of highest priority. Appropriate permanent and safe access shall be provided through design to enable vehicle and personnel after-hours access, regular servicing of plant, equipment, roofs etc.

Particular attention must be paid to the means of providing routine maintenance as per WH & S requirements e.g. cleaning of windows, clearing of gutters, changing lamps etc.

The Principal and representatives shall act in accordance with their legal obligation as a Client to consult with Designers, Project Managers and Principal Contractors. This shall ensure that the design, construction planning and construction work is undertaken in a way that prevents or minimizes all health and safety risks, in particular to University property, personnel and others.

17.9 Risk & Disaster Management

Evidence shall be provided to USP by the Designer, Principal Contractor, or Contractor, upon request, that risk management process has been implemented as required by relevant legislation as mentioned elsewhere in this section.

All risk assessments must be compliant with the legislation requirements with documented information about:

- 17.9.1 the nature of the risk or hazard
- 17.9.2 the likelihood of occurrence

- 17.9.3 the likely frequency of occurrence given risk controls in place
- 17.9.4 the severity of injury or damage
- 17.9.5 Further risk control options available to minimize outcomes

Contractor shall STOP WORK and follow all advisories that is sent by USP project Supervisors. It is the responsibilities of the contractor to secure their worksite, assets and make safe any potential hazards.

During Tsunami Evacuations, worksites are to STOP WORK, proceed to the nearest tsunami evacuation site, and wait for further instruction. Emergency wardens need to do roll call for their staffs

Contractors are to take natural disaster insurance cover for property and assets

In the event a Tsunami siren is activated where contractors are working, they are required to evacuate to the Tsunami assembly area with other building occupants and assemble and assemble as a group with site supervisors

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17.10 Electrical Safety

Electrical Designers must ensure that the design of the electrical equipment and the planned installation are electrically safe during construction and when completed as set out in National Building Codes and OHS regulations.

The Principal Contractor must fulfil the legal obligations as per the National Building Codes and OHS regulations. They must also ensure all other Contractors meet their specific legal obligations as designers and installers.

Contractor shall not disconnect, remove damage or tamper with any fixed building utility, eg water, power, IT, fire services and firefighting equipment's unless E&I has been notified and approval is given from the USP Project Supervisor.

Contractor shall not dig, excavate any grounds or road until clearance has been obtained from USP Project Supervisor or Utility authorities to proceed.

Contractor shall immediately notify the USP Project Supervisor if any USP Building or campus utility, eg. Buildings or underground water pipes and sewer lines, overhead power lines, internet, electrical and telephony cables, has been unintentionally damaged or broken.

Where deactivation of building fire detection and alarm system is required, the contractor is to inform the USP Project Supervisor at least 3 working days prior to disconnection.

In the event of a building fire alarm siren is Activated where contractors are working, they are required to evacuate to the fire assembly area with other building occupants and assemble as a group with site supervisors. The emergency wardens should carry out a roll call to ensure all their staff are assembled in assembly area

In particular, after electrical equipment or installation is complete, ensure appropriate testing and examination occurs to ensure that it is electrically safe and records of this are provided to the principal in a timely manner.

17.11 Registrable Plant

The Contractor must ensure that a Plant Registration form is completed for all registrable plant that is installed as part of the project. This form must be lodged with the Local Workplace Health and Safety, prior to the date of completion of building or structure.

The Contractor must also provide a copy of the form to the Principal. For the purposes of registrable plant, Principal shall mean the USP Estates & Infrastructure, Technical Officer (Engineering Trades).

Please forward all relevant information to the appropriate USP contact.

17.12 Working Permits

The contractor must ensure that any works carried out above 1.8 meters, or any hot works is carried out, requires

working height & hot works permit. Also any work carried out in confined or enclosed spaces such as lift shafts, tanks, etc, make sure that Asses site for risk of Asphyxiation and proper ventilation; Coordinate with Usp for any underground/concealed services.

NB: Conduct the necessary site risk assessments for the works. Above mentioned works requires a permit. All safety measures need to be implemented before the permit is issued. All copies of the permit must be emailed to the USP representatives every week. The copy of the permit should be made available at the work site.

17.13 Waste Management

Contractors are responsible for the clean and hygienic cleaning and clearing of waste from their worksite on daily basis. Only non-construction waste can be disposed off in USP provided trolley bins and SCC cages on campus.

Contractors are responsible for collecting and storing their construction waste and litter in their waste skip bins and bags and are responsible for its removal from campus and disposal on a regular basis at their own cost

For hazardous waste materials, for example asbestos and chemicals, contractors are to directly dispose this waste to designated disposal facility under the supervision of Environment Authorities

Contractors should not dispose of construction waste and litter into Campus ground and forest, campus environment, mangrove swamps, drains and sewer line.

18 Signage

18.1 General

The following signage requirements shall form a part of all new or alteration contracts.

All signage requirements shall be identified and presented in a ***Comprehensive Signage Design Document*** and must comply with standards below. Statutory and safety signage is not specifically covered in the Wayfinding Signage Manual but should be included in the ***Comprehensive Signage Design Document***.

18.2 USP Wayfinding Signage Manual

The ***USP Wayfinding Signage Manual*** ⁵ provides an approved strategy and implementation framework for wayfinding and signage systems to be implemented throughout all existing and future buildings and facilities both on and off campus.

The aim of the signage system is to ensure all applications meet quality standards of simplicity, uniformity and aesthetic appeal, while being highly functional in providing clear wayfinding and information and in accordance with National Building Codes or Building Codes of Australia (BCA) regulations.

The signage manual provides information on how to design and specify the complete range of sign types required for effective wayfinding and identification of USP facilities. The manual describes the principles of the wayfinding strategy and details the range of approved sign types, visual and graphic standards and also construction standards which must be adhered to.

This manual is issued by USP Property & Facilities and should be strictly followed to ensure consistent standards are applied when implementing new signage projects throughout the University. Due to ongoing expansion and development of the university, this manual will be reviewed periodically to maintain accuracy and to capture changing signage needs.

18.3 Door Barcode Labels

The purpose of the door barcode labels is to identify the space being entered, according to the Archibus Space Managementsystem. Secondly to assist with the yearly assets survey using handheld scanners.

The door barcode label must be located on the main entry door, hinge side, top and hidden from view when door is closed, as per the standard. The full installation standard is available by emailing fm_records@USP.edu.au

The Project Coordinator/Manager must request the door barcode labels from Infrastructure Systems & Information Unit by emailing fm_records@USP.edu.au

The responsibility for installation is as follow:

⁵ Refer to Appendix 18.2 Wayfinding Signage Manual, Issue C, Dated 15.11.2012

1. For a project involving maximum 10 spaces – Infrastructure Systems & Information Unit will produce the barcodes and Security will install the barcodes.
2. For a project involving more than 10 spaces – Infrastructure Systems & Information Unit will produce the barcodes and the Project Coordinator/Manager will arrange for the installation as part of the project signage work.

18.4 Other Specific Signage

Details of the following signs, where applicable, are to be obtained from USP:

- 18.4.1 Building project sign board - Layout to be as per USP Standard Detail S1737
- 18.4.2 Opening plaques for buildings

19 Teaching Spaces

19.1 Introduction

A primary objective in the design of teaching spaces should be to provide for multi-use spaces that enable pedagogical flexibility. The briefing of each space should confirm that USP's preferred pedagogical approaches are supported as well as supporting any special requirements

In addition teaching spaces must be safe for staff and students, be cost efficient, designed to accommodate minor changes without significant costs and comply with National Building Code.

University teaching facilities are generally used for a range of functions such as:

- Classes
- Computer aided learning
- Examinations
- Conferences
- Public events

USP provides teaching spaces in two modes; centrally managed and booked general teaching spaces, and specialist teaching spaces that are not generally bookable and are controlled and used by specific departments.

The following factors should be considered in the design of learning and teaching spaces:

- The shift to active learning, flipped classroom and group-based learning
- Use of electronic teaching aids
- Increasing use of laptop computers in class
- Simplicity in use of equipment
- The introduction of wireless computing
- The need to cater for students and staff with disabilities

19.2 Design Theory

Planning of teaching spaces for projection and display requires consideration of the most distant viewer situated at the most acute angle to the screen. The most demanding task is the projection of computer information, which is normally designed to be read at close proximity to the computer screen. Optical calculations, based on text legibility and information index should be undertaken by the appropriate consultant for each specialised space.

All teaching rooms, including computer rooms, must have visual surveillance available from the corridor in the form of a vision panel in the door or glazed panels to the corridor. See also [Section 3 Architectural Design](#).

19.3 Learning and Teaching Space Classification

Learning and teaching rooms are categorised into:

- general learning and teaching spaces
- computer laboratories and
- specialist learning and teaching spaces

General Learning and Teaching Spaces

General teaching spaces are those spaces available for use by all University departments, and include lecture theatres and classrooms.

Classrooms are multipurpose rooms with flat floors and movable furniture. Lecture Theatres are centrally controlled specialist teaching facilities that may have multiple uses and generally have tiered or sloping floors, fixed seating and writing facilities as standard.

The use of general learning and teaching space is arranged by the Facilities Team at the E&I Department

The technology component of general learning and teaching space is arranged by ITS Department.

Computer Laboratories

Computer laboratories are a combination of centrally controlled spaces which are bookable and managed by the department and Faculty controlled spaces which are non-bookable. They usually have a flat floor with fixed furniture.

Specialist Teaching Spaces

Specialist learning and teaching spaces are those controlled and bookable through the XXXXXX

These include scientific laboratories, computer laboratories, workshops, performance rooms, kitchens, studios and language laboratories. These rooms are usually custom designed for a specific purpose.

Conference Rooms

Conference, meeting and boardrooms may be used as teaching spaces and for administrative purposes, therefore conference rooms do require a range of teaching and presentation technology.

19.4 Learning and Teaching Space Furniture & Fittings

Learning and Teaching Space Furniture - General

Learning and teaching spaces should have loose furniture where possible, the detailed specifications to be determined for each project in consultation with the Facilities or Design team. The following sections provide guidelines for each specific type of learning and teaching space as well as identifying requirements for people with disabilities (PWD)

General Teaching Spaces Furniture - Classrooms

Provide standardised furniture, principally loose tables and chairs, for both the standard workstations and PWD workstation(s). All chairs to take a minimum 80Kg, and at least 25% of seats to be large seat pans. This applies also to tablet armchairs. Provide sufficient chairs to serve both the standard workstations and PWD workstation(s).

In addition, provide PWD workstation furniture (suitable for use by people with disabilities and in conformity with AS1428.2) at a ratio of 1:30 to standard workstations (tables and chairs), unless otherwise advised.

The PWD furniture provision shall comprise a loose height-adjustable horizontal bench/work surface (nominally 1200w x 800d), appropriately located for PWD access. Variation from this standard will be in consultation with the DRC.

Provision for PWD shall be in the following ratios: 2 for up to 100 seats, 4 for up to 200 seats, 6 for more than 200 seats. At each of these positions, provide a permanently located height-adjustable horizontal bench/work surface (nominally 1200w x 700d). These locations are also envisaged to be used by large, pregnant or other individuals who experience difficulty in using standard fixed theatre seating. Loose seats comparable in finish to the standard theatre seating are required to provide seating to these positions when occupied by non-wheelchair users.

Furniture designed to accommodate Audiovisual equipment shall be sized to accept a standard 19-inch rack 600mm deep and 720mm high with a min of 100mm clearance in height and side (including hinges) at the side and 150mm at the rear. Access to the rear of the rack shall be provided via a hinged and lockable door. All AV equipment furniture is to be designed to provide adequate ventilation suitable for a 1000W heat load.

General Teaching Space Furniture - Lecture Theatres

All benches, desks, lecterns, fixed seating and PWD furniture shall be provided as part of the building project. Fixed seating with tablet arms shall Sebel "Griffin". Sebel "Westmead" bench seating may be acceptable for different situations. Selected style is to be assessed on life cycle costs, quality of construction, functionality, warranty, ability to withstand expected usage traits, and supply of spare parts. Selected seating shall be by approval of USP Estates and Infrastructure department.

Left-handed tablet arms shall be provided at a ratio of 1:40. These should be installed at the left-hand end of a row adjacent to a passageway (relative to facing the front of the room). Left-handed tablets must be a different colour so that they can be identified by the students.

Audiovisual equipment accommodation shall be via a custom bench typically purchased by ITS team. Any non-standard furniture shall accommodate an equipment frame measuring 1100mm wide by 800mm deep by 800mm high with clear access to front and rear.

Computer Laboratory Furniture

The standard furniture provision shall comprise a fixed bench workstation with typical dimensions of 1200w x 900d x 700h with above-bench services (power 1 double GPO and 1 data per PC), cable tidy to enable concealment of excess cabling, and provision in the bench framing for the later installation of computer hardware security cabling. This furniture may be in form of a multiple workstation unit.

In computer laboratories generally, provide PWD workstations (generally as described above for Classrooms) at a ratio of 1:30 to standard workstations, unless otherwise advised.

In computer laboratories operated full time (i.e. 24 hour operation), the PWD workstations provided shall be electrically-operated height-adjustable version of the typical PWD workstation, and provided at the same ratio as standard workstations.

The PWD workstations provided shall be manually operated, height-adjustable workstation

Facilities for printing should be built into each computer laboratory. One printer space should be available for each 20 computers. If only one printer is to be placed in a lab, then it should be to PWD specification. Each printer requires 2 double GPOs and 2 data outlets and space for a printer, a value card reader and a PC.

Portable computers should be supported. Provide sufficient GPOs to support a ratio of one portable computer for two fixed computers.

Provide a large plasma screen that is clearly visible with network, power and TV aerial points. Provide security cameras for Computer labs as per ITS teams descriptions.

All chairs to be gas lift and on castors.

Specialist Teaching Spaces

Furniture, both fixed and loose in special teaching spaces may be designed to suit the particular teaching or research activities of the space.

For laboratory, refer Section 20 Special Requirements for Laboratories, including PWD provision.

Conference Room Furniture

Furniture typically consists of a central meeting table and fixed cabinets on a side wall or walls. At least one wall shall be reserved for projection - either with a fixed screen or motorised screen of appropriate size (refer 19.6.1).

The meeting table shall typically include provision to connect a presenter's portable computer for presentation purposes. The table design shall permit concealed wiring from the table to the AV projection system. Services provided include power, network, telephone and AV connections (typically VGA and audio). Sockets shall be mounted in a suitable recess in the table top, or in an approved 'pop-up' connection device. Liaison with Audiovisual Services is required.

A section of the cabinet work shall be reserved as the 'AV cupboard'. This cabinet shall be provided with ventilation suitable for a 1000W heat load. The cabinet shall accommodate an equipment rack measuring 560mm wide by 720mm high by 600mm deep with a minimum of 100mm clearance in height and at the side (including hinges) and 150mm at the rear. There should be no plinth or kick-board – i.e. rack should sit on the floor. Where possible, access to the rear of the rack shall be provided.

A ceiling feature to house and conceal the data projector is recommended for 'high profile' conference rooms. Ventilation and access must be in compliance with manufacturer's instructions. Refer 19.6 Projection Facilities, Projector Mounting.

Clocks

Clocks shall be placed in all teaching rooms in positions where they can be seen by the lecturer and the students.

Vertical Writing Surfaces

The preferred vertical writing surface is a whiteboard. Whiteboards will be installed as per specifications in Section 9 Furniture and Fittings. The location of the whiteboard shall allow for both projection (if installed) and the whiteboard to be used simultaneously

Telephones

There is no requirement for telephones in learning and teaching spaces.

Security

The primary access doors for all new and refurbished general teaching spaces and computer rooms will be solid core doors with visual access panels.

Wireless computing

In consultation with the Information Technology Services Department, a wireless access point should be incorporated into new and refurbished general teaching spaces having a seating capacity of 25 or more.

Power points for Laptops

In all learning and teaching rooms and areas where students can gather provide adequate power points so that students can use their own devices. Locations and extent of provision to be installed in consultation with Estates and Infrastructure department. Where power points are provided, ensure that they are suitably sized to take transformer/plugs. .

19.5 Audio-visual Provision

The level of AV facilities to be provided in general teaching spaces is described in the following table. Refer Section 23-AV Standards for Classrooms and Lecture Theatres.

ITS will act as the audio-visual consultant for any project involving the installation of AV equipment or facilities.

ITS will act as the installation contractor where applicable and appropriate.

Level of audio-visual facilities will be categorized as per table 19.1 below. A brief summary of categories:

SMR	Standard Meeting Room; A typical Media equipped Meeting Room with a standard range of AV facilities
VCR	Video Conference Room; A typical Media equipped high end Video Conference Room with a comprehensive range of AV facilities for high end Meeting / Board Rooms
PBL	Problem Based Learning; A typical Media Equipped flat floor podium with a single data projector and comprehensive range of AV facilities for Collaborative Learning Space (standard flat floor classroom)
Tiered Theatre	A dual-projector fully equipped Tiered Lecture Theatre with high definition wide screen projection capable of displaying two different images simultaneously

AV FACILITY	SMR	VC R	PB L	Tiered Theatre
Data Projector	Opt	Opt	Std	Std
Dual Data Projector	-	Opt	Opt	Opt
	-	-	-	-
Flat Screen Monitor	Std	Std	Opt	-
Separate DVD Player	-	-	-	-
Installed Computer	Std	Std	Std	Std
Laptop Connection – HDMI/VGA	Std	Std	Std	Std
Wireless (WiFi Coverage)	Std	Std	Std	Std
Telephone	Opt	Std	Std	Std
Web Camera	-	-	Opt	Std
Document Camera	-	Opt	Std	Std
	-	-	-	-
Microphone Wireless	-	Opt	Std	Std
Microphone Fixed	Opt	Std	-	Std
Voice Reinforcement (PA)	-	Opt	Std	Std
Program Audio System	Std	Std	Std	Std
Surround Audio System	-	-	-	Opt
Hearing Augmentation	Opt	Std	Std	Std
Simple Button Panel (AMX)	Std	-	-	-
Comprehensive Touch Panel (AMX)	-	Std	Std	Std
Lighting Controls at Bench	-	-	Opt	Std
Lecture Capture	-	-	-	Std
Interactive Screen	Opt	-	-	-
Cable Cubby	Opt	Std	Std	Std
Collaborative Work Station (CoW)	Opt	-	-	-
Bio Box	-	-	-	Opt

Legend:

- '-' = not provided or not applicable
 'Std' = standard provision
 'Opt' = optional provision

19.6 Projection Facilities

Learning and teaching spaces should be designed to accommodate projection capability in accordance with the following design considerations.

5.3H Rule

Rule Optimum projected image height will be one-sixth the distance to the rear-most seating position. That is, the distance to the most distant seat should be no more than 5.3 times the height of the image (5.3H). Note for specialised classrooms (i.e. biological laboratories and engineering) The distance to the most distant seat should be no more than 4 times the height of the image (4.0H). In addition, no seat should be closer than twice the image height (2H) to the screen and the horizontal viewing angle should not be greater than 45 degrees from the opposite edge of the image. Vertical viewing angle should not exceed 35 degrees to the upper edge of the image.

Aspect Ratio

Width is determined by the aspect ratio and should be approximately 2:1 (width: height ratio). This aspect ratio will cope with current 16:10, 16:9 and 4:3. Image masking is not required.

In Tiered theatres the screen must accommodate two 16:10 images side-by-side.

Sightlines

Ideally the lower edge of the image should not be obscured by the presenter, but must not be lower than 1200mm above floor level in tiered lecture theatres. 1350mm or higher above floor level in general for flat floor classrooms and theatres is preferred. Where ceiling height is restrictive, screens should be offset to minimise obstruction by the presenter.

Projection Walls

Where practical, a suitably treated white wall is preferable to dedicated projection screens. This offers flexibility in the placement of projected images and maximises the scope for multiple images. Roll-down screens should be avoided wherever possible as they are easily damaged. Where roll-down screens cannot be avoided, motorised units are recommended.

Projection Wall Surface Finish

Unless otherwise specifically required, plasterboard walls used for projection in spaces other than major lecture theatres and specialised spaces will be finished to level 4 standard as defined in AS/NZS 2589:2007.

Projection walls in major theatres and specialised spaces will have a plasterboard surface, prepared and finished to a level 5 standard as defined in AS/NZS 2589:2007

All surfaces used for projection must be matt white, flat and uniform in texture. Any gloss will cause reflections or 'hot spots' and is unacceptable

Multiple Images

The capability to project at least two simultaneous images (each complying with the 5.3H rule in [Section 23 AV Stds for Classrooms and Lecture Theatres](#)) should be provided in any new or refurbished lecture theatre wherever practical. Particular attention to screen-to-projector relationships is required.

Projector Mounting

Data projectors shall be securely mounted in a position which permits access for servicing without the need for scaffolding. Where the mounting position with standard lens is greater than 3.5 metres from the floor or access with a ladder is difficult due to furniture or tiering, consideration must be given to mounting the projector(s) at the rear of the theatre. The projector housing must be designed to prevent unauthorised interference and theft and provide ventilation to the manufacturer's specifications.

Where a projector is installed in a solid plasterboard ceiling, an access hatch shall be provided within 600mm of the projector mounting pole. Refer [Section 7 Ceilings and Ceiling Finishes](#).

Projector Performance

Minimum brightness specification for any installation is 3500 ANSI lumens. For larger lecture theatres 5000 ANSI lumens or greater is required. All projectors will have network connections for remote diagnostic and security monitoring.

19.7 AV Infrastructure Services

Services to support audio-visual equipment in teaching spaces (power, data and voice communication) will vary depending on the intensity of AV provision made. These matters are described in [Section 23 AV Stds for Classrooms and Lecture Theatres](#). Details of AV cabling and documentation are also described in this Section.

19.8 Teaching Space Design Considerations

Windows

Any exterior windows should be treated to minimise or reduce extraneous light which will degrade projected images.

In Computer Laboratories it should be possible to darken the room to a very low level (e.g. 10 lux).

In Lecture Theatres complete blackout is required.

Acoustics

Particular attention should be paid to the acoustic treatment of all presentation spaces. Every person in the space should be able to hear the presenter clearly. The measure of acoustics in a teaching space is the Speech Transmission Index (STI). The minimum standard required is a rating of STI 0.6 – 0.75. Preference for teaching spaces is a rating of STI between 0.75 and 1.0

Reverberations and reflections (echoes) which degrade speech intelligibility must be eliminated. This is particularly important in larger spaces where reverberation times are longer. All spaces are to be constructed in such a way as to control reverberation and echo internally and provide isolation from all noise sources. The signal amplified or unamplified speech to noise (all other sound) ratios at the listener position should be better than 25dB to optimise intelligibility. Rear and side wall reflections should be minimised by appropriate acoustic treatment.

Isolation from external noise is essential. Noise from air-conditioning and ventilation system must be minimised. High-volume, low-velocity air circulation in ducting and vents will minimise noise.

For large theatres (200 or more seats) specialist advice on acoustic treatment, speaker selection and placement, and equipment configuration is essential.

19.9 People with Disabilities (PWD) Provision

General Teaching Spaces and Computer Laboratories

Furniture provision has been described above.

In Lecture Theatres, podiums and stage areas shall comply with the requirements of AS 1428.2 Clause 26.

Specialised Teaching Spaces

Requirements in specialised learning and teaching spaces such as laboratories are discussed in [Section 20 Special Requirements for Laboratories](#). Requirements for other specialised teaching spaces should generally comply with code requirements referred to above. The provision of these facilities should, unless otherwise advised, be on the basis of 1:30 standard workstations.

Hearing Augmentation

In all lecture theatres and general learning and teaching spaces, hearing assistance systems shall be via an approved infra-red (IR) hearing augmentation system installed in the room. Refer to Section 16.5 Audio Visual Facilities – Hearing Augmentation – Listening systems – for the type and make of the hearing system.

Hearing augmentation may be required in specialist learning and teaching spaces; the requirement must be established during the design briefing stage.

19.10 Projection Room & Bio-box

Requirement

A separate projection room or Bio-box to be provided, where necessary, in Lecture Theatres to house projectors and audio-visual control equipment. The Projector room / Bio box should be fully air conditioned and temperature to be set at 20 degrees Celsius. Typically the Bio-box will accommodate data projectors, an equipment rack (or racks), electrical switchboard and lighting dimmers for the theatre. In some theatres, the Bio-box will accommodate staff and equipment used for video recording lectures.

Location

The bio- box shall be located for optimum sightlines to the theatre's projection screens. In plan view, it must enable projectors to be mounted on the normal of the screens' centre lines.

In side elevation view, the projectors must not be higher than the normal of the top edge of the projection screen, not lower than the normal of the lower edge.

There shall be no obstructions between the projection screens and the projectors.

Layout

A projector opening shall be sufficient in size to allow unobstructed projection of images. Size and location shall be determined by ITS staff at design stage. The height of the Bio-box floor shall be chosen so that sightlines from projectors mounted on the shelf are clear of people immediately in front of the biobox.

Easy access to the bio- box from within the theatre and from outside the theatre is desirable. Outside access is to enable technical staff to enter without disturbing proceedings in the theatre. Bio-box doors should be keyed differently to the theatre

20 Special Requirements for Laboratories

20.1 Design Issues

Laboratory Definition

This Section deals with spaces used for teaching or research activity in which there is some potential hazard to users; conventionally referred to as wet laboratories, such spaces will generally involve the use of reticulated water and/or gases and are distinguished here from "dry laboratories", a term used to describe electronically-intensive teaching spaces such as computer labs or language labs. Dry laboratories are not addressed in this section; they are described as teaching spaces in [Section 19 Teaching Spaces](#).

This section deals with laboratories which are defined as 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 or analysis. Such work may involve the use of chemicals including dangerous goods, hazardous substances, pathogens and harmful radiation, quarantine materials, or processes including electrical or mechanical or hydraulic work which could also be hazardous.

The laboratory includes such support areas as instrument and preparation areas, laboratory stores, special chemical stores, special cold storage areas e.g. cadaver storage, animal holding areas and any offices ancillary to the laboratory. Office, administrative and write-up spaces should not be part of laboratory spaces.

These design standards deal only with teaching and research laboratories within the University context. Facilities for larger scale pilot plant production or manufacturing are not within the scope of this Section. Should such facilities be under consideration, specialist consultancy advice on regulatory requirements associated with such products, as well as the appropriate risk assessment must be undertaken.

Regulatory Requirements

Laboratory spaces must be designed to comply with the applicable parts of AS/NZ 2982.1 and/or AS2982, AS/NZS or AS 2243 Parts 1-10 inclusive, AS 1940, AS 4332, AS or AS/NZS 2430, and referenced and related documents including the Queensland Workplace Health and Safety Act and regulations and the National Building Codes or Building Codes of Australia.

In some circumstances it may be appropriate to reference relevant facility guidelines from Queensland Health State legislation and advisory standards, relevant depending on the nature of the possible laboratory hazard, include:-

- Workplace Health and Safety Laboratory Management System Guide 1994
- Workplace Health and Safety Act 1995
- Workplace Health and Safety Regulation 1997 (with regular amendments)
- Workplace Health and Safety (Miscellaneous) Regulation 1995 (with regular amendments)
- Hazardous Substances Advisory Standard 1998
- Queensland Health (Drugs and Poisons) Regulations 1996
- Radiation Safety Act 1999
- Radiation Safety Regulation 1999
- Radiation Safety Standards published by Queensland Health which set out the requirements for licensing radiation sources in use (e.g. PR001) and in storage (e.g. PR002)
- Workplace Health and Safety Risk Management Advisory Standard 2000

- Gene Technology Act (2000) and Regulation (2001)
- AQIS

It should be noted that a number of Australian Standards principally deal with operational procedures and practices in laboratories which are the responsibility of the users of the facility. The users may not be fully conversant with these requirements.

With respect to regulatory compliance, it should be noted that the Queensland Workplace Health and Safety (Miscellaneous) Regulation 1995, in the context of the use of specified dangerous goods in laboratories, refers to AS 2982 published in 1987. While this Standard has been superseded by AS/NZS 2982.1 (1997), the reference in the current state regulation is to the previous Australian Standard. Note that the reference in the Regulation (Clause 127) excludes several significant sections of the Standard.

The excluded sections in AS2982 (i.e. 1987) refer to laboratory compartmentation and flammability hazard rating (2.2.3.1 & 2.2.3.3), travel distances (2.3.3), distance between exits (2.3.4), egress doors (2.3.6.3), corridor width (2.3.7.1), hydrants, hose reels and fire hose (7.2) and fire protection equipment (12.6).

It is the intention of the University to retain recognition of the concept of flammability hazard rating and the implications of the application of this principle. This position is driven by the experience that typically teaching laboratories are used for a diverse range of experimental and demonstration activities in which the likelihood of the use of flammables exists. Accordingly, it is the requirement of any laboratory design brief to consider and determine the maximum quantities of flammables likely to be used in teaching laboratories. Where found to exceed the L (low) flammability hazard rating specified in Table 2.1 of AS2982, the design, unless otherwise agreed with the University, must exceed the minimum regulatory requirement and provide, at the least, the following:

- Fire-rated construction to achieve the laboratory compartmentation requirements of section 2.2.3.1
- Travel distances complying with section 2.3.3
- Distances between exits complying with section 2.3.4
- Egress doors complying with section 2.3.6.3 and
- Corridor width complying with section 2.3.7.1

It is also a requirement of the University that the design comply with specific requirements set out in AS/NZS2982.1 with respect to tertiary teaching laboratories (a matter more clearly expressed than in AS2982) that there be no storage of "flammable liquids" or "chemicals emitting hazardous vapours" in the laboratory.

Depending on the nature of the laboratory, the completed facilities may also be required to be designed to satisfy specific regulatory requirements. For example, laboratories dealing with genetically modified organisms (GMOs) must satisfy the requirements of the Commonwealth Gene Technology Act-2000.

The Laboratory Brief

Complementary to the preparation of the FDB generally, the laboratory design brief must clearly define the operational requirements of the laboratory and associated spaces. Appendix A1 of AS2982.1 contains a schedule of planning design and construction considerations applicable to laboratories.

The design brief must determine the type of laboratories: they may be a teaching or a research facility with specialised containment, fume exhaust, waste handling or other special requirements. Code requirements

for such particular laboratory provisions as eyewash and safety shower stations, services isolation provision, bench clearances and the like must be satisfied.

The design brief must determine the type of laboratories: they may be a teaching or a research facility with specialised containment, fume exhaust, waste handling or other special requirements. Code requirements for such special provisions as eyewash and safety shower stations, services isolation provision, bench clearances must be satisfied.

This brief must identify potential hazards (toxic, flammable, chemical, biological, infectious, radioactive, odour/smells) associated with the operation of the facility, and must identify the quantities and classifications of chemicals to be stored and used in the laboratory. While AS/NZS 2982.1 touches on chemical storage issues, AS 1940 and AS 2243.10 should also be closely referenced.

Ensure there is adequate provision for laboratory storage of equipment, consumables and for chemicals. Note that special code requirements apply to chemicals subject to hazard type, flammability and quantity. Note that special code requirements apply to chemicals subject to classification and hazard type (flammability, toxicity corrosive), segregation by classification, and quantity. Cupboards for chemical storage may be custom designed or special proprietary types with internal bunding, closing doors, of various materials (typically steel or polypropylene) and may be vented and lockable. Note that the stated (theoretical) capacities of proprietary storage cabinets do not reflect the realistic/practical storage capacity when storage container sizes are taken into account.

The brief must also realistically predict the extent and types of chemical, equipment and/or consumable storage required in the laboratory. It is the University's experience that frequently in laboratories the provision of this type of space is inadequate.

The brief must also determine what wastes are likely to be produced and the methods of handling solid, liquid and gaseous wastes. Considerations of disposal implications with respect to airborne, waterborne or liquid radiological and toxic wastes must take into account relevant environmental protection legislation.

Determine the extent of PWD (persons with disabilities) accessible requirements with respect to lab benching, fume cupboards, laminar flow cabinets and biohazard cabinets.

Address the following design items as applicable:

Design Items	
New Buildings	• slab to slab heights • service voids/ducts • external servicespaces
Existing Buildings	ceilings/ceiling heights
General	• fixed or removable joinery • laboratory services ducted versus fixed joinery

Risk Assessment

From the design brief, a detailed risk assessment (analogous to HAZOP procedures) involving all key stakeholders must be carried out to document and record identified risks and responses.

A suggested methodology is that set out in the Workplace Health and Safety publication dated May 1994 Guide: Laboratory Health and Safety Management System. While in a number of respects this document is no longer current (it refers, for example, to superseded editions of several Australian Standards), the guide does set out a logical process for dealing with risk assessment and management in laboratories. The more recently published Workplace Health and Safety Risk Management Advisory Standard 2000, deals more generically with the same process using a five step sequence of risk assessment and response.

20.2 Consultation

To ensure compliance with the design guidelines on there shall be close collaboration and coordination between the consultants and Engineering Services staff attached to USP's Property & Facilities Department

The Consultants will be required to attend documentation reviews with Engineering Services staff (electrical/mechanical/hydraulic) at the following key stages:

- At completion of schematic design
- At 50% completion of design development
- At 90% completion of tender documentation

These consultations are regarded as mandatory project milestones and will be validated in the form of a Project/Consultants Meeting minute by the Project Manager. The number of reviews will reduce to two for smaller projects where schematic design and design development become an integral phase. The Consultant will contact USP's Engineering Services staff and arrange review meetings in a timely manner and shall submit a copy of all relevant review documents at least 5 working days prior to the scheduled review meeting.

The Project Manager will issue a current list of USP'S technical contacts to consultants at the inaugural Project/Consultants meeting.

20.3 Laboratory Furniture

Generally, laboratory furniture shall be designed to satisfy the needs of the particular laboratory activities and may comprise wall, peninsula or island benching. Benching may be fixed, loose or mobile (with castors), and where fixed will typically incorporate integral splashbacks to wall intersections. Benching may incorporate shelving, or shelving may be wall mounted. Bench dimensions shall take account of ergonomics, functional and equipment dimensional considerations.

Loose Laboratory Furniture

While it is common in project procurement to categorise unfixed furnishings as "loose furniture" funded by other than building construction budgets, this approach to the specialised provision of loose laboratory furniture such as under-bench units, lab stools, chairs and tables is generally inappropriate. Laboratory under-bench furniture will typically be custom made to integrate functionally and aesthetically with laboratory benching, and should be included in the construction budget as part of the building project.

Details shall be determined in conjunction with USP.

Bench Surfaces

Bench surfaces within laboratories are to be designed to suit the use of the laboratories. Joints in bench tops are to be minimised.

In circumstances where special or particular chemicals are to be used, the user should carry out performance evaluation (physical testing) of proposed bench surfacing options. Such tests will trial the performance of alternate materials in circumstances (types and concentrations of chemicals) likely to be encountered in the particular laboratory. Manufacturer's claims for chemical-resistance performance do not always satisfy user demands.

Bench top colour selection should take into account the expected laboratory activities, including risks of marking, staining or burning and the texture/pattern of the material. Colour of bench top to be approved by the University. All bench tops are to incorporate an approved drip mould.

Benchtop material options comprise the following or their product equivalents:

Trespa TopLab Plus cellulose fibre reinforced thermosetting resin board material (typically 16mm) (or approved equal) suitable for wet laboratories where some significant potential for chemical contact exists.

Limited colour range.

Note: check that prospective alternate materials have equivalent properties.

"Chemical resistant" laminate over moisture resistant Craftwood. All faces and edges (including bottom) to be covered with chemical resistant laminate, which may be postforming grade. "Chemical resistant" is a notional concept and these materials are suited to some low chemical contact uses only.

Trespa Athlon resin board material (typically 16mm). An alternative to laminate; does not have the chemical resistance properties of TopLab.

Bench Framing

Welded bench framing may be either powdercoated mild steel or stainless steel to suit the application. Where risk of corrosive exposure exists, ensure that any powdercoat used is corrosion resistant, such as epoxy powdercoat.

Bench framing must be engineered to suit the anticipated loads. Heavy loose equipment such as laminar flow cabinets and bio-hazard cabinets, for example, will require heavy duty bench framing.

Bench leg spacing should be designed to take account of anticipated bench activity, single or dual work or study groups. Leg spacing to accommodate at least two under-bench units is typically preferred.

20.4 Special Laboratory Equipment

Depending on the type of laboratory, provision for special laboratory equipment may be required. Equipment may be either floor mounted (free standing) or bench mounted. This may include the following:

Glass Washer

Provision may be required for the installation of a three phase commercial laboratory glass dishwasher. The following services may be provided:

- a) Power supply which may be 10A, 15A or 3P to suit the load of the dishwasher
- b) Hot water, cold water and possibly laboratory-quality rinse water from the laboratory services terminating in an appropriately sized and type of valve.

Ensure that adequate storage space has been provided near glass washers for accessory trays which may be used in the machine.

Ice Maker

Provision may be required for the installation of a special ice maker. The following services shall be provided: water (check water quality required: filtration may be required water quality may be RO or deionised), 240v power, drainage (for ice melt from cabinet (check tundish/drain height/location). Provide sufficient space for maintenance access.

Autoclave

Provision may be required the installation of a commercial quality autoclave/steam steriliser. The following services may be required: power (check capacity/rating) exhaust ducting (verify requirement and usage cycles), water (check type and quality), drainage.

Provide sufficient space for maintenance access and for the steam generator if required. Determine in the operation of the steriliser, particularly at opening, whether specialised exhaust for odour removal is required.

Low Temperature Freezers and Cold Rooms

Provision may be required for the installation of a special low temperature (typically -20, -50 or -80 deg C) proprietary freezers or purpose-built cold rooms. Check requirements for power (typically 10A or 15A), CO2 "blanket" systems, alarms (over-temperature local and remote), and floor setdowns for cold rooms and verify that air-conditioning loads fully account for these systems. Provide floor wastes outside the doorways of cold rooms in accordance with regulatory requirements.

Furnaces

Being heavy high temperature equipment, provide heavy duty benching, non-combustible adjacent surfaces and power to suit the appliance (typically 10A, 15A or 20A). Consider whether special ventilation or exhaust is required.

Microwave Ovens/Reactors

Provide suitable benching and power to suit the appliance (typically 10A or 15A). Consider whether special ventilation or exhaust is required. As these devices present some risk of explosion, locate them to minimise explosion risk to operator and other laboratory occupants.

Environmental Cabinets

Provide sufficient space to accommodate these large appliances. Provide power water of suitable quality and drainage tundish, as required to suit the equipment. Water quality should ensure that the risk of blockage (and consequent flooding) of humidification systems is minimised.

Vibration Isolation/Balance Benches

Users may require vibration-isolated benching for measuring or microscopic work. Determine quality of vibration-isolation required; furniture may comprise basic steel framed rigid benching, terrazzo-topped steel benching or proprietary airbag suspended furniture.

Monitor Brackets

Wall and ceiling mount monitor brackets must be to a design applicable to the make and model of the monitor to be used in each specialised situation.

20.5 Finishes

Refer Section 5 (Internal Walls, Partitions and Finishes), [Section 6 Floors and Floor Finishes](#) and Section 7 (Ceilings and Ceiling Finishes) respectively. Ensure that code requirements are met with respect to selected finishes; considerations which may be applicable include flammability, slip-resistance, ease of cleaning (smoothness, provision of coves, sealed joints, avoidance of construction joints), resistance to chemicals and/or cleaning/decontamination agents.

In wet laboratories where the risk of water spills and flooding may exist, detailing and construction sequence may need to be considered to achieve the optimal flood containment and minimal risk of leakage to lower floors. In high risk areas, consideration of containment may be required.

20.6 Hydraulics

Laboratories should typically contain both laboratory process sinks and hand wash basins dedicated to that activity and located near entry/exit points. Provision of both hot and cold water is recommended. See below for safety shower and eye wash requirements.

Laboratory Fixtures and Fittings

Laboratory sinks may be centre bowl or double bowl laboratory sinks with draining boards and 300mm high integral splashbacks, inset bench type or pot sink type to suit the application. Sinks are typically fabricated from Type 316 stainless steel and shall be certified as such by the sink supplier. Copies of such certification shall be provided to the Superintendent. In some instances where corrosive chemical exposure is likely, the use of porcelain bowl sinks (preferably installed without an expressed rim, i.e. under bench mounted) may be necessary. Self-draining PVC runnel sinks shall be installed in benches where required by the Space Description Forms.

Water supply

Water supply to fixtures and fittings must take into account the service and its quality. Potable supply must be provided to safety equipment (safety showers, eyewash stations, hand wash basins)

Special laboratory water

Special watersystems (such as deionised, demineralised, reverse osmosis or purified) where required should be accurately defined in terms of demand and water quality. Laboratories may provide their own water treatment/purification systems which may require pre-treated water, UV sterilisation, carbon filtration, storage tanks/vessels, recirculation pumps, special piping and avoidance of dead legs, and special metal-free tapware. Systems may be either stand-alone or recirculating depending on quality and quantity.

Safety Showers

Safety showers and eyewash stations are to be provided in accordance with AS/NZS 2982.1. 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 main exit from the laboratory.

A floor drain under the shower is generally not recommended by USP however, the final design concept will be as agreed with project specific stakeholders. In some biological laboratory applications, the presence of a floor waste may be an unnecessary source of biological contamination - review with key stakeholders.

Eye wash stations are not to be drained onto the floor but piped to waste.

Waste water

Determine the nature of liquid wastes to be produced and whether dilution, neutralisation or holding may be required.

The sealing of floor wastes should be considered in light of chemical requirements and EPA provisions such as preventing chemicals from entering drainage systems and the environment. This includes waste from safety showers.

20.7 Air-Conditioning & Ventilation

Laboratory requirements may include the provision of fume cupboards, specialised ventilation or local exhaust systems. The impact of such systems on air-conditioning loads, and opportunities for fresh or tempered air make-up should be considered.

In laboratory briefing, any requirements for 24 hour air-conditioning must be identified. Note that some experimental procedures require irregular extended operating hours.

Requirements for humidity control must be clearly specified by users. The particular requirements of equipment or processes must be clearly understood and documented: absolute humidity limits (high or low) or acceptable humidity ranges may be the design criteria.

PC-2 facilities are to be equipped to measure and display the pressure difference between the facility and adjacent areas. The display must be able to be read before entering the facility. NB. This is standard requirement for PC-3 facilities that is also adopted by USP for PC-2 facilities.

Determine the requirements with respect to fume cupboards, laminar flow cabinets and biohazard cabinets. Code requirements for space clearances to fume cupboards must be satisfied.

With respect to fume cupboards, the requirements for fume scrubbing must be determined. Consider the visual impact of exhaust flues. Consider the location and dimensions of exhaust flues in terms of their aerodynamic effectiveness taking account of prevailing wind directions, proximity to adjoining window or ventilation openings, proximity to adjoining buildings or other obstructions as sources of turbulence and the like. If necessary in problematic sites or to satisfy EPA requirements, a detailed air flow/dispersion study may be necessary.

[Refer Section 24 \(Air Conditioning and Ventilation\).](#)

20.8 Lighting & Power

Refer [Section 27 Electrical Services](#).

Note the particular requirements of laboratory-related codes with respect to outlet locations above benching, service isolation and proximity to flammable liquid cabinets and other sources of ignition.

20.9 Communications, Data & Security

Ensure that the brief adequately addresses the particular laboratory requirements for communications and equipment alarms, security systems, access control, and data provision. Refer also Section 23 (AV Standards for USP Classrooms and Lecture Theatres).

20.10 Fume Exhaust Systems

[Refer Section 24 \(Air Conditioning and Ventilation\).](#)

20.11 Health & Safety Provisions

Typical minimum safety provisions to satisfy AS/NZS 2982.1 may include safety showers and eye wash stations, hand washing facilities, safety and evacuation signage, noticeboards, placarding and storage of safety equipment and data records such as MSDS.

Safety Showers and Eyewash

Refer [subheading 20.5](#) above

Safety Isolators

Provide the relevant safety isolators for power, gas and other services as required by the relevant standards and regulations. Services isolation shall not include reticulation to safety equipment such as eyewash and safety showers. Position isolators adjacent to doors and away from light switches if possible. The use of a combined isolating device addressing all reticulated services in one action is preferred.

In addition in teaching and research laboratories, it is desirable that each bench be separately isolatable for maintenance purposes. Confirm this requirement for each laboratory.

Services Outlets

[Refer Section 25](#) (Sanitary Plumbing and Drainage) and [Section 26](#) (Piped Services and Storage Tanks). All laboratory service outlets for reticulated services including water, demineralised water, LP gas, vacuum, compressed air and special gases shall be approved types. Reticulation systems and outlets for specialised services such as high purity and ultra-high purity gases should be provided with all necessary fittings such as stop valves, pressure regulators, flow control valves, special diaphragms and the like. Laboratory fittings shall be epoxy coated and generally colour coded as per the DIN Standard. The preferred manufacturer of laboratory tapware is Broen. Other brands will be subject to approval. The preferred manufacturer of specialised quick-connect couplings and fittings is Swagelok. Other brands will be subject to approval.

20.12 Access to Laboratories for People with Disabilities

General

This section sets out some guidelines for the design of laboratories in order to provide access for people with disabilities. In general, each teaching laboratory shall have at least one workstation per laboratory which is adjustable to allow use by a person with a disability. Some general principles are set out below. The publication Accessible Scientific Laboratory Design by Jaye Johnson (now at the WA State Disability Liaison Office) and published by the University of Western Australia Student Services is a useful primer on this subject.

The most common problem for people with disabilities in laboratories is that of heights of working surfaces and the inadequacy of space below the surface. Laboratory spaces are usually designed for standing work which limits their use by those who use wheelchairs or have poor balance, co-ordination and endurance.

Flexibility of design, including adjustability, helps to fit the working environment to the range of users. One workstation per 40 users should be designed to be easily adjustable by the user to enable a full range of bench heights to be used giving access to all services. The design should also ensure that items such as fume cupboards and sinks can be arranged so that at least one is accessible to people with disabilities.

A location towards the front of the laboratory is desirable to facilitate lip-reading for visually impaired students.

Working Heights

Although standard heights of wet laboratory benches are normally high enough, if unobstructed, to allow a wheelchair to fit below the bench, they may be too high for wheelchair users. Reference should be made to AS 1428.2 Section 24 “Furniture & Fittings” for standards for tables, counters and worktops.

Access

It is important that access between benches is adequate and not less than set out in AS 1428.1.

Reach Distances

Reach Distances for disabled workstations should comply with the provisions nominated in Section 22 of AS 1428.2.

Laboratory Services

The controls for power, water, gas etc. in wet laboratories are usually placed on a service spine above the bench top and away from potential hazard. In many cases, the location and separation of the services is determined by regulation. Consideration should be given in the design of the workstation for people with disabilities to the placement of services and controls in a position accessible to people with disabilities. Reference should be made to Section 12 of AS 1428.1 for details.

Hearing Augmentation - Listening System

Provide an audio-frequency induction loop system in accordance with AS 1428.2 for persons with impaired hearing in laboratories. The audio loop system must consist of a low impedance coil recessed into the floor and a suitable amplifier mounted in an equipment rack in an adjacent preparation room.

20.13 Special Hazard Laboratories

Spaces within laboratories or entire laboratories in which hazardous materials or products are used must be designed and operated in conformity with specific Standards and State legislation. In some cases no specific regulation currently exists, in which case reference to national or international best practice must be made.

Examples of laboratory activities which may require careful specific consideration include:

- Biological or microbiological laboratories
- Vivariums or plant houses
- Clean laboratories
- X-ray and radiological laboratories
- NMR (nuclear magnetic resonance) facilities
- Electron microscopy
- Use of cryogenics (e.g. liquid nitrogen or helium).

Examples to issues to be addressed may include:

- Containment strategies
- Clean room construction and specialised mechanical installations for high quality particulate air filtration
- Non-ionising radiation exposure (magnetic/electrical fields, laser, RF, IR and UV)
- Ionising radiation exposure (X-ray, gamma rays, alpha particles, beta particles)
- Hazardous goods handling (e.g. cryogenics - very low temperatures, oxygen displacement, delivery by lifts, special storage)
- Mechanical vibration or freedom from vibration.

Part 2 - Services

21 Videoconference Facilities

21.1 Design Issues

This section outlines additional requirements for videoconference applications in new and refurbished rooms.

The purpose of a videoconference is to 'connect' people in geographically distant sites visually and aurally to enable an exchange of information. Applications include:

- Meetings
- Interviews
- Research collaboration
- Teaching (small or large group)

In all cases, the goal is to create a single 'virtual' working environment with the enabling technology becoming 'invisible' to the participants. Natural looking images and clear natural sound are fundamental requirements.

While videoconference rooms may be purpose-built, more typically they are multi-function or multi-purpose rooms. Careful design is required to balance sometimes conflicting requirements and to integrate the videoconference system with other audiovisual facilities.

An additional consideration for videoconferencing over and above normal room design requirements is the quality of the image and sound transmitted to the remote site(s). This image is generated by one or more video cameras that 'see' the local participants. Viewing angles, sightlines, background, and lighting impact on the transmitted image quality.

Conversely the quality of the received image is affected by viewing angles and sightlines, but lighting requirements conflict with the needs of the camera(s). Image size is also important.

The quality of the image and sound received from the remote site is largely beyond our control, but the quality of the outgoing image and sound is determined by factors within our control. Failure to address fundamental lighting and acoustic issues will greatly reduce the usefulness of videoconferencing as a communications medium.

21.2 Definitions

(To be read in conjunction with definitions in [Section 23 AV Stds for Classrooms and Lecture Theatres](#))

- Near end - the site of the local participants
- Far end - the remote site or sites
- Endpoint - the device transmitting images and voice to/from the far end
- ISDN - Integrated Services Digital Network - a digital telephone line used to transmit/receive videoconference calls where a network connection is unavailable.
- IP - Internet Protocol - a network-based method of videoconference connection
- H323 - standard protocol for IP-based videoconference calls

- H320 - standard protocol for ISDN-based videoconference calls
- SIP - Session Initiation Protocol - an emerging network-based communications protocol offering greater efficiency than H323.
- Access Grid - an alternate video collaboration method using a high-speed network connection. Currently access grids are incompatible with video conference facilities. USP does not recommend the use of access grids

21.3 Acoustics

The acoustic environment must be treated to minimise internal reverberation and external noise intrusion. Location of the room away from traffic noise, plant rooms or other noise sources is essential. Target rooms characteristics are:

- Reverberation time 0.5 seconds (RT60)
- Ambient noise NC30
- Isolation to STC50
- Windows to be avoided, otherwise acoustically treated

21.4 Lighting

Lighting must be carefully designed to ensure local participants can be clearly 'seen' by the camera or cameras without harsh shadows, and without affecting the visibility of monitors or projection screens.

Lighting shall be uniform, diffuse and of constant colour temperature.

21.5 Room Environment

Room colour scheme must be chosen to produce the best video image as seen by the camera(s) - and hence the remote participants. Rich, uniform pastel colours work best.

There must be a minimum of detail and texture (joints, mouldings, drapes, artwork and shadows) in the cameras' view. (Unnecessary picture detail must be processed by the videoconference endpoint for transmission and degrades the image unnecessarily). In the case of dedicated videoconference rooms, the furniture should not be textured and the table surface a medium colour - not white or overly dark.

A suitably sized USP logo visible by the main camera is recommended to identify the sending location.

Room layout must allow local participants to make 'eye contact' with the remote participants. Furniture layout, screen and camera positioning require careful consideration.

A clock clearly visible to the near-end participants (adjacent to the display wall) is required.

21.6 Images

Dual images are preferred over single image systems. Dual images allow constant 'eye contact' with remote participants while other visual materials (e.g. documents, PowerPoint presentations etc) are displayed.

Both images shall be full HD (1920 x 1080). Large LCD / LED monitors are the preferred display solution.

Image sizes must obey the 5.3H rule in Section 19 - Teaching Spaces Clause .6.1.

21.7 Access

As videoconference technology offers worldwide applications, different time zones dictate that videoconference-enabled rooms may need to be used outside normal business hours. Room access outside normal hours must be considered.

21.8 Services & Equipment

Videoconference endpoints require network (IP) or ISDN connections (or both). IP is the preferred connection method. In addition an ISD/STD phone must be available for troubleshooting. A minimum of three network ports are required in any videoconference-enabled room (endpoint, PC and AMX control system). In dedicated videoconference rooms the minimum number of ports is five.

In larger rooms used for videoconferences additional microphones will be required to provide adequate pickup. This may dictate additional audio processing (e.g. auto-mixers and echo cancellation devices).

In lecture theatres, student interaction may be by means of roving wireless microphones or multiple fixed microphone points.

Where AMX control is provided, the endpoint shall have 2-way RS232 control capabilities. IR control from an AMX system is not acceptable.

20.2 Furniture

Where appropriate an AV Cupboard to house any electronic equipment should be provided. Requirements for ventilation and access are outlined in [Section 19 Teaching Spaces](#) Clause 11.

21.9 Dedicated Videoconference Rooms

Dual images at full HD resolution are required. Large LCD / LED monitors are the preferred display solution.

The main camera should be located directly below the centre of the screen used to present the far-end view of participants or between the screens at approximately 1200mm from the floor.

Recommended light fittings are RDBS Dual Basket 'Mellow Light' units. These fittings contain two LED tubes separately switched to direct lighting in two directions (typically fore and aft). The fittings must be installed with the tubes parallel to the projection screen(s) or monitor(s) and wired to two switched circuits per fitting. Down lighting produces harsh shadows and uneven lighting levels and should therefore be avoided for videoconference applications. Where down lights are fitted they must be in addition to the 'Mellow Lights' specified above, and must be separately controlled.

Furniture arrangement must allow good sightlines to the screen(s) for all local participants. For new facilities, table designs which suit or can adapt to the needs of videoconferences should be considered.

Where appropriate an AV Cupboard to house any electronic equipment should be provided. Requirements for ventilation and access are outlined in Section 19 - Teaching Spaces Clause 11.

A minimum of six network ports

Telephone with STD and IDD access

21.10 Meeting Rooms

Single or dual images. Dual preferred.

All requirements in 22.10, except paragraph 6, apply equally to meeting rooms used for video conference applications.

21.11 Lecture Theatres

Additional considerations for successful use of videoconferencing in lecture theatres include:

- Additional cameras to enable far-end participants to see the presenter and audience.
- Additional audio mixing and distribution for the endpoint.
- Additional microphones for audience interaction.
- A monitor in front of the presenter to enable eye contact with far-end participants.
- Particular attention to theatre acoustics. Reverberation time must be kept to a minimum.
- Particular attention to lighting.
- Accommodation for a technical operator.
- Additional network ports.
- Telephone (STD/IDD) for technical support and troubleshooting.

Maintain the highest image transmission quality. Within USP image quality should be VHS-quality or better - typically 2Mbps. Bandwidth for external connections should be 384Kbps or higher if possible.

22 AV Standards for USP Classrooms and Lecture Theatres

To be read in conjunction with [Section 19 Teaching Spaces](#) and the following two appendices.

- Architects will need to refer to **Appendix 23.1 – Audio-visual Facility Design Standards** for space requirements, generic layouts and furniture design to house AV equipment.
- Electrical engineers and contractors will need to refer to **Appendix 23.2 Audio-visual Installation Standards**⁷

22.1 Definitions

	Word or Short-form Definition
Classroom	General purpose teaching space with a flat floor and loose furniture
Lecture Theatre	A general purpose teaching space which has fixed seating and a tiered or sloping floor. It is typically better more intensively equipped for visual presentations
AV	Audio Visual
Video	Any composite or component video signal in either analogue or digital format
Audio	Any audio signal in either analogue or digital format
RGBHV	A method of connecting devices using five cables to carry red, green, blue, horizontal and vertical signals
VGA	A computer image resolution of 640 by 480 pixels. In the context of cables, VGA means a multicore cable carrying RGBHV signals from one device to another
SVGA	A display image resolution of 800 by 600 pixels
XGA	Display image resolution of 1024 horizontal by 768 vertical picture elements (pixels)
SXGA	A display resolution of 1280 by 1024 pixels
UXGA	A display resolution of 1600 by 1280 pixels
WXGA	Resolution of 1366 by 768 pixels in widescreen format
WSXGA	A display resolution of 1680 by 1050 pixels (widescreen format)
WUXGA	A display resolution of 1920 by 1200 pixels (widescreen format)
PAL	The 'Phase Alternate Line' system of broadcasting analogue television signals in Australia
NTSC	The 'National Television Standards Committee' system of broadcasting analogue television

⁷ Appendix - 23.1 - Audiovisual Installation Standards and Guidelines, Dated 10.10.12

	in the USA
ANSI	The American National Standards Institute- a standards organisation. Commonly used in conjunction with brightness or light output of projectors
VHS	The common Video Home System videotape format
DVD	The common Digital Versatile Disc for video, audio or data storage and playback
CD	The common Compact Disc audio format
CDROM	The common Compact disc Read Only Memory data disc format
VHF	The ‘Very High Frequency’ radio spectrum between 30MHz and 300MHz
UHF	The ‘Ultra High Frequency’ radio spectrum between 300MHz and 3,000MHZ
PC	A personal computer running under a Microsoft Windows platform
OHP	Overhead Projector – an optical device for projecting transparencies onto a screen
Data Projector	An electronic device capable of projecting an image from a computer or video source onto a large display screen. (the terms ‘data projector’ and ‘video projector’ are normally interchangeable)
FOH	‘Front of House’- the front of the room the theatre
ROH	‘Rear of House’
Biobox	A separate projection booth of control room at the rear of a theatre
AMX	A control system used by most universities which is manufactured by AMX Corp
USP ITS	USP’s ITS is responsible for the design installation and maintenance of Audiovisual facilities in general teaching spaces.

22.2 Responsibilities

Audiovisual equipment in general teaching spaces will be specified by AVS.

AVS or nominated audiovisual contractor will act as the audiovisual consultant for any project involving the installation of AV equipment or facilities.

AVS will act as the installation contractor where applicable and appropriate or nominate an approved audio visual contractor.

22.3 Classification System for General Teaching Spaces

The level of AV facilities to be provided in general teaching spaces is described in the Table 1 in [Section 19 Teaching Spaces](#) a summary of which follows:

SMR	Standard Meeting Room; A typical Media equipped Meeting Room with a standard range of AV facilities
VCR	Video Conference Room; A typical Media equipped high end Video Conference Room with a comprehensive range of AV facilities for high end Meeting / Board Rooms
PBL	Problem Based Learning; A typical Media Equipped flat floor podium with a single data projector and comprehensive range of AV facilities for Collaborative Learning Space (standard flat floor classroom)
Tiered Theatre	A dual-projector fully equipped Tiered Lecture Theatre with high definition widescreen projection capable of displaying two different images simultaneously
Studio	Universal design space with basic AV facilities

22.4 Equipment Standards

Audio visual equipment standards will be determined by AVS. Current standards will be documented on the website. Standards are subject to frequent revision, but some minimum specifications are as follows:

- Control systems shall be AMX.
- Control panels in PBL rooms and single projector tiered theatres shall be AMX NXD 700 7" touch screen.
- Control panel shall be AMX NXP-TPL-PR02 interface and ELO intellitouch touch screen monitors 19-22".
- For PBL and Tiered Theatres 19" monitors
- Data projectors shall have RS232 control using a protocol approved by ITS.
- Data projectors shall have a minimum brightness according to screen size. Where possible solid state lamp projectors should be used.
 - o PBL projectors shall produce no less than 3500 ANSI lumens
 - o Tiered Theatres and rooms with images wider than 3 metres shall have projectors producing no less than 6000 ANSI lumens.
- Radio microphones shall be 100% compatible with the AKG DSR700 digital series.
- Document cameras shall provide WXGA or greater outputs and USB compatible.
- Hearing augmentation systems shall use Infrared sound systems designed in accordance with relevant Building Codes and Australian Standards.
- Light dimmers shall be 100% compatible with Dynalite DLE series dimmers and shall communicate with the AMX system via Dy-Net RS485 protocol.
- • Voice reinforcement systems typically use Bose DS16F ceiling speakers.
- • Audio mixers shall be Biamp Nexia or Tesira.
- • Signal distribution shall be shielded CAT6A or Belden optical fibre.

22.5 Projection Facilitation

Design requirements for the provision of projection facilities in teaching rooms are described in [Section 19 Teaching Spaces](#) Clause 6.

22.6 Services & Environment

Identification of varying services requirements for the range of rooms. Level of AV Facilities:

AV FACILITY	SMR	VCR	PB L	Tiered Theatre
Double GPO on Wall or Floor Pit	1	1	1	2
Double GPO in Bio-box				6+
Double GPO in Ceiling for Data Projector (or adjacent to data projector location)		1	1	2

Power

Where possible all audio visual equipment should be on the same power circuit.

Two DGPOs at the front of the room one of which must be near the presenters' position.

Network

Network ports shall be provided as follows:

Level of AV Facilities

AV FACILITY	SMR	VCR	PBL	Tiered Theatre	Studio
Double GPO on Wall or Floor Pit	1	1	1	2	
Double Port in Bio-box				6+	
Double Port in Ceiling for Data Projector (or adjacent to data projector location)		1	1	2	1
Double GPO on wall for Speakers	1	1	1	1	1
Adjacent Control panel location					1

Power

Where possible all audio-visual equipment should be on the same power circuit. Two DGPOs at the front of the room one of which must be near the presenters' position.

Network

Network ports shall be provided as follows:

Level of AV Facilities

AV FACILITY	SMR	VCR	PBL	Tiered Theatre	Studio
Double GPO on Wall or Floor Pit	1	1	1	2	1
Double Port in Bio-box				6+	1
Double Port in Ceiling for Data Projector (or adjacent to data projector location)		1	1	2	1
Wireless Network Connectivity					1

All network ports should be connected to the virtual subnet allocated to lecture theatres on the relevant campus (e.g. subnet 121 at GP).

Phone

An internal-only telephone should be provided at FOH and Biobox (where applicable) in lecture theatres. FOH phones must be of the 'security' type to prevent theft.

Equipment Racks

Audio-visual equipment is typically installed in standard 19" racks. Racks must provide convenient access to the front and rear of the equipment.

Where racks must be installed in joinery (e.g. in a meeting room), and where rear access or side access cannot be provided, the joinery must allow the rack to be easily slid out for servicing. There must be no plinth, and there must be sufficient width and depth (clear of obstructions such as hinges) for the rack and cables.

Regardless of location, there must be sufficient ventilation (air flow) to prevent unacceptable temperature rise. For design purposes, assume a heat load of 1000W (min) and a temperature rise of 10 degrees C above ambient.

22.7 Specifications for Lighting Systems for Lecture Theatres

(This section should be read in conjunction with AS1680.2.3-1994 Interior lighting - Educational and training facilities).

Scope

This document is intended to provide design parameters for lighting systems in lecture theatres to create an optimum visual environment for large-screen presentations. The parameters and specifications apply to a 'typical' lecture and will be subject to variations to meet particular needs.

Control panels or switches are not specified, as they are included in the Theatre Control System installed by USP Audio visual Services.

Introductory Comments

The importance of lighting design in lecture theatres used for video or data projection cannot be over- emphasised. Visibility of the projected image depends on relative brightness of the image versus ambient lighting falling on the screen. The aim is to minimise light falling on the screen, while providing sufficient light in the body of the theatre to allow students to take notes. This can be achieved with careful selection, arrangement and control of light fittings.

All lighting control operations are integrated into the Theatre Control System installed and programmed by USP's ITS department.

Design Goals

- a) General purpose house lighting must be even and omni-directional to minimise shadows and sufficiently bright for reading and writing. Target lighting level is 320 lux.
- b) Lighting for projection applications must be 'vertical', with as little horizontal component as possible. Lighting must be zoned from front to rear to allow differential lighting or 'profiling'. The levels are controlled with multi-channel dimmers. Typical lighting levels are in the 10 to 100 lux region.
- c) Transitions between different lighting configurations and levels must be as smooth possible to minimise 'visual jarring' (e.g. sudden, large changes in brightness).
- d) All theatre lighting (except exit lights) must be remotely controllable from the Theatre Control Systems installed by Audio-visual Services. This is achieved with contactor switching of lighting circuits and digitally controlled dimmers.
- e) Lighting systems must not cause interference to any other audio-visual equipment in the theatre. This includes infra-red (IR), acoustic and electrical interference

House Lighting (detailed specification)

- a) House lighting shall be even and reasonably shadow-free with approximately 320 lux falling on a horizontal surface. LED lighting is the most practical for this purpose.
- b) Lighting shall be arranged in zones from front to rear.
- c) In a larger theatre (say greater than 15metres from front to rear), lights shall be arranged in three zones – front, middle and rear.
- d) In a smaller theatre (say under 15 metres from front to rear), lights shall be arranged in two zones – front and rear.
- e) LED light fittings shall be of 'rapid-start' type with a minimum of flicker and audible noise.
- f) Light switching shall be via Dyalite DMC805 controller or equivalent Dyalite model.
- g) Alternatively light switching may be controlled by electronic relay controllers equivalent to Dyalite DRC320FRMOT or DDRC810MOT or equivalent Dyalite model. These units are software compatible with Dimtek/Dyalite dimmers specified elsewhere and offer ON/OFF- Auto switching control.
- h) Movement detector (PIR in smaller rooms or microwave in larger rooms) are to be installed for complete coverage for the teaching space and provide a dry contact closure signal to the AMX control system. USP ITS recommend where possible the use of Dyalite movement detectors connected to the Dyalite dimmers

Lighting for Projection (detailed specification)

- a) Light fittings shall direct light vertically with a minimum of horizontal lighting component. Recessed down lights are preferred. Care shall be taken to minimise glare. ('Block-light' reflectors are ideal).
- b) Lights shall be spaced so there is significant overlap of beam patterns (so a lamp failure does not create an unusable dark zone).
- c) Lights shall be arranged in zones from front to rear as follows:
- d) In larger theatres (say over 15 metres from front to rear), lights shall be arranged in three zones – front, middle and rear.
- e) In smaller theatres (say under 15 metres from front to rear), lights shall be arranged in two zones – front and rear.
- f) The front zone(s) if lights shall not spill on to the screens.
- g) Lighting levels shall be fully and continuously controllable from 100% light output to less than 2%. Control function (i.e. control input versus light output) shall be approximately linear.
- h) This permits a smooth transition to and from house lights to projections lighting levels. In the case of raising the level from the projection setting to full house lighting, the down lights are ramped up to their full brightness, the LED lights are turned on; and then the down lights are ramped off. In the opposite case, the down lights are quickly raised to full brightness, the LED lights are turned off; and then the down lights are faded down to the desired level. This is a tried and tested system- and it works well.
- i) Approximate target levels for the dimmed settings are 100 lux for the 'Medium' setting and 25 lux for the 'Low' setting
- j) Lighting zones shall be controlled by individual dimmer channels, which are controlled by the Theatre Control System installed by ITS. (Dimmers are specified below)

Additional Lighting (detailed specification)

- a) 'Stage Lighting': Directional lighting shall be installed over the lectern area. This shall comprise at least two narrow-beam adjustable lights (e.g. low voltage dichroic eyeballs). There shall be no spill onto the projection screens, and care shall be taken to avoid reflections off the lectern surfaces.
- b) Spotlights: (where appropriate) Two narrow – beam spotlights shall be installed to light the lecturer for videotaping purposes.
- c) The spotlights shall have full beam control (zoom, focus and shuttering) to adjust and minimise spill onto the screens. 800KW Profile lights made by Prolite in Toowoomba are preferred.
- d) Each spotlight shall be supplied from a separate dimmer channel controlled by the Theatre Control System.
- e) Aisle lighting (where installed) shall be low-intensity and shall be configured for minimum spill onto projection screens (e.g. directed downwards).
- f) Aisle lights shall be controlled by a contactor or dimmer, which is controlled by the Theatre Control System.
- g) Exit lights shall be of low brightness type using green text on a black background. No external control is required or permitted.
- h) Bio-box Lighting shall include LED work lighting and manually dimmable down lights over working areas.
- i) Board lighting shall provide an average level of 300 lux of light across the surface of the board, without creating glare for the viewers and without creating reflections that could obscure the information thereon.
- j) Illuminated 'Lecture in Progress' signs shall be fitted on the outside of each entry door and switched via a contactor which in turn is controlled by the Theatre Control System

Dimmers (detailed specification)

From experience, it is necessary to specify a particular brand and model for theatre use. The primary reason is for software compatibility. USP has standardised on a particular brand of Theatre Control System and has developed and refined a standard method of dimmer control. Other brands of dimmers used different, incompatible serial control protocols.

- a) Dimmers shall be Dimtek DLE-405 or equivalent Dynalite model unit manufactured by Dynalite in Sydney. These units provide four channels of dimming each rated at 5 amps. Where more than four dimming channels are required, additional DLE-405 units shall be installed in a master-slave configuration. Alternatively, a DMC805 controller or equivalent Dynalite model may be used. It provides 4 channels of dimming, 4 channels of switching and 4 channels of DSI control for HF

ballasts.

- b) Where higher current ratings are required, the dimmer shall be a Dimtek DLE-410 or equivalent Dynalite model (4 channels of 10 amps each).
- c) Other models of Dimtek dimmers may be used subject to prior approval by Audio-visual Services. However, approval may be denied in the interests of model commonality.
- d) The dimmers shall be controlled by a serial data link from the Theatre Control System using the 'Dynet' protocol.
- e) There shall be provision for multiple control panels including manual slider controls if required.
- f) Where practical, the dimmer(s) shall be installed in or near the Biobox to facilitate control wiring and adjustment.
- g) The dimmers shall not generate electrical interference to Audio-visual equipment or generate audible noise.
- h) Under no circumstances should dimmers be used to control LED lighting. Any LED dimming shall be via HR ballasts controlled by DSI protocol.
- i) Zones shall generally be configured from front to rear of the room. A typical configuration is:
 - Zone 1 – 'Stage lighting' (reading lights over lectern)
 - Zone 2 – Front Zone (FOH)
 - Zone 3 – Centre Zone
 - Zone 4 – Rear Zone (ROH)
 - Zone 5 – Spotlight 1
 - Zone 6 – Spotlight 2
 - Zone 7 – Aisle lights
 - Zone 8 – Board Lights

Alternatively, Dynalite DRC320FRMOT electronic contactors or equivalent Dynalite model units may be used. This unit provides 3 channels of load switching with inbuilt ON-OFF-AUTO switching and operated on the DyNet communication bus.

Variations (detailed specification)

There shall be no variations from the specifications and parameters outlined above without written approval from USP ITS. This particularly applies to dimmers and the use of LED lights.

22.8 Projection Room & Bio-box

For details of the requirement for a Bio-box, its design and location refer [Section 19 Teaching Spaces](#) Clause 10.

Services

A generous number of DGPOs is required in the Bio-box. At least six double GPOs are required under the projection window and at least four adjacent to any equipment racks.

Where possible, these DGPO's should be on the same circuit as the GPO's provided at the FOH location. A telephone shall be provided (restricted to internal calls).

At least 2 network connections shall be provided.

Lighting

Manually dimmed down lights shall be provided over the projection bench. Separate fluorescent lighting shall be required (manually switched).

22.9 AV Cabling**Responsibility**

In any project involving the installation of AV facilities, the contractor will be responsible for installing cables as specified by ITS.

AVS will specify the type of cables and where they are to be run. The contractor must not substitute cable types or brands without prior written approval of ITS.

Termination

AV Services or nominated AV installer will terminate all signal cables relating to AV equipment - with the exception of data network, telephone, MATV and power services that are the responsibility of other contractors.

Tails

Unless otherwise specified, the contractor must leave 4 metre tails on cables terminating at the FOH equipment bench and any equipment racks; and 2 metre tails elsewhere.

Excessive length of tails is to be avoided.

If pre-terminated cables are used, any excess length shall be pulled back into a suitable void.

Cable Identification

The contractor must label all cables at both ends with a meaningful identification – e.g. 'Video 6 to ROH'.

Cable Paths

AV signal cables should be well separated from power and lighting cables which may cause interference. Minimum separation is 300mm.

Cables should be well supported to avoid any strain or stretch. Where a bundle of cables is run horizontally, the preferred method of support is to secure the bundle to a perforated cable tray with cable ties.

Cables should take the shortest practical path. This applies particularly to coaxial cables carrying video or computer signals.

A spare accessible cable path shall be provided between the 'teaching station' and location of data projector(s). Where the path rises vertically inside a wall, two 50mm conduits into the ceiling space shall be provided. For solid plaster ceilings, suitably located access hatches (450mm square minimum) shall be provided to facilitate running extra cables.

For Tiered Theatres there shall be capacity to install additional cables from the teaching station to the Biobox. A minimum of two 50mm spare conduits shall be provided.

Cable Protection

Any pre-terminated cables (e.g. VGA cables) shall have any contacts protected from physical damage and contamination from dust or paint. As a bare minimum, connectors shall be protected with sturdy plastic bags taped over the cable ends.

Fire-Stopping

Any penetrations through slabs, walls or fire-rated panels shall be fire-sealed to AS1530.1 to AS1530.7 standard. Refer also to National Building Codes or Building Codes of Australia Volume 1 Chapter C. See also [Section 30 Fire Services](#). Clause 23 - Fire Stopping.

Cable Types

Unless specified otherwise, the following cable types shall be used for all AV installations:

Video(Coaxialcable)	Belden 8241
Audio (balanced)	Hartland HC2747
Audio (unbalanced)	RS 367-599
VGA	Pre – terminated cables with moulded connectors. Typically AVS will provide the cables to the builder for installation. The builder must advise AVS of lengths and quantities required with a minimum of two weeks advanced notice. The builder must protect the connectors from damage and contamination.
Speaker (Figure-8)	Double-insulated Fig -8 stranded cable 1sq.mm or larger
UTP	Category -5E or Category 6 with yellow sheath
Multicore audio	Canare MR202-8AT
Microphone	Canare L4E6S
AXlink	Hartland HCY622 (green sheath)
Optical fibres	Belden(core numbers shall be subject to individual system requirements)
Video (Coaxial cable)	Belden 8241

22.10 Drawings

Documentation requirements are detailed in [Section 40 Documentation](#).

Note: - Drawings shall clearly indicate locations of ceiling and wall access panels and any other necessary access panels.

Drawings shall include:

- full details of AV wiring showing approximate cable paths
- equipment locations
- cable types and quantities
- location of projection screens and whiteboards
- any fixed seating
- fixed joinery
- location of lighting dimmers and relevant electrical switchboards

Provide a separate drawing and/or a separate layer in CAD files. Combined power/AV or combined communications/AV drawings are not acceptable.

22.11 Operating & Maintenance Manuals

Documentation requirements are detailed in [Section 40 Documentation](#).

24 Air Conditioning and Ventilation

24.1 Scope

Air conditioning and ventilation services shall conform to the requirements of the latest issue of:

- USP's Design Guidelines including all updates issued at the time
- Building Code of national goveand State and Local Government Building Regulations
- Workplace Health and Safety Act and Regulations
- Electricity Safety Act
- Fire and Rescue Service Act and Regulations
- Environmental Protection Act and Regulations
- Integrated Planning Act and Regulations

Relevant Australian Standards Compliance to the above shall be regarded as the minimum requirements and shall be complied with except where a higher standard is detailed on a project specific basis.

The consultant shall ensure that the design and associated documents highlights to builders and installation contractors all relevant operational issues to be considered in the execution of the building works. Examples include:-

Maintenance of air conditioning, electrical and fire services to those adjoining areas in the building excluded from the contract works areas

Appropriate protection of equipment against dust, water etc.; during the construction phases of the project

24.2 Consultation

There shall be close collaboration and coordination between the consultants and USP's Project Engineer (Mechanical) to ensure compliance with this design guideline on a project specific basis.

The Consultants will be required to attend documentation reviews with the Project Engineer (Mechanical) at the following key stages:

- At completion of schematic design
- At 50% completion of design development
- At 90% completion of tender documentation

These consultations are regarded as mandatory project milestones and will be validated in the form of a Project/ Consultants Meeting minute by the Project Manager. The number of reviews will reduce to two for smaller projects where schematic design and design development become an integral phase. The Consultant will contact USP's Project Engineer (Mechanical) and arrange review meetings in a timely manner and shall submit a copy of all relevant review documents at least 5 working days prior to the scheduled review meeting.

The Project Manager will issue a current list of USP'S technical contacts to consultants at the inaugural Project/ Consultants meeting.

24.3 Design Documentation

The consultant will develop and maintain design documentation available for review by the Project Engineer (Mechanical). 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

24.4 Design Coordination

Particular care is to be taken to ensure coordination of all other aspects of the project e.g. plumbing, data cabling etc. in the context of safe and practical operational and maintenance access to all electrical elements. Some particular USP requirements are listed as follows:-

The separation of pipes and location of pipes in relation to electrical services shall be such that the risk of damage from the contents of the plumbing shall not be a possibility. For example:

- Sanitary plumbing pipes are not to run within switch-rooms and electrical riser shafts.
- Plant rooms acting as air plenums will exclude floor waste gullies and will be drained to outside the plenum to discharge, via an air break, to a tundish drain.
- Firesprinkler pipes are not to run in the substation room directly above the 11KV switchgear etc.

Location of fittings, furniture, doors, plant and other equipment shall be such that there is sufficient clearance for the safe operation and maintenance of the various electrical services systems components. For example:

- GPO and voice and data outlets are generally to run above bench/desk height and not hidden behind or under it.
- Light switch are not to be located behind the hinge side of the door.
- The fire pump room is not to be located directly above the substation or main switchboard room etc.

24.5 Quality Control & Milestone during Construction

In addition to periodic site visits to assess the quality of the installation and accord with design intent, the consultant is expected to attend at a number of milestone events. The consultant should review, list any defects and reinspect if required. These milestone events include the following as a minimum:

a)	Review of equipment/material samples submitted for review and integrity testing of any components proposed for use (e.g. ductwork)
b)	Review of in-ground services prior to being backfilled
c)	Review of contractor's workshop drawings prior to manufacture

d)	Inspection of switchboards at the manufacturers premises prior to delivery to site
e)	Inspection of services in concealed spaces before they are closed over such as wall cavities and ducts
f)	Inspection of above ceiling services prior to the installation of ceiling tiles
g)	Attendance during key commissioning activities and review of test results
h)	Defects inspections at practical completion and preparation of defects lists

24.6 Air Conditioning Method

The design of all systems shall take consideration of the following:

- Energy efficiency
- Lowest life cycle cost.
- Service Access for Maintenance
- Flexibility for future partition alterations
- The quality and standard of equipment and fittings
- Compatibility with existing systems

The consulting engineer shall consult USP Engineering Services when the architectural considerations have adverse consequences for the mechanical systems (Example: Air Conditioning units in ceiling spaces). Air conditioning shall be provided by large air handling units supplied from an existing or new chilled water plant. Small individual air conditioning units shall only be used for specialist areas. Direct expansion (DX) refrigeration systems may only be used with the written permission of USP Project Engineer (Mechanical).

Where possible, air handling units shall serve an entire floor or significant part thereof. Air handling systems shall be either, multi-zone face and bypass or variable air volume and zoned to take account of the building's thermal aspects and its particular occupational use. Preference should be given to VAV systems as they are typically easier to modify to suit future internal refurbishment.

Separate systems will generally be used to serve, lecture theatres, laboratories etc. where usage, or in instances where existing physical limitations, dictate.

Constant volume systems with terminal reheat shall not be used, without approval from USP - Engineering Services.

Air handling units shall not serve more than one floor.

Outside air quantities shall be in accordance with AS1668.2. The arrangement of air handling units shall be consistent with fire and smoke control requirements of AS1668.1.

In all instances, USP Project Engineer (Mechanical) shall be consulted to determine the actual conditioning method to be used.

24.7 Design Conditions

The following design conditions shall generally be adopted.

Summer External Ambient Condition

32.0°C DB

25.5°C WB

Winter External Ambient Condition

9.0°C DB

NB. The Design Conditions cover comfort air conditioning only. Process cooling and special requirement processes shall be discussed with the Project Engineer (Mechanical) prior to concept design.

NB. Cooling tower design capacity to meet the project specific requirements shall be determined in liaison with the Project Engineer (Mechanical).

24.8 Performance Criteria

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

Internal Design Condition

23.0°C DB $\pm$ 1°C

50% RH $\pm$ 5%

Winter Internal Design Condition

21.0°C DB $\pm$ 1 °C

Normal Hours of Operation

Monday to Friday: - 8:00am to 10:00pm

24.9 Population Densities

The following population densities shall generally be adopted.

General office		10 m ² / person
Library reading room		2.5 m ² / person
Laboratory	Undergraduate (1st year)	3.7 m ² / person
Laboratory	Undergraduate (other years)	4.7 m ² / person
Laboratory	Post Graduate	12 m ² /person
Tutorial rooms		1.8 m ² / person
Lecture rooms		1.1 m ² / person
Computer Labs		2.5 m ² / person

24.10 Engineering Calculations

Engineering calculations shall be provided when requested by USP Project Engineer (Mechanical). Diversity factors shall be determined in consultation with USP Project Engineer (Mechanical). Heat load profiles will be calculated with a proven and accepted calculation program such as BSG-ACADSCAMEL or equivalent.

Engineering calculations for the design and selection of all mechanical plant, such as psychometric calculations, air change rates, heat transfer balances, friction losses and pressure drops etc. shall be provided as requested.

24.11 Humidity Control

Particular humidity control shall not be provided unless specifically detailed in the project brief or where special circumstances dictate. In such instances, USP Project Engineer (Mechanical) shall be consulted to determine the extent of humidity control and details of the design concept.

The design of air conditioning systems however shall ensure that the relative humidity does not exceed 65% or fall below 40% during normal operation.

24.12 Noise & Vibration Control

This Section shall be read in conjunction with Section 14.00 Acoustics.

In general, noise levels shall comply with AS2107. Where particular acoustic requirements exist, they shall be detailed in the project brief.

a)	Systems shall be designed to minimise the transmission of noise from any air conditioning and ventilation plant. Sound attenuators and or internally insulated ductwork shall be installed where necessary to minimise the transmission of plant noise.
b)	Systems shall be designed to minimise the transmission of vibration to the structure from mechanical equipment. Where reciprocating or rotating equipment is installed it shall be isolated from the structure by vibration isolators to ensure nominated noise levels are achieved.
c)	All pipe work that is connected to chillers, pumps, cooling towers etc., shall include flexible connections.
d)	All ducts connected to fans or any rotating equipment shall be provided with vibration isolation, such as flexible duct connections.

24.13 Plant & Equipment

Pumps - Close coupled pumps shall not be used. 50mm suction and over shall be "Back End Pull Out Type" Ajax 2000 Series or Southern Cross or approved equal. Under 50 mm suction they shall be Ajax "Vertical Split End Type" or approved equal. Impellers shall be bronze; casing above 25mm: gunmetal, below 25mm: bronze; shafts shall be stainless steel. All seals shall be mechanical seals. All pumps shall be mounted on a spring inertia base. Pump Motors - shall be totally enclosed fan cooled and normally be limited to 1450 rpm maximum. Motors shall have an IP56 rating.

Filters - shall be Email or equal. The following is a guide to the type of filters to be specified:

Air handling units and large fan coil units

Deep Bed Bag Filters		
AS 1132 Efficiencies:-	No. 2	82%
	No. 3	92%
	No. 4	84%
Fan coil units		
V Form Panel Filters		
AS 1132 Efficiencies:-	No. 2	80%
	No. 3	82%
	No. 4	78%

Grease filters - Honeycomb Kitchen Filters

Filter banks - shall be equipped with a Dwyer Magnahelic gauge or approved equal.

Chiller Sets - Chiller Sets shall be Trane negative pressure or PowerPax positive pressure type, or approved equal and predominantly water cooled. Heat rejection to the wet bulb is the preferred method. Multi chiller installations shall utilise PowerPax chillers as the low load set and base loads handled by Trane multi stage centrifugal chillers. The primary chilled water and condenser water pumps start/stop relays shall be wired in parallel with the DDC and the chiller controls. The type of chiller will be selected based on the following factors as a minimum: - efficiency, noise, vibration, maintenance costs, and capital costs. **Chiller Sets shall utilise the following types of compressors as a minimum requirement:**

Centrifugal - Compressor construction

- Casing shall be close-grain cast iron arranged to allow access to the rotor assembly inlet guide vanes and wearing parts.
- Rotors shall be heat treated alloy steel or high strength cast aluminium impeller statically and dynamically balanced for vibration free operation. Rotor assemblies shall be over speed tested.
- Bearings shall be accessible precision bored main bearings of the insert journal type and separate thrust bearings to axially position the impeller and absorb any unbalanced thrust.

- Guide vanes or variable speed drives shall provide stepless capacity control, which maintains stable operating conditions and responds to variations in load from leaving chilled water set point temperature.
- Drive type shall be either direct drive or high speed helical gear train.
- Open drive compressor shaft seals shall be oil lubricated mechanical shaft seals which are efficient under both vacuum and pressure conditions.
- Lubrication shall be provided by the use of an oil separator, pump, filter, oil cooler, thermostatically controlled oil heater and pressurised lubrication during run-up and coast-down including coast-down after a power failure.
- Oil heaters will operate during off cycles of the compressor.

Centrifugal – Oil-less and Magnetic Bearing

- The compressor shall comply with the Danfoss TurboCor specification.

The following compressor types may be considered at the discretion of USP Project Engineer

(Mechanical) Twin Rotor Screw - Compressor Construction

- Compressor casing shall be close-grain cast iron.
- Rotors shall be carbon steel individual rotors with the male rotor directly driven or connected to the motor by a flexible coupling.
- Capacity control shall be positive hydraulic stepless capacity control assembly including machined cast iron single slide valve, a piston and interconnecting spindle.
- Lubrication shall be by the provision of an oil separator, pump or pressure differential oil system, filter and oil cooler.
- Crankcase heaters will operate during off cycles of the compressor.

Reciprocating

The compressor shall be a proprietary compressor and motor assembly, in common enclosure.

The following accessories shall be a minimum requirement:

- Packed and capped back-seating refrigerant suction and discharge service valves.
- Access fittings for evacuation and refrigerant charging.
- Crankcase heaters shall operate during off cycles of the compressor.
- Fine mesh suction filters.

Hermetic motor shall be fully sealed, suction gas cooled type with internal over-temperature protection.

Hermetic compressors

The compressor shall be of welded steel enclosure with at least three mounting feet, with vibration isolating mountings. Internally spring mount the compressor.

Semi-hermetic compressors

The compressor shall be non-porous cast iron stator enclosure integrally cast with the compressor crankcase, provided with a gasketed end closure; at least three integrally cast mounting feet, and incorporating necessary fittings and accessories.

The following accessories shall be the minimum requirement:

- Reversible, positive displacement crankshaft driven oil pump, oil pressure regulating valve and oil pump suction strainer.
- Positive indication of crankcase oil level.
- Crankcase oil and gas equaliser for multiple compressors on a common circuit.
- Cylinder unloading devices with necessary solenoid valves, pressure switches, tappings and connections. Provide the designated number of steps of capacity.

Open compressors

Type: Provide compressor and motor, separately mounted on a steel frame, connected by coupling.

The following accessories shall be the minimum requirement:

- Individually replaceable and interchangeable cylinder sleeves.
- Reversible, positive displacement crankshaft driven oil pump, oil pressure regulating valve and oil pump suction strainer.
- Positive indication of crankcase oil level.
- Crankcase oil and gas equaliser for multiple compressors on a common circuit.
- Cylinder unloading devices with necessary solenoid valves, pressure switches, tappings and connections. Provide the designated number of steps of capacity.

Coupling shall be:

- Direct couplings such that the coupling centre can be withdrawn with shafts in assembled position.
- Drive alignment shall be provided by the manufacturer. Check alignment on site. Dowel finally aligned machinery with parallel pins, or position the motor by means of adjustable bolts set at right angles on each corner of the motor.

Coupling guard shall enclose the coupling with an expanded metal coupling guard. USP

Project Engineer (Mechanical) shall be consulted for all chiller selections.

Cooling Towers - shall comply with all relevant codes, standards, acts and regulations. Towers shall be designed and installed strictly in accordance with AS 3666 and AS 1055 as a minimum requirement and particular care is to be taken with respect to the possibility of transferring carry-over into occupied spaces and intakes of air conditioning and ventilation systems as a result of tower placement. Cooling tower design capacity to meet the project specific requirements shall be determined in liaison with the Project Engineer (Mechanical).

Cooling tower drift loss performance shall comply with AS 4180.1

Thermal performance testing will be to C.T.I. Code ATC 105.

The specification will include a provision to prove by test measurements and calculations that cooling towers satisfy performance criteria. And such tests shall be conducted during October to March.

The design of any new cooling tower installation shall include an optional fee for a detail risk assessment of the proposed cooling tower installation.

Cooling Towers shall be predominantly stainless steel or fibreglass construction. All fasteners and fan shafts shall be stainless steel. The type of tower will be selected based on the following factors as a minimum: - efficiency, noise, vibration, maintenance costs, and capital costs.

Water metering shall be in accordance with Section 26 (*Piped Services and Storage Tanks*).

Air handling units and fan coil units - shall comply fully with AS 3666 and shall be approved by the Facilities Operations Section prior to specifying.

Large AHU shall be built up sandwich panel or proprietary equipment manufactured by Modutherm, Trane, Air Conditioning products or approved equal.

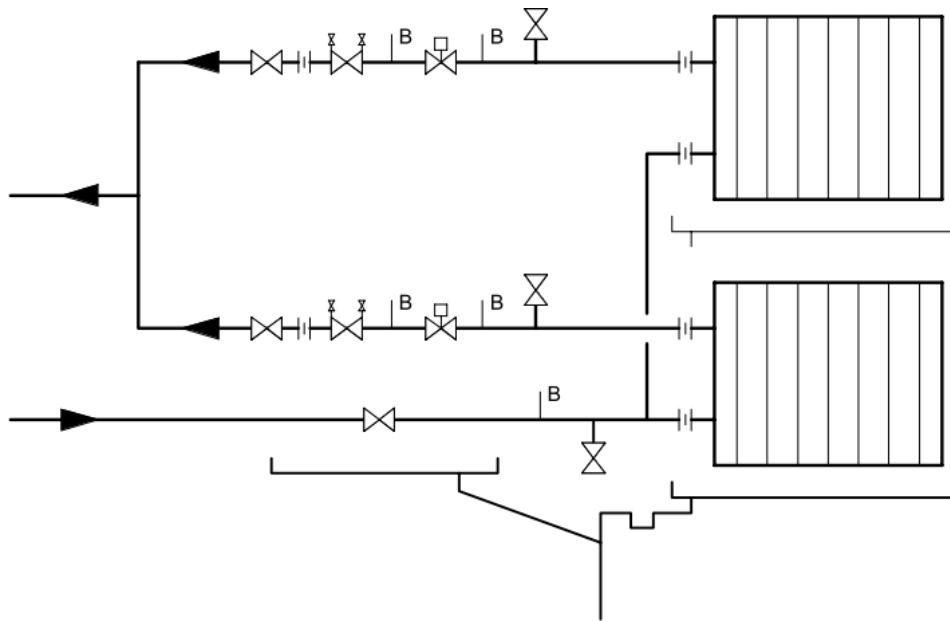
Vertical AHU shall be, Air Conditioning Products, Fan Coil Industries or approved equal.

Air handling equipment for use on USP projects shall be designed to inherently provide enhanced dehumidification at low loads. Accordingly single coil air handlers are not to be used without permission of the USP Project Engineer (Mechanical).

Technical Requirements – Twin Coil Arrangements

On all air handlers handling more than 750 l/s in general use, or where required for particular requirements of humidity controlled areas, provide air handling units complying with the following:

- Minimum Two chilled water coils arranged for 33% and 67% airflow and capacity. The designer is to consider whether the size and duties of the system require triple coils
- Each coil to be provided with individual chilled water control valves, isolation and balancing valves
- Separate condensate drain trays for each coil, drained to the exterior of the unit. Single coils with independent circuits are not permitted.
- Control the coil loading so that in response to a cooling or dehumidification call, the small coil loads from 0-100% first then the large coil from 0-100% and then both coils together. Provide overlap of control ranges to ensure stability.
- Each coil must be selected to provide the calculated duty without excessive water flow. Design return chilled water temperatures below 12 degrees at full load are not permitted.
- In multiple coil units, provide a full size drain tray to the base of the unit and ensure that any condensation caused by mixing air streams is effectively drained from the unit. Ensure that water carryover into ductwork is prevented.
- Ensure full service access is provided to all elements of the complete system. Ensure that all trays, drains and air handling unit casings are able to be cleaned and maintained regularly without disassembly.



TYPICAL COIL ARRANGEMENT TWIN COIL SYSTEM

NOT TO SCALE

Additional Control requirements – Multiple Coil Arrangements - Optional

Confirm with the USP Project Engineer (Mechanical) whether such additional control requirements below are required.

- Provide Variable Speed Drives to all air handling equipment with multiple coils. For single zone/ constant volume systems - during lower load periods (less than 75% total cooling call - adjustable) the supply air fan shall also modulate down to assist in humidity control. The minimum air quantity shall be 60% of the nominal supply air quantity. For VAV systems such air flow reduction should be inherent in the operation of the supply air fan.
- The control deadbands and proportional bands are to be finely commissioned to verify correct operation and are to be inspected/ retested during peak seasons and mid seasons at least once each.
- Allow an additional minimum 8 hours commissioning and verification throughout the defects period with reporting to be provided to the Engineering Manager.

Designer /Consulting Engineer Responsibilities

Take full responsibility for the following:

- Selecting twin or multiple coil units to meet the system requirements, to the satisfaction of the Engineering Manager
- Ensuring that units are not extensively oversized which may lead to deteriorated dehumidification characteristics
- Ensuring that air handlers comply in all other aspects with Design Guidelines and Australian Standards / MEPS / NCC as relevant to the project
- Reviewing contractor selections to ensure units are not selected with excessively low design return water temperatures which may affect chilled water system operation.

- Checking psychrometrics and providing upon request plotted psychrometric charts of all associated air processes through the unit at full and part load.
- Ensuring service access, maintainability, correct operation.
- Reviewing the proposed controls Functional Description and amending to the requirements of the system. Witnessing the correct operation of the coils and control algorithms.

Under Ceiling CHW Fan Coil Units - shall be SINKO SC Series and selected for a CHW 6⁰ C dT. Where units require heating they shall be factory fitted with heating elements, powder coated supply air register, Pen HPT and pre wired to a terminal strip. All under ceiling CHW Fan Coil Units shall incorporate an external electrical isolator.

CHW Ceiling Cassette Units - shall be Carrier Hydronic units with electric heating. The condenser pump shall be hard wired to operate from the condenser alarm and load switch.

Ventilation fans - shall be "Fantech", "Fans Direct" or approved equal manufacture and shall be of a type suited to the particular project requirements. Fans and motors shall have 10% additional capacity for future refurbishment flexibility.

Variable air volume units - shall be pressure independent velocity sensing type by, "Tempmaster", "Air Grilles", "Holyoake" or approved equal. VAV units must have the capability to close off completely when controlled to the relaxed position. Refurbishment of existing plant may dictate the use of an alternative suited to the particular project requirements. Selection of variable air volume units shall have regard to air circulation rates in periods of low operating duty. Variable air volume units shall be positioned to provide satisfactory maintenance access, to the HPT, (protected by a Penn A25AN1 heater protection thermostat installed outside of VAV box for ease of testing the HPT), heaters, volume actuators and controls. VAV boxes shall be selected with 20% additional capacity to allow future refurbishment flexibility. Fan assisted VAV boxes are not to be used.

USP Project Engineer (Mechanical) shall be consulted for all VAV selections.

Heaters - shall be electric and heating elements shall be balanced across three phases. All heater banks shall be protected by a Penn A25AN1 heater protection thermostat. Heater elements shall be stainless steel. Hot water heating coils will not be specified.

Access - to electric duct heaters in tee bar ceilings and solid set ceilings shall be via a metal hinged access hatch (Rondo or approved equal).

Belts and Pulleys - All belt drive equipment shall have a minimum of two vee belts. All equipment pulleys shall be equivalent to Taperlock.

24.14 Plant Rooms & Equipment Location

Equipment Location - All equipment such as air-handling plant, fans, outside air fans, pumps, switchboards etc. shall be located for easy access and maintainability in accordance with AS 3666. Maintenance access shall be provided to all items of plant with particular attention being given to filters, drain trays and traps, bearings, motors, fans scroll etc. Air handling units and Fan coil units shall not be installed in a concealed ceiling space.

Plant Above Ceilings - Label all ceiling access to indicate location of all equipment. The following items shall be identified: - CHW isolation valves, CHW balancing valves, CHW air bleeds, VAV Boxes and, Ventilation Fans.

Equipment Identification - All items of equipment, both in plant rooms and in the field, shall be suitably identified with screw-fixed Traffolyte or approved equal labels of an approved size and type. Thermometer bulbs, pressure gauge tappings and remote sensing points shall be similarly labelled to indicate their function.

Outside air intakes - for large air handling systems, supply air greater than 2000 L/s, shall be provided with pre-filter located at the outside air intake grille.

Bundling - Provide adequate bunding and tanking, trafficable membrane etc. to all plant rooms with special emphasis on the bunding of all penetrations in plant room floors, sealing of membrane etc. to prevent flooding to lower levels.

Floor Waste - Provide all mechanical plant room with a trapped floor waste, except where the plant room is used as a return air plenum then compliance with AS3500.2 and AS3666.1 is mandatory.

Hose Cock - Provide all plant room with 20mm hose cock.

Data Point - Provide data outlet configured for TCP/IP protocol adjacent to one MSSB, for each building.

Lighting - Provide lighting to plant room in accordance with AS1680. The minimum rating of light fittings for plant rooms shall be IP55. Where there is more than one entry lights shall be double switched.

Fire Alarms - All plant rooms shall have horn speakers and strobe lights for details refer to [Section 30 Fire Services](#).

Refrigeration Alarms - shall be fitted in accordance with AS 1677. The detection system shall be based in the "Gastech" FX Series infra-red ppm detectors and installed local and remote monitoring of pre alarm, alarm, and system fault.

Ventilation - Plant rooms shall be ventilated in accordance with AS 1668 and AS 1677.

24.15 Pipe work, Valves & Fittings

Chilled water and condenser water lines shall generally be up to 150mm diameter Type B Copper.

*Copper - *Copper piping shall be manufactured from phosphorous deoxidised non arsenical copper to AS1572:122A and shall comply with AS1432, AS1571, AS1572 and ASB160 as appropriate.

*Medium Black Steel - *Steel tubes for pressure piping shall be manufactured from carbon steel complying with AS1074. Where steel tubes of Australian manufacture cannot be obtained in the larger pipe sizes i.e. above 150mm, American Petroleum Institute API 5L Grade B or ASTM A53 Grade B may be used to the approval of the USP Project Engineer (Mechanical).

*Stainless Steel- *Stainless steel pipework shall be spiral butt weld from 316 stainless steel sheet and shall comply with AS 1449.

The pipework shall have a minimum of 2mm wall thickness. All welded joints shall be fully butt weld by TIG process and joints shall be passivated after welding.

Water metering of make-up water shall be in accordance with [Section 26 Piped Services and Storage Tanks](#).

Pipe Supports

The distance between pipe supports is not to exceed the following:

Pipe Nominal	Intervals for Steel Pipe Horizontal Runs mm	Intervals for Steel Pipe Vertical Runs mm	Intervals for Copper Pipe Horizontal Runs mm	Intervals for Copper Pipe Vertical Runs mm
15	1500	2000	1250	2000
20	1500	2500	1500	2500
25	1500	3000	1500	3000
32	2500	3500	2000	3500
40	3000	3750	2500	3750
50	3000	4000	3000	4000
65	3000	4000	3000	4000
80	3500	4500	4000	4500
100	4000	4500	4000	4500
150 and above	5000	5000	5000	5000

Unless otherwise indicated, hangers, saddles and clamps shall be of mild steel of not less than the following sizes:

Pipe Diameter	Hanger	Saddle or Clamp
Up to 40mm	10mm diameter	25mm x 3mm
50mm –80mm	13mm diameter	50mm x 3mm
90mm –125mm	16mm diameter	50mm x 6.5mm
150mm –200mm	20mm diameter	50mm x 9.5mm
Above 200mm	25mm diameter	50mm x 9.5mm

Effective hanger rod lengths shall be selected so that the ratio of the effective rod length to maximum pipe movement shall exceed 6:1.

Hanger rods and associated brackets and supports shall be selected within the permissible stresses allowed under AS 1250.

Hanger rods shall be fabricated from black mild steel rod. Threads shall be painted after installation with one coat of zinc chromate primer to provide protection against corrosion. Alternatively, galvanised rods may be used.

Underground chilled water pipe shall be "Insapipe" or approved equal, up to 150mm diameter. Insapipe

Industries shall undertake to supply, if requested, certified test data relating to:

- Non-destructive testing of steel pipe welds.
- Pressure testing of carrier pipe.
- Thermal conductivity of insulation.
- Thermal aging of insulation.
- Mechanical properties of casing materials.
- Mechanical properties of completed foam system.
- Biological properties of foam system.
- Physical properties of completed system.
- Tests on typical field joints under cyclic thermal conditions under external water pressure head.
- System test in which a representative pipe circuit is subjected to cyclic thermal conditions under external water pressure head.

Balancing Valves for CHW cooling coils shall be Tour & Anderson manufacture, and shall be in easily accessible positions installed in the horizontal plane. All valves shall be labelled for their size, service and function. Pressure compensated flow control valves shall only be used for specific applications as approved by USP Project Engineer (Mechanical). **Isolation Valves** in the following configurations shall be used for all chilled water and condenser water systems. All valves shall be labelled with punched metal tags for their size, service and function.

Isolating Valves:	
Up to and including 50mm	Ball valves with:
	- screwed ends BSP
	- bronze body
	- stainless steel ball and stem
	Gate valves with
	- screwed ends BSP
	- bronze body
	- bronze seat and disc
	- non-rising spindle
Over 50mm	Butterfly valves (gear type above 80mm)
	- lugged body to Table "E"
	- cast iron body
	- bronze disc
	- stainless steel shaft
	- Buna N seat
Throttling Valves:	
Up to and including 50mm	Globe valves with
	- screwed ends BSP
	- bronze body
	- bronze or stainless seat and disc
	- screwed bonnet
Over 50mm	Butterfly valves as for "Isolating valves"
Balancing Valves:	
Up to and including 50mm	Balancing valve
	- equal to T & A STAD
Over 50mm	Butterfly valves as for "Isolating valves"

	Balancing valve equal to T & A STAF
Check Valves:	Dual flap type with
	-cast iron body
	-bronze plates
	-stainless steel pin and springs
	-Buna N Seal
Strainers:	
Up to and including 50mm	“Y” type (or Victaulic suction diffusers) with
	-screwed ends BSP
	-bronze body
	-bronze screen
	-equal to BEP 509
Over 50mm	“Y” type (or Victaulic suction diffusers) with
	flanged Table "E" ends (or Victaulic)
	-bronze body
	-bronze screen
	-valve and drain line
	-equal to BEP 508

Two-way chilled water control valves of the equal percentage type shall be used. Chilled water control valves shall be installed in the horizontal plane complete with an insulated stainless steel condensate tray. All valves shall be labelled with punched metal tags for their size, service and function. Bungs in chilled water control valves shall be non-ferrous. Valve actuators must be able to fully open and close the valve within 30 seconds.

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

Headers are to be provided with at least one spare flanged connection for future use complete with lugged isolation valves and valved 12mm by-pass to prevent dead-legs.

Reducers - in horizontal CHW or CW pipe shall be acentric reducers for larger than 50mm.

Branches - T-Pieces and riser take-offs shall be proprietary fittings.

Pipe penetrations - through fire rated walls shall be treated to maintain fire separation, for details refer to [Section 30 Fire Services](#).

All risers shall be provided with dirt legs and drains at the bottom. Each level of pipework shall be isolated and provided with drains at the low point of each branch and at the riser.

Condensate Drains - All condensate drains shall be a minimum of 25mm diameter and all traps shall be fitted with barrel unions.

Binder cocks shall be fitted to all chilled water and condenser water headers all chillers the main flow and return line from a chiller plant, each main flow and return feeder or riser, to all flow and return lines to air handling units, adjacent to all DDC sensors.

Air Bleeds - at the top of each vertical riser an automatic air bleed valve shall be fitted. The automatic air bleed shall be fitted with an isolation valve and a permanent connection to a drain point complete with a section of clear hose.

24 hours units: Adequate take-offs and run-outs will be provided to service any known areas requiring 24 hour air conditioning.

Pressure Testing - all pipes shall be pressure tested to the nominated pressure and witnessed by the design engineer.

Identification - all pipes shall be identified in accordance with AS 1345 for the Identification of Piping, Conduits and Ducts and AS 1318, Industrial Accident Prevention Signs. "Safetyman" adhesive labels are an acceptable method for identification of pipework. Flow direction arrows shall be provided to all pipework. All externally exposed pipework shall be fully painted in accordance with the University's "Colour Schedule for Plant and Equipment" [Section 3 Identification Schedule for Plant and Equipment](#). Colour standards shall be in accordance with AS2700.

24.16 Pipe work Insulation

- a) Insulation Sample - The contractor shall submit a sample section of 50mm insulated CHW pipe including a hanger and support block to Engineering Services for comment prior to commencing on site
- b) Chilled water pipework including valves and fittings shall be insulated with sectional preformed polystyrene insulation complete with field applied mastic vapour barrier. Insulation shall be self-extinguishing expanded polystyrene having a thermal conductivity not greater than 0.033 W/mK at 100°C and be supplied in moulded half sections.
- c) At hangers provide insulation blocks of high density urethane, high density phenolic foam, except for pipes up to 25mm diameter where zinc annealed saddles may be used. For pipes 25mm and larger, two rolled half sections of 1.2mm zinc anneal shall be installed at the hanger to avoid damage to the insulation. Marine ply block may be used for pipe larger than 80mm
- d) Valves and strainers adjacent to fan coil units shall be installed in the horizontal and not insulated but provided with drained stainless steel safety tray to catch condensate.
- e) Insulation half sections shall be overlapped by 75mm to avoid circumferential joints and be compartmentalised (i.e. joints flashed) every 5 metres or adjacent to support blocks, fittings, take offs etc. to prevent longitudinal moisture transfer.

- f) Insulation shall be glued continuously to the pipework and between sections with Fosters 252 to prevent longitudinal moisture transfer. A continuous mastic vapour barrier system shall be provided over the entire length of the pipework, including hangers and support blocks by applying a coat of Fosters 30-90 embedded with reinforced glass cloth overlapped 50mm. Apply a second coat of Fosters 30-90 after the first has been allowed to dry. All applications shall be in accordance with Foster's recommendations.
- g) Provide AS1345 colour coded banding to all pipework together with flow direction arrows.
- h) Provide insulation similarly to all valves fixtures and fittings. Pack penetrations for valve spindles, etc with grease to provide a continuous vapour barrier.
- i) Pipe work exposed to view shall be metal sheathed with 0.5mm zincanneal sheet fixed by means of metal straps at 500mm maximum centres. All edges shall be swaged and overlapped 50mm.
- j) Insulation for valves, flanges and fittings shall have hinged and clipped casings (not screw fixed) for easy removal for maintenance purposes.
- k) Minimum insulation thicknesses shall be as follows:

Pipe Size	Insulation Thickness
Up to 25mm	25mm
32 to 100mm	40mm
Over 100mm	50mm

- l) Condensate drains shall be insulated with 10mm Armaflex or equal and glued with Armstrong 520 Adhesive or equal. Insulation around the trap shall not be glued.
- m) Chilled water pumps shall be left uninsulated. A stainless steel drip tray shall be fitted under the pumps to catch the condensate and drained to waste.

24.17 Ductwork & Registers

Ductwork

a)	All sheet metal duct design and construction methods and standards shall comply with the requirements of the latest edition of AS 4254. The minimum pressure rating and seal class shall be 500Pa / Class B.
b)	Generally exposed duct in an occupied area shall be spiral wound circular or oval duct.
c)	Fibre glass ductwork shall not be used.
d)	Ceiling supply air plenums shall not be used, return air ceiling plenums are acceptable and the area behind the return air grille shall be painted matt black.
e)	All sheet metal ductwork, unless otherwise indicated to the contrary, shall be manufactured from hot dipped galvanised steel sheet complying with the requirements of AS1397. All manufacturers' labels will be removed from installed ductwork.
f)	Ductwork should be designed to limit air velocities to a maximum of 6 m/s.
g)	Duct shall be provided with flexible connections for connection to any rotation machinery.
h)	Duct materials and sealants shall be of the fire resistant type and comply with AS1668.1

i)	Penetrations through walls and floors shall be packed with insulation and shall be flanged on both sides of the penetration. No ductwork is to be concreted into wall openings. For detail on fire separation refer to Section 30 Fire Services .
j)	Duct access panels for cleaning as per AS 3666 and service access to fire dampers shall be provided, the access panel shall be complete with sash clamps and rubber seal.
k)	Cushion head boxes shall be installed over all ceiling mounted supply and return air grilles. Cushion head boxes shall be of galvanized sheet metal construction and internally insulated to match the insulation thickness of the connecting duct. All internal surfaces within the cushion head shall be painted matt black. Cushion heads shall be independently supported from the ceiling system.
l)	All flex duct spigots with dampers shall incorporate a standoff locking quadrant.
m)	The flex duct fire smoke index rating shall be 4 zero. Flex duct shall be supported from the roof structure or slab above, utilising half saddles of gutter guard and woven plastic strapping.

Registers

a)	All supply, return and exhaust registers shall be of aluminium construction with removable core and powder coated to suit the particular project requirements. Manufacture shall be Air Grilles, Dragon, Holyoake or equal approved manufacture. Vertical return air grilles shall be designed to inhibit through vision.
b)	Ceiling supply air diffusers shall be 4-way blow with blanking plates for air distribution control.
c)	Side blow wall registers shall be double deflection with adjustable blades and the front blades shall be horizontal. Opposed blade dampers or adjustable scoops shall be fitted to the rear of the register for balancing and volume control.
d)	Outside air intakes shall be a slimline weatherproof Louvre angle frame, complete with 12mm X 12mm vermin mesh, colour to suit the particular project requirements. Outside air intakes to large air handling units shall be provided with easily removable media filters to pre-filter the air.
e)	Toilet and general exhaust grilles shall be egg crate grilles with a removable core or lined bar grilles. Return air and door grilles shall be half chevron of aluminium construction.

24.18 Ductwork Insulation

General - All insulation materials used in the installation shall conform to AS 1668.1. In order to maximise internal duct hygiene and simplify ongoing ductwork cleaning programmes, external insulation of duct is the preferred methodology in the absence of specific acoustic performance requirements. The insulation materials shall be non-hygroscopic, resistant to bacteria, algae, vermin and growth of moulds or fungi. The thermal conductivity of the insulation shall be not more than 0.035 W/mK at a mean temperature of 20°C.

External Duct Insulation - Ducts to be externally insulated shall be wrapped with "Sisalation 450" faced fibreglass insulation of density not less than 25 kg/m³. At all insulation joints a 75mm wide lap of "Sisalation 450" shall be taped to the facing of the adjoining insulation to form a continuous vapour barrier. The laps

shall be securely taped with an approved pressure sensitive tape and all mating surfaces shall be clean and dry before application of the tape.

a)	On all vertical ducts and on the underside of horizontal ducts where duct sizes exceed 450mm in width the insulation shall be fixed with pins and speed clips at not more than 300mm centres.
b)	After the insulation is securely glued at all joints, nylon bands shall be fixed around the ducts at not greater than 600mm centres.
c)	Internal Insulation
d)	Ductwork shall be insulation to a thickness shown on the drawings with a semi-rigid mineral wool or fibreglass in batt or board form with a thermal conductivity of 0.036 W/mK at 20°C. Insulation shall be in accordance with the relevant sections AS 4254 - 1995 "Ductwork for air handling systems in building." All insulation shall be perforated (10%) Sisalation 450 faced. The facing shall be turned under the insulation for a length of 75mm. Provide mounting pins and speed clips at 300mm centres to secure the insulation. Speed clips shall not unduly depress the insulation.
e)	Internal surfaces of ductwork that are exposed to view behind grilles shall be painted matt black.

24.19 Water Treatment

General

Condenser water systems shall be provided with an approved automatic water treatment system to prevent scaling, corrosion, biological fouling, microbiological growth and bacteriological growth. The condenser water control and dosing controller shall be an "Aquarius QB" supplied by "Aquarius Technologies" or an approved equal. Active pH control by acid injection is not acceptable. The chilled water system shall be dosed by means of a manual by-pass chemical dosing pot.

Provide water treatment to limit corrosion rates to the following:

- Mild steel and iron: 5 mm/year.
- Stainless steel: 0.025 mm/year, with no pitting.
- Copper: 0.05 mm/year.
- The condenser water pump shall be provided with a daily run signal to circulate condenser water.

Cathodic Protection

Sacrificial anodes shall be supplied by the Water Treatment Service Provider and fitted by the mechanical contractor to all chiller end boxes. Anodes shall be of magnesium composition; the selection of type is to be made by the Water Treatment Service Provider. Anodes shall be inspected at least annually by the mechanical contractor and the Water Treatment Service Provider, and replaced when more than 50% of the original weight or size has been lost.

Initial Fill and Hydro-static Testing

As water is initially introduced into any section of the System by the mechanical contractor, the Water Treatment Service Provider shall simultaneously introduce a suitable oxygen scavenger/corrosion inhibitor. The chemical is to be added at constant frequency to the ingress water, at the point of ingress, by automatic dosing equipment. The mechanical contractor shall provide any mechanical/electrical/plumbing and similar facilities which may be needed for safe dosing to take place.

When the mechanical contractor begins circulating the water through the System, the Water Treatment Service Provider shall test the treated water at different points in the System, given the presence of proper sampling points. The Water Treatment Service Provider shall test the treated water at regular intervals for the duration of the hydrostatic test, dosing more oxygen scavenger/corrosion inhibitor if required. The hydrostatic test itself shall be performed by the mechanical contractor. The mechanical contractor may choose to perform the chemical dosing and testing, after consulting the Water Treatment Service Provider in respect of advice on safety and other details.

Alkaline Clean

Subsequent to the hydrostatic test discussed in Section Initial Fill and Hydro-static Testing, the Water Treatment Service Provider shall dose the System with a suitable alkaline chemical clean agent designed to disperse solids, remove oil and grease and leave a clean waterside surface. The treated water shall be circulated for a minimum 24 hours through the entire System. A water bleed is then set to flush out undesirable solids, and the System allowed to make-up with raw water until the pH, clarity and general appearance of the System water, at any point in the System, is clean and indistinguishable from that of the ingress raw water. The mechanical contractor shall ensure that raw water will make-up adequately during the bleed process, given the bleed rate. The mechanical contractor may choose to perform the chemical dosing and testing, after consulting the Water Treatment Service Provider in respect of advice on safety and other details. Immediately following the bleeding process, the System shall be dosed with corrosion/scale inhibitor and biocides to gain adequate passivation levels.

Water Conservation Values

The water treatment programme shall maintain condenser water conductivity at levels representing at least five cycles of concentration. For the duration of the defects liability period, the operating cycles shall be shown on each service report with any faults causing a reduction in cycles (eg. cooling tower overflow) noted.

Water metering shall be in accordance with Section 26 (*Piped Services and Storage Tanks*).

24.20 Air-Conditioning Electrical System

Labels

Permanent, clearly legible Traffolyte or equal approved labels shall be mechanically fixed to all internal and external controls.

Fire Alarm Relays

Fire Alarm relays shall be provided in accordance with the requirements of AS1668 and AS1670 as applicable. The air handling plant shall transition to fire mode automatically in the event of an alarm and shall re-start automatically once the alarm has been cleared.

Spare Capacity

For any building which is not fully air conditioned a minimum of 30% spare capacity, additional physical space within the enclosure and additional electrical capacity shall be provided in all Switchboards, Sub-boards and Control Panels to allow for future extension. For fully air conditioned buildings spare capacity may be reduced to 10%.

Segregation

Ensure that control cabling is segregated within switch boards in accordance with AS 3000.

Fuses

A minimum of three (3) fuses of each size and type installed shall be secured in holding clips on the inside of Switchboard Cubicle Doors.

Meters

Hours run meters shall be provided on all items of equipment which are duplicated or run in parallel.

Pulsed Kilowatt-Hour Meters

Shall be installed in the main Electrical Switch Board to monitor both the Mechanical and Electrical Load for each building, for details please refer to [Section 27 Electrical Services](#).

Cables

All cables shall be run on cable tray, in conduits or on catenary wires, a maximum of four wires per catenary. Cable trays, conduits or catenary wires shall be supported directly from the building structure and shall not be supported from any of the mechanical plant such as duct, AHUs etc... All Cables shall be terminated in terminal strips and identified by numbered ferrules at each termination including field terminations. All cables entering switchboards, etc., which are part of a multi-core cable and any other cable which is unused, shall be terminated on a terminal block and shall be labelled as to its origin and numbered. All neutral and control wiring shall also be number ferrelled both in the switchboard and at field terminations.

MSSB

The Mechanical Services Switchboard shall be electrical orange X15 (AS 2700) and white internally. The MSSB form of construction shall be Form 2 and shall be constructed with the mains isolator located on the fascia, if the fascia is hinged then the isolator shall have an appropriate cut-out such that the isolator is fully functional and accessible with the fascia in the open position. Traffolyte labels or equal approved shall be mechanically fixed to all internal and external components. No components are to mounted on the sides or base of the switchboard and no components shall be located less than 200mm above the base of the switch board. The MSSB shall be located on 100mm high concrete plinth. Cable ducts within the MSSB shall be sized to allow easy circuit diagnosis and have a minimum of 25% spare capacity for expansion.

Indicator Lights

MSSB indication lights mounted on the fascia shall be "Rafi 24V/AC" or approved equal. The MSSB shall be fitted with an indicator light test switch.

Control Switches

MSSB rotary control switches shall be "Kraus and Naimer CG4" or approved equal.

Heater protection

Heater protection thermostats complete with fault lights shall be provided to all heaters. Air flow switches shall be incorporated in all heated air systems with fault lights on switchboards. The wiring within the heater box from the terminal strip to the elements shall have fibreglass insulation.

Circuit Reference Numbers

Electrical drawings shall be prepared with Circuit Reference Numbers to indicate the number of contacts and their location to I.S. Standard on an approved drawing.

GPO's

Provide a GPO in each switchboard and a single 20W Fluorescent lamp in each switchboard greater than 2m² in face area.

VSDs

Variable Speed Drives shall be "Danfoss HVAC" or approved equal

Spare Plug in Relay

Provide a spare plug-in relay for each type used within each switchboard. The relays shall be mounted in a tray fixed to the switchboard cubicle door adjacent the spare fuses.

Earth and Neutral Bar

The earth and neutral bar shall be sized to accommodate separately all earth and neutral cables. Multi- joining of cables prior to termination on bars is not acceptable.

Thermoscan

All new and modified MSSB shall be checked by the contractor prior to practical completion using a Thermoscan unit or similar. Any defects found shall be rectified and a complete report including thermal photographs shall be supplied prior to the Certificate of Practical Completion being granted.

DDC Controls

Not to be located within the MSSB.

24.21 Air-Conditioning & Ventilation Controls

The controls system associated with any mechanical plant shall utilise a Building Management System (BMS) based on direct digital control (DDC). The BMS shall be supplied, engineered and commissioned to be fully compatible with the existing TAC Pacific INET 2000 control system. The functional control shall be as per [Section 32 Building Management System](#).

24.22 Underground Services

Underground chilled water pipe shall be "Insapipe" or approved equal. The transition from one material to another should be made adjacent to the buildings in formed concrete pit, which shall be accessible by means of "Gatic" Lids. The CHW pit lid shall be labelled with a brass engraved marker. See also [Section 38 Roads](#) Clause 5.9 'Access holes and Inspection Chambers'.

Services shall be identified by laying continuous PVC marker tape on the sand bed 300mm above the pipe. The marker tape shall be colour coded, magnetic and be printed with the identification of the contents of the pipe and/or conduits. Services shall be identified by brass markers cast into any hard landscaping or cast into concrete markers set at ground level.

All valves shall be accessible in drained concrete pits. All bolts, washers, fittings etc shall be stainless steel. Thrust brackets in pits shall be hot dipped galvanised. All valve pits shall be formed with an accessible sump.

24.23 Connection to Existing Chilled Water Systems

Where required as part of the project brief, buildings to be connected to existing chilled water systems shall be designed to be compatible with the existing distribution system. The existing and proposed connected load and diversity will be assessed against the existing chiller refrigeration capacity. The system hydraulics and pumping capacity will also be reviewed. The overall chilled water system capacity will be discussed with USP Engineering Services at the concept stages of design.

24.24 Testing & Commissioning

NEBB Certification - Testing and balancing of air distribution systems, hydronic distribution system and the connected plant and equipment shall be performed by a firm certified by the National Environmental Balancing Bureau (NEBB). Testing and balancing shall be in accordance with NEBB Procedural Standards for Testing, Adjusting and Balancing of Environment Systems published by NEBB, Current Edition. NEBB reporting forms shall be used and when completed signed and stamped with the qualified testing and balancing supervisors seal. Calibration and maintenance of all instruments shall be in accordance with NEBB standard.

The consultant will provide a detailed commissioning plan and methodology as part of the draft tender documentation for discussion with USP Engineering Services.

24.25 Maintenance Requirements (DLP Period)

All construction/ installation contracts shall allow for the performance of regular preventive maintenance of the works during the period of the defects liability period inclusive of all consumables (e.g. filters on Fan Coil Units e.g. v-belts). 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 service, fire alarms, hydraulic systems, lifts etc. maintenance shall be carried out not less frequently than monthly.

24.26 Maintenance

Design Requirements - It is imperative that all facilities are constructed bearing in mind life-cycle costs including maintenance. Designs will be rejected which make inadequate provision for:

- Servicing and maintenance
- Removal and replacement of plant and equipment
- Access

Durability Access Panels - Drawings shall clearly indicate locations of ceiling and wall access panels and any other necessary access panels.

Service Reports - Service report after every service carried out by the contractor during the defects liability period shall be signed by Facilities Operations Section personnel and a copy left at the campus workshop.

All asset categories as per the list in 40.6.14 "Equipment lists/asset registers" are to be bar-coded or signed as per the Asset Register ID numbers. It is the contractors' responsibility to liaise with USP to ensure that adequate details for this requirement are entered into the Excel template files and produced at or before practical completion. Consult with USP as to sign size, material etc.

24.27 Drawings

Documentation requirements are detailed in [Section 40 Documentation](#)

Design documentation to include schematic drawings detailing chilled water reticulation and all air flows associated with air conditioning and ventilation systems. Such schematics will clearly display design flows, isolation devices and control devices. Design consultants will liaise with USP's Project Engineer (Mechanical) to ensure compliance with this documentation requirement.

Note: - A laminated copy of the appropriate as-installed A1 size drawings to be located in plant rooms and MSSB switchboards. A plan cabinet will be provided and affixed to the plant room wall.

24.28 Operating & Maintenance Manuals

Documentation requirements are detailed in [Section 40 Documentation](#)

Notwithstanding the requirements detailed in Section 40, the following additional information will be required to be included in the Operating and Maintenance Manual:

Provide the following in the mechanical maintenance manuals in addition to that specified in the *General requirements* Part 4 Section 40:

Installation description: General description of the installation.

Systems descriptions: Technical description of the systems installed, written to ensure that the principal's staff fully understand the scope and facilities provided. Identify function, normal operating characteristics, and limiting conditions.

Systems performance: Technical description of the mode of operation of the systems installed. Equipment

descriptions:

- Manufacturers' technical literature for equipment installed, assembled specifically for the project, excluding irrelevant matter. Mark each product data sheet to clearly identify specific products and component parts used in the installation, and data applicable to the installation. Original documents only - photocopies are unacceptable.
 - Supplements to product data to illustrate relations of component parts. Include typed text as necessary.
- Operation procedures:
- Safe starting up, running-in, operating and shutting down procedures for systems installed. Include logical step-by-step sequence of instructions for each procedure.
 - Control sequences and flow diagrams for systems installed.

- Legend for colour-coded services.
- Schedules of fixed and variable equipment settings established during commissioning and maintenance.
- Procedures for seasonal changeovers.

Maintenance procedures:

- Schedule of normal consumable items, local sources of supply, and expected replacement intervals up to a running time of 40,000 hours. Include lubricant and lubrication schedules for equipment.
- Schedule of maintenance work including frequency and manufacturers' recommended tests.
- Instructions for use of tools and testing equipment.
- Emergency procedures, including telephone numbers for emergency services, and procedures for fault finding.
- Material safety data sheets (MSDS).

Certificates:

- Copies of test certificates for the mechanical installation and equipment used in the installation.
- Test and balancing reports.

Drawings:

- Air and Water Schematics.
- Switchgear and control gear assembly circuit schedules including electrical service characteristics, controls and communications.

Charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams. Re-commissioning instructions.

Prototype periodic maintenance and performance report.

Schedules to be used for recording re-commissioning data so that changes in the system over time can be identified.

Instructions and schedules for complying with AS 1851.6, AS/NZS 3666.2 and AS/NZS 3666.3.

Periodic maintenance and performance report

At the frequency stated in the Maintenance requirements schedule provide a report summarising the maintenance performed and the performance of the mechanical plant in the preceding period. Set out the report in a form that permits comparison with previous reports. Include the following as minimum requirements:

- Dates and number of site labour hours for programmed maintenance.
- Dates, number of site labour hours and nature of work for corrective maintenance. Dates and number of site labour hours for defects liability rectification if within the defects liability period.
- Quantity and type of refrigerant used.
- Peak load and load profile for chillers.
- Peak load and load profile for electrical power consumed by mechanical plant.
- Mechanical plant gas consumption and load profile.
- List of any motors for which the motor current varied by more than 10% from the current measured during commissioning.
- Results of recommissioning if scheduled for the period.

A labelled CD or DVD containing PDF versions of all documentation contained in the O&M Manual together with AutoCAD DWG "pack and go" files of all associated drawings and electrical schematics will be included in each manual.

25 Sanitary Plumbing, Drainage Stormwater Harvesting and Water Reuse

25.1 Scope

Sanitary Plumbing and Drainage Services shall conform with the requirements of the latest issue of:

- USP's Design Guidelines including all updates issued at the time.
- NBC (National Building Code) and Local Building Regulations
- Occupational Health and Safety Act and Regulations
- Relevant Australian Standards Compliance to the above shall be regarded as the minimum requirements and shall be complied with except where a higher standard is detailed on a project specific basis.

The consultant shall ensure that the design and associated documents highlights to builders and installation contractors all relevant operational issues to be considered in the execution of the building works. Examples include:

- Maintenance of water, drainage, electrical and fire services to those adjoining areas in the building excluded from the contract works areas,
- Appropriate protection of equipment against dust, water etc, during the construction phases of the project

25.2 Consultation

There shall be close collaboration and coordination between the consultants and USP's Senior Technical Officer (Essential Services) to ensure compliance with this design guideline on a project specific basis.

The Consultants will be required to attend documentation reviews with the Senior Technical Officer (Essential Services) at the following key stages:

- At completion of schematic design
- At 50% completion of design development
- At 90% completion of tender documentation

These consultations are regarded as mandatory project milestones and will be validated in the form of a Project/Consultants Meeting minute by the Project Manager. The number of reviews will reduce to two for smaller projects where schematic design and design development become an integral phase. The Consultant will contact USP's Technical Officer (Hydraulics) and arrange review meetings in a timely manner and shall submit a copy of all relevant review documents at least 5 working days prior to the scheduled review meeting. The Project Manager at the inaugural Project/Consultants meeting will issue a current list of USP's technical contacts to consultants.

25.3 Design Documentation

The consultant shall develop and maintain design documentation available for review by the Senior Technical Officer (Essential Services).

25.4 Design Coordination

Particular care is to be taken to ensure coordination of all other aspects of the project eg fire services, electrical services, data cabling etc in the context of safe and practical operational and maintenance access to all electrical elements. Some particular USP requirements are listed as follows:-

- The separation of pipes and location of pipes in relation to electrical services shall be such that the risk of damage from the contents of the plumbing shall not be a possibility.
- E.g. sanitary plumbing pipes are not to run within switchrooms and electrical riser shafts.
- E.g. Firesprinkler pipes are not to run in the substation room directly above the 11KV switchgear etc.

25.5 Sanitary Plumbing

Materials for pipework above ground shall be UPVC, HDPE, Copper type B, PPE 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.

Contact Estates and Infrastructure for approval of the proposed fire rating method.

Pipe work shall be concealed where possible in accessible ducts and ceiling spaces.

Plumbing ducts, access panels, false ceilings etc. - Drawings shall be checked by the hydraulic consultant to ensure all sizes and clearances etc. to conform with 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 Standard Sewerage Law, Standard Water Supply Law and AS 3500.

25.6 Sewerage System

Design: Generally the system shall be designed in accordance with the relevant local authorities.

Materials shall be DWV PVC pipes and fittings with solvent welded joints and HDPE for trade waste requirements. Earthenware pipe should be given consideration in the design depending on the future of the building occupants.

Pipelines to be identified with approved marker tape as shown below.

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Inspection chambers shall be installed in accordance with Local Authority requirements. Gas air-tight covers shall be used throughout. Stamp "SAN" into each cover. Gatic type light duty covers shall be used except in roadways where medium duty covers shall be used. Brass edged covers are to be used where particular floor or paving finishes are to be used. Tops of chambers in landscaped areas shall be installed to match finished landscaped levels. Lids must be compatible with gatic lifters.

Chambers over 1200mm and to 3000mm in depth shall have hot dipped galvanised step irons or ladder. No ladder is to be installed over 3000mm.

Chambers in forest areas shall be locatable by means of a white painted 75 x 75 hardwood identification post 600mm high above ground with the top 100mm painted black.

Inspection openings shall be brought to finished ground level and capped with a screwed brass cap. See also 'Inspection Chambers' in [Section 38 Roads](#) Clause 5.9.

Trade Waste: Generally all waste lines from laboratories shall be UPVC or HDPE to local authority requirements and to the current AS 2033. Neutralising traps shall be installed if required by Local Authority regulations.

Grease traps shall be installed from all commercial kitchen areas. A hose tap with a non-return valve is to be located within five meters of the grease trap. Garbage disposal units shall not be installed. All trade waste installations shall conform to Local Authority standards.

25.7 Sanitary Fittings & Fixtures (Product Selection)

On a project specific basis alternative product options may be submitted to the Senior Technical Officer (Essential Services) for consideration. Such products will meet or exceed all quality aspects of the specified product and will only be documented for installation subsequent to written approval from USP.

Vanity Basins:	Caroma Cameo Overflow in White (Code No. 658104) with White Basin Button (Code No. 687084W) and D157 Tie Hooks (Code No. 687017).
Disabled Vanity Basins:	Caroma Laser Semi-Recessed in White (Code No. 656114) with D250 Brackets (Code No. 687186).
Wall Hung Basins:	Caroma Flora 500 Wall Basin in White (Code No. 641230) with White Basin Button (Code No. 687084W) and D206 Concealed Hanger Bracket (Code No. 687014).
WC Pans and Cisterns:	Caroma "Smartflush" Caravelle 2000 Suite in White with Vandal Resistant Cistern lid Fixing Kit (Code No. 413276) or Caroma "Smartflush" Trident Sovereign 2000 Connector Toilet Suite with Vandal Resistant Cistern lid Fixing Kit (Code No. 413276)
Toilet Seats:	Caroma Regal Toilet Seat (White - Code No. 301131GM)
Disabled Toilet Suite:	Caroma Care Concorde Disabled Pan (S Trap-Code No 614400 / P Trap-Code No. 614350) with Sovereign 2000 Cistern in White (Code No. 405067), Vandal Resistant Cistern lid Fixing Kit (Code No. 413276), Extended 450 x 450mm Flushpipe (Code No. 201264) and Colani Rehabilitation Seat in White (Code No. 813000W).
Cleaner's Sink:	Caroma Cleaner's Sink (Code No. 811592) with D1520 Wall Bracket (Code No. 811594) and CP Bucket Grate to suit (Code No. 811593.)
Urinals:	Caroma Torres Urinal (Code No. 666101W Back inlet or 666102W bottom inlet) with bracket to suit (Code No. 687120 back inlet or 687121 bottom inlet) The water supply/flushing to the urinals is to be controlled by a direct fed system as monitored on Zip watersaver's or Zip Pearl infrared sensor and flush timer. Zip watersaver to be powered supply not battery supply. Zip sensor to be set to maxim delay and minimal flush.
Waterless Urinals	Waterless urinals are to be considered on a project specific basis and must be confirmed with the Senior Technical Officer Essential Services
Shower:	Showers in disabled toilets shall meet the full requirements of the current AS1428.
Drinking Fountain:	Zip Chill fountain in double tier version or approved equal with heights for adults and wheelchair users to comply with AS 1428.1. One chiller unit is to supply the double tier unit and cup filler is to be mounted on the bowl of the lower unit.

Taps & Faucets

To ensure compatibility with fittings and fixtures across the campus, the University has standardised on the following fittings which shall be specified. Departures may only be made on a project specific basis with the prior agreement of Design Team. All handles except hose cocks will be anti vandal.

All taps shall be CP brass construction with jumper valves.

Basins:	Enware CS Series brass, chrome plated, half basin set with gooseneck aerated spout or pillar cock with a WELS 5 Star rating.
Disabled Basin:	Enware brass, chrome plated, long lever action pillow cock, ¼ turn with aerator spout with a WELS 5 Star rating.
Cisterns:	Enware CS Series brass, chrome plated, vandal proof right angle stop cock.
Cleaners Sink:	Enware CS Series brass chrome plated vandal proof bib cock with aerated spout and 50mm BIB extension with a WELS 5 Star rating
Plant Rooms:	Enware CS Series brass chrome plated vandal proof bib cock with aerated spout and 50mm BIB extension with a WELS 5 Star rating.
Emergency Showers:	Enware model EW1050 emergency shower wall mounted with 304SS tube and drench head, pull on, push off through rod and ring. Provide a bracket on the wall to hold the rod clear in access ways.
Shower Heads:	Energy saving type, "Enware VP310 Anti Vandal shower" brass chrome plated vandal proof, non-directional with a WELS 5 Star rating.
Toilets:	Enware brass chrome plated, vandal proof half inch hose cock with shroud with a WELS 5 Star rating.
Eyewash:	Enware Model EE120 Eye and Face Wash Fountain, wall mounted.
Flush Valves:	Caroma DAL approved for direct mains pressure.
Dishwashers:	Refer Section 9 Furniture and Fittings
Plant Room	Enware CS Series brass chrome plated vandal proof bib cock with aerated spout and 50mm BIB extension with a WELS 5 Star rating.

25.8 Floor Wastes

Floor wastes shall have a minimum 80 mm diameter inlet with c.p. brass screw in gratings. Penetrations for floor wastes in suspended concrete slabs shall be cored after the slab is cast at the lowest point of the area to be drained. The floor wastes complete with puddle flanges shall be epoxy grouted into the penetration. Casting in of floor wastes will not be permitted.

Floor waste gullies next to urinals shall be charged from the flush pipe from the urinal or from a timed sensor via a solenoid valve. Charging of a floor waste gully from a hose tap will not be accepted.

25.9 Test Pressures

All tests to be carried out in conjunction with Local Authority and current AS3500.

25.10 Stormwater Harvesting & Water Reuse

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 waste water etc for irrigation and toilet flushing. There shall be close collaboration and coordination between the consultants and USP's Senior Technical Officer (Essential Services) in regards to stormwater reuse. A feasibility and cost report listing stormwater re-use opportunities must be provided to USP's Senior Technical Officer (Essential Services). 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.

25.11 Stormwater Drainage

Pipe sizing: Minimum of 150mm pipe size unless approved. Flooding frequency shall generally be one in 50 years. All stormwater drainage shall be in accordance with the Relevant authority codes .

Materials: Materials shall be sanitary grade DWV PVC pipes and fittings, Class X reinforced concrete pipe, fibre reinforced cement pipe and fittings or F.C. stormwater pipes and fittings.

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.

Inspection pits: Shall be provided at major changes of direction and junctions. Pits are to be a minimum 600sq. All pits to have silt traps installed. Stamp "S-W" into covers. Light duty covers shall be used except in roadways where medium duty covers shall be used. Where particular floor or paving finishes are used tops of pits in landscaped areas shall be installed to match finished landscape levels. Pits in forest areas shall be locatable by means of a white painted hardwood post 600 high above ground with the top 100mm painted grey. All inspection pits over 1200mm and to 3000mm in depth are to have a hot dipped galvanized HD ladder or step irons installed. No ladder is to be installed over 3000mm in depth.

Discharge: All stormwater lines shall discharge directly into the closest useable major natural watercourse or existing pits or lines. The route, point of outlet and method of discharge is to be approved by the Essentials Team.

25.12 Grated Drains

All grated drains for the collection of surface run-off shall have the main bars running in the direction of flow. "Forge-weld" brand grates complete with matching metal frames should be used in these situations in lieu of cast iron. Square stainless steel grated sumps shall be provided in tiled areas.

25.13 Installation for Sewer & Stormwater Pipe Work

Refer to [Section 26 Piped Services and Storage Tanks](#) Clause 15 - "Underground Pipe work and Valves".

25.14 Mechanical Plant Rooms

The following items shall be provided in all Mechanical Plant Rooms: -

Trapped floor waste gully and at least one tundish. If the floor waste gully is connected to sewer the floor waste gully shall be charged by a 15mm copper line connected to a solenoid valve and time clock/switch set to discharge for 30 seconds, seven days a week. If the plant room is a return air plenum floor waste gullies are not to be installed.

RPZ valve or designated non-potable water supply.

25.15 Testing & Commissioning

Appropriate commissioning of equipment and systems will ensure that the as-designed performance, functionality and reliability of equipment and systems is proven and documented prior to project "practical completion".

A detailed commissioning plan and methodology should be prepared as part of the draft tender documents. This methodology will require the installer/ commissioner of equipment and systems to provide the following minimum documentation:-

- Cause/ effect matrix for the equipment / system being operated including system interface information relevant to other systems e.g. Power failure causes standby generator to start and Cardax alarm to be transmitted to USP Central Monitoring Station.
- Pre-start and start-up check sheets

Subsequent to consultation and review by USP Engineering Services this documentation is to be included in the as issued tender documents. This commissioning plan and associated documentation/ deliverables requested under the construction contract to be reviewed by the consultant during the construction phase of the project and prior to the start of commissioning to ensure such documentation is project specific and sufficiently detailed. Actual commissioning data / check sheets etc. to be reviewed and approved by the consultant during and at the end of commissioning but prior to the issue of 'practical completion'

The consultant will provide USP Engineering Services and the Project Manager with an overview of the as-commissioned performance of all equipment and services prior to the "Superintendent" issuing practical completion for the project.

25.16 Maintenance

All asset categories as per the list in 40.6.14 "Equipment lists/asset registers" to be barcoded or signed as per the Asset Register ID numbers. It is the contractors' responsibility to liaise with USP to ensure that adequate details for this requirement are entered into the Excel template files and produced at or before practical completion. Consult with USP as to sign size, material etc.

25.17 Drawings

Documentation requirements are detailed in [Section 40 Documentation](#).

Note: - Drawings shall clearly indicate locations of ceiling and wall access panels and any other necessary access panels.

25.18 Operating & Maintenance Manuals

Documentation requirements are detailed in [Section 40 Documentation](#).

26 Piped Services & Storage Tanks

26.1 Scope

This section of the Guidelines outlines the minimum requirements for the following services:

- cold water;
- hot water;
- Fire Water Main
- demineralised and/or distilled water;
- gas (liquefied petroleum);
- laboratory gases;
- compressed air;
- vacuum;
- tanks and hot water systems

Consultants will ensure that the delivery of such services conforms with the requirements of the latest issue of:

- USP's Design Guidelines including all updates issued at the time.
- National Building Codes and Local Building Regulations
- Occupational Health and Safety Act and Regulations
- Relevant Australian Standards
- Compliance to the above shall be regarded as the minimum requirements and shall be complied with except where a higher standard is detailed on a project specific basis.
- Ensure that the design and associated documents highlights to builders and installation contractors all relevant operational issues to be considered in the execution of the building works. Examples include:
 - Maintenance of water, drainage, electrical and fire services to those adjoining areas in the building excluded from the contract works areas.

Appropriate protection of equipment against dust, water etc., during the construction phases of the project.

26.2 Consultation

There shall be close collaboration and coordination between the consultants and USP's Senior Technical Officer (Essential Services) to ensure compliance with this design guideline on a project specific basis.

The Consultants will be required to attend documentation reviews with the Senior Technical Officer (Essential Services) at the following key stages:

- At completion of schematic design
- At 50% completion of design development
- At 90% completion of tender documentation

These consultations are regarded as mandatory project milestones and will be validated in the form of a Project/ Consultants Meeting minute by the Project Manager. The number of reviews will reduce to two for smaller projects where schematic design and design development become an integral phase. The Consultant

will contact USP's Senior Technical Officer (Essential Services) and arrange review meetings in a timely manner and shall submit a copy of all relevant review documents at least 5 working days prior to the scheduled review meeting.

The Project Manager at the inaugural Project/ Consultants meeting will issue a current list of USP's technical contacts to consultants.

26.3 Design Documentation

The consultant will develop and maintain design documentation available for review by the Essential Services Team.

26.4 Design Coordination

Particular care is to be taken to ensure coordination of all other aspects of the project in relation to its hydraulic services requirements. The design coordination focus shall be on the ease of maintenance with respect to appropriate location and safe working clearances for the life of the building plus minimizing of any future potential risks.

26.5 General Design Comments

In general, each riser shall be isolated at the bottom (or top in cases of downfeeds). Branch lines shall be isolated at the riser on each level and further where servicing an outlet or group of outlets in a laboratory or on a bench. In all cases, isolation valves shall be readily accessible at floor level behind duct doors or stainless steel access hatches. Groups of fixtures and single fixtures are to be isolated adjacent to the units i.e. every fixture is to have its own isolating valve. In cases of water supply, compressed air and gas, ring main distribution pipes should be used wherever possible. All fittings shall comply with the requirements of MP 52 2005 and shall have AS markings and manufacturer's Licence No. stamped into the fitting.

Brackets for all pipe supports shall be "Unistrut" with threaded rod hangers and appropriate saddles. In all cases, the pipe work is to be separated from the hanging bracket by the use of "Uni-cush" tape or approved equal.

26.6 Water Supply

Materials

Pipe work: Reticulation within buildings shall be in PVC and where applicable with the appropriate FRL rating to the pipework and pipe supports.

Mains and fittings buried in the ground shall be either:

- Class K9 concrete lined ductile cast iron in polythene wrapping;
- Type B copper with Polylag or Denso tape wrapping;
- "Blue Brute" PVC for mains 100mm diameter or above installed with trace wire; or

- Buried mains less than 100mm diameter shall be copper with Denso tape wrapping. Valves, fittings etc, the area shall be completely wrapped in Denso tape to a minimum of 100mm each side of the valve or fitting.

Where mains pass through walls and floors they shall be sleeved and caulked.

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

Copper Pipe Jointing: Shall be silver soldered capillary fittings containing not less than 15% silver. Alternative jointing methods subject to the review and approval of USP's Essentials Team.

Valves: Isolation valves shall be seat gate valves where service exceeds 80mm diameter. Ball valves shall be used on services less than 80mm diameter. Balance valves shall be globe valves. Stat valves shall be used for hot water balance valves. Brass stop cocks, chrome plated where exposed can only be used to isolate sanitary fixtures. Valves shall be tagged to identify areas served. On water main branches to buildings valves shall be installed on the upstream and downstream sides of each branch take off and also on the branch line.

Valves in the ground: All bolts, nuts, washers etc, located in the ground or in pits shall be Grade 316 stainless steel. Any brackets located in pits shall be hot dipped galvanised. All valves are to be wrapped in DENSO tape.

Backflow Prevention Device: All water systems shall be designed to include a nominated back flow prevention device to meet the requirements of AS 2845.3 and AS 3500.1. Valves 80mm and over shall be stainless steel. The device shall be applicable to the relevant hazard. Barrel unions are to be fitted between the upstream and downstream isolation valves to allow for the unrestricted removal of the backflow device for maintenance.

Backflow devices are not to be fitted where they may promote damage to buildings or their contents, where valves are concealed adequate drainage is to be provided for the full discharge volume of the valve.

Water filter: equivalent to CUNO APS117 shall be installed prior to equipment such as, coffee machines, ice machines etc.

26.7 Cold Water

Buildings shall be supplied through a two-piped system from mains pressure except when deemed undesirable by the University; one for potable water, the second via an RPZD in the valve room for non- potable supplies. All laboratories shall be supplied through either main pressure from the non-potable system or via a break tank if required by the end user. All installation is to comply with AS 3500.

Branch lines shall be of the following minimum sizes:

Serving one outlet	15mm min not exceed 1.5m
Serving two outlets	20mm min

Serving three outlets	25mm min
Above three outlets	as required

Minimum outlet pressure shall be 100kPa.

26.8 Hose Cocks

All external hose cocks shall be 20mm nominal, brass, supplied with vandal proof heads, mounted on a "white" painted, ex 75 x 75, hardwood post, finishing 600mm above ground away from the building facade. Final locations shall be determined in consultation with the Superintendent. In circumstances where hose cocks are unavoidably mounted on the face of the building, these shall be stood off the face by not less than 50mm with an aluminium bracket approved by the Superintendent. Groups of hose cocks shall be capable of being isolated by ball valves.

26.9 Hot Water

General

Hot water services shall be a minimum of 15mm copper tube, type B to AS 1432. Short branches up to 1.5m may be 15mm if serving only one outlet. Dead legs should be restricted to 3m maximum.

Laboratories Hot water should be centralised using a number of mains pressure HWS in parallel with insulated flow and return lines incorporating a circulating pump plus stand-by pump.

General Hot Water

Where large kitchens etc. or similar are required a centralised system as for laboratories shall be incorporated.

The hot water service to laboratories shall be separate from all other hot water requirements to the remainder of the building. The water supply to the hot water systems servicing the laboratories shall come from either main pressure from the non-potable system or the break storage tank. (Refer Clause 26.7).

Insulation

All hot water pipes shall be insulated with preformed Thermotec insulation minimum thickness of 10mm. In plantrooms, walk-in ducts and exposed to the environment, the pipework and insulation shall be metal sheathed with zinc annealed sheathing, edges swaged and overlapped. Wooden blocks shall be used at all supports.

The minimum insulation thickness to hot water piping shall be 25mm for pipes less than 50mm nominal bore and 38mm for pipes of 50mm and above. Hot water lines should not be encased in walls; however, where this is unavoidable, Broadflex/Armaflex with maximum wall thickness and glued joints to manufacturers recommendations should be used.

Hot Water Points

In addition to areas specifically mentioned, hot water shall be provided to the following points:

1. All Showers must be fitted with a tempering valve
2. Disabled showers and basins must be fitted with TMV Thermostatic Mixing Valve
3. Common Room Kitchen Hot water service shall be provided at the common room kitchen. An additional

outlet shall be provided for a dishwasher viz. 20mm diameter copper, 200 litres per hour. Common rooms shall have their own hot water system of not less than 50 litre capacity.

4. Toilet Hand Basins are not to be provided with hot water unless specifically called for in the Space Description Forms or required by AS1428.

Hot Water Systems

Solar Hot Water Systems - Prime consideration should be given to the installation of electrically boosted "solar" hot water units or heat pump hot water units. In all cases, the consultant should check that the flows and temperatures available are suitable to the application.

Heat pump Hot Water Systems - Prime consideration should be given to the installation of Heat Pump hot water units or solar hot water units. In all cases, the consultant should check that the flows and temperatures available are suitable to the application.

Gas Hot Water Systems - Gas fired hot water units shall be "Rheem" or approved equal mains pressure units in single or multiple installations.

Instantaneous Hot Water Units - Hot water to single isolated areas may be provided using a local quick recovery/instantaneous under sink mounted units. These units must not be the "vented through the tap type". The proposed installation of the instantaneous units must be approved by Property & Facilities, Operations before installation.

Electric Hot Water Systems - Electric Hot Water systems shall only be used as a last option. Hot water may be provided by single or multiple electric mains pressure hot water units as "Rheem or equal" with 3.6kw elements where the above units cannot meet the design requirements. Allow for sufficient space around the unit for removal of elements and above the unit for the withdrawal of anodes.

**Overflows/relief valves/Safe trays* - *Overflows/relief valves to hot water units shall discharge to a separate tundish and not over the copper safe tray. Copper safe trays must be installed under all units and at sufficient height to allow the overflow pipe fall to a drainage connection point. Units shall be mounted within the safe tray and the tray drained in accordance with AS 3500.4.

26.10 Demineralised Water

Commercial demineralised plant shall be used in conjunction with a bulk external delivery system for regenerative systems. Storage tanks shall be 316 stainless steel. Water supply valve to demineralised plant shall be an RPZD in accordance with AS 3500.

Reticulation shall be means of PVC piping installed to eliminate air pockets. Regenerative systems shall be incorporated in the demineralised water plant. Valves shall be of PVC or stainless steel. Water polishers shall be provided where required by the Space Description Forms. Conductivity meters shall be of the digital type. A spare set of consumable components shall be supplied with each plant. Provide circulating pumps to continuously treat water.

26.11 LP Gas

Pipe work shall be Type "B" copper. The following minimum sizes shall be used:

Servicing one outlet	20mm min
Servicing three outlets	25mm min
Above two outlets	As required.

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.

26.12 Laboratory Gases

Gases shall be supplied from bottles located within a lockable ventilated storage space located external to the building which is easily accessible by the service road.

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.

Pipe work and valves shall be of a material or type appropriate to the particular gas. Refer [Section 20 Special Requirements for Laboratories](#).

26.13 Compressed Air

Compressed air shall be supplied from duplicate air compressors within the building. Where possible, interconnect the system with the system in adjacent building(s) to provide back-up. Compressors selection will be based on the project specific functional/ performance brief and in consultation with the Essential Services Team.

The compressor shall be effectively silenced. Air cleaners shall be substantially mounted. Unless otherwise called for, compressed air shall be reticulated at 700kPa and regulated at each laboratory.

Pipe work shall be type "B" copper with silver soldered joints used for compressed air. All valves shall be ball valves. Refer [Section 20 Special Requirements for Laboratories](#).

26.14 Vacuum

Vacuum shall be supplied by means of duplicate vacuum pumps within the building. Where possible, interconnect the system with a like system in adjacent building(s) to provide back-up. Vacuum pumps shall be capable of passing fluids from the system without damage to the pump. Pump impellers shall be bronze with bronze end plates.

Vacuum pumps shall be mounted together with their motor on an integral galvanised steel base and shall be effectively isolated from the structure. Water seals with safety interlocks shall be provided to each pump. Piping to the vacuum pump water seals shall be as recommended by the pump manufacturer.

Pipe work shall be high pressure PVC. Plugged tees shall be used in place of bends to allow for cleaning or piping. Isolation valves shall be lined ball valves. Pipe reducers shall be of the eccentric type.

A vacuum tank shall be provided to limit the number of starts per hour of the vacuum pump(s). The tank shall be provided with all necessary gauges, safety valves, pressure stats for automatic operation.

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. Refer [Section 20 Special Requirements for Laboratories](#).

26.15 Service Outlets

All laboratory outlets shall be "BROEN", "Enware" or "Galvin Engineering" laboratory fittings to suit user requirements. They shall be epoxy coated finished with selected colour coding. Handles to international colour coding except hot water.

26.16 Identification of Pipe work

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.

The ground colour shall be applied to a length of not less than 300mm where the ground colour shall be used in conjunction with adhesive labels for identification. The location of identification marking shall be at intervals of not more than 3m and adjacent to branches, junctions, valves, both sides of walls and control points. Such markings shall be placed so that they are easily seen from all approaches.

Safety colours where applied shall be over a length of not less than 75 mm at locations and intervals as nominated for ground colours.

Ground colours used in conjunction with safety colours shall be applied to each side of the safety colour.

The direction of the flow shall be indicated by an arrow adjacent each colour band. "Safety man or similar" adhesive labels shall be used for identification and indication of the direction of flow of pipework.

26.17 Underground Pipe work & Valves

All underground pipework shall have a minimum of 600mm cover to topmost surface of pipe or pipes. Pipes shall be buried in sand with a minimum of 75mm sand below, and 150mm sand above and to side of pipe. Pipes shall be laid side by side and not one above the other. 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.

All underground pipework shall be identified by laying continuous PVC marker tape not less than 300mm above the pipe.

Trenches shall be backfilled only with selected fill and compacted in layers not exceeding 200mm to a relative density of 90%.

All valves shall be accessible in concrete pits which shall be drained. All bolts, washers etc shall be stainless steel. Thrust brackets in pits shall be hot dipped galvanised. Pipes shall be sleeved where they pass through the pit wall. Refer to sketch diagram at the end of this section.

All underground services are to be identified on the surface to the approval of the Superintendent.

26.18 Pumps (where required to achieve nominated pressure or flows)

General

Pumps shall be "Davey", "Grundfos" or "Lowara" with a Hydrovar installed if appropriate. All seals shall be mechanical seals. Pumps shall be mounted on a galvanised steel spring mounted frame. Calculations are required for all pumps installed and should include all design assumptions, standards and other influencing factors.

Where duty & standby pumps are installed the control logic shall denote that the pumps are to operate on sequential starts between pump 1 & pump 2.

Circuit diagrams are to be provided on the inside face of the control panel door, if room prohibits a laminated copy on fade resistant paper shall be mounted on the wall directly adjacent the control panel.

Where a BMS exists the pumps are to be connected to alert for pump fault alarm as a minimum, along with alarm light and bell. The alarm light and bell are to be located so as to alert staff of a failure.

Cold Water Booster Pumps

Dual cold water pumps shall be provided. One pump shall be capable of providing the flow and pressures required. The other pump shall act as standby. Facilities shall include for manual changeover for duty and standby pumps. Hours-run meters shall be provided for each pump.

Oil filled Pressure gauges with a nominal 150mm diameter face of the bourdon-tube type complete with an isolation ball valve shall be provided on each side of the pump on a minimum 15mm stub and bleed point. Where the potential exists for the suction pressure to be below normal gauge pressure combination pressure gauges are to be fitted to indicate these pressures. Pumps shall be activated by a drop in system pressure. The system shall be automatically controlled by means of a pressure tank sized to suit the system.

Hot Water Pumps

Hot water circulating pumps shall be provided in hot water loops to minimise dead legs, where a central system is installed.

The hot water circulating pump 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 a thermostat in the return line. A time clock shall be provided to the power source of the pump.

Visually accessible temperature devices are to be provided on the upstream and downstream sides of the circulation pump to enable monitoring of the systems operational temperature, also to allow the correct adjustment to the circulation pump. Where the system is required to provide larger volumes a more intelligent logic system controlling the circulating system should be considered.

The designer is to provide the operational criteria for the circulating pump along with the required temperatures in and out of the system and the pump setting.

26.19 Tanks

Tank Construction

All tanks other than those associated with hot water systems shall be circular, sectional panel or GPR tanks with potable membranes. Useable tank capacity shall be 10,000 litres unless noted otherwise herein, but in no case should be less than 50 litres per fixture. Demineralised water tanks shall be a minimum capacity of 2000 litres. Tanks shall have a lid complete with access manhole and internal and external ladders, all in stainless steel. All tanks shall be fitted with strainer and water meter to the inlet. See also [Section 12 Structural Design](#) Clause 13.

Overflows

Overflows shall be capable of discharging the full inlet water quantity but in any case, shall be not less than 150mm diameter. Drained to waste stainless steel safety trays shall be provided to all tanks and tanks shall be mounted within the tray in accordance with AS 3500.1. Allowances to be made to completely drain the tanks with the outlet 1½ times the diameter of the inlet.

Alarms

All tanks shall be provided with high, low and extra low level alarms. Float switches shall be of "Mobrey" or "Flygt" manufacture. In addition, a pressure switch shall be provided to sound an alarm should the system pressure fail. Both tank and pressure alarms are to be connected via a DDC panel to the CMS (see [Section 32 Building Management System](#)). Pressure pumps shall be de-energised when the extra low level alarm activated or loss of suction occurs.

Inlet Valves

Inlet valves to tanks shall be remote mounted "Clayton", non-modulating model, 124G/01A series.

26.20 Water Meters

Provide pulse capable water meters to the following systems:

- Potable Cold water supply to building.
- Hot water supply potable and non-potable.
- Non-potable cold water supply to the building.
- Main Irrigation point.
- Supply water to cooling towers.
- Chilled water make up.
- Chemical dosing dump point for cooling towers.
- Supply to Trade waste areas e.g. new kitchens/coffee shops.
- Cold water supply to cold water storage tanks (where installed).
- Demineralised water supply to storage tank or to a building.
- Water meters shall be "Davey Shepherd", "RMC" or "Kent" brand.

26.21 CMS Control & Alarm Points

A Risk assessment shall be performed to ascertain if alarms should be provided for the below items. If so provide alarms, grouped as one alarm for each of the following to be connected to the CMS via a DDC control panel in the building:

Cold water tank	high, low and extra low level alarms
Demineralised water tank	high and low alarms
Booster pump(s) alarms	failure and low pressure
Compressed air alarms	compressor overload
	low oil pressure
	low air pressure
Vacuum alarms	overload
	high vacuum

	water seal failure
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26.22 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 Actor Authority having jurisdiction or these Guidelines, whichever is the greatest.

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 Essential Team. 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.

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

Notice shall be given at least 72 hours 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.

Hold points are to be provided for the following - covering up of drains, wall sheeting over services and covering of water and fire services.

All test results shall be recorded and included in the maintenance manuals.

26.23 Test Pressures

- a) Water supply pipelines including Fire Mains and Services: 2.1 MPa for twelve (12) hours and generally kept charged thereafter.
- b) Fire Hydrants and Hose Reels shall be tested for pressure and flow as required by the Building Act. Such tests to be certified by the responsible consultant.
- c) Pipe work for gases shall be tested in accordance with the relevant code or standard or twice the working pressure whichever is the greater.
- d) PVC pipework for demineralised water shall be tested to three (3) times the working pressure for 24 hours.

26.24 Floor Penetration

Floor penetrations for groups of pipes in wet areas shall have a cast concrete upstand or bund. In all locations metal pipes shall be sleeved and caulked. The sleeve shall be copper, standing 30mm above the finished floor. Appropriate fire ratings shall be maintained by the use of fire collars and caulking where necessary. Where a group of pipes penetrate the floor, it may be preferable to create a concrete upstand around the group of penetrations with appropriate rating.

26.25 Services Ducts

Where possible all services shall be run in accessible service ducts, fire rated at the floor. Access to services ducts shall be by hinged and locked doors in accordance with [Section 10 Doors](#).

26.26 Mechanical Plant Rooms

The following items shall be provided in all Mechanical Plant Rooms: -

- Trapped floor waste gully and at least one tundish. Floor waste gully shall be charged by a 15mm copper line connected to a solenoid valve and time clock/switch set to discharge for 1 minutes seven days a week - This is not required if floor waste gully is connected to stormwater
- RPZ valve or designated non-potable water supply.
- One hose cock

26.27 Testing & Commissioning

Appropriate commissioning of equipment and systems will ensure that the as-designed performance, functionality and reliability of equipment and systems is proven and documented prior to project "practical completion".

The consultant will provide a detailed commissioning plan and methodology as part of the draft tender documents. This methodology will require the installer/ commissioner of equipment and systems to provide the following minimum documentation:-

- Cause/ effect matrix for the equipment / system being operated including system interface information relevant to other systems e.g. Power failure causes standby generator to start and alarm to be transmitted to USP Central Monitoring Station.
- Pre-start and start-up check sheets

Subsequent to consultation and review by USP Essential Team this documentation is to be included in the as issued tender documents. This commissioning plan and associated documentation/ deliverables requested under the construction contract to be reviewed by the consultant during the construction phase of the project and prior to the start of commissioning to ensure such documentation is project specific and sufficiently detailed. Actual commissioning data / check sheets etc. to be reviewed and approved by the consultant during and at the end of commissioning but prior to the issue of 'practical completion'.

The consultant will provide USP Engineering Services and the Project Manager with an overview of the as-commissioned performance of all equipment and services prior to the "Superintendent" issuing practical completion for the project.

26.28 Maintenance

Design Requirements - It is imperative that all facilities are constructed bearing in mind life-cycle costs including maintenance. Designs will be rejected which make inadequate provision for:

- Servicing and maintenance
- Removal and replacement of plant and equipment
- Access
- Durability
- and which opt for minimizing capital cost at the expense of on-going maintenance costs.

Drawings shall clearly indicate locations of ceiling and wall access panels and other necessary access space, distance to adjacent walls, etc. Location tags shall be placed on access panels and ceiling tiles indicating that a test gate or a control valve is installed behind such tile or panel.

All asset categories to be barcoded or signed as per the Asset Register. It is the contractors' responsibility to liaise with USP to ensure that adequate details for this requirement are entered into the Excel template files and produced at or before practical completion. Consult with USP as to sign size, material etc.

26.29 Maintenance Requirements (DLP Period)

All construction/ installation contracts shall allow for the performance of regular preventive maintenance of the works during the period of the defects liability period inclusive of all consumables (e.g. water filters on ZIP water coolers). 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 service, fire alarms, hydraulic systems, lifts etc. maintenance shall be carried out not less frequently than monthly.

26.30 Drawings

Documentation requirements are detailed in [Section 40 Documentation](#).

Note - Drawings shall clearly indicate locations of ceiling and wall access panels and any other necessary access panels

26.31 Operating & Maintenance Manuals

Documentation requirements are detailed [Section 40 Documentation](#).

27 Electrical Services

27.1 Scope

Refer also to [Section 4 External Walls and Windows](#).

This section outlines the University's minimum requirements for electrical services.

The electrical installation and facilities shall conform with the requirements of the latest issue of:

- USP's Design Guidelines including all updates issued at the time
- the Local Electricity Supply Utility Condition of supply
- the Local Building Regulations and the National Building Codes or Building Codes of Australia
- Queensland Electrical Safety Act 2002
- AS 3000, Wiring Rules and other relevant Australian Standards
- Workplace Health and Safety Requirements

Current Australian standards shall be fully complied with as a minimum. Additional more stringent requirements may be called up specific to each project.

The consultant shall ensure that the design and associated documents highlights to builders and installation contractors all relevant operational issues to be considered in the execution of the building works. Examples include:-

Maintenance of electrical, communications, fire and security services to those adjoining areas in the building excluded from the contract works areas.

Appropriate protection of switch room equipment against dust, water etc, during the duration of the project.

Project in existing buildings, shall include safe disposal of lamps and control gear containing heavy metals and other hazardous materials. Environmentally responsible practice shall be used to dispose of lamps, control gear and switch gear. Evidence of this environmentally responsible method needs to be included in the O & M manual.

27.2 Consultation

There shall be close collaboration and coordination between the consultants and USP's Project Engineer (Electrical) to ensure compliance with this design guideline on a project specific basis.

The Consultants will be required to attend documentation reviews with the Project Engineer (Electrical) at the following key stages:

- At completion of schematic design
- At 50% completion of design development
- At 90% completion of tender documentation

These consultations are regarded as mandatory project milestones and will be validated in the form of a Project/ Consultants Meeting minute by the Project Manager. The number of reviews will reduce to two for

smaller projects where schematic design and design development become an integral phase. The Consultant will contact USP's Project Engineer (Electrical) and arrange review meetings in a timely manner and shall submit a copy of all relevant review documents at least 5 working days prior to the scheduled review meeting.

The Project Manager will issue a current list of USP'S technical contacts to consultants at the inaugural Project/Consultants meeting.

27.3 Electrical Design Documentation

The consultant will develop and maintain design documentation available for review by the Project Engineer (Electrical). As a minimum requirement, design documentation will include the following:

- a) Maximum demand calculations for each switchboard, net and with spare capacity; (Where the spare capacity falls below 20% this is to be brought to the attention of the respective project manager and minuted at the project meeting, early in the project program)
- b) Voltage drop schematic, e.g. from substation to MSB to DB to load centre (where applicable) to socket outlet or permanent connection.
- c) Line diagram schematics of the main switchboard with fault current withstand rating, size and ratings of switchgear and cables entering or leaving the board.
- d) Design parameters for the design of the main switchboard including IP rating, degree of compartmentation, busbar design parameters such as degree of ventilation, maximum temperature rise, and degree of enclosure
- e) Coordination study of all protection devices from the MSB to the final sub-circuit miniature circuit breaker to ensure proper discrimination of the cascading devices.
- f) Details of distribution boards including number of poles, rating of busbar and main switch and number of spare poles.
- g) Details of lightning and surge protection, earthing schematic and fault loop impedances for non RCD circuits.
- h) Layout of cable tray/ladder routes with size and quantity noted.
- i) Layouts of underground services with quantity and size of cables and conduits noted.
- j) Schedule of luminaire types and outlets.
- k) Lighting energy calculations as per National Building Codes or Building Codes of Australia Part J6.
- l) Luminaire layouts and switching/control schematics.
- m) Locations, types and classifications of emergency lighting.
- n) Substation- Transformer, switchgear, HV cables layouts, type, size and quantity.
- o) For more complex projects, like generators (e.g. solar or gas) provide a "cause and effect matrix" for fault/diagnostic/testing purposes.

Note - All lighting and power drawings are to show the Circuit Breaker No. and distribution board feeding the circuit. The use of "L" and "P" on the design, tender or 'as-constructed' drawings, will not be accepted

27.4 Design Coordination

Particular care is to be taken to ensure coordination of all other aspects of the project e.g. plumbing, data cabling etc. in the context of safe and practical operational and maintenance access to all electrical elements. Some particular USP requirements are listed as follows:-

The separation of pipes and location of pipes in relation to electrical services shall be such that the risk of damage from the contents of the plumbing shall not be a possibility.

E.g. sanitary plumbing pipes are not to run within switchrooms and electrical riser shafts.

E.g. Fire sprinkler pipes are not to run in the substation room directly above the 11KV switchgear etc.

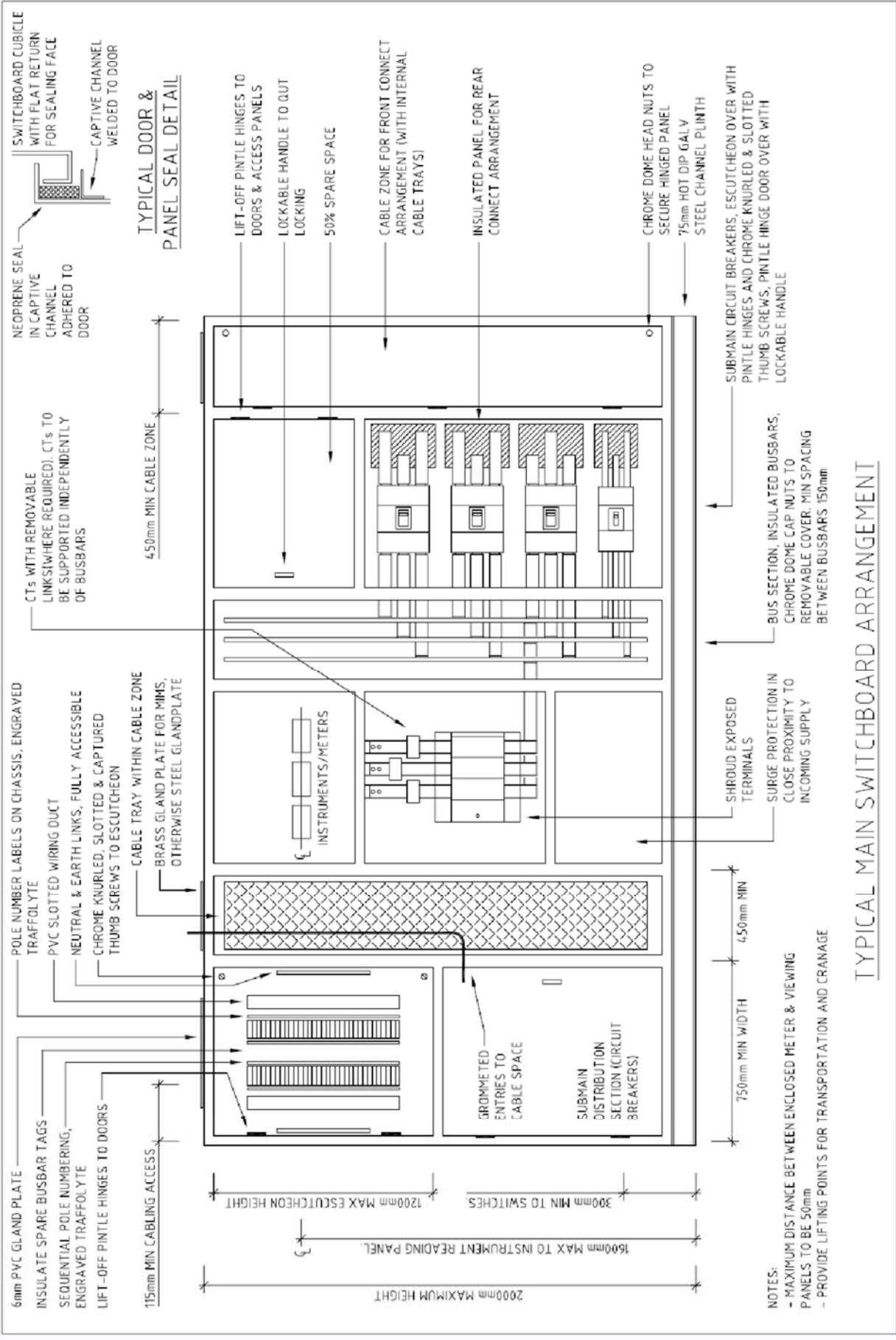
Location of fittings, furniture, doors, plant and other equipment shall be such that there are sufficient clearances for the safe operation and maintenance of the various electrical services systems components.

E.g. GPO and voice and data outlets are generally to run above bench/desk height and not hidden behind or under it.

Light switch are not to be located behind the hinge side of the door.

E.g. the fire pump room is not to be located directly above the substation or main switchboard room etc.

See drawing on next page for typical main switchboard arrangement.



27.5 Quality Control & Milestones during Construction

In addition to periodic site visits to assess the quality of the installation and accord with design intent, the consultant is expected to attend at a number of milestone events. The consultant should review, list any defects and reinspect if required. These milestone events include the following as a minimum:-

a)	Review of electrical samples submitted for review and integrity testing of any components proposed for use (e.g. Ezi-Fix cable fixings say)
b)	Review of in-ground services prior to being backfilled
c)	Review of contractor's workshop drawings prior to manufacture e.g. Electrical Switchboards
d)	Inspection of switchboards at the manufacturers premises prior to delivery to site
e)	Inspection of services in concealed spaces before they are closed over such as wall cavities and ducts
f)	Inspection of above ceiling services prior to the installation of ceiling tiles
g)	Attendance during key commissioning activities and review of test results
h)	Defects inspections at practical completion and preparation of defects lists

27.6 Lighting

Design concepts

a)	For new and larger projects (will be confirmed in the USP briefing document), the Consultant will be required to carry out a brief study of lighting solutions appropriate to the project, the results of which are to be summarised in a brief design report, including capital, operating and maintenance cost comparisons. The report is to be submitted to the Project Engineer (Electrical) early in the schematic design phase.
b)	Minimum light reflectance (percentages) for space or room surfaces will be discussed and agreed between the lighting design Consultant and Architect/interior designer at an early stage of the schematic design phase. For approximate reflectance refer to AS1680.1.2006 Table E1. Reflectance for the ceiling are to be at least 0.8 or better. Reflectance for walls are to be at least 0.6 or better. Reflectance for floors and furniture at least 0.4 or better
c)	External area lighting in the vicinity of the building is to be provided by the building project. The Consultant shall carry out an assessment of external lighting needs for each project based on the classification parameters outlined in AS/NZS 1158.3.1. This will enable the project consultant and USP to determine lighting levels and preferred lighting concepts. Where USP nominated lighting levels are higher than the Standard recommendations, the higher lux levels shall be implemented. The Consultant shall ensure also that the requirements of AS 4282 "Control of the obtrusive effects of outdoor lighting" are adhered to. Wherever possible, it is USP's intention to avoid the adverse

	effects of skyglow.
d)	Indoor lighting in all buildings shall generally be fluorescent type.
e)	All luminaries, lamps and control equipment used in the design shall be long-life and energy efficient type.
f)	Alternative lamp and luminaries will be considered. USP acceptance of these will be at the discretion of the Project Engineer (Electrical).
g)	Generally, indirect lighting is not encouraged. Indirect lighting solutions will only be considered where all other alternatives have been exhausted for specialist applications at the discretion of the Project Engineer (Electrical).
h)	Architectural Feature lighting in the foyer and high profile public spaces will be energy efficient, require minimum maintenance and can be easily accessed.
i)	Dimming Control is only used in specialist applications.
j)	Fluorescent luminaries are to be switched in strategic groups for energy management and lighting control purposes.
k)	Specialist Application lighting will be nominated by the USP stakeholder in the space design brief. Specialist Applications Lighting solutions will be presented to USP Project Engineer (Electrical) for review.
l)	All Incandescent lamps are not to be used without expressed agreement of the Project Engineer (Electrical)

Performance Guidelines - General

- Illumination Performance of lighting installation*

All external lighting shall be designed to enhance safe movement, personal safety and security. Refer to section on Security and apply Crime Prevention through Environmental Design (CPTED). The average levels of illumination shall apply as per AS/NZS 1680 and AS/NZS 1158 suite of standards.

- Design Requirements - Luminaire types, Luminaries location*

All lighting installations have to present well through the life of the building. Particular consideration will be given to the availability of maintenance spares in the future. The design of the luminaire and its location has to allow the maintenance of the fittings with ease.

Luminaries should be manufactured from Australian made components and be approved by the Electricity Authority. All luminaries shall be supplied complete with lamps.

Fluorescent luminaries shall of the high efficiency type incorporating high frequency electronic ballasts

All luminaries shall be adequately ventilated. Temperature rise in the fittings should be restricted to 50C above ambient.

Diffusers shall be integral to the luminaire and easily removable. All components shall be easily accessible, with the luminaire in-situ. Fittings which have to be dismantled in order to replace lamps or tubes shall not be used.

Where existing fluorescent luminaires are to be reused, or approval for non-electronic ballasts has been given, the luminaires shall incorporate starters of the non-flickering warm/soft start electronic type, power factor corrected and be of the switch start type complete with fuse terminal blocks and electronic ballasts.

Luminaire design and layout should satisfy the intensity, glare and uniformity requirements for open offices with sufficient flexibility to enable partitioning of individual perimeter or island offices. For internal areas preference shall be given to T8 26mm linear fluorescent lamp source luminaires. Generally, the number of different lamp source types shall be kept to a minimum.

The length and type of luminaire shall suit the ceiling module and/or location of installation.

The colour and type of fluorescent tubes shall be Tri Phosphor, 26mm, 4000oK" Philips TLD Super 80 or equivalent in all areas unless stated differently in the brief to suit specific functions. Where equivalent low mercury level lamps, such as the Philips Alto TLD range, are available they shall be employed.

External lighting of buildings shall be discussed with the Project Engineer (Electrical). Roads and paths associated with a particular building shall be illuminated as part of that building project. These areas are to be lit in compliance to AS 1158 and AS 4282 as nominated above. Where paths run adjacent to, through or beneath buildings, the luminaire shall be mounted on the external wall of the building. White light (using metal halide fittings) shall be employed. Road and pathway lighting which is apart from a building which requires separate illumination shall be achieved using pole-mounted luminaires to match existing on that campus, as approved by the Project Engineer (Electrical) - lighting bollards are generally unacceptable. All other external lighting, other than for sports fields, shall be Metal Halide or LED with good colours. All sports field, street and path lighting poles shall have terminals and circuit breakers located in the base. Footings for luminaire poles shall consist of fabricated steel holding-down pole mounting and fixings into prepared excavated holes with in-situ concrete, direct buried poles are unacceptable. All external luminaires shall possess a suitable International Protection (IP) rating, to AS 1939, for the location of the luminaire. As a minimum the IP rating shall be such that the luminaire prevents the ingress of insects.

Labelling of Light Poles - Every light pole shall be labelled as follows;- pole Number/University grid reference/Substation No./Circuit No./Lamp Details

Where false fully accessible ceiling exists, luminaires shall be connected to the wiring loom by means of a three-pin plug and 1800 mm 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 felt pen and a Brother P/Touch label fitted to the inner reflector of the luminaire. The loom socket shall be firmly fixed to the concrete ceiling, purlins or catenary wires. Support of other services or ceiling hangers is unacceptable.

Downlights shall not be used for general illumination unless they are of the compact fluorescent type and then only with the express agreement of the Project Engineer (Electrical). No new installation of ELV incandescent lamps will be allowed. Downlights are not to be used in external areas.

Performance Guidelines - Special Considerations

a)	Works of Art
	In the public areas of the building and in all meeting rooms within the building, ensure the spaces can be used to display the University's Art Collection. Liaison should occur at an early date in the development of the plans with the Project Engineer (Electrical) to designate "gallery" areas. Highly susceptible artworks should not be illuminated to more than 50 lux. The following guidelines are indicated for such gallery areas: • Designated walls in gallery areas should receive no direct sunlight. • Lighting in designated gallery areas should provide an even illumination of the wall. • Spotlights or wall washers are used they should be dimmable to allow adjustment of the lighting level between 50 lux for works on paper and 150 lux for works on canvas. Optimum beam angle for viewing and to avoid shadows and glare is 30° from the vertical. Works of Art display lighting shall be mounted on USP approved proprietary type lighting track. • Where fluorescent lighting is used, such lighting shall use low UV fluorescent lamps or have lamps fitted with UV absorbing polyester sleeves. • Gallery areas or walls are to be kept free of services, e.g. clocks, GPO's, data/voice outlets, security card readers etc.
b)	Illumination of Signs and General Displays
	Illumination of Signs and General Displays shall be placed so that unwanted reflections shall not occur on the sign. For external signs, illumination should be from above rather than from below to limit the contribution to sky glow. The luminance factor of the surface of numbers, letters or symbols shall be not less than 0.3 (30 percent) different from their background. For external signs, such as the USP logo sign, on a building, lamps utilized and the control gear shall be mounted in an easily accessible location in the building. The light source used for signs and displays shall be efficient and long life type.
c)	Auditoria, Lecture Theatres, Seminar Rooms, Teaching Spaces etc.
	Auditoria, Lecture Theatres, Seminar Rooms, Teaching Spaces or the like shall be provided with illumination complying with AS1680.2.3. In addition to the requirements of this standard adequate focussed lighting, without excess shadows, shall be provided on both the face of the presenter for lip reading and on the interpreter for sign language interpretation. Refer to Section 23 AV Standards for Classrooms and Lecture Theatres for additional requirements.
d)	Videoconferencing rooms
	Videoconferencing rooms shall be provided with illumination that complies with the recommendations of AS1680.2.3 - 1994 clause 10.15. Luminaries within such rooms shall employ T8 linear 4000K fluorescent lamps with a lighting control system interfaced to the AMX audiovisual system. The Consultant should address key aspects in the design such as key and back lighting of subjects plus fill light. Dramatic style lighting should also be avoided in these facilities in favour of a mix of indirect (acceptable in this context) and direct lighting, dimmable and lighting

	levels around 500 lux.
e)	Stairs and Ramps
	Within stairwells luminaries shall be mounted on the walls or to the soffit of the landings. Luminaries shall not be mounted above stairs and ramps or where access to the luminaries for maintenance cannot be achieved in a safe manner without the need to use scaffolding. Aisle stairs and ramps within rooms that have dimmable lighting, e.g. auditoria, lecture theatres and the like, shall be fitted with Hawko aluminium extrusion luminaries incorporating LED lamp sources, so as to comply with the recommendations of AS1680.

27.7 Lighting Control

Lighting control generally shall employ group switching strategy for energy management. This may be via

- a manual switch on the wall in conjunction with a occupancy detector
- a timer, contactor, relay and by-pass switch or
- the building management system timer

Dimming controls may be used in specialist applications such as Theatres, Studios and Laboratories.

Switches

Switches should, wherever possible, be located on permanent walls or columns. Switches shall be mounted 1 metre above the finished floor level. Block switching shall not be used except where special circumstances dictate, such as in Libraries. Intention to block switch areas should be discussed with the Project Engineer (Electrical) prior to final design. All switch plates shall be identified with type-written labels with black lettering as to circuit and switchboard of origin. In general, light switches shall be Clipsal C2000 series with

I.D. covers and Clipsal 30FLM15 for fluorescent loads or approved equal, 15 Amp min and screw fixed. In equal access facilities these switches are to be a 15A switch mechanism with larger rocker.

Switches for use by people with disabilities shall conform with the requirements set out in AS 1428.1-2001, with a 35mm min width toggle.

Motion Detection

Motion detection should be considered for all areas and discussed with USP. The following areas require motion detection.

In all refurbishment areas where there are teaching spaces created then lighting control with the use of presence detectors will have to be included in the design as a part of the USP Energy management strategy.

In all teaching spaces, the lighting control design shall include presence detectors. In each

teaching space the following will be installed:

- A key bypass switch to override the presence detector system
- Master presence detector and slave presence units to cover the space as appropriate

Lunchroom and Meeting rooms:

- Install presence detectors for lighting control as detailed for teaching spaces.

Detector Type and Layout

- Refer to Tables A, B, C and D to identify USP's approved BEG detector types suitable for particular space types, type of sensing required in the space, mounting heights and sensing ranges.
- Refer to Tables 1, 2 and 3 for detector ranges

Location of Detectors

- Detectors shall be located so the detector detection range is not impeded by the building structure e.g. beams, changes in ceiling height or other building elements such as surface mounted air conditioning ducts, cable trays and pipe work etc
- detectors shall not be installed closer than 600mm from a HVAC ceiling grille

Key Switches

Key lockable switches are 20A rated Clipsal keyed alike switches to USP requirements.

In teaching spaces and other areas requiring key switches the key switch shall be mounted adjacent the lighting switches in each room.

Standard key switches are to be L8F268 keyed.

Key switches are not required in the following areas-

- Offices
- Foyers and general areas
- Corridors
- Lunchrooms
- Meeting Rooms
- Car parks
- Toilets, air locks and locker rooms

Contact Control Boxes

A contactor control box shall be provided for each master detector if the total load on the master detector exceeds 850 watts or 10 off 2x36W fluorescent luminaires. The contactor control box shall be mounted in the ceiling space above the lighting switch location for the room or space.

Detectors are supplied by iAutomation Pty Ltd. Contact Craig Dentry of iAutomation Ph(03) 9563 2944 for further information on detectors.

The standard installation configurations are as per the attached drawings:-

1. Standard Schematic Master Slave configuration BEG PD4
2. Standard Schematic Master Slave configuration BEG PD4 for greater than 10 2X36 W luminaires or multiple lighting circuits
3. Lighting control contactor box (240Vac Coil)
4. Lighting control contactor box (24Vac Coil)

Installation Commissioning notes are available on request from USP.

TABLE A- Offices, Meeting Rooms, Lecture Theatres, Laboratories, Teaching Space and other similar areas (Presence Detection)

Detector	Detector Type	Mounting Height Range	Maximum Sensing Range	Mounting Type	Comments
PD4-M	Motion Sensor -Master single channel	2 - 3.5 metres	Maximum detector spacing based on Table 1	Surface mount or recessed	
PD4-S	Motion Sensor - Slave	2 - 3.5 metres	Maximum detector spacing based on Table 1	Surface mount or recessed	
General					Notes:
1. Use of other types of detectors proposed for these areas requires approval of USP.					
2. Two channel detectors shall be provided.					

TABLE B - Corridors & Car Parks (Motion Detection)

Detector	Detector Type	Mounting Height Range	Maximum Sensing Range	Mounting Type	Comments
PD4-M-C	Corridor Master Single	2 - 3 metres	Maximum detector spacing shall be based on walking toward distances only. Maximum spacing between detectors is 20 metres	Surface mount or recessed	
PD4-S-C	Corridor Slave	2 - 3 metres	Maximum detector spacing shall be based on walking toward distances only. Maximum spacing between detectors is 20 metres	Surface mount or recessed	
PD4-M	Motion Sensor - Master	2 - 5 metres	Detector spacing based on Table 1 (Maximum spacing 80% of walking across distance)	Surface mount or recessed	
PD4-S	Motion Sensor - Slave	2 - 5 metres	Detector spacing based on Table 1 (Maximum spacing 80% of walking across distance)	Surface mount or recessed	
PD4M - M- GH	Great Height Master	2 - 10 metres	Detector spacing based on Table 3 (Maximum spacing 80% of walking across distance)	Surface mount or recessed	Use only for ceilings above 5 metres in height
PD4-S- GH	Great Height Slave	2 - 10 metres	Detector spacing based on Table 3 (Maximum spacing 80% of walking across distance)	Surface mount or recessed	Use only for ceilings above 5 metres in height

General Notes:

1. Areas within corridors provided with seating shall be provided with presence detection for the seated areas utilising PD4-M and PD4-S detectors
2. Detectors shall be placed in close proximity to distribution board cupboards opening into corridors to ensure detection (presence detection) of persons at distribution boards.
3. Two channel detectors shall be provided.
4. Use of other types of detectors proposed for these areas shall require approval of USP.

TABLE C - Foyers and other General Areas (Motion Detection)					
Detector	Detector Type	Mounting Height Range	Maximum Sensing Range	Mounting Type	Comments
PD4-M	Motion Sensor - Master	2 - 5 metres	Detector spacing based on Table 1 (Maximum spacing 80% of walking across distance)	Surface mount or recessed	
PD4-S	Motion Sensor - Slave	2 - 5 metres	Detector spacing based on Table 1 (Maximum spacing 80% of walking across distance)	Surface mount or recessed	
PD4M - M-GH	Great Height Master	2 - 10 metres	Detector spacing based on Table 3 (Maximum spacing 80% of walking across distance)	Surface mount	Use only for ceilings above 5 metres in height
PD4-S-GH	Great Height Slave	2 - 10 metres	Detector spacing based on Table 3 (Maximum spacing 80% of walking across distance)	Surface mount	Use only for ceilings above 5 metres in height
General Notes: 1. Areas within Foyers and General Areas provided with seating shall be provided with presence detection for the seated areas utilising PD4-M and PD4-S detectors at spacing's suitable for presence detection 2. Detectors shall be placed in close proximity to distribution board cupboards opening into foyers and general areas to ensure detection (presence detection) of persons at distribution boards. 3. Two channel detectors shall be provided. 4. Use of other types of detectors proposed for these areas requires approval of USP.					

TABLE D - Toilets, Air Locks & Locker Rooms (Motion Detection)					
Detector	Detector Type	Mounting Height Range	Maximum Sensing Range	Mounting Type	Comments
PD4-M	Motion Sensor - Master	2 - 5 metres	Detector spacing based on Table 1. (Maximum spacing 80% of walking across distance)	Surface mount or recessed	
PD4-S	Motion Sensor - Slave	2 - 5 metres	Detector spacing based on Table 1 (Maximum spacing 80% of walking across distance)	Surface mount or recessed	
PD2-M	Motion Sensor - Master	2 - 5.0 metres	Detector spacing based on Table 2 (Maximum spacing 80% of walking across distance)	Surface mount or recessed	
PD2-S	Motion Sensor - Slave	2 - 5.0 metres	Detector spacing based on Table 2 (Maximum spacing 80% of walking across distance)	Surface mount or recessed	
PD4M - M-GH	Great Height Master	2 - 10 metres	Detector spacing based on Table 3 (Maximum spacing 80% of walking across distance)	Surface mount	Use only for ceilings above 5 metres in height
PD4-S-GH	Great Height Slave	2 - 10 metres	Detector spacing based on Table 3 (Maximum spacing 80% of walking across distance)	Surface mount	Use only for ceilings above 5 metres in height

General Notes:

1. Areas provided with seating (locker rooms) shall be provided with presence detection for the seated areas

- utilising PD4-M and PD4-S detectors at spacings suitable for presence detection.
2. Use of other types of detectors proposed for these areas requires approval of USP.
 3. Two channel detectors shall be provided.

Installation Commissioning notes is available on request from USP.

TABLE 1 - PD4 Occupancy Sensor

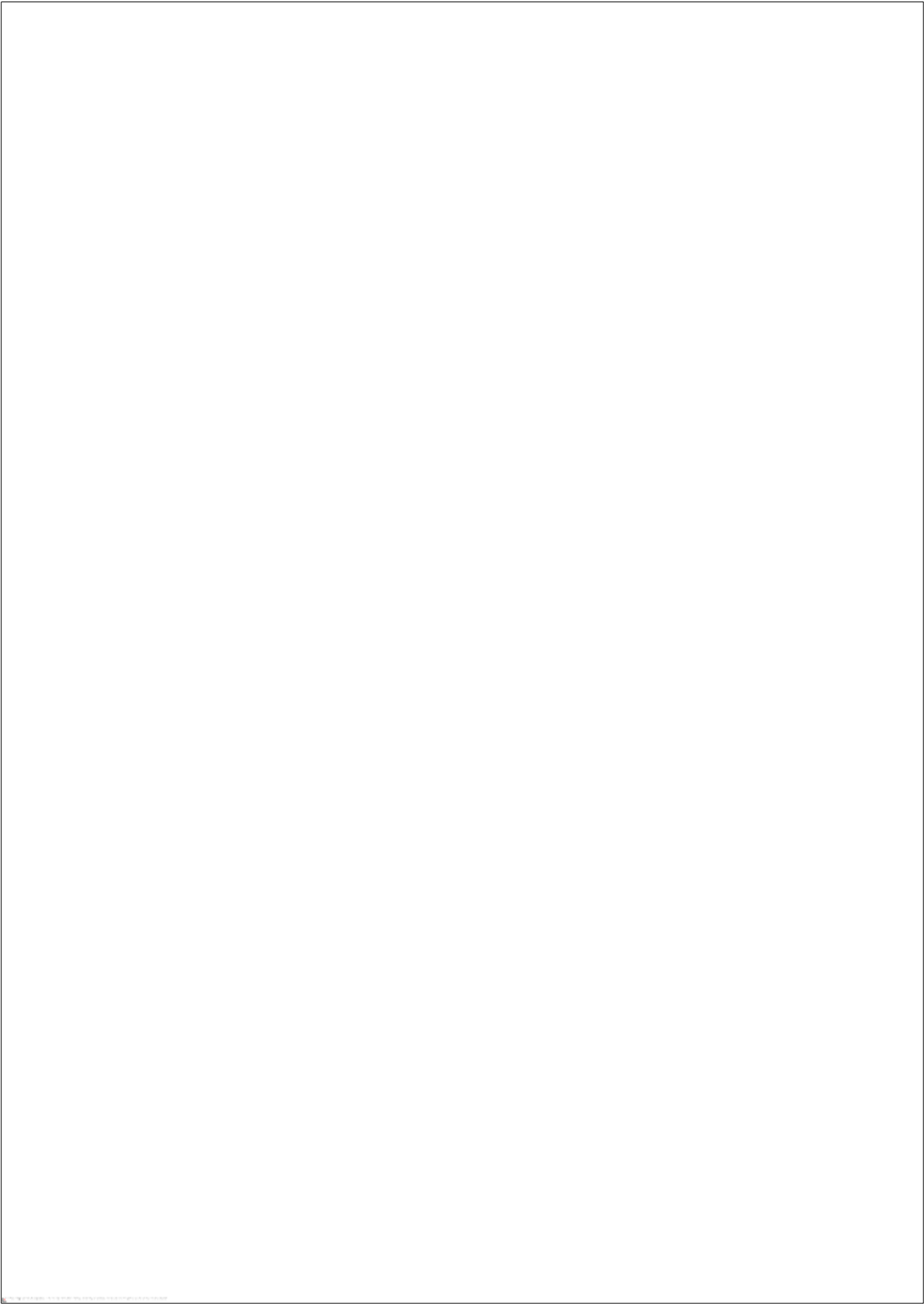
Mounting height	Range (circular detection)			Presence detection
	Presence Detection (Seated Activity)	Motion Detection Walking Across	Motion Detection Walking Towards	Maximum Recommended mounting distance between detectors
2.0	r = 2.6	r = 8.5	r = 3.2	4.5 metres
2.5	r = 3.2	r = 12.0	r = 4.0	5.6 metres
3.0	r = 3.8	r = 14.5	r = 4.8	6.6 metres
3.5	r = 4.5	r = 17.0	r = 5.5	8.0 metres
4.0	Not Applicable	r = 19.5	r = 6.8	N/A
4.5	Not Applicable	r = 22.0	r = 7.2	N/A
5	Not Applicable	r = 24.0	r = 8.0	N/A

TABLE 2 - PD2 Occupancy Sensor

Mounting height	Range (circular detection)		
	Presence Detection (Seated Activity)	Motion Detection Walking Across	Motion Detection Walking Towards
2.0	r = 2.0	r = 4.0	r = 2.5
2.5	r = 2.5	r = 5.0	r = 3.0
3.0	r = 3.0	r = 6.0	r = 3.7
3.5	Not Applicable	r = 7.0	r = 4.3
4.0	Not Applicable	r = 8.0	r = 4.8
4.5	Not Applicable	r = 9.0	r = 5.5
5	Not Applicable	r = 10.0	r = 6.0

TABLE 3 - PD4-GH Occupancy Sensor

Mounting height	Range (oval detection)	
	Motion Detection Walking Across	
2.0	r = 7.5m	Dia = 15.0m
2.5	r = 9.0m	Dia = 18.0m
3.0	r = 11.0m	Dia = 22.0m
3.5	r = 13.0m	Dia = 26.0m
4.0	r = 15.0m	Dia = 30.0m
4.5	r = 17.0m	Dia = 34.0m
5	r = 18.5m	Dia = 37.0m
6.0	r = 18.5m	Dia = 37.0m
7.0	r = 18.5m	Dia = 37.0m
8.0	r = 22.0m	Dia = 44.0m
9.0	r = 22.0m	Dia = 44.0m
10.0	r = 22.0m	Dia = 44.0m







External Lighting Corridors

If BMS controls are readily available use BMS system otherwise provide a PE call to control external lighting in parallel with local timer clock.

External lighting shall be provided to operate during normal hours of darkness. Corridor and foyer lighting shall also be provided throughout all buildings. This lighting shall be switched in the following groups:

- | | |
|----------|-------------------|
| Group 1: | External Lighting |
| Group 2: | Foyer Lighting |
| Group 3: | Corridor Lighting |

These lighting groups shall each be contactor controlled at the local sub-board. Each group shall have a local Auto/Off/Manual switch at the local sub-board for testing purposes. The contractors shall be labelled as to what they control and not just "C1 C@" etc but External Lighting etc. The photo-electric sensor is to work in parallel with the time clock and in conjunction with the switching contactors. Provide a terminal strip for future connections to a Building Management System.

For New building or refurbished building:

Group 1:

External lighting 100% will be controlled at the local distribution board via local control circuit. PE cell and timer in parallel like the electrical distribution board with a service bypass isolator in an accessible appropriate location.

Group 2:

Foyer lighting be circuited such that 50% lighting can be controlled at the local distribution board and 50A% can be controlled manually from a switch on the wall. All will be controlled in parallel with an occupancy detector.

Group 3:

Corridor lighting should be circuited such that 95% of lighting is controlled by motion detectors. The remaining 5% shall comprise of the luminaries located at intersections of corridors, entry and exit doorways, entry to fire stairs and lifts. These shall remain lit for safety and security 24 hours a day.

Enclosed Fire Escape Stairs and Internal Stairs

All windowless fire escape stairs and internal stairs shall have circuits controlled only at the distribution board. Stairs which have sufficient natural lighting shall have lights controlled by the daylight contactors at the local sub-board as part of Group 1 External Lighting.

Toilets

All toilets shall have lighting circuits controlled only at the distribution board via a maintenance bypass isolator and connected to occupancy detectors in the toilets. The occupancy detector will have an adjustable run-on timer from 20 minutes to 1 hour.

Dimming

Electronic dimmers shall be specified wherever dimming is nominated. DSI or 0(1)-10V controllers shall be provided for dimmable fluorescent luminaries. Digitally controlled dimmable fluorescent ballasts will also be considered, where applicable.

Natural Lighting

Where two or more luminaries on the same switching circuit are close to windows they shall be separately switched from the rest of the room to conserve energy when daylight is available. If there is a large window area, automatic stepless dimming control shall be considered. It is crucial that daylight is integrated with lighting control system to take advantage of the available daylight.

27.8 Emergency Evacuation Lighting

For Projects on Existing Buildings

Where Central Emergency Lighting Systems exist on the University's sites, they are to be replaced with a Single Point System at the earliest opportunity. Modifications to an existing Central Emergency Lighting System to facilitate localised minor works will only be considered under extenuating circumstances, with written approval by USP.

Where multiple types of emergency lighting systems exist in an installation, the areas served by the respective system types shall be segregated and easily delineated to AS2293 requirements and USP approval. Central Emergency Lighting Systems shall be replaced progressively during minor works. Redundant cabling and equipment associated with central battery systems or redundant systems shall be removed.

Refurbished installations shall be provided with manual testing facilities located at local electrical switchboards, unless they comprise an existing monitored system.

For major refurbishment projects and new buildings

The feasibility of an automated computerised maintenance testing and monitored system shall be investigated for all new building and major projects and a report shall be submitted for USP approval before the commencement of any detail design. This feasibility report will include a cost benefit analysis inclusive of capital, maintenance, operating and life cycle costs, and likely payback period for that particular project.

Should an automated maintenance testing and monitored system be accepted by USP, the complete emergency lighting system shall be monitored and controlled by a master controller (with software) via a communication network. The "Emergency Lighting Computerised Testing and Monitoring System" shall be provided as a complete and operational system. The system shall be designed and installed to allow a minimum of 20% spare capacity in the system as a whole and in each sub-group of the system for future expansion.

The final connection shall be to a computer complete with interface and software located on the respective campus. The emergency lighting LAN cable is to be proprietary data cable (yellow) as nominated by the manufacturer of the testing and monitoring system, if appropriate to the system studied.

In all projects

The emergency lighting system shall be designed and installed to the requirements of the BCA, Fire Safety Act and AS 2293. A Single Point System shall be installed incorporating self-contained emergency luminaries and an AS2293 compliant Maintenance Test facility. For general arrangements refer to Typical Emergency Lighting Design Schematics AC000 005 001E and AC000 005 002E

Each luminaire shall be of the **Premium range / quality** of the approved brands and come complete with its own battery, charger, mains failure relay, and dc/ac inverter (in case of fluorescent type). The sensing circuit shall automatically switch the luminaire to emergency mode upon failure of the local lighting circuit. The supply wiring (active, neutral and earth) to emergency luminaries shall originate at the local switchboard containing the lighting supply circuit breaker and shall not be looped from the adjacent normal lighting wiring, i.e. emergency lighting should be activated in the area where normal lighting has failed.

Quick Disconnect Facility:

Emergency luminaries shall be installed with a quick disconnect facility to facilitate safe maintenance and replacement without interruption of the electrical circuit associated with the emergency lighting. Final arrangements shall be to USP approval. Examples of acceptable arrangements are as follows:

a)	"Quickfit" arrangements for exit luminaries;
b)	Flex and plug for recessed luminaries (or surface mounted luminaries where aesthetics is not an issue). Where luminaries are recessed in set ceilings, sockets shall be accessible by the flex dropping through and from the luminaire cut-out. The whole emergency light assembly including the battery pack must be removable through the luminaire cut out.
c)	Internal dis-connectors for 240V wiring to allow the control gear assembly to be removed leaving the energised fixed wiring in place.

Additional Requests:

In addition to the requirements of the BCA and AS2293, emergency lighting shall be provided as follows:

a)	Provide an emergency light on every stair landing. In non-enclosed stairs, or stairs where natural light is sufficient for day time use, stair lighting shall be switched by the external lighting controls. Stair lights shall be maintained and non-maintained type suitable to the application. Luminaries shall be accessible for testing and maintenance using a step ladder in accordance with Workplace Health and Safety requirements, and in all instances without the use of scaffolding (maximum mounting height of 3.6m above floor level unless specific arrangements for maintenance are provided to USP approval).
b)	Public Amenities (toilets, change rooms etc.).
c)	Switch rooms and plant rooms (Electrical, fire services, voice/data & communication, HVAC, Audio-Visual etc.)
d)	Electrical Main Switchboard room shall be provided with an emergency light in the front and back of the main switchboard.

e)	Electrical services switchboard cupboards, and riser cupboards containing switchgear, to facilitate trouble shooting in the event of a power outage.
f)	Security sensitive areas such as cashiers, money handling areas, emergency call points and the like, and areas with specific surveillance requirements, to be discussed with USP on a specific situation basis.
g)	For rooms with dimmer controlled lighting systems (such as AMX or Dynalite), provide sensing directly from the load side of the supply circuit breaker (the line side of dimming device). Where devices are supplied by a multi-phase circuit, provide sensing to all phases such that a failure on any one phase activates the emergency lighting to the respective area. Monitoring of the supply shall be via a proprietary sensing unit interfaced with the emergency lighting controls. The final arrangement shall comply with AS/NZS 2293.
h)	Where normal lighting is provided with HID type luminaries (delayed lamp restrike), provide a delay timer to maintain the operation of the emergency lighting for a period of 15 minutes following the restoration of supply to normal lighting.
i)	Uniformity: unless otherwise approved, all equipment including, luminaries, fittings and accessories shall be of a uniform type throughout. Final selection of fittings shall be to USP approval. Refer to preferred luminaire types.

Luminaire Types

Unless otherwise approved by USP, all luminaire types shall be only the **Premium range / quality** of the approved brands and as follows:

a)	Emergency Exit Luminaries: "Millennium Quickfit" series with 50,000 hour cold cathode lamp or LED, maintained type, white letters on green background . In theatre and projection situations, luminaries shall be green lettering on black background with the bottom face of the stand-off lens clear . Where emergency exit luminaire types are to match existing, maintained type with long life lamps are to be used. On whole floor refurbishments, all exit signs will be "running man" pictogram in white on green background to be sized appropriately for the viewing distances.
b)	Emergency Luminaries (general): Preferred LED or Spitfire", non-maintained, large head for non- tiled ceilings (for control gear access). Provide proprietary clear cover where mounting heights are less than 2400mm, and in public amenities with ceiling heights less than 2700mm (to prevent unauthorised removal of the lamp), and where installed above hazardous areas (laboratories and the like).
c)	Emergency Luminaries to switch rooms, services risers and plant rooms shall be fluorescent lamp (batten) type lamp protection to suit the application (e.g. wire guard, diffuser).
d)	Battery Types: Nickel Cadmium is the preferred battery type. Lead acid types are not acceptable unless specifically approved by USP (for floodlight units or similar).

e)	Diffusers shall be easily removable without displacing luminaries. Luminaries which have to be dismantled in order to replace lamps shall not be used. Luminaries nominated indicate the style and type of luminaire required. The decision of USP shall be final regarding acceptance or otherwise of any alternative offered.
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Emergency Lighting Testing Facilities

An AS/ANZ 2293 compliant Emergency Lighting Testing Facilities shall be provided for all emergency lighting installations. For non-automated maintenance testing and monitored systems, a manual testing facility shall be provided, generally as follows:

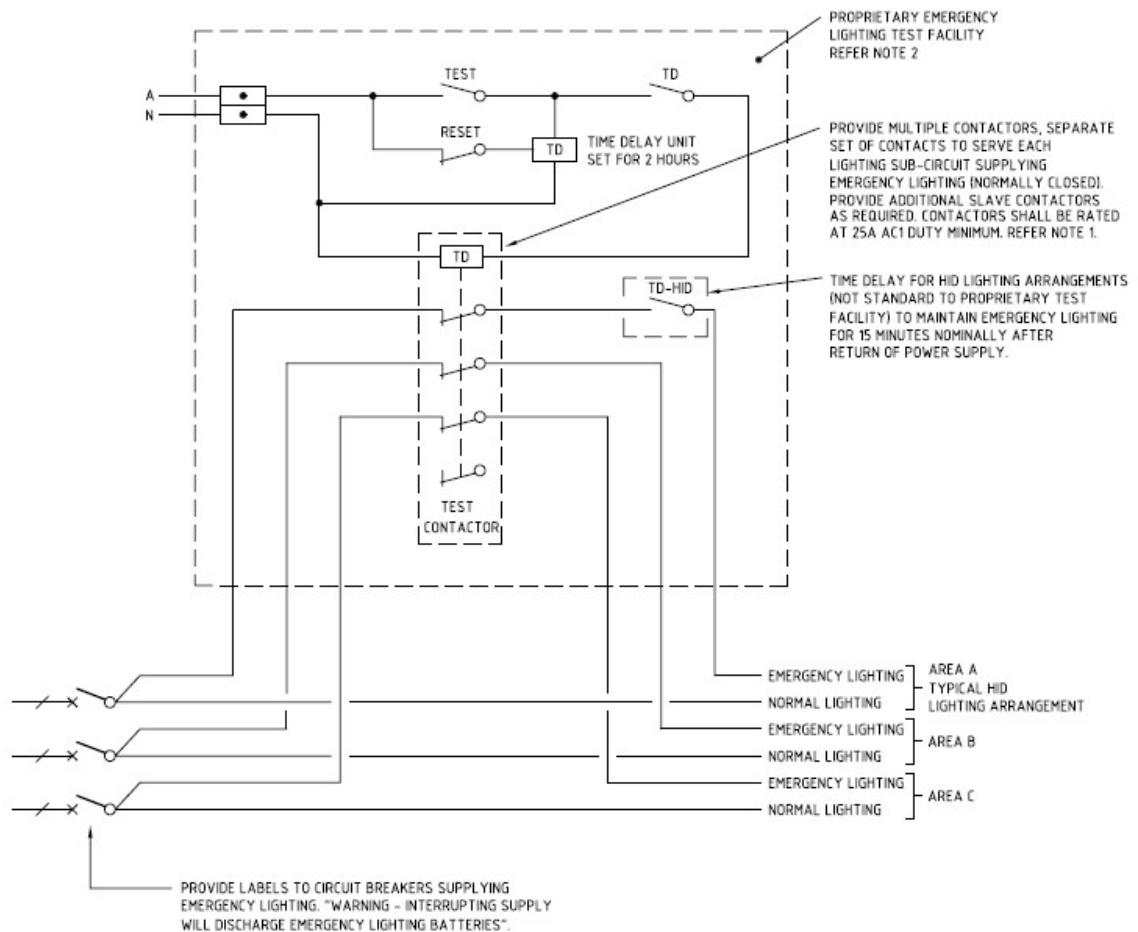
a)	Provide a 240 V un-switched active supply to each emergency and emergency exit luminaire, connected from the circuit breaker supplying the nearest appropriate local lighting final sub-circuit through the testing contactor.
b)	Operation of the test switch shall initiate a two hour timed cycle which energises the emergency lighting test contactor/s (normally closed contacts) and in so doing, breaks the un-switched active sensing supply to all emergency luminaries. At the end of the two hour cycle, the contactor/s shall automatically de-energise restoring the system to its normal operational state.
c)	Emergency lighting testing facilities shall be associated with local distribution switchboards serving the normal lighting for the designated area. Each switchboard supplying lighting with emergency lighting connected shall be provided with its own test facility.
d)	For new switchboards, or existing switchboard with adequate space available, the testing facility shall be incorporated into the switchboard. The preferred arrangement is a proprietary testing unit (ABB or approved equal), DIN rail mounted with test switch mounted into the escutcheon.
e)	For existing switchboards not suitable for incorporating the testing facility, the preferred arrangement is a proprietary testing unit (ABB or approved equal), DIN rail mounted with test switch, housed in its own enclosure mounted adjacent the switchboard within the associated cupboard or plant room.
f)	Where space is not available in existing cupboards or plant rooms, or the testing facility is exposed, the preferred arrangement is a proprietary testing unit (ABB or approved equal), DIN rail mounted, key operated test switch, housed in its own enclosure. Locate the testing facility at high level in a position not accessible to the Public to USP approval).
g)	Provide a label adjacent to every circuit breaker which provides supply to emergency lights. The label shall be worded: "Warning - Interruption of Supply will Discharge Emergency Lighting Batteries".
h)	For general arrangements refer to Typical Emergency Lighting Design Schematics AC000 005 001E and AC000 005 002E

Specific Requirements

Specific requirements are as follows:

a)	Emergency Lighting Systems shall be installed as per manufacturer's specifications, AS/NZS 2293.1 and .2 and USP Design Guidelines current at the date of order.
b)	The commissioning and "As Installed" documentation of the system shall be provided in hard and soft (electronic) copy complying with both the requirements of AS/NZS 2293.1 and .2 and the University's recording system. "As Installed" drawings shall be legible at A3 size to facilitate testing. Drawings shall indicate luminaire positions, individual light fitting numbers, and locations of major components such as routers, controllers, test facilities and switchboards. Emergency Lighting Schedules shall be complete in all fields incorporating information including circuit numbers, luminaire ID, luminaire and lamp information, location and date installed. All fields within software packages are to be fully populated. Log books can only be used in special circumstances with written authorisation by USP. Sample documentation and templates may be obtained from the Senior Technical Officer (Mechanical and Electrical Contracts)
c)	It is the Principal Contractor or Managing Contractor's responsibility to ensure that USP's current Emergency and Evacuation lighting maintenance Contractor, (Queensland Evacuation Lighting, contact Adrian Bowker, Mobile 0411 537 459), in conjunction with the electrical trade contractor, must complete the following tasks before the emergency lighting system will be accepted by USP. • Inspect and test emergency lighting circuitry to confirm compliance with USP's requirements. (Typical Emergency Lighting Design Schematics AC000 005 001E and AC000 005 002E in USP's Design Standard and Guide line) • Supply and install USP's unique ID numbering and labelling system to each emergency and exit light. • The Principal Contractor or Managing Contractor's and or the electrical trade contractor shall provide required data of fittings and marked up drawings in hard and soft (electronic) copy to comply with USP's recording system and PM Track requirements it is the Principal Contractor or Managing Contractors responsibility to ensure this occurs. Note - Log books can only be used in special circumstances with written authorisation by USP
d)	At the completion of work, the emergency lighting system shall be commissioned and certified as complying with the requirements of AS/NZS 2293, the BCA and the Electrical Safety Act. Certificates shall be included in the "As Installed" documentation.

Following are two Typical Emergency Lighting Schematics.



NOTES

1. ADDITIONAL CONTACTORS FOR MINITRONICS TEST UNITS SHALL BE CAT No 04054. (PROVIDED WITH ENCLOSURE).
2. FOR STANILITE UNITS WITH INTEGRAL TIME DELAY FUNCTION, CAT No SHALL BE ELTUD.



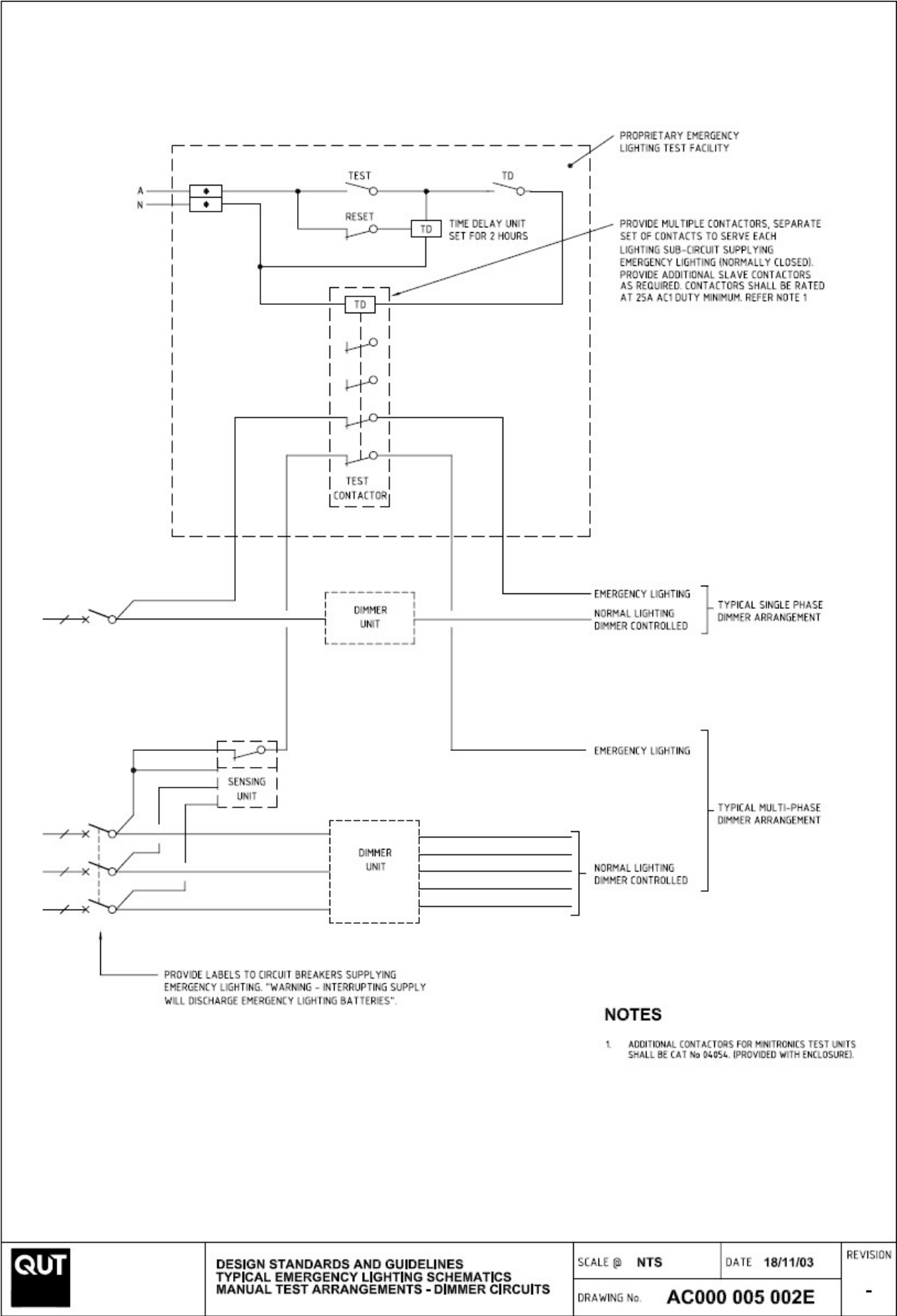
DESIGN STANDARDS AND GUIDELINES
TYPICAL EMERGENCY LIGHTING SCHEMATICS
MANUAL TEST ARRANGEMENTS.

SCALE @ NTS

DATE 18/11/03

REVISION

DRAWING No. **AC000 005 001E**



27.9 Power

GPO Design Requirements - As a general guide where no details are otherwise provided a minimum of two double GPO's shall be provided for each 10 square metres of floor area with a capacity to grow to 120VA/Sq m requirement.

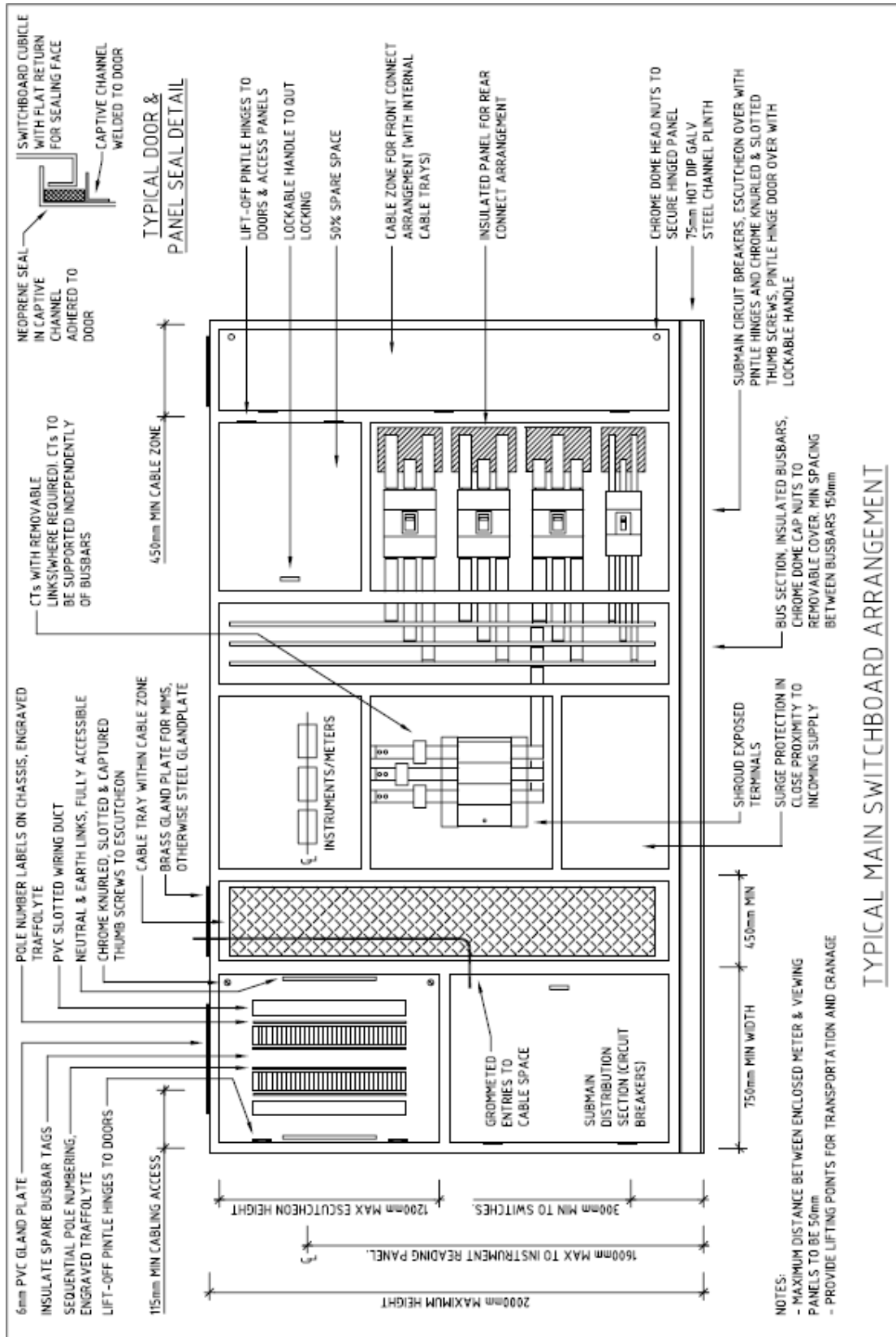
General Notes

a)	Wiring - Power circuits shall be wired in not less than stranded 2.5 mm ² PVC wiring and shall not be loaded above 75% of the permissible values outlined in AS 3000
b)	Mounting Heights - Unless stated otherwise, wall mounted general purpose outlets shall be mounted at centre line 300mm above finished floor level. The height shall be varied in the case of face brick walls where the outlet shall be mounted in the centre of the brick nearest the indicated mounting position and nearest to centre line 300mm above floor.
c)	Note special requirements for laboratories in relation to mounting heights required to accommodate hazardous zones where flammable liquids are used. (AS/NZS 2430.3.6:1997)
d)	Unless stated otherwise, general purpose outlets mounted on walls and above fixed benches, counters or cupboards shall be mounted at centre line 200mm above the top of the unit concerned, and preferably to line up with all light switches.
e)	Socket outlets: Use dual 10A single phase switched socket outlets in all locations which call for general purpose outlets, also referred to as GPO's, unless nominated otherwise. GPO's shall be Clipsal C2000 series with I.D. covers; generally their colour shall be white. All outlets shall be fitted with type written labels indicating circuit number and distribution board of origin, e.g. DB2A-15. (Note: the requirement for large toggle size switches to GPO's in those areas designated as needing to accommodate people with disabilities.)
f)	Special purpose outlets shall be Clipsal IP55 or similar. Three-phase outlets shall be Clipsal and shall have 5 round pins. These outlets shall be identified by means of circuit identification Brother P/Touch PT85 labels.
g)	Where not mounted in wall duct or not otherwise determined by the situation, GPO's shall be mounted at 1 metre above finished floor level unless otherwise stated on the Project brief.
h)	Where GPO's are mounted in fire rated walls or partitions provide proprietary type fire rated steel backing boxes to ensure that the design fire rating of the wall is maintained.
i)	Toilet GPO: Allow a GPO adjacent to the mirror in toilets. Ensure that GPO's in toilets for disabled persons comply with the relevant code requirements in relation to mounting height and toggle height.
j)	Cleaners GPO's: Allow a single GPO at each 20 m 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, for cleaner's use. These GPO's shall be on dedicated circuit protected by RCD, mounted 300mm from final floor finish.

k)	Common Room, Tearoom Kitchens: In general, USP allow for separate circuits (15A) for percolators and a microwave oven (3 total). Allow 6 additional Double GPO's on separate circuits (i.e. 6 circuits) in the server area and other GPO's for vending machines. Allow separate supply for a Refrigerator, a Dishwasher and a ZIP 3 to 5 litre boiling water unit and a double GPO under the kitchen sink for chill water unit etc. The Consultant should assess and review the adequacy or otherwise of this provision in conjunction with the Project Engineer and Users and adjust the stated provision accordingly
l)	Hot water units and Circulating Pump: Allow to provide power connection to Hot water units Rheem 50L to 315L units. Size of unit to be determined by each application.
m)	Hydraulic pumps like cold water pump, sump pumps, fire services pumps etc have to be provided with the appropriate power supply.
n)	Audio-Visual Equipment shall be provided with the appropriate power requirements as described in Section 23 AV Stds for Classrooms and Lecture Theatres . All Biobox associated equipment shall be supplied via a dedicated Biobox electrical sub-board.
o)	Communications Equipment shall be provided with the appropriate power requirements as described in Section 28 Communications. All communications equipment shall be supplied via dedicated circuits on the local electrical sub-board.

27.10 Switchboards & Sub-boards

Typical Main Switchboard arrangement



Main Switchboard - General Notes

- a) The overall design of the Main switchboard shall consider the ease of maintenance and future modifications for the life of the building. Control equipment shall be located so the equipment can be safely accessed for fault finding without the need to isolate the supply to the switchboard. The main switchboard shall be of type tested (Form 2 and Form 3 as per BCA generally) construction, floor mounted, free-standing compartmented cubicle type construction. The switchboard construction shall be appropriate for the Prospective Fault Level of each situation. Provision shall be made to extend the main busbar systems in either direction. The Main switchboard room shall be designed to cater for this extension in either direction plus sufficient clearances for a safe working environment. Over and above any space provision for future expansion, the Consultants shall ensure that there is a minimum of 1m clearance around a main switchboard.
- b) At least 25% spare space complete with busbars shall be provided as an absolute minimum, spare spaces shall be distributed across each section of the switchboard and each section shall contain at least one off spare space. No equipment is to be mounted less than 300mm above the floor. The switchboard inspection panels on the cubicle are to be constructed such that the panels are no larger than 900mm by 900mm area and hinged securely.
- c) The IP rating for all boards shall be suitable for the location of the switchboard and agreed with the Superintendent prior to tender. Minimum rating required is IP54.
- d) A non-fading print of the "as constructed" line diagram schematic drawing of the main switchboard shall be installed on a wall within the main switch room mounted in a frame with non-reflective glass. The line diagram must include the size, rating and length of all incoming and outgoing cables and the rating, model and manufacture of all switchgear and measurement instruments mounted in the switchboard.
- e) Provide electrically safe access for the thermo-scanning tests.

Distribution Boards- General Notes

Distribution Boards shall be arranged for wall mounting unless circumstances dictate otherwise. 100% spare space shall be provided on all distribution boards in science type buildings. In non-science-type academic buildings, provide 75% spare space on all distribution boards. Non-Academic buildings shall have 50% spare capacity. Distribution boards shall be provided within areas of heavy load concentration and within each laboratory. All light and power circuits to be loaded to less than 75% of their rated capacity. All distribution boards to be made large enough to cater for all incoming mains and outgoing cables and the positioning of Transformers, Terminal Blocks and Contactors so that cable to these items can be done in a neat and tidy manner. All cables feeding Circuit Breakers to be via ducting complete with spare capacity with easily removed lids.

- a) Busbars shall be extended into the spare space and circuit breakers (1 off 20A SP and 1 off 20A SP RCD) shall be fitted to the spare space. Sub-mains shall be sized for the appropriate spare capacity, and cables shall be labelled indicating size and source of supply and length of cable.
- b) Minimum acceptable clearance between circuit breakers and the side of the distribution board shall be 115mm.
- c) Distribution Boards shall be clearly labelled with an individual identifying number and the source of the incoming supply. Distribution boards shall be identified with "Dbxy" where x is equal to the building level and y is equal to a series of uppercase letters starting with A for each level, e.g. DB3B would be the second DB on the third level of that building. Mechanical Services Switchboards (MSSB) shall be identified with MSSB-z where z is equal to the room number that the MSSB is located in.
- d) All Distribution switchboard circuit schedules/legend shall be A4 size and provide information on GPO, light and equipment, corresponding circuit identification labelling on the outlet, with USP room numbers used to describe the location/area which the circuit serves. Sample DB circuit schedule is as below:

DB Name:		DB 4A incoming from MSB 250A TP CFS	
Installation Contractor:		XYZ Electrics P/L	Checking Electrician: A. Sparky
Installation Date:		15 SEPT 2001	
Modification date:		20 MAY 2002/ 5 AUG 2002/	
Circuit ID No.	Neutral ID No.	Circuit Load Description	Circuit Breaker Rating/Type
1	1	3 DGPO each Rm445 Rm446	20A SP RCD
2	2	8GPO Rm 415 added 5/8/02 2GPO	20A SP RCD
3	3	Hot Water system Rm450 added 20/5/02	20A SP
4	4	14 Fluoro Lights Rm415	20A SP

Provide a soft copy of the altered Distribution board schedule in Microsoft Excel OR Word file format onto the CD Rom or Floppy diskette referred to in this design Guideline section on Operational & Maintenance Documentation requirements.

- e) All switchboards and distribution boards shall be designed to be vermin proof with hinged lockable doors. All escutcheon panels
- f) shall be hinged and secured with a minimum of 2 number thumbscrews. Keys shall be included in the hardware schedule and be as per section 10.10 (see Keying System details).

Fuse Cartridges

All fuses shall be HRC cartridge type conforming to AS 2005 and AS 3135. Fuse carriers shall be fully shrouded type. A minimum of three (3) spare cartridges for each rating shall be supplied at each switchboard position mounted on a suitable rack. At the main switchboard position, fuses shall be located in a wall mounted moisture proof enclosure in the switch room. At distribution boards, the fuses shall be mounted in a convenient location in the respective cupboards. In special circumstances DIN fuses may be acceptable after consultation with the Superintendent.

Electricity Meters in Main Switch Rooms

The main incoming supply to each building shall have a USP private meter. EDM I Km 6 Model

2000 - 0600 - 141 - H - JN - 014 - M3

The CTs shall match main incoming supply switch size.

The SmartBuilding Services are to be engaged to commission on all these EDM I Meters. SmartBuilding Services contact is Rob Stewart (Ph: 3205 5288). These meters are to be supplied with modems or network connections capability. This is to be determined on a case by case basis.

Labelling

Each and every control, switch etc. on main switchboards, distribution boards etc. shall be clearly labelled. All labels shall be engraved black on white, white traffolyte or white, red, white traffolyte for emergency lights and fire secured by means of screws, nuts and washers. Gluing or the use of self tapping screws is unacceptable. Labelling within the switch boards for relays, contactors etc should be on standoff brackets.

Circuit schedules

Circuit schedules shall be typed and shall be provided at all switchboard positions. (Note the type font size is to be a minimum of 12 legibility in poor lighting conditions) Circuit numbering shall be continuous without segregation between light and power to achieve maximum efficiency. Schedules shall be secured in purpose made clear PVC covered holders. Circuit schedules shall indicate the room number 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.

Colour

All switchboards shall be colour orange X15 (AS 2700) externally and white internally. Emergency services sections shall be colour red R13 external and white internally.

Residual Current Device (RCD) protection

Residual Current Device (RCD) protection shall be provided to all power sub circuits unless otherwise stated, use Cutler Hammer ELQ 116C.3 30 m.A. breakers, or approved equivalent, to provide single circuit RCD protection. Where power outlets are not RCD protected, they shall be clearly identified as such. Each 20A 240V circuit breakers will have an upper limit of 12 double GPO per circuit and each 16A 240V circuit breaker will have an upper limit of 14 twin 36W tube fluorescent luminaire per circuit.

General Requirements

- a) Duplex type circuit breakers shall not be used. Any existing duplex circuit breakers are to be replaced with any new works.
- b) 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.
- c) All active cables entering circuit breakers shall be via cable lugs. All control wiring shall be number ferruled with numbers as indicated on as constructed drawings.
- d) Neutral and earth bars shall have the same number of terminations as there are circuit breaker 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. Blue Point connections shall not be permitted within switchboards and distribution boards.

Electrical tee-off boxes

Where electrical tee-off boxes are used, they shall be accessible, painted orange X 15 and labelled on the front to indicate the switchboard served by the box and origin of supply. If a fused tee-off box is used, and there is sufficient cupboard depth Weber style fused isolators are preferred, Provide labelling on the front panel of the fused tee-off box stating which switchboard is serviced by the fuses. Ensure that there is adequate space for access to the fused take-off box.

Preferred Standard equipment

Preferred Standard equipment for all switchboards and distribution boards for light, power, air-conditioning or other building services is as follows:

Circuit Breakers to final sub-circuits	Cutler Hammer Quick-lag miniature circuit breakers, Terasaki, Schnieder or approved equivalent.
Auto/Off/Manual Switches	Kraus and Naimer CG4. (or approved equal)
Active Links	Blue Point or Busbar System (or approved equal)
Push buttons	Shrouded type
Indicating lights	Rafi 24V or 240V rated (or approved equal)
Contactors	Sprecher and Schuh (or approved equal)

27.11 Electrical Riser Cupboard

A dedicated electrical services riser shall be provided for the reticulation of electrical services throughout the building. The minimum size of the electrical riser shall be 1500mm x 500mm. Each electrical riser shall have maintained emergency lighting, a double 10A switched socket outlet and a 32A, 3 phase key switched power outlet suitable for a captive plug connection.

Ensure that the fire rating between floors is maintained and that all cable penetrations are fire-stopped in an approved manner.

27.12 General Wiring

General

Ensure that cabling serving each level of occupied space remains within that occupied space, i.e. power cabling is not to reticulate via the ceiling space below. Horizontal cabling shall generally be reticulated via accessible ceiling spaces on trays (when grouped), with vertical runs routed via wall cavities and discretely positioned vertical runs of perimeter cable duct. Local distribution to GPO's (in low concentrations) shall be via wall and stud-partition cavities, and for heavier concentrations or where flexibility is required, via multi-compartment perimeter cable duct.

Power and lighting cable

Cabling shall not be less than 2.5 mm², stranded copper conductors. Colour coding shall be in accordance with AS3000. Control wiring shall be white, or brown. Field control wiring for extra low voltage (less than 32 V a.c. / 110 V d.c.) shall be not less than 1.5 mm² stranded copper. Control wiring within switch board can be 1.5 mm² but once these control cables leave the board they are to be 2.5 mm² and leave via a terminal block. Sub circuit cabling shall be installed using the loop in - loop out principle. Junction boxes, with identification labels shall only be used after written approval from the Superintendent.

Cable Entries

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 shall be used when the cable rating exceeds 100 amps.

Cable Ladders, Conduits and Conduit Saddles

a)	These components shall have the following colour coding throughout the entire installation:
	Orange for power, lighting and 240V controls.
	Grey extra low voltage or low voltage controls.
	White for telecommunication and data services.
	Red for fire services.
b)	Where cable ladders, conduits and conduit saddles are in public areas, they should be painted to match background colouring.
c)	Conduit saddles shall be of the stand-off type in exposed areas or on painted walls.
d)	Cable ladders and ducts shall be fully galvanised and colour banded (400mm) at least every 3 metres, at each change of direction and either side of any partition or barrier they may pass through.
e)	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.

Cabling in Ceiling Spaces and Risers

a)	Main sub-board feeders and sub-circuit wirings shall generally be run on cable ladder in risers and major cable routes in ceiling voids. Cables shall be supported clear of ceiling structure by approved cable supports system e.g. "Unicon or Ezi-Fix" at a maximum interval of 1.2m, cable tied to catenary wires, or suspended hangers such as flat steel hoop iron complete with "Unicon or Ezi-Fix". Installed samples of Ezi-Fix should be requested by the Consultant for performance checking.
b)	Care must be taken to have enough slack in the cable runs to eliminate stretching of the cable and strain on the "Unicon or Ezi-Fix".
c)	The practice of laying the cable on ceiling tile and tying cable to the ceiling support or outside of a "Unicorn" with cable tie will be rejected.
d)	If more than six (6) cables run in ceiling space in parallel, a cable tray shall be used.

Conduit Jointing

Where connections are made between fixed and flexible conduits it is to be done by the appropriate adaptor and not glued.

Redundant Cabling

Where cables are made redundant they **MUST** be removed in their entirety, and the legend card amended.

Channel Duct

a)	Distribution of power and communication wiring may be by means of three channel perimeter grey aluminium duct equal to Skirtec CA15050 complete with factory manufactured corners and fittings and marviplate duct covers.
b)	Sheet metal cable duct will not be acceptable.
c)	Where conduits cannot be cast in floor slabs, use Service Poles similar to Moduline Space Pole.
d)	Where island rooms exist, these shall be conduited to allow for the installation of power from the relevant distribution board where these are not installed in the first instance.
e)	All ducts shall have a minimum of 2 x 32 mm feeds from the distribution board to each section of the duct.
f)	Ensure that any trimming of ceiling penetrations for ducts or Space Poles is catered for in the documentation.
g)	Floor outlet boxes shall only be employed with the approval of the Project Engineer (Electrical). Where required, the Consultant should discuss brand options with the Project Engineer (Electrical) and provide a recommendation
h)	In computer laboratories, 3 channel duct shall be run on the wall above benches and along fascias of computer benches. In other areas, ducting shall be run at approximately 1000 mm above floor to service desks and benches. These shall be discussed with the Project Engineer (Electrical) before final resolution.

Cabling layout in partitions

Power circuits within partitions or wall cavities shall be installed vertically from the ceiling space to the outlet or connection position, outlets within 1m of each other may be connected horizontally, 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, such that they may be withdrawn and that sufficient segregation would be afforded to a new telecommunication cable being installed across its path.

Sub mains and mains cables

Sub mains and mains cables run on cable ladders/trays shall be installed in trefoil. All sub mains for distribution boards are to be installed within electrical risers or down corridors. No sub mains are to be installed through occupied rooms or offices.

Fire Compartment Considerations

The Electrical sub circuit cables are to run within its individual fire compartment. Cables shall not be installed within the ceiling space of the floor below that it is to service, except for between the main switch room and the electrical services riser. For any cables traversing fire compartments, the penetration is to be fire stopped and the cable fire rated or cable route be in a fire rated enclosure.

Separation of cabling systems on cable supports

In order to maintain non-interference of services the following separation distances are to be maintained:

Power 415/240V cables and Audio visual cables	300mm MINIMUM
Power 415/240V cables and Data/comms cables	300mm MINIMUM
Audio visual cables and Data/comms cables	150mm MINIMUM
415V/240V power cables support systems	Generally to be run on opposite side of the corridor to the Audio-visual and data/comms cable support system.

27.13 Underground Electrical Services

All underground electrical services shall be installed in accordance with the requirements of AS 3000 and shall be laid in sand with 75mm below and 150mm above and to sides and shall be identified by laying an approved continuous PVC marker tape 300mm min above the conduits.

Note that spare conduits are required to be installed during the installation of underground services. The Consultant shall liaise with the Project Engineer to resolve the number and configuration of spare conduits required and shall be allowed for in the overall design.

Only selected backfill shall be used and shall be compacted in layers not exceeding 200 mm to a density of 90%. The minimum cover shall be in accordance with AS 3000 and in any case, not less than 600 mm to top of conduit. Concrete cover to conduits to a lesser depth will be allowed only after written approval.

Minimum size of underground conduit shall be 25mm. Underground cable shall be double insulated cable, not less than 2.5mm². All spare ground conduits to be fitted with a 2.5sqmm TPI cable as a draw wire.

Underground cable joints are not acceptable.

Maximum distance between pits on underground cable runs shall be 60m.

All underground pits shall have their lids marked with a brass plate indicating the service installed and the route from the pit, and shall be adequately drained. See [Section 38 Roads](#) Clause 5.9 Inspection Chambers.

Brass marker plates shall be installed at kerbs and road crossings and any changes in direction. The lettering shall be not less than 10mm high. In unpaved areas, the markers shall be set in a concrete pad not less than 300 mm square x 200 deep.

Separation distances to other services as required by relevant Australian Standards, Acts and Regulations shall be observed.

All other underground cabling and services will be run in designated accommodation. For example fibre optic cables will run in communications conduits and not 11kV or 415V/240V conduits.

27.14 Testing

The entire installation shall be thoroughly tested by an independent testing authority prior to being energised. These tests shall verify all functions and test that all protective devices are operating correctly. Testing shall be fully in accordance with AS 3000 and supply authority requirements. Testing shall include all mandatory tests as per AS3000 and the following additional tests as described in AS3000:2000 clause 6.3.4:

An independent tester shall on verification of operation of 50% of RCD's, should any of the RCD's fail this test the remainder of the installed RCD's shall also be tested.

The installer and designer must work together to deliver an installation that works to the intent of the design. The designer shall certify in writing that the installation function complies with the design documents and works.

At the completion of the commissioning tests period, make allowance (nominally 2 hours) for a site inspection by USP's Project Engineer (Electrical) or nominee to undertake random verification of commissioning tests.

27.15 Thermoscan (Infrared) Testing

On all projects with a total connected electrical load exceeding 100 kW, the Main Switchboard, distribution boards and load centres 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. 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.

27.16 High Voltage System

a)	Whenever any work is to be performed on the high voltage system at the University, the following procedures are to be followed:
b)	All High Voltage Switching shall be performed by the appropriate ENERGEX staff or ENERGEX authorised nominee.
c)	An ENERGEX accredited Safety Officer shall be in attendance for any work carried out in a substation.
d)	Switching requests shall be in writing on the appropriate ENERGEX form and approved by the Superintendent before being submitted to ENERGEX. The form shall be lodged with ENERGEX by the Contractor in advance of the desired switching date with sufficient notice to meet the construction program. A photocopy or duplicate shall be lodged with the Superintendent at the same time.
e)	Where any high voltage cable is to be cut, altered or moved, the Contractor shall arrange with ENERGEX to test and mark the cable to ensure that it is the correct cable and that it is not "live" before work commences.
f)	All work shall be checked and/or tested as appropriate before the switching is carried out by ENERGEX

	at the end of the job.
g)	The Contractor shall meet all costs associated with the above.
h)	Wherever possible all new substations should be installed within the ring main system on the respective campus. 'Spur lines' or radial feeding of new substations should be avoided.
i)	The all new 11kV sub-station accommodation shall be keyed to a standard SM Series (Service Master) as nominated by USP security office. This key will be made available to ENERGEX.

27.17 Electrical Colours

Main Electrical Switchboard	Orange	X15
Electrical Distribution Board	Orange	X15
Mechanical Service Switchboard	Orange	X15
Power Load Centres	Orange	X15
Cable Trays, Ladders & Ducts	Orange	X15
Fire Alarm Cable Ladders, & Ducts	Signal Red	R13
Telecommunication Cable Trays, Ladders & Ducts	White	
Electrical Conduits	Orange	X15
Telecommunication Conduits	White	

27.18 ELV Conduits & Cable Trays

Cable trays, ladders and ducts shall be colour banded, 400mm wide every 3m, at each change of direction and each side of and wall or barrier that it may pass through. The colour banding paint specified shall preferably comprise reflective type paint that will assist in identifying the colour identification banding on the cable tray in dark situations when for example viewed with a torch.

27.19 Lightning Protection

a)	Lightning protection shall be provided to all buildings if recommended using risk assessment criteria specified by AS 1768. Copper conductors shall be used. Test points are to be provided at the lowest level of the building.
b)	Transient over voltage protectors shall be provided on all power cables entering or leaving the building and USP nominated distribution boards in order to protect equipment connected to the buildings power distribution system from transient over voltages. The protector must not interfere with or restrict the normal operation of the electrical network e.g. corrupt the normal mains power supply, break or shutdown the power supply during operation or have an excessive earth leakage current. The protector shall be connected via high energy fuses to facilitate ease of replacement.
c)	The protector shall be rated for a peak discharge current of no less than 10kA (8/20 ms waveform). The peak let through voltage shall not exceed 600V, for protectors with a nominal working voltage of 230 or 240 volts. This peak transient let-through voltage shall not be exceeded for all combinations of conductors: phase to neutral, phase to earth, neutral to earth.
d)	The protector shall have continuous indication of its protection status, indicating the following: full protection present, reduced protection - replacement required, and no protection - failure of protector. Status indication shall warn of protection failure between all combinations of conductors, including neutral to earth. Transient over voltage protectors shall be provided on all power cables entering or

27.20 Building Management System Interface (TAC)

Refer [Section 32 Building Management System](#).

27.21 AMX AV Control - Auditorium, Lecture Theatres, Seminar Rooms etc.

The requirements shall be as per Audio Visual [Section 23 AV Stds for Classrooms and Lecture Theatres](#) and apply to all rooms designated to be fitted with an AMX audio visual equipment controller, whether the AMX is being installed in the contract or nominated as a future installation item.

All luminaries within the auditoria, or the like, with the exception of the emergency luminaries, shall be controlled via a Dynalite Dimtek energy management controller, or approved equivalent, linked to an AMX audio visual equipment controller. One off lighting controller per room or AMX audio visual system whichever is the greater. The system shall be complete with controller, switch panel (ON/OFF at entry), control wiring, programming and interface to the AMX audio visual system in each room.

The lighting control system shall be programmed to operate with a number of pre-set scenes. Different scenes shall be required when the system is controlled via AMX to that when the system is operated via the switch panel, final scene configuration shall be to the approval of the USP representative responsible for AV systems. Switching groups typically within such areas shall be controlled as follows:

Switching Group	Control
General Fluorescent Luminaries	Switched
Stair Nose Luminaries	Switched -on when general luminaries are less than 100%, except for when room is not in use or AMX is off.
White board luminaries	Switched
Lecturer's Position Spotlight)	Dimmed
Lectern Luminaire (mounted within Lectern)	Switched

The Switch panel shall be located at the main entry to the room and programmed to be operational at all times. Buttons on the switch panel shall be engraved with the words LIGHTSON and LIGHTSOFF.

The Switch panel shall be located at the main entry to the room and programmed to be operational when the AMX is off and disabled when the AMX is on. Buttons on the switch panel shall be engraved with the words LIGHTS ON and LIGHTS OFF.

The interface between the AMX system and the lighting control system shall be sufficient to enable the above switching group control by the AMX via the lighting control system. Interface cabling is within the contractor's scope of works, AMX system active equipment by USP. Refer to Audio-visual Section [23 AV Stds for Classrooms and Lecture Theatres](#) for other audiovisual cabling requirements.

Submit details of system configuration and programming for approval by the Superintendent.

Tuition to up to three University staff, nominated by the Superintendent, covering the maintenance, operation and programming of the system shall be provided within the contract.

27.22 Maintenance

Design Requirements - It is imperative that all facilities are constructed bearing in mind life-cycle costs including maintenance. Designs will be rejected which make inadequate provision for:-

- Servicing and maintenance;
- Removal and replacement of plant and equipment;
- Access;
- Durability and;
- Minimizing capital cost at the expense of on-going maintenance costs.

Drawings shall clearly indicate locations of ceiling and wall access panels and other necessary access space, distance to adjacent walls, etc. Location tags shall be placed on access panels and ceiling tiles indicating that electrical equipment is installed behind such tile or panel

All asset categories as per the list in 40.6.14 "Equipment lists/asset registers" to be barcoded or signed as per the Asset Register ID numbers. It is the contractors' responsibility to liaise with USP to ensure that adequate

details for this requirement are entered into the Excel template files and produced at or before practical completion. Consult with USP as to sign size, material etc.

27.23 Maintenance Requirements (DLP Period)

All construction/ installation contracts shall allow for the performance of regular preventive maintenance of the works during the period of the defects liability period inclusive of all consumables. 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 service, fire alarms, hydraulic systems, lifts etc, maintenance shall be carried out not less frequently than monthly.

27.24 Drawings

Documentation requirements are detailed in [Section 40 Documentation](#). Notes:-

- Detailed workshop drawings of switchboards shall be provided. They shall be drawn to a minimum scale of 1:20 and shall show plan, front elevation, and rear elevation in the cases of rear access switchboards, sectional views through plan and elevation sections showing each variation of cubicle layout, segregation and bus-bar arrangements. These drawings shall also include schedules of all equipment, with manufacturer and model nominated, and a line diagram reflecting the actual configuration of the busbars, nominating size and rating of each section.
- "As Constructed" layout drawings are to show final circuit identification as circuit breaker numbers
- Drawings shall clearly indicate locations of ceiling and wall access panels and any other necessary access panels.
- One complete set of relevant as-installed single line circuit drawings to be laminated and installed in switch rooms and/or electrical switch boards as appropriate.

27.25 Operating & Maintenance Manuals

Documentation requirements are detailed in [Section 40 Documentation](#).

28. Communications

28.1. Important Notes and Introduction

As a mandatory requirement but by the discretion of USP Infrastructure Services, the project shall be supplied a project specific “Communications Design Brief” for any building project that has an impact on the university’s communications infrastructure and services.

The “Communications Design Brief” will supersede and/or exceed specification contained within this document (DSG section 28) and shall be recognized as the primary specification for that particular project.

The “Communications Design Brief” will define specific instruction for issue of Tender or for Construction purpose by detailing product, scope and communications infrastructure requirements for any particular sized project and USP building.

The following wording contained within this section specifies the “minimum” requirements for communications cabling on all USP sites and shall be used as a “reference only” and to “supplement” the project specific “Communications Design Brief”.

Generic communications specifications and replication of specification from previous projects will not be accepted.

There shall be close collaboration and coordination between the Project (consultants, contractors, project managers) and USP Infrastructure Services to ensure complete and thorough understanding of the USP Communications Network and Infrastructure to ensure specific project requirements and specifications are understood and complied with.

28.2. Contacts

USP Infrastructure Services (positioned within the Department of Information Technology Services) is responsible for USP communications infrastructure and services.

Contact: Team Leader, IT Networks (Installations Team)
Email: nic-dec@USP.edu.au | Ph. 07 313 86600

28.3. Exclusions

USP Data Centre work (including Data Centre Design and Development) is excluded from this specification. Contact the above mentioned for further advice.

Specifications relating to Audio Visual, Printing and Desktop Computing services are excluded.

- Refer to other sections of the USP DSG for information pertaining to AV;

- Consult the USP Property & Facilities Project Coordinator for advice relating to Printing and Desktop Computing

Procurement and installation of USP ICT equipment

Unless specifically instructed otherwise by USP, all USP ICT equipment will be procured and installed by USP Infrastructure Services.

- An exception to the above may include mounting of Wireless Access Points where a working at heights issue exists. For example, equipment mountings 3mtrs or more above floor height.
- The Project Contractor shall advise USP Infrastructure Services of locations where working at heights may be an issue.

28.4. Licenses, Certifications and Selection

ALL contractors and their employees working on USP premises and installing communications infrastructure SHALL conform to ACMA Regulations and be carried out by licensed ACMA cabling contractor personnel.

All works must be performed by a Queensland endorsed Molex certified contractor. The contractor shall demonstrate their certified installer status and submit a copy of their current Certification Certificate with the tender response. Any Cable Installer that quotes for the structured cabling work for USP must be able to perform the design, installation, termination, testing and provide Molex certification without the use of sub-Contractors.

Selection of Cable Installer shall be facilitated through the tendering process managed by USP Property & Facilities. USP Infrastructure Services DOES NOT supply or endorse a preferred list of selected contractors to tender for cabling work on Capital Works projects. However, if requested by the project, USP reserves the right to appoint a preferred Cable Installer as recommended by USP Infrastructure Services for Quality Assurance and/or Quality Control reasons.

28.5. Standards

INDUSTRY

Latest editions of AS/NZS 3000, 3080, 3084, 3085-1

Latest editions of SAA/NZS HB27

Latest editions of AS/ACIF S008, S009

AS/ACIF S009:2006.

I.E.E.E. 802.3/xxx

I.E.E.E. 802.11 /xx

USP

USP has selected Molex Premise Networks P/L as the “common platform” standard for structured cabling solutions. Molex standards and work practices shall be maintained.

Structured Molex Category 6 and/or Category 6A Integrated Data & Voice Cabling terminating into RJ45 connectors that supports:

- 1 Gigabit Ethernet (802.3 z) to the desktop (Category 6)

- 10 Gigabit Ethernet (802.3 an) to the desktop and across building backbone cabling (Category 6A and fibre only)
- Power over Ethernet (802.3 af & at) to the desktop
- Wireless technology (802.11 n and developing standards such as 802.11 ac & ad)
- Voice over Internet Protocol (VoIP)
- TDM - Analogue and Digital telephones
- Teaching, Learning and Research applications
- Streaming Media and Video applications
- Audio Visual and Teleconferencing applications
- Property & Facilities applications such as BMS, Digital Signage, EMS and Security systems

Dual OS1 Molex “campus” fibre, shall be installed across diverse paths from the designated points of origin. The fibre shall terminate into the nominated “Primary & Secondary” communications rooms within building or precinct. The fibre shall support 802.3 ae.

Interconnecting Molex Category 6A Copper & OS3 fibre tie cables between “Primary & Secondary” building Communications Rooms to support the 802.3 standards and systems above.

OM1 fibre may also be required in some buildings and therefore specified for the project.

Full Wireless service to all professional, teaching, learning and community areas both internally and externally.

- Wireless services shall be installed to provide the coverage that meets performance and resilience requirements.
- Wireless service should also extend to Car park and recreation areas.

28.6. Warranty

The project shall require the successful Molex Certified Installer (CI), in association with Molex Premise Networks P/L, to deliver on completion of the installation a Molex warranty under Molex’s Certified Installation Program. This certification shall provide a Twenty-Five (25) year warranty on the connecting hardware, the performance of the end-to-end cabling system, and on its ability to support relevant ratified and performance standards. The CI shall demonstrate their Queensland CI status and submit a copy of their current Certification Certificate with the tender response.

Upon completion of works and certification from Molex the original Twenty-Five (25) year warranty shall be submitted to:

IT Network (Attn. Installations Team Leader) University of
the South Pacific
ITS Infrastructure Services
88 Musk Ave
Kelvin Grove Qld 4059

28.7. Mandatory Communication and Site Inspections

By directly making contact by phone, the Contractor shall advise USP Infrastructure Services BEFORE entering and carrying out work within an existing USP Communications Room as it may be necessary to meet with USP Infrastructure Services to confirm scope of work and impact on existing services.

Contact: USP IT Networks – Ph. 07 313 86600

During construction the Contractor SHALL maintain regular contact with USP Infrastructure Services and ADVISE USP Infrastructure Services when the specified site-inspection milestones are approaching to arrange inspection.

Minimum notice of 3 working days is required.

Both USP Infrastructure Services AND a Queensland representative from Molex Premise Networks P/L will be involved in site-inspections.

For Quality Assurance and Manufacturer Warranty purposes, an invitation from the Contractor SHALL be extended to Molex Premise Networks P/L advising that milestones are reached (or approaching) to arrange inspection. Contact:

Grant Colledge, Queensland State Manager

Email: Grant.Colledge@molex.com

Mobile: 0407 136 181

Site-inspection milestones where both USP and Molex shall be present are as follows:

- Prior to commencement of rough-in to confirm details and specification;
- No later than 75% through rough-in PRIOR to sheeting of walls and ceilings;
- Prior to labeling and termination where an example of the outlet label shall be provided for approval;
- weeks prior to Practical Completion; and
- Upon project hand-over.

28.8. Mandatory Documentation

PROVISIONAL

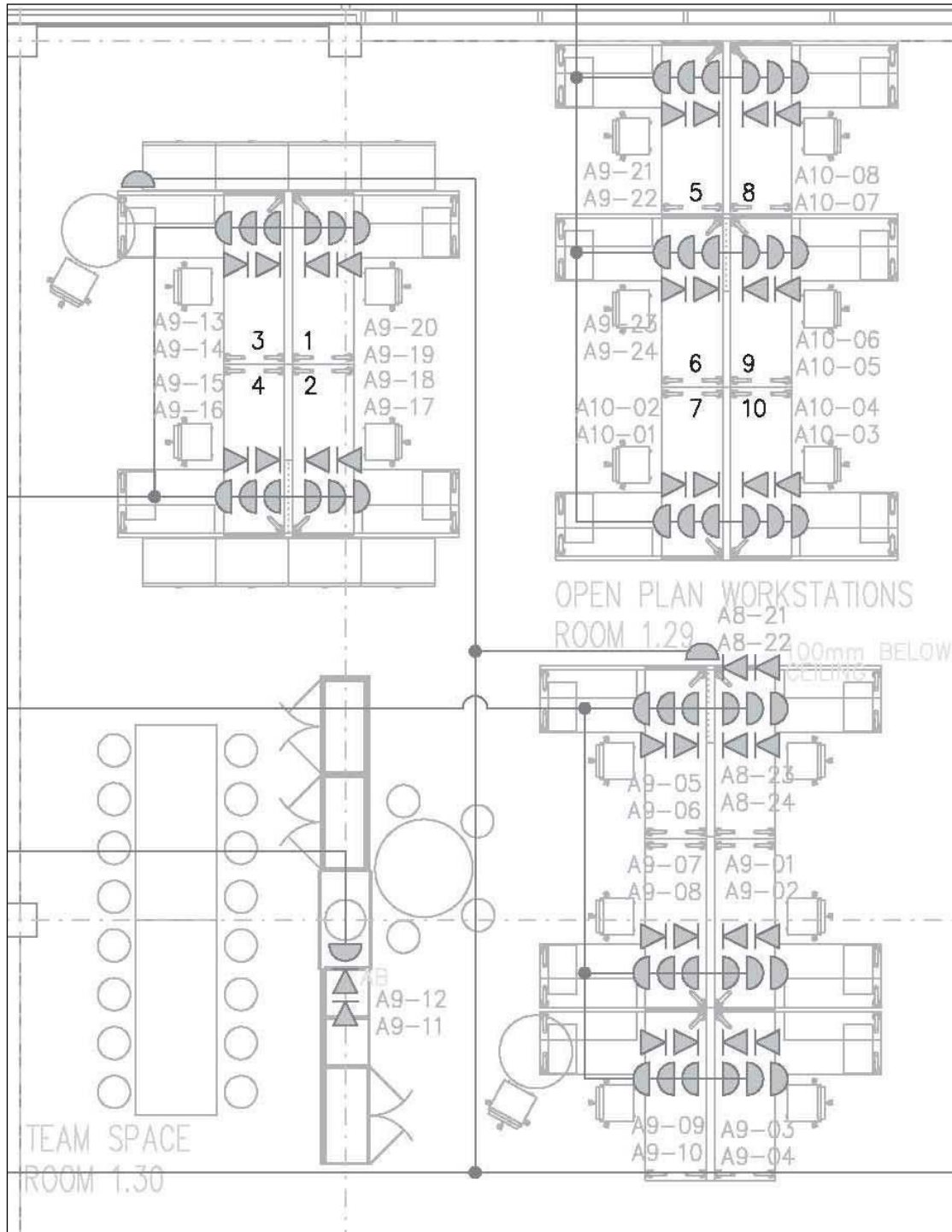
Provisional “pre-handover” documentation SHALL be supplied directly to USP Infrastructure Services AT LEAST 1 WEEK PRIOR TO practical completion. This documentation shall contain the following:

- “Marked up” drawings that identify outlet number in each room as shown in example below.
 - Details shall be marked on the latest version of the construction drawings as close to actual location within room as possible.
 - It is acceptable to submit hand written marked up Provisional drawings; however the hand writing MUST be clearly legible.
- Microsoft Excel Spreadsheet (in original .xls or .xlsx spreadsheet format) with the following layout as shown in example below:
 - OLD Outlet number (in 1st column) to identify redundant cable and changes;
 - OLD Location (room) number (in 2nd column);
 - NEW Outlet number (in 3rd column);

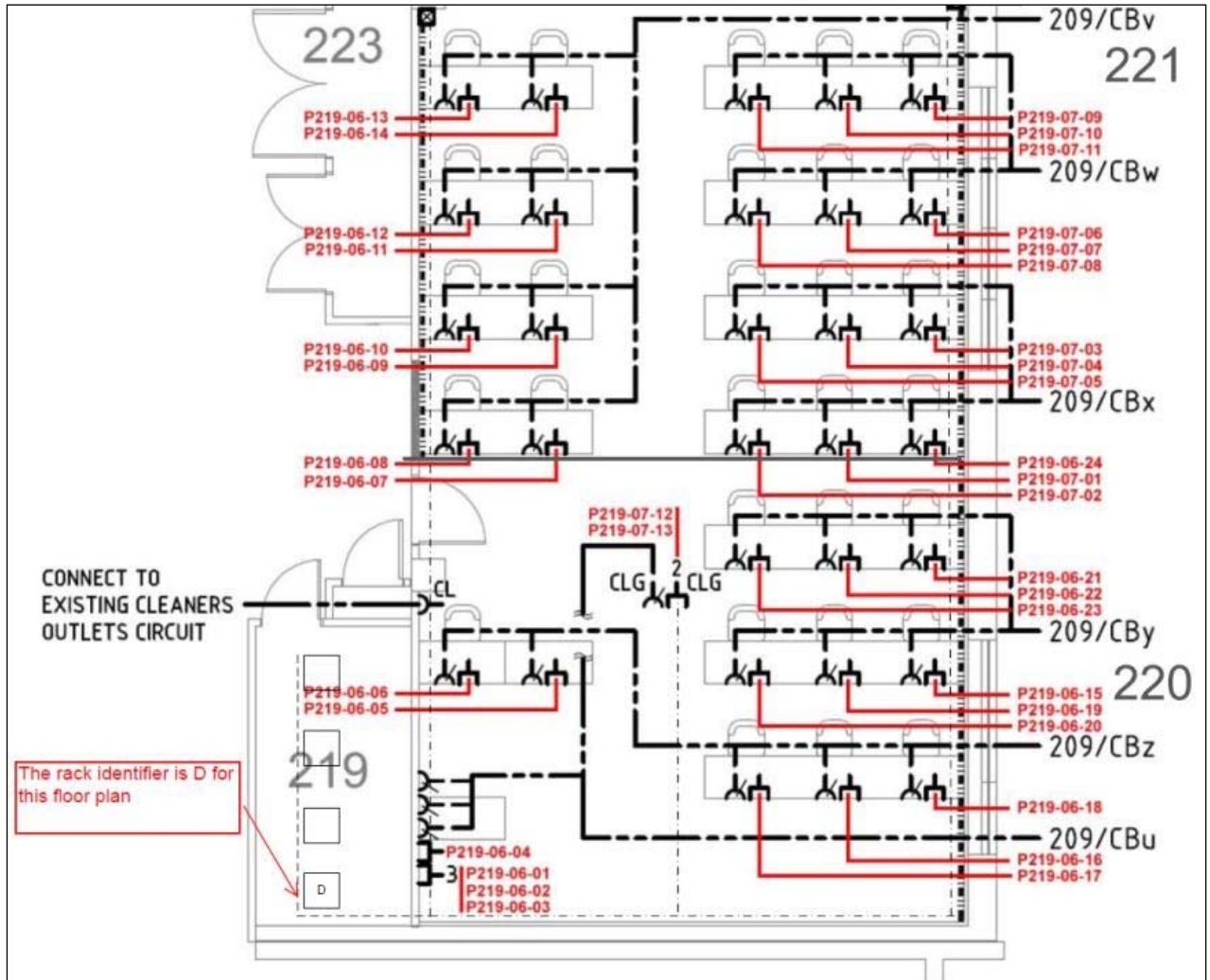
- NEW Location (room) number (in 4th column);
- Workstation number (in 5th column if applicable) and
- Comments; included description of where installed (in 6th column).

“Acceptable examples of Marked up drawings”

(Example 1)



(Example 2)



“Example of Microsoft Excel Spreadsheet”

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
OLD Outlet #	OLD Location	NEW Outlet #	NEW Location	Work-station number	Comments
P404-A02-22	P303				Cable run totally removed
P404-A02-23	P303				Cable run totally removed
P404-A02-24	P303				Cable run totally removed
P404-C10-01	P303	P404-C10-01	P303	1	Upgraded to CAT6. Workstation.
P404-C10-02	P303	P404-C10-02	P303	1	Upgraded to CAT6. Workstation.
P404-C10-03	P303	P404-C10-03	P303	2	Upgraded to CAT6. Workstation.
P404-C10-04	P303	P404-C10-04	P303	2	Upgraded to CAT6. Workstation.
P404-C10-05	P303	P404-C10-05	P303A		Upgraded to CAT6. Office.
P404-C10-06	P303	P404-C10-06	P303A		Upgraded to CAT6. Office.
		P404-C23-01	P403		Lectern
		P404-C23-02	P403		AV Projector
		P404-C23-03	P403		AV Projector
		P404-C23-04	P302		Phone – wall mounted
		P404-C23-05	P303	3	Workstation
		P404-C23-06	P303	3	Workstation
		P404-C23-07	P303	4	Workstation
		P404-C23-08	P303	4	Workstation
		P404-C23-09	P303	5	Workstation
		P404-C23-10	P303	5	Workstation
		P404-C23-11	P522		Cardax
		P404-C23-12	P522		Cardax
		P404-C23-13	P500		Office
		P404-C23-14	P500		Office

“Example of UTP Test result summary”

					
Cable ID	Summary	Test Limit	Length	Headroom	Date / Time
A205-A01-01	PASS	Aus/NZ PL max Class D	27.1 (m)	6.6 dB	07/30/2009 08:14am
A205-A01-02	PASS	Aus/NZ PL max Class D	27.3 (m)	7.7 dB	07/30/2009 08:14am
A205-A01-03	PASS	Aus/NZ PL max Class D	26.1 (m)	6.9 dB	07/30/2009 08:15am
A205-A01-04	PASS	Aus/NZ PL max Class D	24.9 (m)	6.9 dB	07/30/2009 08:16am
A205-A01-05	PASS	Aus/NZ PL max Class D	25.7 (m)	4.5 dB	07/30/2009 08:16am
A205-A01-06	PASS	Aus/NZ PL max Class D	26.1 (m)	6.4 dB	07/30/2009 08:16am
A205-A01-07	PASS	Aus/NZ PL max Class D	24.5 (m)	5.3 dB	07/30/2009 08:17am
A205-A01-08	PASS	Aus/NZ PL max Class D	24.5 (m)	6.5 dB	07/30/2009 08:18am
A205-A01-09	PASS	Aus/NZ PL max Class D	25.3 (m)	7.9 dB	07/30/2009 08:19am
A205-A01-10	PASS	Aus/NZ PL max Class D	24.5 (m)	8.6 dB	07/30/2009 08:19am
A205-A01-11	PASS	Aus/NZ PL max Class D	25.7 (m)	5.3 dB	07/30/2009 08:19am
A205-A01-12	PASS	Aus/NZ PL max Class D	25.9 (m)	5.3 dB	07/30/2009 08:20am
A205-A05-05	PASS	Aus/NZ PL max Class D	33.8 (m)	5.6 dB	07/30/2009 07:15am
A205-A05-06	PASS	Aus/NZ PL max Class D	33.8 (m)	4.6 dB	07/30/2009 07:15am
A205-A05-07	PASS	Aus/NZ PL max Class D	32.0 (m)	9.0 dB	07/30/2009 07:27am
A205-A05-08	PASS	Aus/NZ PL max Class D	32.2 (m)	4.5 dB	07/30/2009 07:28am
A205-A05-09	PASS	Aus/NZ PL max Class D	28.7 (m)	8.2 dB	07/30/2009 07:29am
A205-A05-10	PASS	Aus/NZ PL max Class D	28.7 (m)	7.2 dB	07/30/2009 07:30am
A205-A05-11	PASS	Aus/NZ PL max Class D	38.3 (m)	8.3 dB	07/30/2009 07:18am
A205-A05-12	PASS	Aus/NZ PL max Class D	38.3 (m)	8.9 dB	07/30/2009 07:19am
A205-A05-13	PASS	Aus/NZ PL max Class D	30.4 (m)	7.9 dB	07/30/2009 07:23am
A205-A05-14	PASS	Aus/NZ PL max Class D	30.4 (m)	8.1 dB	07/30/2009 07:24am
A205-A05-15	PASS	Aus/NZ PL max Class D	32.4 (m)	7.6 dB	07/30/2009 07:24am
A205-A05-16	PASS	Aus/NZ PL max Class D	32.6 (m)	7.9 dB	07/30/2009 07:25am
A205-A05-17	PASS	Aus/NZ PL max Class D	38.7 (m)	7.3 dB	07/30/2009 07:20am
A205-A05-18	PASS	Aus/NZ PL max Class D	38.7 (m)	7.4 dB	07/30/2009 07:22am

FINAL

Final As-built documentation SHALL be supplied directly to USP Infrastructure Services NO LATER THAN 1 MONTH after occupancy has been achieved. Documentation includes:

- Updates to the Provisional documentation as shown above.
- Summary of UTP Cable test results identifying the following; and as shown in the example below:
 - Cable ID/Outlet number;
 - Pass/Fail (note Failed results SHALL be rectified by the project prior to practical completion handover for commissioning stage);
 - Test Standard; and
 - Length.

Fibre Documentation

- Detailed drawings showing how newly installed fibre optic cable is reticulated across campus and building service paths;
- All test results, including OTDR traces (standard handover test results from other carriers); and
- If externally routed through other carriers, the project shall supply a diagram illustrating the end to end fibre service, indicating what carriers are used along the way (ie. Pivit, QR, BCC, Nextgen etc.). This diagram should also show what patches exist, and where.

28.9. Restricted Areas of University

MINIMUM notice of five (5) USP business days shall be given prior to scheduling ANY activities in restricted areas; in particular activities that may impact power to these areas. Three (3) USP business days notice is required for investigative activities.

Restricted areas facilitate Data and Voice Campus distribution infrastructure (passive & active) and the University's Corporate Systems.

Approval (and possible supervision) by USP Infrastructure Services is required when working in a Restricted Area of the University.

Restricted locations are:

Gardens Point Campus

V block – Room V109

*A block – Room A115

Kelvin Grove Campus

R block – Room R104/104A

*A block – Room A118

Caboolture Campus

C block – Room C217

Secondary campus distributors are marked with an *. These locations also contain USP PABX systems and the campus "voice" distributors.

Contact IT Networks for further advice. Phone: 313 8660 or Email: nic-dec@USP.edu.au

28.10. Communications Room Functional Design

Depending upon cable density the standard USP Communications Room will consist of, but not necessarily limited to the following requirements and functionality:

Room Size

Minimum size of 12 square metres with room dimensions 3m x 4m.

Clearances shall be maintained between walls and a minimum 3 sides of the equipment racks to provision suitable working space for service/support staff and for future growth (ie. At least one extra rack).

Room size is dependent on the following considerations that determine the number of equipment racks to be installed:

- Concentration of cable terminating in room.
- Active “IT Networks” equipment requirements.
- Other services that share the room. Note this requires approval by Infrastructure Services.

Air Conditioning

Air Conditioning is required 24x7x365.

Absolutely no running parts of the A/C unit shall be positioned above equipment racks.

Security

Secure restricted access into room:

- Via Cardax electronic access controlled system.
- Access to the services within a Communications Room shall be limited to USP Infrastructure Services only.

Room Numbering

The USP Infrastructure Systems and Information Unit shall allocate unique room numbering that MUST be accurate for data outlet labelling purposes and remain static for the life of the building.

Room numbering shall be easily identifiable and clear so as not to confuse with another Communications Room on the same floor or within the building.

Avoid using another Communications Room number and appending with an alphabetical letter or other character to differentiate.

Lighting

Suitable lighting front & rear of racks that allows reading of small print.

Power

Suitable power on dedicated circuits (10A, 20A & 32A) and Earthing (see Power).

Flooring

Sealed floor coverings (anti-static)

Structured Wiring and Cable Tray

(See Structured Cabling Distribution and Voice Infrastructure)

Equipment Racks

(See Equipment Racks)

Where possible the following approach shall apply for the allocation of Equipment racks:

- One rack allocated to Campus and Backbone Distribution cable (both Fibre and Copper) only
- (At least) One rack allocated to Work-area structured cable only
- (At least) One rack allocated to Active “IT Networks” equipment
- (At least) One rack allocated to future growth
- Where required but pending approval from USP Infrastructure Services - allow separate rack/s for Other Services. Ensure spare capacity is maintained at the end of row for future growth.

Clearances shall be maintained between walls and a minimum 3 sides of the equipment racks to provision suitable working space for service/support staff and for future growth (ie. an extra rack).

The USP supplied Communications Design Brief will supply a Rack Layout diagram that specifies the desired patch panel and cable management placement.

Serviceability

Sufficient capacity for future growth & changes - see ***Service Access & Capacity***.

Penetrations

Must be sealed using USP APPROVED Fireproofing and Weatherproofing materials and provide for spare capacity (see Penetrations and Fire Containment AND Spare Capacity).

Active USP Communications Equipment

The room shall only house equipment managed by USP Infrastructure Services unless otherwise consulted in advance and approved by USP Infrastructure Services.

“Example of a fully operational USP Communications Room”



28.11. Cable Management

Each equipment rack shall be supplied with Horizontal AND Vertical cable management.

NOTE, 2 post open frame racks will be supplied in a bundled solution from Rack Technologies consisting of Rack Technologies cable management products. Refer to “Equipment Racks” for further information.

HORIZONTAL

“Molex” cable management with hinged covers and T-Finger design shall be supplied; see examples below. Per rack supply both 1 RU and 2 RU formats as follows:

Six (6) – 1 RU Horizontal Cable Managers | Product code CMA-00085.

“Example of Molex 1 RU Cable Manager - Dimensions mm (WxDxH): 482 x 136.6 x 48.9”



Four (4) – 2 RU Horizontal Cable Managers | Product code CMA-00087.

“Example of Molex 2 RU Cable Manager - Dimensions mm (WxDxH): 482 x 136.6 x 89”

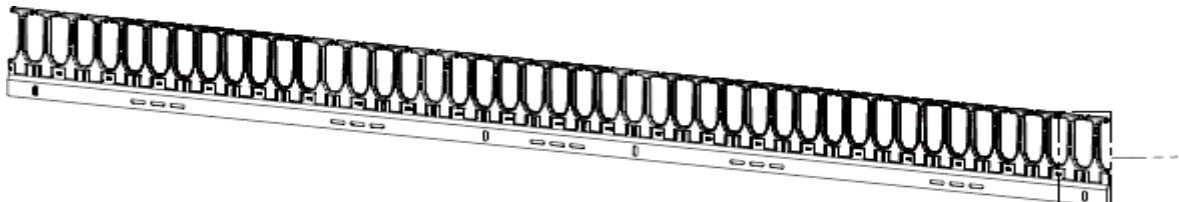


VERTICAL

“Rack Technologies” cable management with single side assembly and T-Finger design which integrate with B&R manufactured racks shall be supplied; see example below. Per rack supply as follows:

Two (2) – 45 RU Vertical Cable Managers | Product code IQCM45100.

“Example of RT 45 RU Vertical Cable Manager - Dimensions mm (WxD): 1955.8 x 174”



Refer to the “Communications Design Brief” for specific details and layout.

28.12. Equipment Racks

Where space permits USP specifies a 45RU 2 or 4 post open frame solution with accessories that physically secures the rack and/or supports cable. The required solution will allow a high level of serviceability and functionality providing unimpeded access to passive and/or active equipment and permitting the installation and/or removal of cable in an unobstructed manner without the need to thread patch cords away from fixed posts. Removable panels at the front, rear and side of 4 post frames will provide the security and access required to achieve the desired level of functionality.

Clearances shall be maintained between walls and a minimum 3 sides of the equipment racks to provision suitable working space for service/support staff and for future growth (ie. an extra rack).

USP has a diverse range of old and new buildings with older buildings often facilitating smaller communications rooms, and various models of rack systems. As an example USP facilitates rack solutions from Molex, MFB, B&R and RT among others and the majority of the legacy rack solutions are a 39RU 4 post open frame.

In some buildings space is very poor and a 2 post open frame solution is the best option to increase capacity or provide for better serviceability and future growth.

Depending upon building and project the type of rack solution required will vary. The following specification provides options for different scenarios however the actual requirement will be detailed in the USP supplied “Communications Design Brief”.

EXISTING & MINOR WORKS

Unless otherwise specified by USP, equipment racks shall match existing racks as best possible.

Vertical mounting brackets shall be set to the front most position on frame OR to match neighbouring rack/s.

NEW & MAJOR WORKS – 45RU “4 POST” FRAME

Solutions shall be manufactured by B&R Systems or Rack Technologies. Refer to the project specific “Communications Design Brief” supplied by USP Infrastructure Services.

Typical Requirements and functionality:

- Dimensions (Height x Width x Depth): 44-45 RU / 600-800mm / 1000-1200mm
- Meshed/Perforated Doors (front & back) to allow suitable air flow. Doors should be lockable and capable of being hung on either side of cabinet.
- Side cable zones (both sides) – 200mm wide extending full height & depth of rack.
- Side panels shall be installed where clearance from the side of rack to wall exceeds 500mm.
- All doors and panels to be supplied with quick release spring pin hinges.

Where angled patch panels are used the vertical mounting brackets at the FRONT OF RACK must be set back a minimum of 40mm from the facing side of the front frame post. Whilst the rear mounting brackets can be set flush with the back frame post.

NEW & MAJOR WORKS – 45RU “2 POST” FRAME

Solution manufactured by Rack Technologies. Typical

Requirements and functionality:

- Dimensions (Height x Width x Depth): 45 RU / 515mm / 145mm
- Front cable management (Qty 2 per frame) – 150mm wide x 93mm depth
- Top of rack cable management/waterfall support tray (Qty 1 per frame)

NOTE: DONOT use the cable management specified above to support structured cabling. Cablofil cable tray products (or equivalent) shall be used to support structured cabling.

28.13. Structured Cabling Distribution

USP uses an “integrated” structured cabling design that is implemented physically within the building in a “star or extended star” topology but connects logically across the campus in a “tree” topology.

Campus Distribution (Data)

OS-1 Fibre shall run from both the Campus Distributor and nominated secondary campus distributor terminating into Fibre Optic Breakout Trays within the “primary” communications room of each building via diverse underground campus paths.

- Major works MUST establish a diverse fibre path if not already present.
- Off-campus sites will require the establishment of building lead-in conduits and pits that connect to/from the street as instructed. Fibre service and installation will be carried out by an external service provider of choice – such as AARNET who are the primary internet service providers for USP.
- Ensure that protocols relating to restricted areas are followed. See “Restricted Areas” for Campus distribution locations and conditions.

Campus Distribution (Voice)

Minimum 50 pair underground Voice tie cable terminating into Krone blocks shall be allowed from Campus to Building Distributor for New buildings. The Building Distributor shall be located in the primary Communications Room – (see Voice Infrastructure).

Building & Floor Distribution

Each building shall facilitate a “Primary” Communications Room (Bldg Distributor).

If required “Secondary” Communications Room shall be established with interconnecting tie cables (Fibre & UTP) fed from the “Primary” Communications Room.

- When spanning multiple floors vertical Service Risers with suitable penetrations must be provided – (see Service Risers)
- Communications room shall service a maximum of 3 floors, providing all cable runs DONOT exceed cable length limitations.
- Refer to the project specific “Communications Design Brief” supplied by USP Infrastructure Services.

“Example of Cable tray supporting cable within rack”



Horizontal Distribution

The contractor shall refer to the Rack Layout diagram supplied with the project specific “Communications Design Brief” supplied by USP Infrastructure Services for site installation requirements.

- PATCH PANELS – shall be FLAT Molex 24 port 19” 1RU rack-mountable.
 - PowerCat 6 (PID-00141).
 - PowerCat 6A (PID-00217)
- Angled patch panels SHALL ONLY be used when specified in the project specific “Communications Design Brief”.
- Cables shall not be directly laid on ceiling tiles.
- Cable shall be run on cable tray or tied to catenary wires.
- CABLE TRAY
 - Use of cable baskets/tray equivalent to Cablofil cable tray products shall be used to support vertical and horizontal cables within the Communications Room. Refer to example below:

- Cable trays shall be at least 1 mm thick and 150, 300, or 450mm wide with all sides rolled or folded. All bends, tee and joining pieces, covers and cable retainers shall be shop manufactured. All trays shall be hot dipped galvanised, fittings and accessories will be of the same manufacturer.
- ‘L’ type brackets or “trapeze” brackets will support ceiling mounted trays. Floor and vertically mounted trays will use Uni-Strut as supporting mounts.
- Where cable trays are exposed or liable to mechanical damage they will be protected.
- Any cable tray that is located in an exposed location shall be enclosed unless agreed by the Site Manager. This enclosure will be determined on-site to its functionality and as such may be removable for access. The materials used for this enclosure will be made of steel and should this be removable, handles will be provided. The structure to support this enclosure can be made from metal framing and will be installed in an approved and tradesman like manner. All exposed materials shall be painted in accordance with USP IT requirements.
- Any metal covers deemed necessary for the installation to comply with segregation standards shall be of the “Flat” or “Peaked” type and shall be secured to the tray in a tradesman like manner. These metal covers shall have retaining chains with a minimum length of 500mm.
- **Catenary Cable**
 - Catenary wire shall be minimum seven strand galvanised steel wire.
 - The in-ceiling cable support structure shall comprise catenary wire suitably anchored and supported to the ceiling slab and tensioned by way of turnbuckles.
 - Cables shall be bundled to a maximum of 24 UTP cables per catenary and shall be secured utilising correctly employed nylon cable ties or hook & loop type cable fasteners.
 - Where multiple catenary wires are required for the one route, then, cable tray as defined should be used and mounted so as to be compliant with local regulatory specifications.
 - Where any cables traverse electrical power cables, consideration shall be given to the appropriate regulatory requirements and adequate separation shall be provided.

Fibre Optic Cable

A minimum sized 24 core Fibre Optic cable that terminates into a fibre optic breakout tray shall be allowed for in all instances. Larger projects may require up to 48 cores of fibre.

Depending upon situation the following cable type shall be installed:

- Underground application: Molex OS1 (9/125 Micron) – Loose Tube Water Block Gel Filled Nylon
- Indoor/Outdoor application: Molex OS1 (9/125 Micron) – Tight Buffered Riser LSOH Jacket
- Internal application only: Molex OM3 (50/125 Micron) – Tight Buffered Riser LSOH Jacket

Cable SHALL be run from designated Campus “fibre” Distributors to the Building Distributor terminating with a minimum 3 metres service loop at the Building Distributor end.

- Due to space constraints the service loop required at the Campus Distributor is to be advised by USP Infrastructure Services.
- Service loops shall be allowed for at major intersections (both internal & external) to cater for repairs.

- The service loop shall be secured in a tidy manner vertically to one side of rack without impeding other infrastructure, services or access to the rear of rack. Contractor shall consult with USP Infrastructure Services to confirm placement.

LABELING – Cable SHALL be permanently tagged at each pit, service riser and opening using indelible ink (or markings) with the following identification standard:

- From – To | Cable type & Cable size | Month & Year installed | Contractor Name
- EXAMPLE:

C400-V109 OS1-24 Mar2010 CI101

Completed cable runs SHALL not exceed the maximum distances dictated by relevant standards and shall be in accordance with manufacturer's installation and certification instructions (and relevant standards) and completed in a neat and professional manner.

Fibre Optical Breakout Tray (FOBOT)

- Campus Distributor – cables shall be terminated into an Optical Fibre Systems, 1RU FOBOT – Product code: OFS-900.
- Building Distributor – cables shall be terminated into an agreed Molex product.

Terminations shall be made as follows:

- Externally run fibre shall be terminated into Green SC connectors.
- Internally run fibre shall be terminated into Blue SC connectors.

All terminations shall be fitted with a plastic dust cap upon the completion of fibre termination.

Unshielded & Shielded Twisted Pair Cable

Depending upon building requirements Molex Category 6 and/or 6A IDC products shall be installed. Terminations shall be done to the T568A wiring standard.

Molex Category 6

- Cable: PowerCat6 UTP 4 Pair Blue PVC cable, product code CAA-00076
- Patch Panel: PowerCat 6 1 rack unit 24 port, product code PID-00141
- Jack: PowerCat6 MOD-Clip DataGate Plus Jack, product code MMC-00010-02
- Patch Cord: PowerCat6 Slim boot patch cord – white (various lengths)

Molex Category 6A

- Cable: PowerCat6A U/FTP LSOH cable Violet, product code CAA-0322L-VL
- Patch Panel: PowerCat 6A Shielded 1 rack unit 24 port, product code PID-00217
- Jack: PowerCat 6A MOD-Clip Shielded Jack 8W White, product code MMC-00017-02
- Patch Cord: PowerCat6A Slim boot patch cord – white (various lengths)

Cable SHALL be a continuous run from the wall outlet to the termination Patch Panel with no intervening FDs or joins. If any cable is damaged or too short, replace the full length of cable rather than repairing with a joint/splice.

Cable runs shall not exceed 90 meters, be exposed to moisture or be painted.

Every cable shall be identified and tagged at both ends of each run.

Avoid excessive tension when drawing cable through building cavities, conduits, etc and do not allow any kinks or knots to form in the cable.

At least 200mm of slack cable shall be left at each end after termination of the cable. Spare length shall be secured to the dedicated cable zone of the equipment rack or tidily rested within cable tray in the Communications Room.

Velcro shall be used at all times to secure cable ensuring that cable is evenly supported and protected from crushing or trampling during and after installation. The cable sheath shall not be appreciably distorted.

Ensure suitable bend radius is maintained at all times. Use of waterfall tray systems shall be implemented when cable is expected to turn at sharp angles.

Minimum 50mm clearance from power cables and appliances shall be maintained whether or not there is an interposing barrier. However, where deemed necessary to cross power cables, cross at right angles.

Installation be in accordance with manufacturer's installation and certification instructions (and relevant standards) and completed in a neat and professional manner.

Patch Cords

- No Patch Cords shall be manufactured, assembled or fabricated on site.
- At various lengths the project shall supply patch cords to the quantity of 200% the total number of cables installed. That is, for every 100 cables installed and terminated – 200 patch cords of various lengths shall be supplied.
- The patch cords shall be supplied to USP Infrastructure Services 2 weeks BEFORE practical completion.
- Required lengths will differ from project to project and will be confirmed in the project specific USP supplied Communications Design Brief.
- The actual figure supplied shall be rounded up to the nearest multiple of 5.
- The following guide can be used to estimate the percentages of each length to be supplied: 55% 1mtr ; 25% 1.5mtr ; 10% 2mtr; 5% 3mtr; 5% 5mtr. Colour = White.

Flexible Furniture and Floor Box Arrangements

Structured cabling infrastructure is not designed to operate in a flexible or mobile manner. Flexible furniture arrangements can therefore contradict the copper cabling design and installation standards, therefore jeopardizing any warranty arrangements and the longevity and rated performance of the data cabling channel.

If the building is to be furnished with flexible furniture the contractor shall notify USP Infrastructure Services in advance as the network cabling design to the desktops must comply with Australian and industry standards for warranty and ongoing support purposes. Likewise, if Floor boxes are to be used then a sufficient bend radius and separation to electrical cabling must be maintained throughout. The following shall be carried out when implementing a Flexible furniture and/or Floor box arrangement:

- The flexible furniture and Floor box design MUST comply with Australian, industry and the manufacturers cabling standards.
- So that warranty is not compromised, the project shall engage Molex Premise Networks (as the cable manufacturer specified by USP) to ensure compatibility between flexible furniture solution and/or floor boxes with cable products.
- The use of MUTO's (multi user telecommunications outlets) is permissible; however the MUTO must be situated in an unobstructed and serviceable location in the ceiling, at floor boxes or at service columns. The MUTO is typically positioned near the fixed GPO's.
- Ensuring that the overall length between end device and network equipment located at the Communications Room doesn't exceed 100m, variable lengths of Molex fly leads of up to 10 meters can be used to provide connection to IT devices.
- The cabling contractor to supply Molex certified MUTO's and fly leads to suit furniture requirements.

28.14. Consolidation Points

Consolidation Point architecture SHALL ONLY be installed and used on floors where a USP Communications Room does not exist. This allowance will provision future floor cabling without compromising Fire Proofing materials that seal penetrations and eliminates risk of damage to existing cables.

As a standard, consolidation points shall support 24 cables and be located NO CLOSER than 15 meters to the point of distribution (ie Communications Room).

Consolidation Points shall be positioned in an accessible and serviceable location that allows for growth. Category 6A

cable does not support Consolidation Point architecture.

Refer to the project specific "Communications Design Brief" supplied by Infrastructure Services.

28.15. Cable Testing

Copper – 100% of all cable runs SHALL be tested for compliance to standards and to ensure the integrity of the cable and correct pair assignments between the wall outlet and termination panel.

Optic Fibre Cable – 100% Optic fibre cores SHALL be tested for standards compliance (with an Optical Time Domain Reflectometer) and certificate issued confirming the integrity/characteristics of all fibre cores.

28.16. Voice Infrastructure

The USP Voice network consists of Analogue, Digital & Voice over IP (VoIP) technologies with many USP buildings facilitating separate voice infrastructure to carry Analogue & Digital signals.

The current university voice standard is VoIP connected through the structured (and integrated) building wiring.

To accommodate for legacy voice services and cater for Integrated Voice & Data cabling, where not already present - the project shall:

- Establish a minimum 50pr voice grade underground cable from CD to BD/MDF.
- Establish a minimum 50pr voice grade tie cable from BD/MDF into the “primary” Communications Room. The tie cable shall terminate at a Krone frame.
- Where a voice BD does not exist the lead-in cable will terminate directly into the “primary” Communications Room onto a Krone frame.
- A tail from the Krone frame shall be installed that terminates into a Molex 50 port IDC voice patch panel, product code PID-00162.
- Krone disconnect modules SHALL be installed in 100 pair blocks.
- An updated Log book shall be provided.

Refer to the project specific “Communications Design Brief” supplied by Infrastructure Services.

28.17. Telecommunications Outlets

Cable Type & Termination

Refer to “Structured Cabling Distribution - Unshielded & Shielded Twisted Pair Cable” for cable type & termination specification.

Wall Plate

Specification may depend upon architectural and functional requirements but where this does not apply the following shall be used:

- Clipsal 2000 or Slimline range wall plates shall be used - see examples below. These allow sufficient room for the identifier to be mounted in full - above or below the outlet.

“Examples of Clipsal Wall Plates”



- Wall plates shall be devoid of vertical/horizontal identification windows where possible. Where face plates with windows have been installed the contractor SHALL not attempt to install the identifier within the window.

- The minimum text size specified for USP telecommunications outlets is 3mm and these windows do not permit the identifier to be inserted “in full”. Text that is smaller than 3mm becomes too difficult to read.
- Each faceplate shall contain the identifier of each telecommunications outlet by both a physical label on the external and visible surface of the faceplate and also handwritten in black permanent ink behind the front cover on the fixed surface.
- Refer to Labelling.
- Colour of wall plate to match the surrounds (default = white).

Mounting

Where possible, workstation outlets shall be positioned above bench height to allow ease of access for service & support staff:

- Avoid installation of outlets behind workstation kick boards and privacy screens.
- Refer to the furniture design specification for project to determine furniture requirements.
 - Outlets in partition walls to be routed through conduit (or duct or similar enclosure) from ceiling space to wall box to enable subsequent access - minimum conduit size 20mm.

Allocations

Work areas shall be allocated the following Telecommunications Outlets unless otherwise specified by USP:

- Student areas shall have “1” outlet installed and terminated per workstation;
- Fixed and Open Plan offices shall have “2” outlets installed and terminated per workstation;
- Wireless Access Points (WAP) shall have “2” outlets installed and terminated per device. WAP location to be advised within the project specific “Communications Design Brief” or an allowance of one WAP per 100sqmtrs of internal space. Outlets positioned visibly 50mm below ceiling on wall or directly to the underside of ceiling panel – not above;
- Printing & Multi-function devices shall have “2” outlets installed and terminated per device;
- Reception areas shall have “3” outlets installed and terminated per workstation;
- AV Services areas shall have “3” outlets installed and terminated per device;
- Multi-function rooms shall be serviced with a minimum of “4” outlets installed and terminated with double outlets positioned apart within room;
- Specialised work areas and individual requirements beyond what is specified above will require direct User Group input.

Labelling

Lettering colour shall be BLACK text on white, containing UPPERCASE characters. SIZE

– shall be NO SMALLER than 3 mm in size.

- 3mm sized text allows for easy identification of outlets in poor light or that are mounted at ceiling height.
- Exemptions MUST be approved by USP Infrastructure Services.

UNIQUE IDENTIFIER

“Example of FULL and unique Identifiers on a Triple Gang Plate”



Each outlet shall be labelled using its FULL unique identifier in the following standard:

- Bldg Identifier & Communications Room – Rack & Patch Panel – Port Number
 - EXAMPLE: **SN320-C14-10** Bldg ID= SN Communications Room= 320 – Rack=C Panel= 14 – Port= 10
- USP Infrastructure Services shall confirm the “Building and Communications Room” identifier.
- DO NOT abbreviate any part of the unique identifier.
- DO NOT insert unnecessary spaces and characters.
- Unless otherwise specified (or approved) by USP Infrastructure Services DO NOT deviate from this standard; see examples above and below.
- ADHESION – Surfaces must be cleaned from dust, oils and any foreign materials that may affect the permanent bonding of label to surface. Labels shall be equivalent in size and quality to that manufactured by Brady Australia Pty Ltd (ref. B422 Gloss Polyester material, permanent adhesive – product code XC-1500-580-WT-BK).
- POSITIONING – The label shall be positioned above or below the RJ45 outlet on the external surface of the face plate.
- Each outlet shall be identified using black permanent ink on the fixed surface behind the faceplate (in case of damaged, defaced or lost label/faceplate).
- A label example shall be supplied to USP-Infrastructure Services for approval PRIOR TO labelling and termination of outlets.

28.18. Wireless Local Area Networks (WLAN)

“Example of Ceiling (underside) mounted outlet”



“Example of Wall mounted outlet”



Building Projects shall allow for ubiquitous wireless service across all staff, student, research and public areas affected by the project.

Dependent upon other interferences, building materials and functional requirements, the allowance for wireless service shall be allocated in a grid fashion as follows:

- One(1) Wireless Access Point(WAP) in every 100sq metres(10m x 10m) of “open” floorspace, and
- One (1) WAP for every 25 user’s in group clusters.

Two(2) CAT6/6A RJ45 outlets per Wireless Access Point(WAP) shall be included.

Outlets should not be positioned directly above staff workstations.

Power over Ethernet (POE) equipment will service WAPs that are installed within cable length limitations; therefore power is not required to these locations.

Data outlets for internal WAPs must be installed on the underside of the ceiling or approximately 50mm below the ceiling (not above) against a wall where available - See examples.

Avoid positioning of outlets adjacent to objects and equipment that may cause interferences or signal degradation such as high voltage electrical equipment, generators, industrial microwaves, metallic objects,

bookshelves etc. WAPs should have an unimpeded line of sight to client device. The objects and equipment listed above can impact device performance if they are between the user and WAP.

More densely populated areas and areas with potentially interfering objects and walls will require a higher concentration of WAPs to be installed. Additional CAT6/6A RJ45 outlets shall be allocated.

External WAPs will require 1 x 10 Amp GPO and a suitable weatherproof enclosure to house equipment. WAP

placement shall be located in a secure BUT serviceable location.

WAPs positioned above 3m may require installation by the contractor. The project shall advise USP Infrastructure Services of these locations as they become known.

The project shall consult with BOTH the client representatives and USP Infrastructure Services to confirm PRIORITY areas of coverage, functional requirements and data outlet allocations and placement.

28.19. Power

Each Communications Room shall be provisioned with 10A, 20A & 32A power outlets on individual circuits as per the Communications Room Layout diagram shown within the USP Communications Design Brief. All work to be performed by licensed electrical contractors with cables tagged accordingly.

To cater for dual power supplies on active equipment and RCD testing, (where possible) power shall be distributed across dedicated circuits FROM separate switchboards;

Equipment “Racks” shall be provisioned with a minimum of one (1) IP 56/66 rated 3 pin Combination Switched Socket that is safely supported ABOVE each rack (or min 2200mm above floor) as shown in the example below. Circuit requirements shall be defined within the USP Communications Design Brief but as a general rule, a minimum of one (1) 32A circuit will be specified with all new/major building projects.

“Example of 3 pin Combination Switched Socket & Straight Captive Plug”



Flat pin arrangement shall be supplied for 10A & 20A circuits.

Round pin arrangements shall be supplied for 32A circuits.

One (1) Switched Power Distribution Unit shall be provided for each equipment Rack. Rack Technologies “IQ range” or APC manufactured PDU’s shall be procured and depending upon project, the following minimum specification shall be supplied for each circuit capacity:

10A circuit PDU

10A Outlets: Eight (8) IEC320 C13 outlets
Protection: One (1) 10 AMP Circuit Breaker

20A circuit PDU

10A Outlets: Fourteen (14) IEC320 C13 outlets
16A Outlets: Two (2) IEC320 C19 outlets
Protection: One (1) 16 AMP Circuit Breakers

32A circuit PDU

10A Outlets: Fourteen (14) IEC320 C13 outlets
16A Outlets: Two (2) IEC320 C19 outlets
Protection: Two (2) 16 AMP Circuit Breakers

Each PDU input connection must be fitted with the relevant circuit rated Orange coloured Clipsal IP 56/66 rated 3 pin straight Captive plug as shown in the example above. Power cord shall be a minimum 3mtrs in length.

Each PDU shall be installed into the equipment rack as instructed by USP Infrastructure Services.

Each PDU shall be connected into mains power to ensure it is operational. Once tested working, leave connected.

Active Equipment “Wall Cabinets” shall be provisioned with a double 10A GPO on dedicated circuit that is installed in a serviceable and secure location (preferably towards the bottom) inside the cabinet.

Earthing of Communications infrastructure shall comply with the Australian Standard AS/ACIF S009 and AS/NZS 3000 or local equivalents.

28.20. Service Access and Risers

Access

Service access panels which provide safe working access to cable paths throughout the building SHALL be included at regular intervals to allow for servicing and new installations. Service access panels shall be no greater than 5 meters apart.

Service access panels shall be no greater than 5 meters apart and provide for unimpeded access to neighbouring access panels.

Suitable clearances to/from other services shall be maintained at all times.

Risers

ICT riser cupboards SHALL be provided on each floor; in particular, floors that do not facilitate a Communications Room. The cupboard is intended to provide accessible space to service and accommodate peripheral communications infrastructure. The ICT riser typically accommodates passive communications infrastructure only, but other services such as Security may choose to install systems in these spaces.

ICT riser cupboards shall be enclosed and form a riser internal to the building and provide suitable penetrations and accessibility for servicing.

The ICT risers shall be identified “USP ICT Riser”.

The floor shall be suitably sealed.

Dimensions - Cupboards SHALL extend from floor to ceiling with a minimum door opening width of 1500mm and a minimum depth of 800mm.

Power - Two (2) double 10A GPOs SHALL be provided in each cupboard (additional GPOs may be required at designated cupboards). Install GPO's on each side wall of cupboard.

Lighting - Suitable fluorescent lighting SHALL be provided in each cupboard, mounted above door.

ICT risers shall be secured by an approved keying system (Abloy S.M134) or as assigned by USP Security.

28.21. Conduits

A minimum of two (2) white 100mm PVC conduits shall be allowed as lead-in conduits to service each new building. The conduits shall be connected internally into the building service paths that lead to the Primary Communications Room AND externally into existing campus infrastructure.

Large radius bends (100mm or more) are required on all pipes where there is a need for pipes to change direction.

Conduits shall be reserved for the sole use of USP Infrastructure Services and accommodate USP Communications cable only.

Conduits shall be labelled 'USP Communications' at each pit, opening, floor or wall and at intervals not exceeding 5 metres.

Draw wires SHALL be installed in all conduits.

Where commercial tenancies and external service providers are required to service the building or site a "Carrier Neutral" conduit system shall be investigated to accommodate external TELCO cable infrastructure.

28.22. Access Pits

A minimum of P5 sized pits shall be used to provide suitable accessibility to underground USP communications cable.

Pits shall be installed on the building perimeter that connects into existing campus infrastructure and building lead-in conduits.

Conduit entry shall be made only at the ends of pits and on the same plane as the longest dimension.

Where a change in direction is necessary, large radius bends must be used. The consultant shall liaise with USP regarding the total number and type of communications services required, and the location of the pit.

28.23. Penetrations and Fire Containment

To ensure that Structural or Heritage issues are not compromised ALL penetrations MUST be approved by USP Property & Facilities.

Penetrations shall allow for spare capacity (see Spare Capacity).

All penetrations MUST be sealed using USP APPROVED Fire Proofing materials adhering to USP Property & Facilities design guideline requirements.

New and major building projects SHALL use the Fire Stop solution "CT120 Cable Transit system" to house communications cables which penetrate through fire sealed/rated penetrations.

- It is USP's intent that the "CT120 Cable Transit system" shall be used in ALL SITUATIONS for communications cables as opposed to traditional fire stop mastic products.
- The "CT120 Cable Transit system" allows for future growth and changes without compromising fire stop materials and obtained certifications. It also reduces the risk of damage to neighbouring cables during these activities.

28.24. Spare Capacity

In general allow a minimum of 33% spare capacity for future growth across all Communications infrastructure EXCEPT for the following:

- Hole penetrations through concrete, structural or fire rated walls and floors:
 - 100mm or greater – allow a minimum of 33% spare capacity of one hole.
 - 50mm-100mm – allow a minimum of 66% spare capacity of one hole.
 - Less than 50mm – allow 100% spare capacity of one hole.
- Catenary wire - Where more than 12 cables have been installed on the catenary wire the project shall install an additional catenary in parallel for future growth.

28.25. Redundant Infrastructure

Redundant communications infrastructure SHALL be identified and documented with details supplied to Infrastructure Services once complete (see Contacts).

ALL redundant infrastructure shall be completely removed and disposed of by the contractor unless otherwise instructed. This includes:

- Redundant Cross Connect jumpers to telephony frames.
- Redundant UTP and Fibre cable ANYWHERE in the building (includes communications room racks and cabinets, workstations, horizontal paths, vertical risers and ceiling spaces).
- Redundant telephone and data outlets.
- Redundant patch panels.
- Redundant cable in underground conduit infrastructure.
- Redundant equipment racks and equipment.
- Redundant labeling, and
- Redundant furniture located in communications rooms.

29 Lifts

29.1 Scope

This section outlines the University's minimum requirements for new and refurbished lift services which shall be designed and documented by the Consultant specifically for each USP Project.

Standard range of Brand lifts will not be accepted unless they are modified to suit USP's Design Standards.

Where a Standard range of Brand lift is accepted it must be accompanied by a list of deviations from USP's Estates and Infrastructure Department, and signed off as being accepted by USP's Manager Design.

The lift installation and associated facilities shall conform to the requirements of the latest issue of USP's Design Standards "Lift Services" Specification.

USP's Design Standards and Guidelines including all updates that are current at the date that the contract is signed. In cases of dispute or contradiction the **relevant Australian Standard** will take precedence AS 1735.15:2021 & AS 1428.1:2021

AS/NZS 3000:2018 Amd 2:2021, Wiring Rules should be followed

Workplace Health and Safety Requirements

USP's Design Standards for People with Disability must be in accordance with AS1735.15:2021 and AS1428.1:2021

Current Australian standards shall be fully complied with. Additional more stringent requirements may be called up specific to each project.

The consultant shall ensure that the design and associated documents highlights to builders and installation contractors all relevant operational issues to be considered in the execution of the building works. Examples include:

- Maintenance of electrical, communications, fire and security services to those adjoining areas in the building excluded from the contract works areas.
- Appropriate protection of all equipment against dust, water etc during the duration of the project.

29.2 Consultation

There shall be close collaboration and coordination between the consultants and USP's Manager Design to ensure compliance with this design guideline on a project specific basis.

- The Consultants will be required to attend documentation reviews with the Manager Design at the following key stages:

- At completion of schematic design
- At 50% completion of design development
- At 90% completion of tender documentation

These consultations are regarded as mandatory project milestones and will be validated in the form of a Project/Consultants Meeting minute by the Manager Design. The number of reviews will reduce to two for smaller projects where schematic design and design development become an integral phase. The Consultant will contact USP's Manager Design and arrange review meetings in a timely manner. A copy of all relevant review documents will be issued for perusal at least 5 working days prior to the scheduled review meeting.

The Manager Design will issue to consultants a current list of USP'S technical contacts at the inaugural Project/Consultants meeting

29.3 Lift Shafts

- In general, the lift shaft shall be water proof of reinforced concrete but in low rise buildings a structure of concrete block with reinforcing rod and side fill is acceptable provided that sufficient fasteningsubstrate is available for landing entrances and guide rails. Other construction shall be water proof and to the approval of the Manager Design.
- The clearance between the lift car and the lift shaft walls shall be in accordance with the requirements of AS 1735.15:2021
- The presence of any areas in which production of toxic fumes may occur shall be considered when the location of a lift shaft is to be determined.
- In general, the lift shaft shall not be pressurized.
- A ten per cent (10%) Shaft Plan Area ventilation hole shall be provided.
- The effect on the Building Structure, with respect to component loads and stresses, by the inclusion of a lift shaft, shall be accurately determined and all possible modes of failure shall be analyzed and the structure modified accordingly.
- Where glass paneled lift, shafts are installed particular attention must be paid to any internal lighting of the shaft which could cause the infiltration of night flying insects that congregate to the light source and become a health and safety and aesthetic issue.
- Where lift shafts are installed in public spaces special attention should be paid to the effects of the elements i.e. Water, wind, solar on the structure and controls e.g. Water proof landing buttons and drainage away from the landings.
- Provide floor level numbers and Braille on each side of the extended landing door jambs on each floor.

29.4 Lift Cars

- In general, the front of the car shall be of stainless-steel construction with a car position indicator and operating panel on the front wall of the car. Interior finish shall be stainless steel with material finishes as defined by the project specific fit out brief. Stainless steel paneling is to be fitted to the upper rear walls. NB A Project Specific Lift Car Fit out brief will be developed by the consultant in liaison with the Manager Design

- b) Lifts shall be designed for use by people with disabilities and shall be constructed such that operating controls etc. are easily accessible (refer AS 1735.15:2021) and USP's Disabled Access Requirements Check List.
NOTE: The lift car must be the minimum size as stipulated in AS1428. 1:2021

Project specific requirements may necessitate a larger size car, consequently USP's Manager Design must be requested to review and approve the lift size on a project specific basis.

The car sizes of refurbished lifts shall be considered on a case by case basis. Handrails to be stainless steel sheathed fire-retardant timber, bolted (not screwed) through the walls and removable from within the lift car. Hand rails shall be provided along the length of all side and rear walls.

- c) All wall panels shall be removable from within the lift car.
- d) The following shall be provided for in all lift cars:
- Where the lift shaft services three or more floors, the lift shall be deemed to be an emergency lift and shall have stretcher provision. The lift designer shall first consult the Building Certifier as to whether a lift servicing less than three floors shall be deemed an emergency lift.
 - All lifts shall have adequate quiet exhaust ventilation in accordance with AS 1735.15:2021
 - Locks and Keys for Isolation, Exclusive Use and Security shall be the ABLOY brand or equivalent with the key designation Number supplied by USP Security.
 - Control panels for MRL lifts shall be lockable using an ABLOY brand or equivalent lock with the key designation number supplied by USP security.
 - All lifts shall have flush mounted keyed switches located in the main COP for the control of lights and ventilation fans.
 - A lockable access hatch for outside recovery purposes shall be built into the ceiling of the lift.
 - Each car shall have an appropriate Load Notice displayed on the front wall, which will include the telephone number of the USP Helpdesk (323 2117) to call in an emergency, and also the Number of the lift which should be obtained from the Manager Design
 - Each car shall have an emergency stop button that can be removed and blanked off if required with an emergency alarm and intercom in accordance with AS 1735.15:2021
 - Each lift shall have its own separate telephone line and USP Extension number.
 - An intercom shall be provided for each Car Operating Panel in the lift car and shall be connected via a Telecom pair using a USP extension (Extension number to be supplied by USP) to the Central Monitoring Station at the University Security Office and, the bell shall be located in close proximity to the lift car.
 - Stainless steel rubbing rails.
 - Floor finish specification will be project specific. In some circumstances, carpet mats may be required. Tiles of any description shall not be used.
 - The ceiling of the lift car shall be a drop ceiling type with tamper proof recessed fluorescent lighting (Dichroic lamps shall not be used) and shall be accessible for lamp replacement and testing without the use of any tools.
 - Emergency lighting shall be in accordance with AS 1735.15:2021.
 - Protective blankets shall be provided for each installed lift in a building with notice to indicate where a glass panel is protected.

29.5 Lift-Well Pits

Lift pits must always extend to solid earth, in accordance with AS 1735.15:2021

29.6 Lift Control Systems

All Lift Control Systems shall be generally fully re-programmable, without the need for rewriting of software, this requirement to suit any specific patterns or peculiarities of the Building Traffic demands.

Lift Control Systems shall NOT be subject to any Software Locks, Passwords or the use of Proprietary Tools for Effective and un-restricted on-going maintenance and/or re-setting, and/or re-programming of Lift System parameters. This requirement applies whether the on-going Maintenance Service Provider is the Original Equipment Manufacturer/Supplier or not.

Any such software locks, passwords and/or Proprietary Tools, necessary to achieve these requirements, are to be handed to, and become the Property of USP immediately upon expiry of the Project Defects Liability Period.

29.7 Microprocessor Based Lift Control Systems

USP shall be fully licensed to use any/all firmware and software supplied by the Original Equipment Manufacturer/Supplier, and/or necessary to achieve effective and un-restricted on-going maintenance and/or re-setting, and/or re-programming of Lift System parameters.

Firmware

The Original Equipment Manufacturer/Supplier shall maintain a complete backup source of firmware for USP; with a copy of same to be retained within the lift motor room or other agreed location on site.

This backup source shall consist of a boxed set of RAM, ROM and EPROM chips as applicable to the equipment, loaded with the complete functional software for the operation of the equipment.

Should it be necessary to replace a piece of firmware, the necessary chips shall be taken from the backup set and installed in the equipment.

A new piece of firmware shall be used to replace the chip used.

A log containing brief details of each chip and the date of its creation and replacement shall be kept with the boxed set. Application Software

If, and when requested by USP, the Original Equipment Manufacturer/Supplier shall make available the Application Software and shall train USP's staff/representatives in its use.

Where the Original Equipment Manufacturer/Supplier revises the functionality of the software, this shall be immediately advised in writing to USP.

The Original Equipment Manufacturer/Supplier shall install and commission such functional changes where they relate to safety or where they affect the ongoing upgradability of the software.

Other functional software changes shall be installed and commissioned only upon USP's approval.

Where functionality upgrades of software are approved by USP, and/or safety related software upgrades are fitted by the Original Equipment Manufacturer/Supplier, these shall be fully documented, identified with the version identification and the necessary changes made to the backup source of firmware.

The Original Equipment Manufacturer/Supplier shall provide USP with a description of the change made in each fitted upgrade described above.

29.8 Fire Precautions

- a) All landing doors shall have a minimum one (1) hour fire rating.
- b) All lift shafts shall have a minimum two (2) hour fire rating.
- c) All ventilation panels on the lift cars shall be of the concealed type and located at the rear and sides of the car, except in the case where the lift front and rear serve as access points to the car. Then the ventilation panels shall be at the side of the car.
- d) On all floors where indicator panels indicate the status of the lift services, the fire status shall be displayed.
- e) The lift is to return to the designated floor in fire mode.

29.9 Hoisting Ropes

- a) Each batch of hoist ropes shall be accepted only upon confirmation that the supplier has established the correct load capabilities of the individual strands of cable and has provided the appropriate test certificates to the Division of Occupational Safety for approval.
- b) All cable must conform to the standards of AS 1979 - 1976.
- c) The load used for design of lift roping systems shall have a 10% increase for the purpose of obtaining the safety factor over the maximum load that will be applied by the lift and associated load.

29.10 Lift Machine Rooms

The ventilation system of the Lift Machine Room shall conform to AS 1735.15:2021 and be air-conditioned with a refrigeration type cooling system.

All hydraulic oil tanks shall be fitted with thermostat controlled heaters.

Lift Machine Room doors shall open outward in all cases.

Where Machine room less lifts are specified provide space for storage of specialized lift maintenance tools and wall protection blankets.

29.11 Power

All power to lifts shall comply with AS 3000:2018 Amd 2:2021. Sub-mains shall be designed to provide a maximum voltage drop of 3% at full load operation in the up direction of travel of 5% on full load starting in the up direction.

Power for the Air conditioner in the LMR shall be supplied from the Lift Motor room power board

29.12 Safety

- a) If the velocity of the lift deviates in the down direction by 10% or more from the nominal contract velocity, the safety gear shall operate for any lift vehicle apart from a direct acting hydraulic type.
- b) The design velocity of hydraulic systems shall be between 0.3-0.5m/s.
- c) The system shall comply with all relevant standards in any safety matter.
- d) All lifts shall have a spring return type emergency stop button (that can be removed and blanked off if required) fitted within the car.
- e) Safety gear shall be installed on counterweights if access space is provided under the lift pit.
- f) All lifts shall comply with AS 1735-1-3-2021 with respect to safety, operational and design requirements.
- g) The lifts shall have a no-go situation with doors open when overloaded, and voice to indicate Overload.

Security

The lift shall have in its cabling the facility to install a security swipe card system compatible with USP's security system for access to the lift and each individual floor and in each car.

The Service access key for the lift should be of an approved type as agreed to by Security and the Manager Design, and compatible with the USP security system.

Duplicate key - Deposit Box

A key deposit box capable of holding keys and a swipe card and, approved by the Manager Design shall be provided for each lift or back of lifts, the box shall be mounted (embedded) and fastened in a concrete or block wall only, with two or more Dyna-bolts, adjacent to the lift / lifts on the floor that is the main public entrance to the building (samples of the box should be provided for approval).

The container shall be capable of housing duplicate keys and swipe card to access the lift motor room and or equipment, the unlocking of the container shall be subject to a combination key of the respective lift maintenance contractor's key series, the lock on the box shall be interchangeable and available locally

This container shall be the property of USP but should not be keyed to the USP keying system.

A laminated plastic engraved label with the wording "LIFT MOTOR ROOM KEYS" in 6mm lettering should be mechanically fixed to the wall to identify the container.

29.13 Plant Rooms

Provide adequate bunding, tanking and drainage with special emphasis on bunding of all penetrations in plant room floors to prevent flooding to lower levels.

29.14 Maintenance Requirements (DLP Period)

All construction/ installation contracts shall allow for the performance of regular preventive maintenance of the works during the period of the defects liability period inclusive of all consumables. 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 service, fire alarms, hydraulic systems, lifts etc, maintenance shall be carried out not less frequently than monthly. Response times during DLP shall be as agreed to by USP.

29.15 Drawings

Documentation requirements are detailed in [Section 40 Documentation](#).

29.16 Operating & Maintenance Manuals

Operating and Maintenance manuals shall be provided in electronic format readable by USP's system and in hard copy.

Documentation requirements are detailed in [Section 40 Documentation](#).

Operation and Maintenance Manuals will be written specifically for the lift installation at USP (Standard Brand documentation will not be acceptable) the O & M Manuals Lay out and presentation must be as described in Part 4 Section 40.6 of USP's DSG

29.17 Registration of Lift Services

Prior to putting the lift into operation, the Contractor shall prepare and submit all required documentation to the Statutory Authority and pay all fees, and obtain Registration of the Lift, and Registration of the Lift Design, and Installation approval with the Division of Workplace Health and Safety.

The Contractor shall obtain the relevant details, especially the unique USP lift numbering and address for registering the lift from USP's Manager Design.

All asset categories as per the list in 40.6.14 "Equipment lists/asset registers" to be barcoded or signed as per the Asset Register ID numbers. It is the contractor's responsibility to liaise with USP to ensure that adequate details for this requirement are entered into the Excel template files and produced at or before practical completion. Consult with USP as to sign size, material etc.

The Contractor shall obtain the relevant details, especially the unique USP lift numbering and **Asset Register details** and address for registering the lift from USP's Manager Design.

29.18 Floor Numbering

Refer to [Section 18 Signage](#)

30 Fire Services

30.1 Scope

This design standard sets out the University's minimum requirements for the design, quality of materials and standard of construction of fire protection systems. Requirements detailed by this document will apply to both Greenfield construction projects and upgrade/ refurbishment activities.

The provision of fire services shall conform to the requirements of the latest issue of:

- ☐ USP's Design Standards and Guidelines
- ☐ Fire Services Act Part 9A (Jan 92)
- ☐ Local Building Regulations and the National Building Codes or Building Codes of Australia
- ☐ Relevant Australian Standards
- ☐ Workplace Health and Safety Act

Additional more stringent requirements may be called up on a project specific basis.

The consultant shall ensure that the design and associated documents highlights relevant operational issues to be considered in the execution of the contract works E.g. maintenance of electrical, communications, fire and security services to those adjoining areas in the building excluded from the contract works areas.

30.2 Consultation

There shall be close collaboration and coordination between the consultants and USP's Senior Technical Officer (Essential Services) to ensure compliance with this design guideline on a project specific basis. The Consultants will be required to attend documentation reviews with the Senior Technical Officer (Essential Services) at the following key stages:

- ☐ At completion of schematic design
- ☐ At 50% completion of design development
- ☐ At 90% completion of tender documentation

These consultations are regarded as mandatory project milestones and will be validated in the form of a Project/ Consultants Meeting minute by the Project Manager. The number of reviews will reduce to two for smaller projects where schematic design and design development become an integral phase. The Consultant will contact USP's Senior Technical Officer (Essential Services) and arrange review meetings in a timely manner. A copy of all relevant review documents will be issued for perusal at least 5 working days prior to the scheduled review meeting.

The Project Manager will issue to consultants a current list of USP'S technical contacts at the inaugural Project/ Consultants meeting.

30.3 Quality Control & Milestones during Construction

In addition to periodic site visits to assess the quality of the installation and accord with design intent, the consultant is expected to attend at a number of milestone events. The consultant should review, list any defects and reinspect if required. These milestone events include the following as a minimum:

- ☐ Review of fire services components or materials samples submitted for review and integrity testing prior to final specification
- ☐ Review of in-ground services prior to being backfilled
- ☐ Review of contractor's workshop drawings
- ☐ Inspection of services in concealed spaces before they are closed over such as wall cavities and ducts
- ☐ Inspection of above ceiling services prior to the installation of ceiling tiles
- ☐ Attendance during key commissioning activities and review of test results
- ☐ Defects inspections at practical completion and preparation of defects lists

30.4 Certification

For new works prior to occupation it is mandatory under the Building Act that fire brigade grants the user approval to occupy.

This final Certificate is to be applied for and issued under the direct control of the superintendent. USP will not approve the practical completion of any project without the prior issue of this certificate.

30.5 Design Documentation

The consultant will develop and maintain design documentation available for review by the Senior Technical Officer (Essential Services).

The Senior Technical Officer (Essential Services)) shall be notified in writing in circumstances where the consultant considers that "the deemed to comply" fire safety design solution as presented in the BCA should be replaced by a "performance based" solution. Such notification is to include details of the methodology associated with the proposed solution.

30.6 Design Coordination

Particular care is to be taken to ensure coordination of all other aspects of the project eg plumbing, data cabling etc. in the context of safe and practical operational and maintenance access to all fire services elements.

Some particular USP requirements are listed as follows:-

- ☐ The separation of fire services in relation to electrical services shall be such that the risk of damage from the contents of the plumbing shall not be a possibility.
 - o E.g. sanitary plumbing pipes are not to run within switch rooms and electrical riser shafts.
 - o E.g. Fire sprinkler pipes are not to run in the substation room directly above the 11KV switchgear. Etc.

- E.g. the fire pump room is not to be located directly above the substation or main switchboard room etc.
- The consultant shall ensure that his design and associated documents draws the attention of builders/ installation contractors to relevant operational issues to be considered in the execution of the building works:
 - Maintain of the power in any section where the building is not upgraded or modified.
 - Appropriate protection of switch room equipment against dust, water etc... during the duration of the project
 - Ensure that all fire alarm protection is in working condition in the section of building where no upgrading is undertaken.

30.7 Design Concepts - General Description of USP's Fire Alarm Networks

General Description of the Gardens Point campus Fire Alarm Network

The Site Main Fire Indication Panel is a Simplex 4100 Series FIP. It is situated in R block Fire Control room adjacent to the main entry to the campus.

The main FIP is connected via University communications cabling to the Central Monitoring station located at the Kelvin Grove campus within A block.

All building FIP's are connected via University communications to the Site Main Fire indication board

General Description of the Kelvin Grove campus Fire Alarm Network

The Site Fire Indication Panel is a Simplex 4100 Series FIP. It is situated within the undercroft area at A block near the main entry to the campus.

The main FIP is connected via University communications cabling to the Central Monitoring station located at Kelvin.

All buildings FIP's are connected via University communications to the Site Main Fire indication board.

Creative Industries precinct

The Site Fire Indication Panel is a Simplex 4100 Series FIP. It is situated within Z1 adjacent to the La Botte Theatre near the main entry to the campus.

The main FIP is connected via University communications cabling to the Central Monitoring station located at Kelvin.

All buildings FIP's are connected via University communications to the Site Main Fire indication board

30.8 Design Concepts

All Fire Alarm Systems shall be Fully Addressable and fully Networked into the USP fire alarm system.

All fire alarm systems shall be arranged so that in the event of an alarm condition existing in any protected zone, including the operation of a manual push button alarm, the following functions shall be provided:

- A fire shall be automatically detected.
- Illuminate an indicator light for the relevant circuit on the sub FIP control panel.
- Illuminate an indicator light for the building at the Main Fire Panel.
- Illuminate an indicator light for the building on the main site mimic panel
- Transmit an alarm signal to the Fire Brigade Watch Room via the Main Fire Indicator Panel.

- ☐ Transmit an alarm, Fault and Isolate signal to the Central Monitoring Station located at the Kelvin Grove campus via the main campus FIP.
- ☐ Energize alarms.
- ☐ Shut down any ventilation systems.
- ☐ Operate smoke doors, fire doors, fire dampers etc.
- ☐ Transmit a fire alarm signal to the stair pressurization system.
- ☐ Shutdown the gas installation within the building

The Fire Alarm System shall also incorporate an emergency warning and Communication system to AS2202- 2, including warden inter communications points and public address facilities, or a single zone two tone fire warning system to AS2220 tones along with auto position and PA facility with microphone. The type of system selected shall be Quintrex QE90 or equivalent as approved by USP's Senior Technical Officer (Essential Services).

30.9 Equipment Selection & System Design Requirements

Preferred Equipment

USP's Senior Technical Officer (Essential Services) shall be consulted regarding equipment selections. USP has a number of brand/ model specific selection criteria as detailed:

- ☐ Fire Indicator Panel (FIP) Preferred FIP Simplex 4100/4120 Network (Fully Addressable)
- ☐ Emergency Warning and Intercommunication System. Preferred Quintrex QE 90
- ☐ Detectors (Simplex True Alarm)
- ☐ Addressable Manual Call Points (Ampac CQR key re-settable)
- ☐ Bells
- ☐ Systems for Hazardous Locations
- ☐ Fire Hose Reels Tyco Fire Master
- ☐ Fire Extinguishers

Panel Equipment Allowance should be made for surface mounted or semi-recessed panels especially refurbishment jobs. Panels shall comply with AS4428.1 in addition to AS1670.

Clearance A newly installed fire panel must comply with AS 1670.1 and also be mounted a minimum of 50 mm above a floor.

Adequate storage facilities shall be provided within the FIP for storage of lamps, detectors logbooks etc and As-constructed drawings and manuals.

All sub fire alarm panels shall be totally enclosed suitable for recessed wall mounting in the position approved by the University's Senior Technical Officer (Essential Services). The Fire Indicator Panel will be mounted in a dustproof sheet metal case suitable for surface mounting.

Battery location within the FIP should be treated to render corrosion proof.

A break glass manual call point (key reset-able, (as supplied by Ampac) will be installed in the lower section of the FIP door or in the near vicinity of the indicator panel.

A Red Strobe light shall be installed adjacent to the FIP to indicate FIP location to the QF&RS

Where Magnetic Hold open devices for doors are required, wall or floor mounted magnets shall be used incorporating a release button, with standard door closers fitted separately. Combination door closers and magnetic hold open units will not be allowed to be installed without built in release buttons. (Remote releases preferred.)

Location Diagram shall be on engraved traffolyte and shall indicate all fire zones, exits, isolation valves and fire equipment locations. Prior to engraving the proposed location diagram must be presented to the USP Senior Technical Officer (Essential Services) for approval before installation.

Electrical/ Communication Systems Notes

- ☐ External doors on panels (other than the FIP casing and door) shall enclose all switches and switches
- ☐ All automatic fire alarm systems shall conform to AS 1670.
- ☐ All wiring shall be colour coded and outgoing cables shall be made off to a terminal strip.
- ☐ Non latching "brigade isolate" switch shall be provided with all fire alarm panels if required. (Rotating or other type switches shall not be installed)
- ☐ An indicator shall also be provided on the brigade side of the brigade alarm transmitter to show that an alarm would have been transmitted had the "brigade isolate" switch not been operated.
- ☐ All fire indicator panels shall have a Liquid Crystal Display on the front of the Fire Panel and LED indicators on each zone. Each zone will have switches for individual isolation.
- ☐ Provision is to be made for connection to and appropriate labelling and illumination of existing mimic panel
- ☐ Provision is to be made for connection to the Central Monitoring station located at the Kelvin Grove campus. Indication of Fault, Isolation and Alarm must be indicated at this location.
- ☐ Surge Protection shall be installed external to the FIP
- ☐ If brigade connections are not available the indicator panel shall be provided with space for a code transmitter (PPU) End of line equipment will operate in conjunction with the fire brigade centre's watch room equipment which

Contractor/ Installation Notes

- ☐ All work to be carried out on the master panel and mimic shall only be completed by the incumbent University Servicing Contractor.
- ☐ All equipment connected to the University telephone system shall have a current ATC Permission Number/Austel Permit Number.
- ☐ A 003 key shall also open these external doors only.
- ☐ All locks and key switches to be keyed to 003-fire service key.
- ☐ All circuitry and equipment including detectors and MCP shall be thoroughly tested to the satisfaction of the University's Senior Technical Officer (Essential Services).
- ☐ Automatic fire alarm installations and alterations, will not be regarded as complying with this standard unless the installation is carried out by the
- ☐ manufacturers of approved automatic fire alarm equipment or by a contractor specially authorized by such manufacturer for the purpose, in which case the contractor must also be approved by the University.
- ☐ All redundant and obsolete equipment and wiring must be removed by the installation contractor.
- ☐ The inline jointing of cables will not be permitted within cable runs

30.10 Preferred Contractors

The following companies are listed as preferred contractors who may be employed by the University of the South Pacific to undertake fire protection installations:-

- ☐ Wormald Australia (Fire) Pty Ltd (Tyco)
- ☐ Diligent Fire Protection
- ☐ Johnson Controls

The installation contractor shall provide evidence in writing (a certificate showing registration Number etc.) showing that the company is duly registered with the Fire Protection Contractors Registration Board of Queensland and be registered with the BSA. Only Contractors registered to these Boards shall be permitted to work on fire systems throughout USP.

Other contractors being considered for the installation /modification of any fire system within USP must have the approval of USP prior to any contract being awarded.

30.11 Emergency Warning & Communication Systems

All emergency warning and communication systems shall comply with A.S.2220-2, 1989. These installations shall include but not be limited to the following:

- ☐ Public Address, Alert signal, Evacuation signal, and Warden Intercom system and floor phones as well as visual strobes for the hearing impaired. A computer generated voice over message approved by the University's Technical Officer (Fire Services). The voice over shall commence no later than 20 seconds after the audible alarm has activated.
- ☐ The University's Senior Technical Officer (Essential Services) shall approve all equipment locations.
- ☐ The main key switch may be a multi position rotary switch with fault alarm only at the discretion of the University's Senior Technical Officer (Essential Services).
- ☐ Fire Service Key required for all door locks and key switches shall be keyed to the 003-fire Service key only.
- ☐ The EWIS panel layout shall be installed into a separate box to the Fire Alarm Panel.
- ☐ Both panels shall be located along side each other, in the agreed location and in accordance with the National Building Codes or Building Codes of Australia and the Fire Safety Regulations.
- ☐ WIP Telephones shall be installed within a steel cabinet (example provided by USP) when installed within foyer areas or corridors. Wherever possible WIP telephones should be installed within secure areas e.g. Hose Reel Cabinets.

30.12 Power Requirements

General

All fire alarm systems shall operate from a 24-volt battery with charger.

All alarm systems shall be compatible with University communications equipment for transmission to brigade. All 240-volt supply for Fire Alarm & Fire Evacuation panels shall comply with AS 3000 - Emergency Systems [Section 10 Doors](#) Clause 4.

All circuitry and equipment shall be thoroughly tested before and after installation.

Wiring, Relays & Circuits

All wiring shall be of the size required by the wiring rules for the particular circuit with allowance made for voltage drop. Minimum size of cables is as follows:

- ☐ AC/DC Power Supply Circuit 2.5mm²
- ☐ Detection, Signal and Control 1.5mm²
- ☐ All wiring and cables shall have copper conductors unless otherwise specified. Except for MIMS cable, all conductors shall be stranded.
- ☐ MIMS cable or equivalent PVC insulated cable will be used for the following:-
 - ☐ AC/DC supply
 - ☐ Brigade Line
 - ☐ A/C Trip Line
- ☐ Stairwell Pressurization Control Panel Supply TPI and TPS cables shall be 0.6/1.0kV grade as applicable in AS 3013. Insulation shall be V-75 grade.

MIMS cables shall be copper conductor sheathed in accordance with AS 3187. All circuits to be designed for fail-safe operation.

All relays shall be new. No second hand relays will be used.

Solid State control circuits shall be in individual plug-in cards for easy replacement of Defective circuits. One spare of each type of plug-in card will be provided in the Fire Alarm Board.

30.13 Conduit & Ducting

All conduits to be concealed wherever practical and where conduit passes through damp courses, vapour barriers and the like, damage to these surfaces shall be kept to a minimum and the surface restored to the satisfaction of the superintendent. The minimum cover required for underground conduit should be 300 mm for communications cables and 500 mm for power cables.

Minimum size 20 mm diameters shall be used for conduit.

Where conduits are cast in-situ into concrete they shall be installed in strict accordance with the requirements of the superintendent. Where conduit is required underground, minimum 50mm grey shall be used with 500mm cover.

30.14 Thermal Detectors & Smoke Detectors

Smoke Detectors

All detectors shall comply with the current relevant Code. Smoke detection throughout USP shall be the preferred option throughout USP buildings. The preferred smoke detector is the Simplex True Alarm.

Thermal Detectors

In general Thermal Detectors shall be installed within areas where there is a likelihood of excessive dust or smoke occurring e.g. - lunch rooms, kitchenettes, car parks, etc.

NOTE - ALL DETECTORS SHALL BE INSTALLED WITH INDICATING BASES

Concealed detectors shall be installed using a Franco type bracket and shall be readily accessible for ongoing service requirements and annual testing.

30.15 Portable Fire Extinguishers

Factors Affecting Selection

Physical factors, which affect the selection and need consideration, include the following:

- ☐ Only Extinguishers fitted with Brass valves are to be used, Plastic valves will not be allowed to be installed.
- ☐ Choice of an appropriate extinguishing medium to protect against the type of fire most likely to occur
- ☐ Size and mass of fire extinguisher and the ability of the user to carry and operate it
- ☐ Effects of adverse environmental conditions on the fire extinguisher and its support fixture
- ☐ Possibility of adverse reactions, contamination or other effects of an extinguishment on manufacturing process or other equipment.
- ☐ Possibility of winds or draughts affecting the distribution of the extinguishment

Location of Portable Fire Extinguishers

The location of each portable fire extinguisher shall comply with section 3 of AS 2444, AS2982, the National Building Codes or Building Codes of Australia and also at the discretion of the University's Senior Technical Officer (Essential Services).

Distribution of Portable Fire Extinguishers

In general, the distribution of portable fire extinguishers shall be in accordance with the hazard classification of the area to be protected. (See section 4 AS 2444). Provide sufficient extinguishers of an appropriate type throughout the building with regard to the hazards that can be expected in the various areas. In general the following extinguishers should be used for standardization and shall be provided under the contract.

Application	Type	Size
General office areas	Dry Powder (ABE type)	2.5Kg
Commercial Cooking Areas	Wet Chemical	7.5 Litre
Computer Laboratories	CO2	3.5 Kg
Plant Rooms	Dry Powder (ABE)	2.5 Kg
Fume Cupboards	Dry Powder	5 b Rating
Designated Exits	Dry Powder (ABE)	4.5 Kg
Adjacent each fire hose Reel cabinet	Dry Powder (ABE)	4.5 Kg

30.16 Air Conditioning & Ventilation Systems

HVAC System Design/ Installation Notes

The requirements of AS 1668 must be applied as appropriate.

Trip Relays

The HVAC System designer/ installer is responsible for providing an appropriate trip relay/s in the mechanical services switchboard suitably interfaced with the fire system to provide appropriate mechanical services shutdown functions.

Optical Probe Type Smoke Detectors

Shall be installed on the discharge side of each air filter, and at the ends of every zone where there is a return airshaft or plenum

Smoke Spill Shafts

Shall not contain supply air ducts, except in buildings fitted throughout with an approved sprinkler system and having the spill air contained in ducts having a suitable fire resistance rating. Fire isolated ramps, Stairways or passageways shall not be used as plenums.

Liquid Adhesive Coatings

The flashpoint of liquid adhesive coatings for air filters shall be not less than 160 degrees when measured in accordance with ASTM D92.

Motorized Dampers

Each motorized damper and associated control gear shall be constructed and installed such that it will retain its capacity to function in the smoke spill made with a spill air temperature of 200C at the smoke spill fan for a period equal to the fire resistance rating of the shaft.

Fire-Resistant

Floor Ceiling and Roof-Ceiling Structures Ducting shall not be installed in the space above a suspended ceiling that forms part of a fire-rated floor-ceiling or fire-rated roof-ceiling construction, unless the fire resistance rating includes the presence of ducts.

Electric Duct Heaters

Shall comply with AS1668-Part1 - Casing of electric duct heaters is required to be internally insulated.

Duct material

A fusing temperature of not less than 100 degrees is required in materials used for ducting, flexible connections, duct coverings and internal linings.

Return-Air, Spill-Air and exhaust air systems

Systems that are required to operate as smoke spill systems under fire conditions shall be designed and constructed so that their integrity, up to the limits of their fire resistance ratings, as a passage for air and combustion products under fire conditions will be preserved from the commencement of the fire-rating construction to the point of discharge.

Registers, Grilles and Openings

That are used for collecting smoke-spill shall be located in positions which avoid prejudicing access to fire isolated stairways, fire isolated ramps and passageways.

Smoke Spill Fans and associated Equipment

Such equipment shall be capable of continuous operation when handling spill air at 200C for a period equal to the fire resistance rating of the spill shaft.

When an **air pressurization system** is required to protect a fire isolated stairway, ramp or Passageway from the entry of smoke, such a system will comply with the following rules of AS 1668 Part 1 Section 6, Rules 6.2 to 6.4.

Fire Dampers

Shall be installed in accordance to AS 1682.2 and all duct work attached to a fire damper shall be held in place in accordance to this same standard. All installed Fire Dampers shall be fully accessible by the provision of access ports located adjacent to the relevant Fire Damper and signed to identify the concealed Fire Damper.

30.17 Sprinkler Systems

All sprinkler systems shall conform to AS 2118-1999 and AS2941-1995.

Diesel pump batteries shall be cradled and harnessed in an approved manner.

A test facility shall be installed to the pump set to allow the accurate testing and reporting of cut in pressures.

A drain shall be fitted to pump systems and test facility and shall run to an appropriate waste. (Tank for water reuse if possible)

A pressure relief for the pump as well as system pipe work shall be installed. Throttle valve to be installed to allow for accurate flow readings.

All pumps shall be installed with Mechanical Seals only.

All Gauges shall be installed with a ball valve to enable the service or replacement of the gauge.

30.18 Fire Hose Reels

All Fire Reels are to be 36 Metres in length. Only Fire Master (Tyco) will be used, Fast-Fit or Quick-fit Hose Reels will not be installed within USP. All Hose reels are to be installed with a Gate Valve fitted to allow the removal of the fire hose reel for servicing and or replacement.

30.19 Fire Hydrants - Location Signage

Centre Road Type

A red arrow painted on yellow reflective background with blue reflective indicator.

Footpath Type

A black HR on white reflective background fixed to a 500mm high upright post of 100 x 75 steel RHS and painted red.

Door Signs

Refer to [Section 18 Signage](#)

30.20 Fire Booster Cabinets

All Fire Booster cabinets will be installed in accordance with AS 2419.1. Each Fire Booster cabinet will have installed within a detailed Block Plan, which shall be water-resistant and fade resistant.

Signage - Refer to [Section 18 Signage](#)

30.21 Fire Doors

Signage [Refer Section 18 9 \(Signage\)](#)

- ☐ A required fire door providing direct access to a fire isolated exit, except a door providing direct access from a sole-occupancy unit in a Class 2 or 3 building or Class 4 part of a required smoke door, on the side of the door that faces a person seeking egress
- ☐ A fire door forming part of a horizontal exit and a smoke door that swings in both directions, on both sides of the door
- ☐ A door leading from a fire isolated exit to an open space, on both sides of the door. Upon the completion of any fire door installation, a certificate of compliance and the correct tagging of the door must be completed and issued to USP in accordance with AS 1905.1.1997

30.22 Information for Hearing Impaired Persons

Refer AS1428.4 for application, for tactile information.

Emergency warning Strobe Lights shall be installed within all teaching spaces and lecture theatres throughout USP. The approved strobe light unit is Redback Dual Strobe model S5424 supplied by Inertia or Altronics.

When activated the strobe light shall indicate the Alert and Evacuation modes of the alarm warnings system.

30.23 Passive Fire Protection

USP's preferred Contractor for all Passive Fire Installations is Touchwood Fire Doors.

Fire Stopping of wall / floor penetrations

To prevent the spread of flame and smoke spread in the event of fire, all penetrations through fire-rated walls and floors must be sealed with an approved fire barrier. The USP approved product for use within USP buildings is KBS Mortar Seal or similar. No other product may be used without the written approval of the University's Senior Technical Officer (Essential Services).

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.

Contact the University's Senior Technical Officer (Essential Services) for approval of the proposed fire rating method.

Applicable Codes and Standards

- ☐ All work to be completed in accordance to AS 4072.1 1992 and these guidelines
- ☐ Control joint fire stopping in accordance with 4072.1 1992
- ☐ Service penetration fire stopping systems to BCA Section C3.15 and specification C3.15
- ☐ Fire Resistance tests of building elements AS 1530 Part 4

Ensure that all penetrations to the Works and perimeters to fire walls are stopped to the required FRL. The work shall include but not be limited to the following:

- ☐ Floor control joints: Provide fire stopping to control joints to FRL -/120/120.
- ☐ Wall control joints: Provide fire stopping to joints to the FRL on the drawings.
- ☐ Penetrations to Floor Slabs: fire stopping to all concrete slabs, excluding slab on grade. Fire-stop new penetrations to FRL -/120/120. Fire-stop the floors on any non-fire rated ducts at each and every floor level. The floors of any fire rated fire rated ducts are not required to be fire stopped, excepting the bottom and top level of the duct. The walls of the fire rated duct shall be fire stopped throughout the length of the duct.
- ☐ Penetrations to fire rated walls: Fire stop all penetrations to the required FRL indicated on the drawings.
- ☐ +/- 5mm should be allowed for vertical movement at the isolation joint (10mm in total)
- ☐ +/- 10mm should be allowed for horizontal movement at the joints, however about 70% of this movement is likely to occur in the first 9 months after installation (20mm in total).

Inspections

Contractors are to conduct inspections and carry out remedial works and certify fire-stopping systems using these guidelines.

The inspector must be from a licensed company registered with the BSA in the appropriate Category for this type of work, i.e. Passive Fire Equipment / Wall and Ceiling Linings. Details and proof of licensing must be provided to USP before the Contractor is able to commence works.

The Company conducting Inspections and certifying works must also provide details and proof of their current Public Indemnity Insurance Policy.

The nominated persons carrying out the inspections must provide details of their experience in the field of fire stopping installation and must be a competent person as defined in the Standard Building Regulations and Building Act.

Documentation required by USP on completion of the inspections is to be completed in the following manner and be in the format as suggested by A.S. 4072.1 (see fig 1.).

On completion of each area of work submit to USP, a penetration schedule in the form appended identifying each penetration according to the Space Designation Number from the contract drawings, see figure 1.

- ☐ Floor plans indicating fire compartments and fire wall locations
- ☐ Record drawings (as constructed plans) showing each area referred to in the Penetration Schedule The penetration schedule is to be completed and returned and will become part of the Operation and Maintenance manuals. REFER AS. 4072.1
- ☐ Proforma drawing and schedule available from USP.
- ☐ Format 2 sets of drawings in auto cad format and 1 set of hard copy drawings, for archiving.

Details of the information required under the headings on these forms are as follows:

Floor/ level

The actual floor or level the penetration is on. E.g. Basement, Ground etc. Floor plans are required to accurately indicate the location of all fire walls & compartments.

Penetration No.

The exact location of the penetration in conjunction with the corresponding number on a floor plan, see figure 1. Also see attached sample of identification label (figure 3)

Penetration Type

The penetration size and element of construction through which the penetrant is passing. E.g. 300x300 penetrations through concrete.

Wall, Floor, Ceiling

All penetrations will be listed according to the side appropriate to the type, location and size appropriate to the Fire Rated barrier, i.e. if the barrier is sealed with a mortar system in the slab it will be a floor penetration, if it is sealed by a product being mounted to the underside of slab it will be a ceiling penetration, if sealed at the wall it obviously will be listed as a wall penetration. To show the placement of the penetration, W, F, C to be used.

FRL: Structural Adequacy, Integrity, Insulation.

Details of the actual fire rating the barrier shall give once completed with regards to the element of construction.
E.g. -/ 120/ 120 or -/120/.

Service description size x no. of the actual number of, size and type of services in the penetration. E.g. 2 x 150mm copper pipes, 6 x 10mm electric cables, 65mm PVC pipe or similar description.

Treatment Code

This is to show the actual products or system that has been or will be used to protect the penetration.

E.g. fire collars or mortar system. If a product or system cannot correctly protect a penetration or system (with the evidence of compliance) USP must be informed immediately.

THE USE OF FIRE PILLOWS IS NOT PERMITTED BY USP.**Test Report Ref.**

The actual test report or assessment number given to the product or system by the appropriate testing or assessing authority. E.g. NI 1189 or C 91624.

30.24 Installation

The installer must hold a license registered with the BSA in the appropriate Category for this type of work i.e. Passive Fire Equipment/ Wall and Ceiling Linings. Details and proof of licensing must be provided to USP before the Contractor is able to commence works.

The standards to which the products are to be tested are AS1530.4 & AS4072.1 or assessed to these Standards. Standards from other countries can also be used as long as there is proof of evidence of compliance given by the appropriate authorities, e.g. CSIRO, SSL or an appropriately qualified fire engineer.

A competent person as defined in the Building Act and Standard Building Regulations must carry out installation of the products and systems. Evidence of the installers' experience in installing Passive Fire Systems must be provided to USP before commencement of installation of works on site.

Installation of the barriers must be carried out strictly in accordance with the documentation provided by the product manufacturers and or the approval documentation showing drawings of the tested prototype.

On completion of each fire system there will be a label fixed to the substrate close to the penetration) not located on the floor). It is labelling to identify each penetration from the contract documents. In relation to floor, ceiling and wall penetrations where there are adjoining rooms this label will be fixed to both sides of the substrate. (See fig 3 for sample label).

THE USE OF FIRE PILLOWS IN PENETRATIONS IS NOT PERMITTED BY USP

A competent person as defined in the Building Act and Standard Building Regulations must carry out installation of the products and systems. Evidence of the installers' experience in installing Passive Fire Systems must be provided to USP before commencement of installation of works on site.

30.25 Materials

- ☐ Material Safety Data sheets on all materials to be used in the installation are to be supplied to USP.
- ☐ Ensure materials have not exceeded their shelf life when used.
- ☐ Only asbestos free materials are to be used.
- ☐ In fire conditions materials are to be Non Toxic.
- ☐ Non corrosive materials.
- ☐ Supply ventilation for non-aqueous solvent cured materials.
- ☐ Install materials at a uniform density.
- ☐ Maintain cable separation.
- ☐ Fire stopping materials exposed to view must be finished to a uniform condition.
- ☐ Only currently tested and approved products to be used.
- ☐ Provide Fire Stopping capable of supporting the same loads as the surrounding element or provide structural support around the opening.

30.26 Preparation

- ☐ Loose or damaged barriers must be removed and replaced.
- ☐ Protection of adjacent surfaces from damage arising from installation of new barriers. New barriers must be protected from damage arising from other works.
- ☐ Remove all materials that do not satisfy the required FRL and prepare for new installation.
- ☐ Clean substrates of dirt, dust, grease, oil etc. which may affect the adherence of the new products to the substrates.
- ☐ Install backing rod or damming material to arrest liquid material leakage.
- ☐ Labelling of penetrations/ identification
- ☐ Labelling of penetrations is to be carried out when completed by Contractor (see fig 3 for sample)
- ☐ Label penetration after inspection to indicate adequacy.
- ☐ Provide sample of labelling to be used with the same number label on both sides of the new installation.
- ☐ To ensure the identification will remain for years the labelling will be off the floor.
- ☐ USP numbering system will be the only acceptable form of identification i.e. Campus, Building, Level, Penetration number and location. E.g. GP/ 120/ 07/ 0001/W.

30.27 Certification – Passive Fire protection

The actual inspection to certify existing or new works must be conducted by a Contractor who is a licensed to certify under the BSA requirements. This requires the certifier to hold a license in the field of Passive Fire Equipment/ Walls and Ceilings and hold current Public Indemnity Insurance. Evidence of both must be provided to USP prior to commencement of site works.

Submit approval documents from the authorities as evidence of compliance, in the absence of documentation the work shall be deemed to be not in accordance with the contract and be subject to rejection.

As further form of evidence of compliance a numbered certificate will be issued to USP stating the each barrier has been installed in accordance with the tested prototype or with the assessment or opinion written by the appropriate authority as described in the installation section of these guidelines.

Any penetrants or penetration that are not able to be fire rated must be brought to the attention of USP as soon as it becomes evident this is the case.

On completion of each area of work submit to USP (to USP format on disc in autocad format) for archiving:

- ☐ A penetration schedule in the form appended identifying each penetration according to the Space Designation Number from the contract drawings (see fig 1)
- ☐ Floor plans indicating fire compartments and fire wall locations
- ☐ Record drawings (as constructed plans) showing each area referred to in the Penetration Schedule. The penetration schedule is to be completed and returned and will become part of the Operation and Maintenance manuals. REFER AS. 4072.1
- ☐ Proforma drawing and schedule available from USP.

30.28 Commissioning

The installation contractor will be responsible for the costs associated with the engagement of a Commissioning Engineer to program and commission the system at the conclusion of the project. Generally USP's incumbent maintenance service provider will be nominated for this activity. USP's current maintenance contractor is SIMPLEX International.

In the event that USP's maintenance service provider becomes the installer of the fire system, another service provider may be selected by USP to provide commissioning services.

30.29 Emergency Evacuation Information

Evacuation Sign Standard

The *USP Evacuation Sign Standard* ensures a consistent “look and feel” for all USP evacuation signs. The standard also complies with the *Building Fire Safety Regulation 2008* and the *Fire & Rescue Service Act 1990*. The evacuation sign AutoCAD template, samples and standards document can be requested by emailing fm_records@USP.edu.au

Responsibility for Evacuation Sign Design and Installation

“The principal consultant will prepare Evacuation Plans for the project in accordance with the USP standard formatting available from; fm_records@USP.edu.au and will liaise directly with the USP Emergency Response Coordinator as required (to determine assembly points). Evacuation plans will be prepared as part of the tender documentation, updated at practical completion and then provided to the contractor to install (this will ensure full compliance for the issuing of the Certificate of Classification by the building certifier). In addition to this ‘As Constructed’ EVAC plans will also be provided by the principal consultant as part of the O&M manuals (including the AutoCAD files).”

The above statement is also repeated in the following documents:

- ☐ Terms of Reference for Principal Consultant (Major and Minor works)
- ☐ Terms of Reference for Superintendent

- ☐ Terms of Reference for Project Manager
- ☐ Preliminaries for Building Contractor

30.30 Drawings and Operating & Maintenance Manuals

A copy of the appropriate as-installed drawings must be located in the fire panel. Documentation requirements are detailed in [Section 40 Documentation](#).

30.31 Maintenance

All asset categories as per the list in Section 40 "Equipment lists/asset registers" to be barcoded or signed as per the Asset Register ID numbers. It is the contractor's responsibility to liaise with USP to ensure that adequate details for this requirement are entered into the Excel template files and produced at or before practical completion. Consult with USP as to sign size, material etc.

31 Fume Exhausts & Fume Cupboards

31.1 General

All fume cupboards shall be of the single-sided type of proprietary manufacture and proven design. The fume cupboard installation shall be designed, supplied, installed, tested, commissioned and maintained to the requirements of AS/NZS2243.8 incorporating project specific/user defined options as noted:

- ☐ Materials of construction chosen in consultation with the Users, per the options of Table 32B
- ☐ Fume cupboard sizes chosen in consultation with the Users, in accordance with Clause 32.2
- ☐ Services within the fume cupboards shall be as nominated by the Users, in accordance with the options of Table 31B;
- ☐ Where fire retardant GRP (glass reinforced plastic) fume cupboards are required, these shall conform to manufacturer's standard sizes.

31.2 Cupboard Support

Fume cupboards shall be mounted on a purpose built powder coated galvanised steel frame with adjustable stainless steel feet to match the requirements for Laboratory benching. Height of the working surface shall match the laboratory benching.

31.3 Infill Panels

Infill panel/s shall be provided between the top of the fume cupboard and the ceiling to conceal services connections. Infill panels shall be fabricated from materials similar to that of the fume cupboard exterior.

Access to services above the fume cupboards shall be provided by provision of access panels within the infill panels or removable infill panels.

31.4 Scrubber

Where nominated in the Project Brief or required by Users, fume cupboards shall be provided with a fume scrubber.

Fume scrubbers shall comprise a combination scrubbing and mist eliminator section mounted directly to the outlet of the fume cupboard above the chamber, and incorporating eliminator pads and spray jets. The scrubber shall be constructed of PVC or fire retardant GRP.

Scrubbers shall use recirculated neutralising solution and shall incorporate a storage tank of adequate size located in a suitable cupboard beneath the fume cupboard chamber, together with the pump, automatic bleed, and make-up connection. A PVC spillage tray shall be provided beneath the neutralising tank with raised edges to contain any accidental spillage.

Adequate service access including visual inspection panels shall be provided for the scrubber.

31.5 Exhaust Fan

The fume cupboard exhaust fan shall be of the centrifugal type constructed of PVC and of approved design and manufacture. Fibreglass or stainless steel (316) fabrication may be submitted as an alternative.

All metal parts (including shaft) which may be exposed to corrosive fumes are to be completely covered with PVC.

A drain connection is to be fitted in the bottom of the fan casing. PVC drains are to be run from each fan to a waste point suitable for discharge of chemical waste.

31.6 PVC Ductwork

Ductwork shall be constructed from grey, pressed unplasticised rigid polyvinyl chloride (PVC) sheeting, heat formed to the required sections. Extruded PVC pipe may be used for circular ducting.

All ductwork joints shall be PVC heat welded or flanged and bolted using stainless steel bolts and nuts. Welds shall be V-type, using hot air welding equipment; one run of 3 mm thick welding rod shall be used for 3 mm and 4 mm material and 3 runs of 3 mm or triple welding rod for material 4.5 mm or over. Welding shall be in accordance with AS/NZS 1477.

PVC Ductwork shall be constructed in accordance with the following Table:

Table 32A - PVC Ductwork Construction

Circular Duct Dia. (mm)	Rectangular Duct Longest Side (mm)	Minimum PVC Thickness (mm)	Stiffening of Rectangular Ducts (mm)	Flanges (mm)
up to 400		3	None	25 wide x 4 thick
410 - 600	410 - 600	3	None	30 wide x 6 thick
610 - 750	610 - 680	4.5	None	40 wide x 6 thick
750 - 900	690 - 750	5	None	40 wide x 6 thick
910 - 1200	760 - 1050	6	None	40 wide x 8 thick
1210 - 1500	1060 - 1300	6	40 x 6 on edge every 600	40 wide x 8 thick
1510 - 2100	1310 - 1800	6	50 x 6 on edge every 600	40 wide x 10 thick

Discharge ducts shall be of 316 spiral welded stainless steel, UPVC exhaust stacks should be considered, and shall be suitably supported using stainless steel guy wires or alternative methods, to the approval of USP Project Engineer (Mechanical).

31.7 Gas Services

Laboratory gas services to fume cupboards shall be installed in accordance with the requirements of AS/NZS 2243.8. All fittings shall be of Broen manufacture (check type of fitting in [Section 20 Special Requirements for Laboratories](#)) complete with integral Ballofix isolation valve.

Valve handles shall be of epoxy coated brass. Outlets and valve handles shall be colour coded to International Standard DIN 12920: 1995-10 recommendations.

31.8 Electrical

The power supply to the fume cupboard for the fan, scrubber, light and control system shall be from a dedicated fume cupboard Switchboard, labelled accordingly. A separate power supply shall be brought to the fume cupboard from the appropriate Electrical DB to supply GPO's.

31.9 Controls

Refer AS/NZS 2243.8

32 Building Management System (BMS)

32.1 Scope

This section of the design standard outlines the University's minimum requirements for the Building Management System (BMS). Alterations and additions to the BMS shall be fully compatible with the existing INET seven Direct Digital Control systems as supplied by Schneider Electric. The supply, engineering, commissioning and maintenance of any new BMS equipment shall be contracted to Schneider Electric.

All new installations shall be provided with full BMS control, alternative controls shall not be used without written instruction from the Director, E&I or nominee.

32.2 Consultation

There shall be close collaboration and coordination between the consultants and USP's Property & Facilities Department technical staff (Engineering Services Section) to ensure compliance with this design guideline on a project specific basis.

The Consultants will be required to attend documentation reviews with 'Engineer Services Section' staff at the following key stages:

At completion of schematic design

At 90% completion of tender documentation

On completion of 'draft' BMS graphics pages; prior to commissioning

The consultations are regarded as mandatory project milestones and will be validated in the form of a Project/Consultants Meeting minuted by the Project Manager. The number of reviews will reduce to two for smaller projects where schematic design and development of tender documentation became an integral phase and the second review will review draft graphic pages. The Consultant will contact 'Engineering Services Section' staff and arrange review meetings in a timely manner and shall submit a copy of all relevant review documents at least 5 working days prior to the scheduled review meeting.

The Project Manager will issue a current list of USP's technical contacts to consultants at the inaugural Project/Consultants meeting.

32.3 Installation Practise

Consideration of all sections of the USP Design Standard Guidelines must be undertaken when designing BMS installations. In particular:

Section 20	Special Requirements for Laboratories
Section 22	Videoconference Facilities
Section 23	AV Standards for USP Classrooms and Lecture Theatres

Section 24	Air Conditioning and Ventilation
Section 28	Communications
Section 29	Lifts
Section 31	Fume Exhausts & Fume Cupboards
Section 33	Identification Schedule for Plant & Equipment
Section 40	Documentation

All BMS installation works are to be carried out in a tradesmen like manner by suitably qualified personnel and must comply with AS3000, the ACA Cabling Provider Rules and USP Electrical guidelines.

All cables are to be identified at the field and controller as per the standard Inet seven Direct Digital Control system cable numbering system using USP approved cable numbering materials.

Only cables that are compatible with the existing INET seven Direct Digital Control system shall be used in the installation.

Adequate space must be provided into new enclosures for future cable entry.

Commissioning point lists must be available at controller enclosures and kept up to date throughout the duration of all projects. At the completion of all projects an up to date installation point lists must be available at controller enclosures.

32.4 'Standard' Graphic Page Formats

Additions and alterations to the BMS graphic interface shall be compliant with the current BMS default graphic page format.

Please refer to **Appendix 32.4 BMS Examples of Standard Graphic Pages** for further information on 'Standard' Graphic Page Formats.

32.5 'Standard' Control Strategies - Function Descriptions

'Standard' Control Strategies - Function Descriptions shall be compliant with the current USP Property & Facilities Operations 'Engineer Services Section' BMS control strategies. A notes link shall be supplied on the BMS graphic interface providing a written functional description of the control strategy adopted for each specific part of the project.

Please refer to **Appendix – 32.5 BMS Specifications** for further information on 'Standard' Control Strategies - Function Descriptions.

32.6 'Standard' Control Strategies - Programming Details

'Standard' Control Strategies - Programming Details shall be compliant with the current USP Property & Facilities Operations 'Engineer Services Section' BMS control strategies. A notes link shall be supplied on the BMS graphic interface providing a flow chart description of the control strategy adopted for each specific part of the project.

Please refer to **Appendix – 32.6 BMS Programming Details** for further information on 'Standard' Control Strategies - Programming Details.

32.7 Ventilation Fans

General Ventilation Fan

Start fan according to a BMS adjustable time schedule. If the fan (e.g. toilet exhaust) also runs with an AC unit, then interlock the exhaust with the AC unit's enable signal.

Thermostatic Ventilation Fan

Cycle fan to maintain room temperature within the specified band.

Refrigeration Plant Room Fan

Fan shall run continuously and be controlled via local ON/OFF switch. Monitor the status via an Electric Current Switch and raise an alarm if the fan fails.

32.8 Under Ceiling FCU & CHW Ceiling Cassettes

Fan cool units shall be supplied with 0-10Volt DC modulating Chilled Water Valve and integral 24Volt control for BMS interface. 240V contacts for unit heater and fan shall be wired to a separated terminal strip in the unit.

Common fan start/stop, heater start/ stop, chilled water valve control, Temperature Sensor and push button, may be used to control a single room that is served by multiple fan coil units.

Provide a BMS adjustable time schedule to enable unit start/stop, start unit when push button is pressed. When button is depressed outside of the time schedule, run unit for two hours. Sense room temperature and either control the chilled water valve or cycle the heaters cycle to maintain set point. Modulating chilled water valves must be used where the CHW flow is greater than 0.21/s.

32.9 Air Handling Units

General: - CO2 control

In the following descriptions, the following may be applicable:

Carbon dioxide control: Provide a CO2 sensor in the return air to modulate return air and outside air dampers to maintain CO2 level between 600ppm and 900ppm using proportional control.

Economy cycle and CO2 control: High signal highest signal to modulate dampers.

Single Zone

Provide a daily time schedule for unit enable and shutdown, start unit when push button is pressed. When button is depressed outside of time schedule, run the unit for two hours. Sense room temperature and either modulate the chilled water valve or cycle the heaters cycle to maintain set point.

VAV Air Handling Unit

Provide a daily time schedule for unit enable and shutdown. Start unit when occupancy is established via local pushbutton. When button is depressed outside of time schedule, run the unit for two hours. High signal select VAV cooling demands and reset supply air temperature set point between 12C and 24C as maximum cooling demand varies from maximum to nil. Modulate chilled water valve to maintain supply air temperature set point. Modulate supply fan VSD to maintain supply air static pressure at set point.

VAV

Enable each VAV box when occupancy is established via local pushbutton. When button is depressed outside of time schedule, run the unit for two hours. Sense room temperature and either the VAV damper modulates between minimum and maximum positions or cycle the heaters cycle to maintain set point. Disable VAV box shut when zone is unoccupied.

Face and Bypass

Provide a daily time schedule for unit enable and shutdown. Start unit when occupancy is established via local pushbutton. When button is depressed outside of time schedule, run the unit for two hours. Modulate zone face and bypass dampers or cycle heaters to maintain zone set point. High signal select zone cooling demands and reset air off coil temperature set point between 12C and 24C as maximum cooling demand varies from maximum to nil. Modulate chilled water valve to maintain air off coil temperature set point. Drive bypass dampers to the full face position on unit shut down.

Single zone DX

Provide a daily time schedule for unit enable and shutdown. Start unit when occupancy is established via local pushbutton. When button is depressed outside of time schedule, run the unit for two hours. Sense return air temperature for monitoring only.

32.10 Primary CHW System

Sequence chillers up on rise in entering water temperature. Sequence chillers off on drop in return water temperature and on drop in drawn current (for centrifugal and reciprocating chillers) or drawn electrical KW for screw chillers. Drop off figure for screw chillers is leaving water temperature +3C. Low signal select flow through each chiller. Modulate bypass valve(s) to maintain lowest flow requirement. The CHW pump and CW pump shall be wired in parallel with the chiller output relays and the DDC outputs.

32.11 Cooling Tower

For multiple cooling towers serving a common condenser water system.

For single speed fans, sequence cooling tower fans to maintain CCT entering chiller at set point.

For VSD fans, modulate the first fan to 50% speed, then the next, etc. until all fans are running at 50% speed, then modulate all fans simultaneously to maintain CCT entering chiller at setpoint. Unload in reverse sequence.

For reciprocating and screw chillers, control fans to maintain CCT entering chiller 28C.

For centrifugal chillers, calculate ambient wet bulb temperature from ambient dry bulb temperature and ambient relative humidity. Use ambient wet bulb [plus 3C as the set point for CCT entering chiller, within the range of 29C to 20C (or a figure recommended by the chiller manufacturer)].

32.12 Condenser Water Pumps

Condenser water pumps shall be provided with a time schedule function to run the pump for chemical dosing. The time schedule function shall be interlocked with the chiller staging software so this is a totally automated function and fully user adjustable via the time schedule.

32.13 Secondary CHW Pumps

Modulate secondary pump VSD speed to maintain differential pressure at index run (in field, not the pump plantroom) at set point.

32.14 Refrigerant Monitors

The PPM from each "Gastech" monitor shall monitor via the DDC and the reading used to generate a remote alarm and pre-alarm. The DDC shall also monitor the fault relay from the detector. The detector alarm relay outputs shall be connected to local sirens and amber strobes. The pre-alarm output shall be connected to local clear strobes.

32.15 Immersion Water Temperature Sensors

All chilled water and condenser water immersion water temperature sensors shall be TTS 10011 or TTS 10012.

32.16 HVAC Alarms and System Messages

Information sent to the BMS system alarm manager shall be limited to project specific requested messages only. No other system points shall be message masked.

'Critical' and 'High Priority' alarms as identified in this section and amended on a project specific basis will be masked to match the masking of the campus specific master BMS computer terminal. The 'Action' message associated with these alarms shall be reviewed by USP's nominated technical representative.

In addition specified 'Critical Alarms' will be interfaced with USP's CARDAX Security System to provide an appropriate alarm message on monitoring equipment sited at USP's 24/7 Central Monitoring Station (CMS) located on the Kelvin Grove Campus.

32.17 Electrical

Electric Power Meters

'BMS' monitoring of the outputs of Electric Power Meters will be detailed on a project specific basis.

Internal Lighting

BMS control of internal lighting shall be limited on a project specific basis.

For common areas such as foyers, corridors etc. provide a daily time schedule to enable and shutdown lighting. Start internal lighting when occupancy is established via local pushbutton. When the push button is pressed outside of the time schedule, switch the internal lights on for two hours. The local distribution board will be provided with a rotary AUTO / OFF / TEST switch for maintenance.

External Lighting

BMS control of external lighting shall be managed via ambient LUX readings from the local weather station. A Global Lux Broadcast (GLB) shall be sent from PE cells at the local weather station to BMS controllers with External lighting point control. A GLB Local Enable point in each BMS controller will then establish operation of the specified lighting circuits.

Turn on the GLB Local Enable when below the project specific minimum LUX set point and to TURN OFF when above the maximum LUX set point. Minimum and maximum set points for each controller shall be established on a project specific basis. If the Global Lux Broadcast fails a GLB Reinforce Time Schedule referencing Sunrise/Sunset shall be used to turn on the GLB Local Enable at Sunset and off at Sunrise to ensure standalone operation. The Local Electrical Switch Board will be provided with a rotary AUTO / OFF / TEST switch for maintenance.

32.18 Lift Motor Room

Ventilation

Cycle fan is to maintain room temperature within the specified band. Raise alarm when temperature reaches upper limit.

Alarms

Water level monitoring via water level probe or common LMR alarm, input from LMR control panel - raise high priority alarm with message masked for FM Operations Master BMS computer terminal.

32.19 Energy Management Strategies

Global Temperature Reset

Incorporate USP's 'Global Temperature Reset' strategy.

Chiller Supply Water Temperature Reset

Incorporate USP's 'Chiller' Supply Water Reset.

32.20 General Requirements

Air Conditioning - 'Push to Enable' Buttons

This feature shall include a green neon run light, the switch plates shall be a Clipsal 'CL12032VHWE' switch plate with 'CLI30N24GR' neon, and 'CLI30MBPRWE' bell press return switch. The afterhours push button shall be engraved as follows:

Top	AC??? ZONE??
Middle	RUN
Bottom	PUSH TO ENABLE AIR CONDITIONING

Labels

All temperature sensors and push buttons shall be labelled to identify the specific A/C unit and/or zone.

Input/ Output Schedules

All controller enclosures shall be fitted with a rigid internal document holder to house the controller's points list.

Keys

All controller enclosures shall be keyed alike to 'L & F CL 331'.

32.21 NetPlus Routers

The following IP address shall apply for all USP Inet 527 Netplus Routers:-

Location	IP	SNMP	Gateway	SNMP Name
Reference Host	131.181.156.1			
Gardens Point	131.181.156.???	131.181.156.249	131.181.156.252	
Kelvin Grove	131.181.157.???	131.181.157.8	131.181.157.252	
Carseldine	131.181.158.???	131.181.158.249	131.181.158.252	LAN Address e.g. "four"

32.22 Graphics Development

Graphics page development shall be part of all new works or modifications to existing systems. Graphics page structure shall follow the hierarchical document in the attached flow chart. Graphics page shall include but not be limited to the following:

- ☐ Standard USP colours and font
- ☐ Time Schedule Icons for all plant with time schedules attached
- ☐ Common Time Schedule pages for each building

- ☐ CHW Valve summaries for each Chiller Precinct
- ☐ Building Directory Links to Building on the same Chiller Precinct
- ☐ Floor Plans complete with unit shading and zones
- ☐ Separate graphics structure of all Lighting and Power Metering graphics
- ☐ The colour palette shall be restricted to 256 colours

32.23 Graphic Page Structure



32.24 Documentation

Documentation in the form of revisions to the Combined BMS Operation and Maintenance Manuals and a BMS section for the mechanical Operation and Maintenance Manuals shall be part of all new works or modifications to existing systems. The Combined Operation and Maintenance Manual structure shall follow the hierarchical document in the attached flow chart. The documentation shall include but not be limited to the following:

Function Control Description to describe the operation of the plant in plain English.

Copies of the revised I/O Schedules for all of the following: DDC Enclosures, Mechanical O&M and the Combined BMS O&M.

Updated LAN diagrams for all of the following: DDC Enclosures, Mechanical O&M and the Combined BMS O&M.

IMAGE TO BE INSERTED

32.25 Generic Points List

GENERAL VENT FAN

Point Description	D I	D	AI	A	Field Device	Comments
Fan Start/Stop		1			MSSB	
Fan Status	1				MSSB	From Fan Contactor

THERMOSTATIC VENT FAN

Point Description	D I	D	A I	A	Field Device	Comments
Fan Start/Stop		1			MSSB	
Fan Status	1				MSSB	From Fan Contactor
Room			1		Room Temp Sensor	

REFRIGERATION PLANT ROOM FAN

Point Description	D I	D	AI	A	Field Device	Comments
ON / OFF Switch	1				MSSB	
Fan Status	1				MSBB	From APS

UNDER CEILING FCU

Point Description	D I	D	A I	A	Field Device	Comments
Fan Start / Stop		1			FCU Terminal Strip	
CHW Valve				1	Valve Actuator	Modulating or ON/OFF
Heater		1			FCU Terminal Strip	
Room			1		Room Temp Sensor	
After Hours Push	1				P/Button Switch Plate	
Run neon		1			P/Button Switch Plate	

SINGLE ZONE AHU

Point Description	D I	D	A I	A	Field Device	Comments
Supply Air Temp			1		Duct Temp Sensor	To Be Installed After Heater
Fan Start / Stop		1			MSBB	
Fan Status	1				MSBB, AFS	
CHW Valve				1	Valve Actuator	
Heater		N			MSBB	(N) Number of Steps
Room			1		Room Temp Sensor	
After Hours Push	1				P/Button Switch Plate	
Run neon		1			P / Button Switch Plate	

VAV AHU

Point Description	D I	D	A I	A	Field Device	Comments
Fan Start / Stop		1			MSSB	
Fan Status	1				MSSB, AFS	
CHW Valve				1	Valve Actuator	
Supply air Temp			1		Duct Temp Sensor	
Duct Static			1		DP Duct Sensor	
Supply Air Fan					VSD	

VAV

Point Description	D I	D	A I	A	Field Device	Comments
VAV zone Push	1				P/Button Switch Plate	
VAV zone neon		1			P/Button Switch Plate	
Zone Temperature			1		Room Temp Sensor	
Primary Air			1		Pitot tube	
VAV Damper				1	Damper Actuator	
Heater		N			VAV Terminal	(N) Number of steps

FACE & BYPASS AHU

Point Description	DI	D	A I	A	Field Device	Comments
Supply Air Fan		1			MSBB	
Supply Air Fan	1				MSSB, AFS	
CHW Valve				1	Valve Actuator	
Air of Coil			1		Averaging Sensor	
Zone Push Button	M				P/Button Switch Plate	(M) Number of zones
Zone Neon		M			P/Button Switch Plate	(M) Number of zones
Zone Temperature			M		Room TempSensor	(M) Number of zones
Zone Face				M	Damper Actuator	(M) Number of zones
Zone Heater		X			MSSB	X+MxN (N)Number of zones

SINGLE ZONE DX

Point Description	D I	D	AI	A	Field Device	Comments
Supply Air Temp		1			Duct Temp Sensor	
Unit Start/Stop		1			MSBB	
Push Button	1				P/Button Switch Plate	
Neon		1			P/Button Switch Plate	
Return Air				1	Room Temp Sensor	

AHU ECONOMY CYCLE CHW PUMP

Point Description	DI	D	AI	A	Field Device	Comments
Outside Air				1	Damper Actuator	Interface with smoke
Return Air				1	Damper Actuator	Interface with smoke

AHU CO2 CONTROL CHW PUMP

Point Description	DI	D	AI	A	Field Device	Comments
CO2 Level			1		CO2 Sensor	
Outside Air				1	Damper Actuator	Interface with smoke
Return Air				1	Damper Actuator	Interface with smoke

CHILLER & CHW PUMP

Point Description	DI	D	AI	A	Field Device	Comments
Chiller Enable		1			MSSB	From Chiller Control Panel
Chiller Status	1				MSSB	From Chiller Control Panel
Chiller Fault	1				MSSB	From Chiller Control Panel
CHW Pump		1			MSSB	Parallel to Chiller output
CHW Pump	1				MSSB	Flow Switch
Chiller Amps			1		MSSB	Current Transducer
Entering CHW			1		Immersion Temp	
Leaving CHW			1		Immersion Temp	
Chiller CHWDP			1		DP Sensor	
CHW Bypass				1	Valve Actuator	
Chiller Fault Reset		1			MSBB	From Chiller Control Panel

COOLING TOWER

Point Description	D I	D	A I	A	Field Device	Comments
CT Fan Start		N			MSSB	
CT Fan Status	1				MSSB	
CT Fan VSD	1				MSSB	
CW Pump		1			MSSB	
CW Pumpstatus	1				MSSB	
Ambient			1		External Temp Sensor	
Ambient			1		External Humidity	
Entering CW			1		Immersion Temp	
Leaving CW			1		Immersion Temp	

SECONDARY CHW PUMP

Point Description	D I	D	A I	A	Field Device	Comments
SCHW Pump VSD Feed back			1		MSSB	Speed feedback
SCHW Pump VSD				1	MSSB	
SCHW Pump	1				MSSB	Flow Switch
SCHW DP			1		DP Sensor	Located in the index run
Header CHW			1		Immersion Temp	
Header CHW			1		Immersion Temp	

REFRIGERANT MONITORS CHW PUMP

Point Description	DI	D	A I	A	Field Device	Comments
Refrigerant PPM			1		Refrigerant Detector	Gastech FX Series
Refrigerant	1				Refrigerant Detector	Gastech FX Series

ELECTRICAL METERS

Point Description	DI	D	A I	A	Field Device	Comments
KW hrs Light	1				Meter	Pulsed Input
Line Voltage Light			3		PT	
Line Amps Light			3		CT	
KW hrs	1				Meter	Pulsed Input
Line Voltage			3		PT	
Line Amps			3		CT	

LIGHTING CONTROL

Point Description	DI	D	A I	A	Field Device	Comments
Internal Lights		N			Electrical DB	(N) Number of Floors
Push Button	N				P/Button Switch Plate	(N) Number of Floors
Neon		N			P/Button Switch Plate	(N) Number of Floors
AmbientLightLevel (Lux)			1		Weather Station	Broadcast from Campus Weather Station

LIFT MOTOR ROOM

Point Description	DI	D	A I	A	Field Device	Comments
Fan Start/Stop		1			LMR ControlPanel	
Fan Status	1				LMR ControlPanel	From Fan Contractor
Water Level Alarm	1				Water Level Probe	
LMR Temperature			1		Room Temp Sensor	
LMR Alarm	1				LMR ControlPanel	

33 Identification Schedule for Plant & Equipment

33.1 General

Where colors are not specified for particular items of plant, the University shall be consulted before colors are nominated. All plant and equipment in plant rooms, service risers and wherever exposed to view in unoccupied spaces shall be identified to the following scheme. All pipework, valves and fittings in plant rooms, ducts and wherever exposed to view in unoccupied spaces shall have the identification labels or tags applied for easy identification. Pipe work identification shall be achieved throughout by use of pipe identification marker labels (stickers or tapes) to indicate contents and flow.

Colors are selected from:

- ☐ AS 2700-2011 - Colors for General Purposes
- ☐ AS 1345:9:2021 - The identification of Piping Conduits and Ducts.

In occupied spaces and where pipework, duct or equipment is exposed externally, the Designer shall select colors in conjunction with the University Design Manager.

33.2 Pumps

Domestic Cold Water Pumps	AS 2700 Color or Label
Pump	Description of item on Traffolyte Label
Base	Hot dipped galvanized
Domestic Hot Water Pumps	
Pump	Description of item on Traffolyte Label
Base	Hot dipped galvanized
Fire Service Pumps	
Motor	Signal Red - R13
Pump	Signal Red - R13
Coupling Guard	Signal Red - R13
Base	Hot dipped galvanized
Chilled Water Pumps	
Pump	Description of item on Traffolyte Label
Base	Hot dipped galvanized

Condenser Water Pumps	
Pumps	Description of item on Traffolyte Label
Base	Hot dipped galvanized

33.3 Air-Handling Plants

Fan Coil Units & Conditioner	Description of item on Traffolyte Label
External Motors	Description of item on Traffolyte Label
Toilet Exhaust Systems:	
Fans	Description of item on Traffolyte Label
Base	Hot dipped galvanized
Supply Air Systems:	
Fans	Description of item on Traffolyte Label
Base	Hot dipped galvanized
Fume Exhaust Systems:	Description of item on Traffolyte Label
Supply Air Fans	Description of item on Traffolyte Label
Exhaust Fans	Description of item on Traffolyte Label
Miscellaneous Exhausts (other than those above):	
Fans	Description of item on Traffolyte Label
Base	Hot dipped galvanized

33.4 Air Compressors & Vacuum Pumps

Air Compressors:	
Compressor	Description of item on Traffolyte Label
Base	Hot dipped galvanized
Vacuum Pumps:	
Vacuum Pump	Description of item on Traffolyte Label

Vacuum Tank	Description of item on Traffolyte Label
Base	Hot dipped galvanized

33.5 Refrigeration Systems

Centrifugal Chillers:	Manufactures Colors
Condensing Units (DX system)	Description of item on Traffolyte Label

33.6 Electrical

Main Electrical Switch Board	Orange X15
Sub-Boards Switch Board	Orange X15
Mechanical Service Switch Board	Orange X15

33.7 Pipe work, Valves & Fittings (not Outlets)

Service	Pipe	Valves
Domestic Cold Water	Identification & flow direction sticker	Engraved disc e.g. CW
Domestic Hot Water	Identification & flow direction sticker	Engraved disc e.g. HW
Chilled Water	Identification & flow direction sticker	Engraved disc e.g. CHW
Fire Services Water Mains	Identification & flow direction sticker	Engraved disc e.g. FS
Condenser Water	Identification & flow direction sticker	Engraved disc e.g. CONW
Drains	Identification & flow direction sticker	
Gas L.P.	Identification & flow direction sticker	Engraved disc e.g. GAS LPG
Compressed Air	Identification & flow direction sticker	Engraved disc e.g. Comp Air
Vacuum	Identification & flow direction sticker	Engraved disc e.g. Vac
Oxygen	Identification & flow direction sticker	Engraved disc e.g. Oxy
Acetylene	Identification & flow direction sticker	Engraved disc e.g. Acet
Other Gases	Identification & flow direction sticker	Engraved disc e.g. ???

Demineralise Water	Identification & flow direction sticker	Engraved disc e.g. Demin W
Internal Downpipes & Stormwater	Identification & flow direction sticker	

33.8 Underground Marker Tape

Underground Marker Tape shall be of the magnetic type with service specified on tape and shall be installed not less than 300 mm above the top of the underground service. The color code shall be as follows:-

Service	Color
Sewer	Black
Water (including Chilled and Demineralised Water)	Green
Fire Service	Red
Stormwater	Dark Blue
Electrical	Orange

33.9 Brackets & Supports

Ace Unistrut Mounting Brackets, M.S. Angle Supports and Hanger Rods to be painted hot dipped galvanized where exposed.

Part 3 – External Design

34 Roads, Footpaths and Car Parks

34.1 Introduction

This section sets out the general standards of road and car park design within the University's campuses. Works in other areas may be constructed to similar standards where appropriate.

34.2 Standards

The design standards are based on:

- AS/NZS 2890.1:2004 Off-Street Parking, Part 1 - Car Parking Facilities.
- AS2890.2 2002 Off-Street Parking, Part 2 - Commercial Vehicle Facilities.

34.3 Road Classification and Cross-Section

Classification Types

Roads are classified as:

- Principal Roads carrying the major campus traffic flows, carrying heavy traffic (buses), or special roads.
- Secondary Roads primarily intended to provide access between Principal Roads and buildings or car parks. These roads do not normally provide for through traffic.
- Minor Roads primarily for service access to buildings, and car parks
- Classification will depend on traffic volume, wheel loads, or location on campus, and may change as traffic patterns are altered by future building works etc.

Construction Access

While campus roads would generally correspond to Type B or C roads under the Town Plan, the designer should note that any road (or car park) may need to be used as construction access for future building works. Consequently, all roads should be designed to Type D standard, defined in this section as:

Surface	25mm AC Seal including primer
Top Course	100mm CBR 80 Road Base
Bottom Course	100mm CBR 45 Road Base
Total	225mm minimum

Primary roads should use 40mm AC seal in lieu of 25mm as above.

Pavements

Pavement thickness can be increased by the use of CBR15 sub-base where test results indicate the use of thicker pavements or where sustained heavy loadings may occur such as bus standing areas and waste collection areas.

Soaked CBR Tests

Soaked CBR tests should be used in all sub-grade testing.

AC Sealed Road Widths

AC Seal must have a prime coat and tack coat for new construction, and a tack coat for re-surfacing.

New Road Widths

Where there is no necessity to match existing roads, all new roads should have the following minimum widths between kerbs:

Services Access Only:	Minimum Width
One Way	3.6m
Two Way	4.5m
Roadways:	Minimum Width
No Kerbside Parking	6.0m
Parking One Side	8.0m
Parking Two Sides	10.0m

Earthworks batters are not to be steeper than 3 horizontal to 1 vertical to enable future turf to be cut with ride-on mowers.

34.4 Road Layout & Geometrical Design**Kerbs**

All roads on campuses are generally to be provided with kerb and channel.

Heavy Duty Kerbs +

Heavy-duty kerbs are to be used on the major ring roads and wherever regular bus traffic occurs, i.e. on Principal Roads.

Intersections

Kerb Radii - Dimensions to face of kerb are to be:

Class	Description	Radius (m)
Minor	Service Access	5.0
Secondary	Roads Generally	6.0
Principal	Major Intersections	10.0

All geometry must allow for 8 tonne truck access to represent service or emergency vehicle access. Intersections of two Principal roads must be channelled to allow two lane exit and entry. Intersections of a Secondary and a Principal road should be channelled where site area permits. Intersections of two Secondary roads, or where one road is a Minor road, should not have traffic islands. Where traffic islands are to be used, minimum widths of lanes should be:

- Entry 5.0m
- Exit 3.7m

Provide pram ramps at all intersections.

Grades

a) Road Gradients - These should be limited to 1 in 14 to suit access for people with disabilities, but must not exceed 1

in 8 unless particular site difficulties require steeper grades

b) Service Vehicles - To service vehicle areas, maximum grade shall be 1 in 10 in any direction for fixed bodied vehicles or 1 in 15 where frequent use by semi-trailer vehicles can be expected

c) Special Vehicles - Emergency and Service vehicle access must be considered in all building access road design. Special vehicles to be considered include Fire Service trucks (General Pump), concrete trucks, furniture vans, buses etc. The manoeuvres of these vehicles can be represented by the LOCAL AUTHORITY 8 tonne truck templates, with 500mm extra clearance for buses. Specific bus manoeuvre clearances can be established by site testing with the co-operation of LOCAL AUTHORITY Transport Department.

d) Road Humps - Shall be constructed in accordance with requirements of AS1742.13 (1991).

Sign Post Types

a) Warning signs - At each entry to the property stating that there are humps on the internal roads and that caution must be exercised.

b) Advisory sign - About 10 to 20 metres on each side of the hump, advising of speed hump ahead and indicating safe traverse speed limit. These signs can be W5-10A signs. The warning distance may require adjustment to suit sight distance.

c) Optional Sign - A sign at the hump itself, each side of road. These signs are OPTIONAL.

d) Road Markings - Advisory road markings can be installed about 10 metres clear of the hump on each side. The road markings consist of the word "HUMP" 2000 wide and 2100 long as detailed in drawing RS. These road markings are OPTIONAL.

34.5 Car Parking

Geometry

a) Car Parking Types:

- Kerbside - Parallel Parking
- Kerbside – 60° Angle parking
- Off - street surface car parks

b) Design Car Size - The University design car is taken as 5.0m x 2.4m.

Car Park Layout

Surface Parks		Kerbside Parking		
	Open	Enclosed	Parallel	60°
Bay width	2.5	2.5	2.2	2.4
Bay length	5.0	5.5	5.6	4.5
Aisle width	6.0	6.0	-	-

a) End Bays - Surface parking end bays should be increased in width by 300mm to 2.8m if adjacent to fences or walls.

b) Disabled Person Bay - Disabled person bays shall have a width of 4 metres and should be located at the ends of car bay segments. Kerbside parallel parking is not suitable for disabled person car bays. Therefore bays should be carefully positioned to minimise the risk of oncoming traffic.

c) End Bay Length - Kerbside parking end bay lengths should be increased to 8.0m if adjacent to a fence or wall.

d) Critical Geometry - For cases of critical geometry, the LOCAL AUTHORITY Standard Car template may be used, but the swept path of the LOCAL AUTHORITY car can be used without clearance to allow for the smaller size of the University design car.

e) Service Road Aisles - Provide 2 x 3.5m aisles for service roads from the external road system into car parks and allow for queuing on both entry and exit lanes (particularly off heavy trafficked roads).

New Construction

a) Type B Construction - Car parks can be classed as Minor Roads and may be of Type B construction.

- b) Thickness - Pavement thickness shall be 200mm comprising:
 - Surface - 25mm AC Seal
 - Top Course - 100mm CBR 80 Road Base
 - Bottom Course - 75mm CBR 45 Road Base
- c) CBR Tests - Soaked CBR testing should be used as the basis for pavement thickness design.
- d) New Work - For long term maintenance, it is essential that prime and tack coats to AC Seal be used on new work.

Sealing Existing Car Parks

- a) Thickness - Existing car parks generally have had the equivalent of 100mm pavement.
- b) Sealing - To seal an existing car park, new additional pavement should be 100mm:
 - Surface - 25mm AC Seal
 - Top Course - 75mm CBR 80 Road Base
- c) CBR Tests - Soaked CBR tests should be used to confirm existing pavement thickness and quality.
- d) Coats - Prime coat must be used when sealing previously unsealed car parks, followed by tack coat and AC seal. Resurfacing of existing sealed car parks required tack coat only prior to application of new AC seal.

Car Park Edges

- a) Fences - Car parks may be defined by fences, by kerbs, or both.
- b) Fenced Unsealed - Car parks should have shoulders extending 500mm (or 300mm absolute minimum) beyond the fence line defining the nominal edge of car park.
- c) Fenced Sealed - Car parks should have shoulders as above, with the seal ending on the fence line.
- d) Kerbing - Use LOCAL AUTHORITY Type E barrier kerb or kerb only sections. The kerb only sections should be used for all small car parks adjacent to buildings
- e) Concrete Path - A concrete path is to be constructed behind kerb and channel. If no path is required behind the kerb and channel, then backfill to full height of kerb.
- f) Overhanging - In planning kerbed car park areas, allowance should be made for vehicles to overhang past the face of the kerb by a minimum distance of 500mm.
- g) Avoid - Freestanding kerbing must NOT be used.

Surface Drainage

- a) Grading - Every car park shall be graded to provide adequate run-off of rainwater.
- b) Blockages - The designer must make allowances for blockage of inlet grates by leaves, debris, and accumulated hailstones (Jan 18, 1985 storm).
- c) Catchment Area - This will include any ground, landscaping area or building roof down pipes discharging onto the car park.
- d) Design Criteria - In the absence of more detailed investigations, the following should be used in accordance with Local Urban Drainage Manual (LUDM):
- e) Design Frequency:

	Piped Flow	O'Land Flow
Inner campus areas	50 years	100 years
Outer areas	20 years	50 years
Minimum intensity (any frequency)		200mm/hr
Run Off Coefficient:	Sealed area	0.90
	General areas	0.80
	Ovals	0.60

- f) Overland Flow Path - In all cases an overland flow path must be provided to allow for drainage without damage to buildings when all inlet grates are totally blocked.

Design Flows

- a) Volumes - Minimum design run-off flows for inlet and pipeline design for different area types shall be in accordance with LUDM.
- b) Assessment - Each area type can be assessed and the design flows calculated from the above figures.
- c) Flow Paths - Overland flow paths shall be designed for flows corresponding to the frequencies above. Overland flow path and underground piping shall be regarded as a combined system.
- d) Pipe Gradeline - Hydraulic gradeline for all pipeline design shall be calculated and shall be shown on project drawings.
- e) Tidal Influence - Note tidal influence in any drainage pipes to low areas close to Local River.

Inlets

- a) Gully Pits - These shall be 900 x 600 LOCAL AUTHORITY Type A gullies designed to accept full rainwater flows as above, when 50% blocked.
- b) Field Inlets - These shall have a minimum size of 600mm x 600mm with full size parallel bar heavy service grates. Bicycle safe grates shall be used or pedestrian heelsafe grates where accessed by pedestrians.
- c) Grate Size - A minimum grate size of 450mm square may be used in areas with limited back-catchments and low risk of blockage.
- d) Major Field Inlet - These shall be used in areas of critical stormwater drainage where blockages are liable to cause damage to buildings or vehicles.

Note: Various gully pits and field inlets may be exposed to bicycle and pedestrian traffic and shall be modified accordingly.

Access Holes

- a) LOCAL AUTHORITY Type - Access holes shall be LOCAL AUTHORITY standard type and shall match pipe diameters, but shall not be less than 900mm internal diameter.
- b) Lid - All access holes shall be provided with a heavy service lid (Web Forge or equal) to allow for future traffic access by service or construction vehicles.
- c) Inspection chambers shall be installed in accordance with Local Authority requirements. Gatic type light duty covers shall be used except in roadways where medium duty covers shall be used. Brass edged covers are to be used where particular floor or paving finishes are to be used. Tops of chambers in landscaped areas shall be installed to match finished landscaped levels. Lids must be compatible with gatic lifters.
- d) Damage may occur should incorrect lifting devices/practices be applied to lids.

Pipes

- a) Trafficable Areas - All underground piping shall be reinforced concrete pipes, spigot and socket joints up to 600 diameters and External bound Flush joint for larger pipes, Class 2, 3, 4 + 6 according to traffic loads, on Class C bedding.
- b) Non Trafficable Areas - Piping may be UPVC Class SH up to 150mm diameter, but must be reinforced concrete pipes or FRC as above for 225mm diameter or larger.
- c) Main Drainage Pipes - Pipes starting at a gully pit, field inlet, or manhole shall have a minimum diameter of 300mm and, wherever possible, a minimum fall of 1 in 100.
- d) Backfill to Drainage Lines: -
- e) Compaction - All backfill must be CBR15 material COMPACTED in 200mm layers.

Compaction in trenching is to be

Top 300mm	95% modified AASHO
Next 300mm	90% modified AASHO
Lower levels	85% modified AASHOTop

- f) Top Fill - Selected material, or road base, may need to be specified for the backfill as above.
- g) Around pipe min 100 above and below pipe comprising max 10mm aggregate size drainage gravel in preference to bedding sand. Lay geofabric prior to further backfilling.

Network enabled equipment

Any equipment which connects directly or indirectly to the QUT wired or wireless network needs the approval from the Associate Director Infrastructure Services ITS. Special network security requirements may be required.

38.6 Road marking

Road marking Paint

Paint is to be Road marking Paint, with non-slip additives to reduce the risk of pedestrian slips when wet.

Colours to be used are:

White	general lane and road marking
Yellow	absolute no standing areas, e.g. kerbs near intersections, loading bays, access bays to critical areas
Black	used to delete, or paint over existing markings

Surface Treatment

To "old" concrete or AC surfaces and to fresh AC surfaces, apply two (2) coats of paint as above.

To fresh concrete surfaces, apply an acid etch (10% hydrochloric), then neutraliser, then two (2) coats of paint as above.

Deleted Linemarking

Removal of line marking, including pictograms (e.g. disabled parking) that is no longer required, is to be removed by light grinding to the depth of the paint.

Marking Types

Car Parks	100mm wide x 300mm long strips at kerbside, with two such strips to form T or L junctions at outer edges of car bays
Lane Marking	100mm wide centrelines, 80mm wide lane lines where additional lanes are to be delineated
Stop Lines	450mm wide, full lane width
Holding Lines	300mm wide x 600mm long, spaced 600mm

38.7 Traffic Signs

Campus Types

Traffic signs must generally conform to the Manual of Uniform Traffic Control Devices.

Guidelines

The Manual lists code numbers for many standard signs, together with size codes and guides for the use of the signs.

Sizes

All University signs are "A" size signs, the B or C sizes being reserved for non-built-up areas.

Manual Signs

Types in common campus use include:

Name	Code
Stop	R1-1A
Give Way	R-2A
One Way	R2-1LA, or R2-1RA

Keep Left	R2-3LA, or R2-3RA
No Entry	R2-4A
Pedestrian Crossing	R3-4A
Speed Limit	R4-1A
No Standing Any Time	(New Symbol)
Roundabout	W2-7A
Hump	W5-10A
Direction Arrows	T5-4A

Typical Size

A typical sign would be 300mm wide

38.8 Special Spaces - Service Vehicles

In the allocation of car spaces, the following special uses require consideration:

- University Service Vehicles
- Disabled (Wheelchair symbol)
- Loading Bays

38.9 Slip Resistance of Pedestrian Surface Materials

The contribution of the floor surface to the risk of slipping shall be not more than "low" as defined in AS/NZS4586, unless approved in writing by USP.

38.10 Bollard Standard

Bollards are to be cylindrical with a flat disk top finish of brushed stainless steel, 890mm high above ground level, when fitted x 152mm diameter x 4mm wall thickness.

Removable bollards are to be no greater than 11kgs in weight, fitted into a post hole with a hinged cover plate that will hinge to safely cover the hole once the bollard is removed. Removable bollards are to be inserted 400mm below ground level with 890mm exposed above ground level. Removable bollards are to be secured into the post hole in the upright position by the use of a hasp hole on the hinged cover lid and staple on the bollard. A standard emergency services 003 keyed padlock is to be used to lock the bollard in place. Removable bollards are to be fitted with a hollow hand hold indented into both sides of the bollard 200mm from the top of the bollard.

Fixed bollards are to be of identical size and appearance above ground level less the indented hand holds. Fixed bollards are to be firmly cemented into the ground 500mm below ground level and are to be cement filled.

35 Landscape

35.1 Introduction

These guidelines relate to the USP campus sites, at Gardens Point and Kelvin Grove. Each campus has its own intrinsic quality and character which is important to identify, appreciate consistently develop and preserve continuity.

For existing Hard and Soft Landscape Materials and plant types for each campus, refer USP Maintenance Manual

prepared by Tract Consultants.

35.2 Standards and regulatory requirements

Design and Documentation to respond to relevant current Acts, Codes, Standards Principles which include:

- ☐ Building Codes, Anti Discrimination Acts, Australian Standards, Design for People with Disabilities in accordance with 1428.1 and 1428.4, (some Sections of 1428.2 may apply)
- ☐ Crime Prevention Through Environmental Design (CPTED), Environmental Sustainability, State, Local Government Acts, including Equity Workplace Health and Safety, and required obligations for reporting the presence or suspicion of the presence of contaminationssuchasforRedFireAnts.

35.3 Reference Material

Material produced for the USP to be referenced for each campus project:

- ☐ Current Landscape Master Plans and Site Planning Reports - Kelvin Grove and Gardens Point
- ☐ USP Maintenance Manual Tract Consultants Pty Ltd Gardens Point and Kelvin Grove
- ☐ Landscaping Design Guidelines Manager - Cleaning and Grounds
- ☐ Heritage Management Protocol Kelvin Grove Campus and Heritage Management Protocol Gardens Point prepared by Allom Lovell Architects.

35.4 Site appreciation & investigations

Investigation of the site for each proposed project needs to be undertaken and include:

- ☐ An appreciation of site conditions with:
 - A survey of topographic conditions, aspect, overland flows and run off, rock and soil types
 - An identification and study of circulation, movement predictors, animal habitats, heritage, biological and visual values, access ways and legibility.
- ☐ Identification of site vegetation and existing trees in consultation with the Manager - Cleaning and Grounds and a specialist arborist to report on condition and significance of the trees on site and procedures for removal/transplantation and/or protection and maintenance of trees and other vegetation proposed to be retained during the design process
- ☐ Onsite consultation with USP Facilities personnel for special considerations, existing services, future maintenance.

35.5 Landscape scope

The scope for landscape design for external work includes hard and soft landscape elements, minor earthworks, erosion control, external furniture, signage, drainage, irrigation, and co-ordination with specialist services, structural, civil engineers for gradients and levels, external lighting, hydraulic services (drainage and water supply), establishment and maintenance of plants for a specified period before handover to the University and where the development adjoins a public road co-ordination with the relevant authority for streetscape design.

35.6 Landscape Design

Landscape design and documentation to be complimentary to and integrated with the building and services design and documentation.

The landscape design is to conform to Campus landscape principles, strategies and management held in reference documents and, in particular, to design continuity, sustainability legibility, safety expression and functionality and ongoing maintenance requirements, including discouragement of skateboard use.

35.7 Earthworks

Generally bulk earthworks are designed and documented by the civil engineering consultant. It is

important that all aspects of:

- ☐ Protection of existing trees and vegetation
- ☐ Erosion control measures
- ☐ Stripping and stock piling of topsoil
- ☐ Location of major infrastructure;
- ☐ are co-ordinated with the landscape architect.

35.8 Elements

Generally landscape elements and materials will vary between each campus site, and proposed materials will be required to be submitted for approvals to the University.

Paths and paving

Paths and paving are required to conform to acceptable widths, gradients and cross-falls and the appropriate slip resistance codes for pedestrian use. Proprietary items are to be supported by manufacturer's warranties.

Paths should have a 1 in 14 slope to comply with equal opportunity access standards.

All plantings of trees and palms within paths or paved areas should provide space for the mature growth of the plant. Planting area clear of obstructions should be 2.0 metres X 2.0 metres.

The planted space should provide a depth of soil for the mature roots to penetrate with root barrier around the outer perimeter of the planting hole to a depth that will direct the roots below the hard surface material.

All paving sealed with an approved sealant appropriate to the paving type.

Segmented pavers are to be fixed on a concrete base and laid, cleaned, sealed, to manufacturer's specification.

Concrete to be reinforced, laid on compacted fill (100 mm thick pedestrian use, 150 mm thick for vehicles), and be complete with expansion, construction and dowel joints, and tactile and indicators tiles to AS1428.4. Any colour to be integral and aggregate type and finish to be approved by the University.

External site levels to finish 200mm below the building floor level and 75 mm below damp proof course, except at building entry thresholds.

50 mm conduits are to be provided under paving for future services with locations marked on kerbs/pavements.

Service covers in paths need to finish flush with adjoining pavement and, where possible, align with direction of paving. Lids generally to be 'infill' type lid. Fill lid to match adjoining path finish.

Widths:	Major access ways	3000 mm minimum
	Minor paths	1200 mm minimum

Steps

- Where possible avoid steps in footpaths in external areas.
- Where required, external steps generally shall have 150 mm risers and 305 mm treads; the riser to have 30 raking face.
- Note: No single steps in the external landscape areas.
- Treads to be non-skid with contrast colour nosings.

Ramps and walkways

Ramps and walkways are to be suitable for people with disabilities and include handrails, and kerbs as necessary to code 1428.1.

Handrails

Handrails are to be provided for steps and ramps and generally match adjacent existing handrail design elsewhere on campus to 1428.1.

Materials to be 42 mm OD stainless steel (at main entrance/access ways), hot dip/ galvanised. Fixing details to be provided by structural engineer.

Generally open hook ends to be closed off.

Walls

Walls to be in situ concrete (colour to be integral) masonry/stone as appropriate to the situation and constructed to engineering specification and coated with an approved vandal resistant sealant.

Back of retaining walls to be waterproofed and protected with Cor drain/gravel backfill and agricultural drainage. Design consideration is to be given to capping, falls on capping, possible future staining of walls, use for casual seating and possible misuse by skate boarders.

Fall heights hand rails to BCA and Duty of Care.

Planting on structures

Planting on structures should be avoided unless the depth of the planting media matches the plant species so that the roots of the plants don't overfill the space causing the plants to die.

The planting structure will need to have waterproof membranes and adequate drainage as well as a reliable non-potable watering source. If these factors cannot be guaranteed then no plantings should take place.

Garden edges

Where mown grass abut gardens, kerbs, walls, edges to be concrete, 100 mm wide and 125 mm deep, finished with a steel float and construction joints at 1500 mm maximum centres. Any colour additives to be integral.

Kerbs

Kerbs generally to be in situ concrete 150 mm x 150 mm, with any additives integral. Proprietary pre-formed kerbs, where appropriate, to be laid to manufacturer's specification. Layback kerbs only in approved situations.

Timber

USP generally discourages use of timber in external landscaped areas. However, under special conditions timber may be acceptable provided that all timber design works are approved by USP.

Timber in landscape to be LOSP (Light Organic Solvent Preservative) treated to AS1604-1993 and be Stress Grade F5.

Timber to be painted with two coats of water repellent preservative after cutting and prior to assembly. All exposed edges arised and all fixings hot dipped galvanised.

Timber to be used in external in-ground situations only where approved.

35.9 Drainage

Surface

Where appropriate, stormwater runoff to be captured and/or integrated into ground water.

Falls and run-off for stormwater are to be provided to field gullies and connected to the stormwater system. Pipes to be a minimum 150mm diameter.

Provision is to be made for overland flow from stormwater collection pits. Do not provide for runoff from paved area over grass.

Gully and trench grates to be traversed by pedestrians are to be heel guard type and all grates to be hot dipped and galvanized (stainless steel for quality finish).

Sub surface

Install sub surface drainage in all garden areas adjacent to paths, buildings and turf.

Install sub surface drainage adjacent to paths and buildings in all turfed areas adjacent to paths and buildings.

Corrugated, slotted and socked pipe to be encased in gravel. Solid pipe connections to be used under paved areas.

High end of pipe to be turned up and capped 75 mm above mulch for flushing. Connect sub surface pipe to stormwater system.

35.10 Water Supply

Water is to be supplied to the site for irrigation of designated turf and gardens and for hose points adjacent to the building with appropriate backflow prevention units.

Hose points are to be located for ease of access on building and at approximately 40 metres apart, 800 mm above ground.

Field gullies are to be located under hose cocks.

Water will be sourced from non-potable sources including roof water, fire hydrant cleaning, reverse osmosis units, bores or recycled water and directed into on-site storage tanks incorporated in the design stage to supply water for irrigation and / or cleaning tasks.

All new watering systems should be lilac/purple coloured pipe to indicate it carries non-potable water and all valve boxes and any associated fittings should reflect that the water source is non-potable.

All hose cocks/taps should have pressure reduction valves fitted and have locking mechanism or vandal proof key access to prevent unauthorised use.

35.11 Irrigation

Any irrigation installation involving trenching where existing systems are located underground need to be investigated prior to digging to avoid damage to any existing underground services.

If any underground service is cut, damaged, perforated or stretched then work must stop and waterproof repairs must be carried out and the supply line tested to ensure the repairs are effective. This includes water, irrigation solenoid cable, electrical cable, communications cables, gas and chilled water.

Any installation involving irrigation requires a suitably qualified irrigation person as well as a plumber to ensure the irrigation systems are installed professionally and operating correctly and efficiently.

Any trenching for irrigation must be left open and the lines properly pressure tested before back-filling with sand and identification tape.

All designated grass and gardens are to be irrigated through an automatically controlled irrigation system.

As constructed drawings need to accurately pinpoint underground irrigation lines and solenoid valves. Documentation requirements are detailed in [Section 40 Documentation](#).

All designated garden and turf areas need to be irrigated with automatic controllers with RPZ valves attached on the delivery side.

All controllers should be Hunter IC and any lines feeding water to drippers. All low pressure poly pipe connections whether above or underground will be clamped with stainless steel worm screw clamps not plastic ratchet types.

All watering systems need to operate from pressurised supplies from tank stored water.

All irrigation supply points must clearly display signs containing symbols and/or wording stating this supply is non-potable water and should not be consumed or used for drinking.

Location and operation of computerised watering systems are to be shown to the Manager - Cleaning and Grounds during the installation stage so any defects or alterations can be discussed and rectified without variations.

Systems are to be designed by an authorized irrigation designer with plans and specification included in landscape documentation.

Landscape Architect and Irrigation designer to meet on site with USP Grounds Manager-----before undertaking design.

Controllers for automatic system to be located on outside walls for ease of access for maintenance staff, and enclosed in metal vandal proof lockable cabinets.

Shop and As Built drawings are to be provided to the client with demonstration at handover to the client at the completion of the establishment and maintenance period.

Materials to have a 12-month warranty.

35.12 Landscape Furniture

Furniture, including seats, litter bins, drinking fountains, bike racks, bollards, fences, signs, is to be selected and approved for each campus site. Generally consideration is to be given to matching adjacent, existing furniture and suitability.

All tables should have an equal opportunity height of 750mm-800mm from the finished surface and seats and benches should be 450mm from the finished surface.

Tables, seats and benches should have concrete slabs large enough so that wheel-chairs and mobility scooters can be accommodated equally within the same space.

All furniture needs to be designed/selected to discourage skateboard use. Location of bins to be approved and appropriate to maximise the ease of bin use.

Selection of bins to take account of most appropriate entry type (top, front, side) for given location. Bike racks to be adjacent to buildings and preferably covered and secure.

Any proposal for shade structures need to be approved.

35.13 Gardens

Gardens

Any new plantings around existing buildings or structures need to take into account any awnings or abutments overhead which may impede the mature growth of these plants.

All new and old gardens should be fitted with lilac/purple irrigation lines to indicate the water comes from a non-potable supply source.

All hose cocks/taps should have pressure reduction valves fitted and have locking mechanism or vandal proof key access to prevent unauthorised usage.

Soils

Generally all soils to comply with AS4419(1988). All imported soil mixes to be supplied with a current soil analysis for the soil being supplied and to be certified nut grass free.

Any type of soil, mulch, potting media, potted plant must be free from fire ants and be certified it comes from a fire ant free source.

Site topsoil

Site topsoil may be used in large bush and screen planting areas (G3) provided that:

- ☐ All emergent weeds are progressively removed from site.
- ☐ No sticks / stones / soil clumps in any soil regardless of planting site.
- ☐ Any landscape planting, new or existing needs to have water retention material incorporated into the soil before the mulch is applied.
- ☐ Soil pH is in the 6.5 - 7.0 range.

Imported topsoil types

New Gardens	Approved imported premium quality soil mix pH 6.5 - 7.0
Under Turf	Mineral under turf mix in poorly drained soils. GM 43 (CLS 43) pH 6.5 - 7.0 - Elsewhere

Top dressing for Turf	Sandy fine textured soil pH 6.5 - 7.0.
Planters	There will be no specification to use Hydrocell for any planters, plantings or turf.

Sub grades

- ☐ Sub grades under planted and turfed areas to be scarified to a minimum depth of 150 mm.
- ☐ Unless otherwise specified gypsum to be worked into sub grade at rate of 250 gm/m².

Top soil depths

Gardens	Minimum 300 mm at edges, mound to centre.
Under Turf	100 mm
Planters	Minimum of 600 mm at edges, mound to centre
Trees in Paved Areas	Minimum of 750 mm

35.14 Plants

Please refer to the document "[Landscape Protection Guidelines for USP Campuses](#)".

Existing trees designated for retention

Ensure protection of existing trees to be retained within the work site by fencing and other means, to the extent of the canopy drip lines, with specification to maintain health and vigour of the tree throughout the extent of the site development contract.

Proposed new trees

Tree selection to be dependent on location and considered for potential to provide shade, and/or cause nuisance through aggressive root growth, flower seed or limb shedding on to paths or into roof gutters. Tree selection subject to approval from the University.

- ☐ New trees in paved areas to be advanced stock, protected/staked, with planting holes 2m X 2m and new soil incorporated into existing soil at twice the width and twice the depth of the root ball, drained and provided with irrigation, and root barriers, if required. All new plantings will be species that do not have flowers or seeds which can stain or discolour hard surfaces. Plantings will not add costs to cleaning around the planted area.
- ☐ New trees in grassed areas to be staked with a 2m X 2m planting space, mulched/maintained free of grass.

Proposed new plantings

- ☐ Special consideration to be given to planting around fire hydrants and any signage, manholes, etc. and any areas requiring maintenance access
- ☐ NOTE: Planting types referred to in the Maintenance Manual prepared by Tract Consultants (available from USP Manager - Cleaning and Grounds) should be considered indicative only
- ☐ Selection for type, dependent on palette identified for each campus (refer Appendix of Maintenance Manual prepared by Tract Consultants available from Operations section) and garden category

- ☐ All new plantings to be mulched

Fertilizing

Fertilize each plant at time of planting with long lasting fertilizer suitable for plant species to manufacturer's recommendation:

For Agriform

140 mm pots	1 tablet
200 mm pots	2 tablets
300 mm pots	3 tablets
25 - 100 lt pots	5 tablets

Fertilize during establishment period with liquid fertilizers.

Mulch

Mulch shall be applied to the surface of all gardens.

Mulch type is required to be approved.

Where gravel is used in surface watercourse for stormwater, gravel to be LOR with a 10% proportion of larger spalls and geofabric underlay.

Keep mulch away from plant stems.

All mulch for any garden/landscape planting to be either 25mm hoop pine chips or tree mulch of 25mm or larger to allow for water penetration.

Mulch will be 150mm thick in High profile gardens and 100mm elsewhere. The site location will determine which mulch will be nominated.

No mulch fines are to be used at all in any landscape project or planting.

35.15 Grass

Grass categories

Species of grass proposed for each situation to be approved by the university, and will be determined by site location and in conjunction with Landscape Architects and Manager - Cleaning and Grounds.

Grass on banks

Cultivated mown turf to be laid on banks at gradients no steeper than 1:4 (where possible avoid turf on an incline, all inclines to comply with Workplace Health and Safety Standards).

Fertilizer

Fertiliser will be determined by Manager - Cleaning and Grounds depending on site location.

35.16 Establishment and Maintenance period

All soft landscape work and irrigation to be maintained during an establishment and maintenance period (minimum of 12 months) after practical completion.

After satisfactory completion of this period, arrangements are to be made for a formal handover and familiarization to the USP Facilities Maintenance personnel.

35.17 Defects Liability

All hard landscape work is to have a warranty period for 12 months after practical completion.

35.18 Obligation Design Consultants during Documentation

Cross checking with other consultants for:

- ☐ Bulk earthworks for sub grade levels
- ☐ Location and level of stormwater and sewerage sumps/inspection/chambers in the landscape with paving infill of lids required in pathways
- ☐ Location and levels of ORGs in external areas with required falls away and location of hose cocks over
- ☐ Location of RPZV, check other valves electricity substations, fire hose reel cabinets and other service elements to be located in the landscape
- ☐ Location of lights and power supply in landscape areas
- ☐ Type and extent of light available in interior landscapes
- ☐ Collection and use of rainwater or grey water
- ☐ Water features and fountains equipment
- ☐ Review design verification
- ☐ Checking Bill of Quantities.

35.19 Obligation Landscape Consultant during Construction

Inspections during construction are required.

Certification of the work at practical completion, completion of establishment and maintenance and defects liability period are required.

35.20 Obligation at Completion of Establishment and Period

It is the obligation of the landscape architectural consultant to provide to the relevant personnel:

- ☐ As Built drawings.
- ☐ Warranties for equipment and workmanship.
- ☐ Commission of the irrigation system.
- ☐ Handover to the landscape maintenance staff.

35.21 Details in Drawings

1. Planting Details Refer USP FMDS + G, Edition 3, Section 39 p.39, 40, and 41.
2. Planters on structures.
3. Concrete paving and jointing (Typical)
4. Steps and handrails and tactiles (Typical)

Part 4 - Documentation

36 Documentation

36.1 General

This section details the required documentation, contents and formats that must be followed.

Existing Records

Property & Facilities, Infrastructure Systems & Information (ISI) unit maintain a comprehensive archive of building records. This is to fulfil obligations under the 'Public records Act' 2002 and the need for detailed information required for the ongoing maintenance and development of USP's physical facilities.

For archive details visit the website below: http://www.fmd.USP.edu.au/operations/information_systems/records_archive.jsp

36.2 Design Documents

The following documents shall be provided by the Consultants to USP during the design and construction phase of the project:

- ☐ Copies of all documents including drawings, specifications, certificates, reports, etc necessary to provide the contractor with complete and detailed instructions for the execution of the project. All documents and drawings will show the USP room numbers.
- ☐ Documents necessary for authority approvals, including drawings, specifications, certificates, etc
- ☐ The required documentation for calling of up to 5 tenders, plus 3 sets of A3 prints for USP, A3 prints must be legible.
- ☐ Two sets of documents for signatures as evidence of the Contract
- ☐ Documents for Construction:
 - ☐ Three copies of all construction documents to the Contractor
 - ☐ Two copies to the University's Project Manager
 - ☐ Additional copy of services documents to the University's Project Manager
 - ☐ A full set of documents for the archive, soft copy and legible A4/3 paper copies. The Project Coordinator will provide this as soon as possible to Infrastructure Systems & Information to archive in ALCHEMY.
- ☐ Two copies of all shop drawings, operating and maintenance manuals and supplier's instructions for plant and built-in equipment, where relevant. These drawings, diagrams, manuals and instructions shall be checked by the relevant consultant to ensure that they are adequate for their intended purpose. If for any reason they are not adequate, then necessary actions shall be taken to ensure that adequate material is provided to the University without additional cost to the University.
- ☐ Soft copy of basic architectural floor plans in AutoCAD 2008 to 2012 compatible format at start of construction or at least three months prior to practical completion. This is to enable USP Profile Plans and Room Numbers to be confirmed before As Constructed drawings are finalised.

In addition to all of the above documents, copies will be required for intermittent review by and liaison with the University's Project Manager.

Depending on the size and nature of the project, the consultants will also be required to provide the following documents:

- ☐ Functional Design Brief
- ☐ Schematic Design Documents
- ☐ Detailed Design Report (relating to any discipline)
- ☐ Finishes and Colour boards in electronic format or photo
- ☐ Model & photos of model
- ☐ 3-D presentations
- ☐ Architectural Perspectives
- ☐ Detailed Commissioning Plans (for details see DSG Sections 11, 24, 25, 26, 27, 28, 29, 30, 31 and 32)

36.3 Master Site & Services Information (GIS)

University of the South Pacific (USP) has Master Site and Services CAD Information in place for each campus. The Site & Services CAD Information is a combination of AutoCAD Map3D drawings and Oracle spatial/textual database which is based on National Map Grid of Australia 1994 (region 56) coordinate system (MGA56). It is of utmost importance to USP that all new site and external services works are accurately surveyed as per **MGA56** and incorporated into the existing Site Information Drawings and Database.

Therefore it is the **Contractors responsibility** to notify the USP Infrastructure Systems & Information, GIS Administrator (x83628) of any exposed or intended newly placed underground services, at least two full working days (Monday to Friday) prior to backfilling or covering it.

The GIS Administrator will then decide if surveying and/or photos by himself is required:

- ☐ If required – The USP GIS Administrator will engage a surveyor to carry out and provide the survey work and photos and to the USP GIS Administrator
- ☐ If not required - USP GIS Administrator will visit site himself to take some basic measurements and photos and update the Site Information.
- ☐ The GIS Administrator will then can give permission to the Contractor to cover the exposed or newly placed underground services.

This Contractor is still responsible for accurate, survey quality, As Constructed CAD drawing information for all the new or altered services above or below ground as part of their documentation.

The requirements for USP Site and Services Information do not in any way diminish the requirements for accurate detailed As Constructed Drawings and Documents. The As Constructed Drawings also form a valuable archive resource for Property & Facilities and for future maintenance and improvement projects. Special attention should be given to USP's Definition of "As Constructed Drawings" in the following section.

See also section 3.4 relating to flood water information.

36.4 As Constructed – Definition

USP As-Constructed Drawings definition is to be read in conjunction with USP Design Standards and any requirements contained within the contract document.

5. An As-Constructed Drawing details precisely and accurately what has actually physically been built on the ground and can be segregated according to service area.
6. Services areas are, but not limited to, Architectural, Structural, Drainage, Plumbing (including Gas), Mechanical, Electrical, Communications, Security and Landscape.
7. Each service area As-Constructed drawing must include relevant pertinent features such as: Roadways, paths, steps, signs and light poles, buildings, manholes and pits. The final Architectural plans are normally used for this purpose but this is not a prerequisite. These features should enable with ease, clear identification and orientation when conducting a site visit accompanied with the relevant As Constructed A3 hard copy plan. Any incorrect information that may exist on any base plan must not be shown as part of the As-Constructed drawing.
8. Relevant information, but not limited to, service type, material type, diameters, connection positions to existing infrastructure and invert elevations are to be clearly annotated.
9. All details shown must be accurate and relevant to surrounding features. Traditional surveying methods for the capturing of this information are regarded as the most suitable method. However "taping in" of features from known identifiable objects is acceptable as long as there is always a check and sound procedures are adhered to. At least three measurements should always be taken from different feature points and these should also be form as close as possible an "acute angled triangle" to limit the possibility of error.
10. The accuracy should always be to within 0.1 meter.

It is important to note that As Constructed drawings will be subject to internal audit and this could involve conventional survey methods by a licensed Surveyor.

All As-Constructed drawings are to be supplied in electronic DWG and PDF format as detailed above. See section 40.5 for As Constructed Drawing Standard.

36.5 As Constructed - Drawing Standard

As Constructed, As Built or As Installed drawings covering all relevant building disciplines must be provided for every project. These drawings must include but are not be limited to the following requirements:

Drawing Numbers

Are made up in the following manner:

- ☐ USP project number (sample **C0000761 KG170**),
- ☐ Drawing number (sample **0001** for first architectural drawing)
- ☐ Discipline code (sample **A** for Architectural)

This unique drawing number serves as the unique ID for our records archive. For example drawing **C0000761 KG170 0001/A** is the first Architectural drawing for this sample project.

Abbreviation	Trade
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A	Architectural
AV	Audio Visual
C	Civil
DC	Data / Communications
E	Electrical
F	Fire Alarm Systems
H	Hydraulic
L	Landscaping
M	Mechanical (Air Conditioning Ventilation)
S	Structural
SE	Security Systems
SY	Survey
VT	Vertical Transport (Lifts)

Hard Copy – Drawings Requirements

- Legible when printed in A3 paper format
- Standard Title Block
- The USP logo, drawing numbers and WR. No. must appear on each drawing sheet
- The USP logo may be placed in the title block with reference to Client
- USP drawing number in the bottom right hand corner of each sheet
- Consultant's own identifying system may still be included

Soft Copy - CAD Requirements

Format	All drawings are to be provided in AutoCAD 2008 to 2012 compatible DWG format .	All site plans, floor plans, reflected ceiling plans, sections, part plans and details for each discipline; must be provided in CAD identical to the hard copies.
	All drawings are also to be provided in PDF format .	For each hardcopy plan there must be a corresponding PDF file and AutoCAD file. Where an AutoCAD file contains more than one plan, for example various perspective layouts, then there must be a corresponding PDF file for each separate plan and the tab title must correspond to the drawing file.
Drawing File Naming	The drawing file names must be the USP drawing number. This number with the DWG extension serves as the unique ID for our records archive.	
Fonts	All fonts and font styles must be in accordance with the standard font files provided by AutoCAD.	
Line Types	Use only standard AutoCAD line types .	

Layers	All entity colours and line types must be drawn BY LAYER .	Various drawing entities and annotations shall reside on layers with names relevant to the information they contain. They shall be on separate layers to make them more controllable.
	The layer naming convention must be provided with the CAD files.	
Blocks & Symbols	Must be created on layer 0 and then inserted onto the desired layer	
Scale	All drawing 1:1, except for survey drawings which are in scale 1:1000	
Xref's & Purging	The drawing files must include all the information necessary to view, plot and edit the drawings.	Bind all External Reference files (XREF). Every As-constructed CAD drawing file must contain all information on its own without the need to refer to external drawing files.
	CAD Plots of the drawings must match the hardcopy provided.	Purge all drawings of any unused block, title blocks, fonts, layers, line types, XREF, etc. prior to submission.
		DWG files sizes has to be reasonable and preferably not exceed 10Mb
Plot Style	The colour plot style files must be provided with the CAD files.	
Delivery	Provide one CD, DVD, or USB CAD & PDF drawings must be supplied on CD, DVD or USB with the Operations & Maintenance Manuals.	

Soft Copy - PDF Requirements

Every CAD drawing that's provided must also be provided in a PDF format and must be the exact copy of the final drawing.

Profile Plans

Where ever a project will cause a building floor plan to change or a new floor plan to be created, the USP profile plan for that floor must be updated or created as part of the project to the USP profile drawing standard and ARCHIBUS Space Management System by the Infrastructure Systems & Information unit.

36.6 As Constructed Documents - Operating & Maintenance Manuals

Equipment lists/Asset registers

USP uses the PM_TRACK asset management database for maintenance and legislative reporting requirements.

The Contractor is required to provide to USP detailed information on all assets included in this project. The information must be in the required Asset Register format (obtained from fm_records@USP.edu.au) to assist USP with the uploading into the PM_TRACK database.

The assets must be bar-coded and signed with the ID matching the register ID. USP will provide Excel template files and numbering conventions, which will include, but are not limited to the following list:

Category	Number	Name
Electrical (00-15)	01	Emergency Lighting
	02	Lift (Passenger)
	03	Lift (Service)
	04	RCDs
	05	Lightning Protection

	06	Generator Sets
	07	Generators (Diesel tanks)
	08	Switchgear
	09	Switchboards
	10	Universal Power Supply (UPS)
	11	Appliances
	12	Security Systems
Mechanical (16-34)	16	HVAC (BMS)
	17	HVAC (Chillers)
	18	HVAC (Cooling towers)
	19	HVAC (Filters)
	20	HVAC (General)
	21	HVAC (AHUs)
	22	HVAC (M&E switchboards)(09)
	23	Ventilation fans
	24	Fume Cupboards
	25	Air-compressors
	26	Vacuum pumps
	27	Heater Banks
	28	MOBD (FIRE)
	29	FAN-Intake/Exhaust (FIRE)
	30	Refrigeration plant and equipment
	31	Swimming pool plant and equipment
Fire (35-49)	35	Fire Doors
	36	FIPs
	37	Extinguishers
	38	Hydrants
	39	Sprinklers
	40	Evacuation (FIP?)
	41	Hose reels
	42	Suppression systems
	43	Fire Dampers (fusible link)
	44	Penetrations (Passive)
Hydraulics (50-64)	50	RPZs
	51	TMVs
	52	RO plant/deionisers
	53	Neutralising traps
	54	Grease traps
	55	Main sewer pumps
	56	Pumps
Building (65-79)	57	Hot water systems
	65	Automatic doors
	66	Roller doors, shutters
	67	Roofs & gutters
	68	Height safety systems

Other (80-99)	69	Overhead cranes/hoists
	70	Asbestos register
	80	Underground Fuel Tanks
	81	Flammable Liquids Stores
	82	PC Stock take
	83	Roof Antenna Points
	84	Commercial catering equipment
	85	Special plant and equipment

Operations and Maintenance Manual Contents

The required "typical" layout of manuals is detailed below:

Section	Details
Cover & General	A4 size loose leaf, in commercial quality, 3-ring binders with hard covers, each indexed, divided and titled. Include the following features: • Pagination: Number pages consecutively. • Cover: Identify each binder with typed or printed title "OPERATION AND MAINTENANCE MANUAL", to spine. Identify title of project, volume number, volume subject matter, and date of issue. • Ring size: 50 mm maximum, with compressor bars. • Text: Manufacturers' printed data, including associated diagrams, or typewritten, single-sided on bond paper, in clear concise English. • Dividers: Durable divider for each separate element, with typed description of system and major equipment components. Clearly print short titles under laminated plastic tabs. • Drawings: Fold A3 legible drawings to A4 size and accommodate them in the binders so that they may be unfolded without being detached from the rings. Provide with reinforced punched binder tabs.
Index	1. List of Contractors and Sub-contractors 2. List of Guarantees provided with copies 3. List of Certificates of Approval with copies 4. Copy of Site and Building Survey 5. List of 'As-constructed' drawings supplied 6. List of Specifications supplied 7. Warranty Schedule
Architectural	• As constructed drawings or final drawing set • Hardware • Complete schedule and description • Manufacturer's literature for all hardware items • Keying schedule • Keying diagram (tree) • Maintenance advice • Furniture/joinery

	Where fitted by the contractors supply manufacturer's literature and warranties	
	Finishes - Schedule and Description	Manufacturer's Literature
	For all internal and external finishes	Maintenance advice on: - Roofing - External wall treatments - Windows and doors - Internal wall treatments - Floor finishes
	Colour Scheme	Description, Manufacturer and Colour Name:
	Internal:	- Paint - Laminates - Carpet - Vinyl - Tiles
	External:	- Paint - Pre-finished materials - Tiles - Other external features
Structural	As constructed drawings or final drawing set	
Drainage	- Approved drawings - As Commissioned performance (tests and reports) - As-constructed drawings - Description of system - Manufacturer's literature - Advice on Maintenance	
Plumbing	- Approved drawings - As Commissioned performance (tests and reports) - As-constructed drawings - Description of system - Location drawing for all control valves - Manufacturer's literature - List of replacement fittings - Advice on Maintenance	
Water Services	- Approved drawings - As Commissioned performance (tests and reports) - Description of system - Location drawing for all control valves - Manufacturer's literature for all proprietary items including: - Taps and valves	

		- o Hot watercisterns - o Fire hose reels - o Fire hydrants - o Booster pumps - o Jacking pump - o List of replacement fittings - o Advice on maintenance • As Commissioned performance (tests and reports) • As Constructed Drawings
Mechanical Services	Air Conditioning	• Description of Plant • Operating instructions • Schedules of equipment and suppliers • Servicing and Maintenance Advice • Servicing and Maintenance schedule • Manufacturer's literature • As Commissioned performance (tests and reports) • As-constructed drawings
	Lifts	• Description of Operation • Operating and Maintenance advice • Servicing advice • Manufacturer's literature • As Commissioned performance (tests and reports) • As-constructed drawings
	Emergency Power Plant	• Description of Operation • Operating and Maintenance advice • Servicing advice • Manufacturer's literature • Schedules of equipment and suppliers • As Commissioned performance (tests and reports) • As-constructed drawings
	Pumps & Fans:	• Description of Operation • Operating & Maintenance advice • Servicing Advice • Manufacturers literature • As Commissioned performance (tests and reports) • As-constructed drawings
Electrical Services	Light & Power	• Description & circuitry diagrams • Details of switchboard • Distribution boards circuit ID/load • description Schedules • Schedule of light fittings & Manufacturer's literature • As Commissioned performance (tests and reports)

		As-constructed drawings
	Telephones	- Description of system - Operation advice on PABX etc. - Manufacturer's literature - As Commissioned performance (tests and reports) - Installation diagrams - As-constructed drawings
	Data Reticulation	- Description of system - Location of drawings - Manufacturer's literature - Installation diagrams - Maintenance instructions - As Commissioned performance (tests and reports) - As constructed drawings
	Audio Visual	- Description of system - Location of drawings - Manufacturer's literature - Installation diagrams - Maintenance instructions - As Commissioned performance (tests and reports) - As-constructed drawings
	Electrical Equipment	- Description of operation - Maintenance instructions - Manufacturer's literature (e.g. hand dryers etc.) - As Commissioned performance (tests and reports) - As-constructed drawings
Emergency Response	Evacuation Signs	As-constructed Evacuation Signs drawings
Fire System	Fire Alarm Systems	- Approved drawings (i.e. Approved from Qld. Fire Services Dept.) - Description of operation - Location diagrams - Maintenance instruction - Emergency procedure - Installers certificate - Certificate of compliance - Com and effect matrix - Austal lining details - As Commissioned performance (tests and reports)
	Fire Hydraulics (sprinklers and	- Description of Operation - Location diagrams

	hydrants)	• Maintenance instruction • Emergency procedure • Installers certificate • Certificate of compliance • Com and effect matrix • As Commissioned performance (tests and reports)
Security & Access Systems	Security & Access Systems	• Description of system • Location diagrams and installation drawings • Operating instructions • Manufacturer's literature • As Commissioned performance (tests and reports)
Landscaping	• As-constructed drawings • Schedule of all planting • Manufacturer's operating instructions • Maintenance advice on • Lawns, vines, ground covers, shrubs, trees • Landscape lighting • Irrigation system: ○ Approved drawings ○ As Commissioned performance (tests and reports) ○ As-constructed drawings ○ Description of system ○ Location drawing for all control valves ○ Manufacturer's literature ○ List of replacement fittings ○ Advice on Maintenance	
Equipment Lists	All equipment and registered plant information shall be provided as per the format detailed in "Equipment Registers" available from USP Infrastructure Systems & Information. Email fm_records@USP.edu.au	
Warranties	General: Name the principal as warrantee. Register with manufacturers as necessary. Retain copies delivered with components and equipment. Collate and list all warranties in schedule below.	
	Commencement of Warranty: Commence warranty periods at practical completion or at acceptance of installation, if acceptance is not concurrent with practical completion.	
	Approval of installer: If installation is not by manufacturer, and product warranty is conditional on the manufacturer's approval of the installer, submit the manufacturer's written approval of the installing firm.	
	Warranty schedule	
	Warranty	Form
		Period

Plans	Each manual is to include a full set of relevant A3 plans folded to fit in binder.
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The actual range and content of manuals provided will be dependent on the range and complexity of elements incorporated in the as constructed facility.

Operations and Maintenance Manual – Hardcopy

USP requires two hardcopy Operations and Maintenance manuals and one electronic PDF searchable manual.

Operations and Maintenance Manual – Softcopy PDF

The searchable PDF manual is required from 2012 and it must be an exact copy of the hardcopy manual. The Microsoft Word and Excel files that were used to produce the original manual must also be provided in their original format to the Infrastructure Systems & Information Unit. This is to ensure that USP has all the original document formats if any information updates are required in future.

All the electronic files must be provided on CD, DVD or USB device with the Operations and Maintenance manuals. Only one working copy is required.

36.7 At Practical Completion

At Practical Completion the Contractor must provide Operating and Maintenance Manuals and As Constructed drawings in hard copy, A3 legible and soft copy DWG & PDF format to the USP Project Coordinator.

The content and quality of these documents must have been reviewed and approved by the Project Consultants, prior to distribution to USP.

Approval must be obtained from USP for any deviations from these standards.

The As Constructed set is to include:	
Architectural plans	• A set of floor plans including roof plans relevant to the project with dimensions, floor finishes, walls, doors, partition types and furniture layouts. • Major elevations relevant to the project (exclude detailed internal elevations) • Major sections relevant to the project (exclude detailed sections) • RCP's relevant to the project • Schedules, including blinds & window drapes. • Profile plans with USP ARCHIBUS room numbers and Evacuation plans, or updates to them.
Engineering Documentation	All civil, structural, mechanical, electrical, lift, hydraulics, data and communication, fire services and any other services drawings relevant to the project.
	Drawings: • Provide plans, operating information and schematics appropriate to the long term maintenance of the facility, statutory requirements and as requested elsewhere in this standard. • A consolidated and co-ordinated drawing showing all passive fire requirements- as

	per DSG Section 30 Fire Services - Clause 23.4d • Submit a record or the as constructed drawings that show "as installed" locations of all building elements, plant and equipment. For Services show dimensions, types and location of equipment, cables, piping and ductwork in relation to permanent site features and other underground services. Connection points to existing services must be clearly indicated on the drawings. Include relationship to building structure and other services, and changes made during commissioning and the maintenance period. • Include schematic/diagrammatic drawings of each system showing piping and wiring, and principal items of equipment. • This set must include all records, approvals, certificates, amended specifications, information and shop drawings for all building elements of the project. Such elements would typically include:- architectural, structural, civil, plumbing and drainage, electrical, mechanical, fire services and landscape. • The title block, project number and drawing numbering system on all drawings must follow the USP standard Format, see below. Any deviation to the standard format will not be accepted without the prior approval of USP Infrastructure Systems & Information Manager.
	O&M Manuals: • As Constructed documents must include operating and maintenance manuals for all plant and equipment and lists of prescribed equipment must be provided. • As Constructed Documents and Maintenance Manuals must be provided in both hard and soft copy. The soft copy is to be scanned in colour (min 200dpi) Acrobat PDF file of all pages in the hard copy and/or approved MS Office and CAD files. Note non relevant information such as a full supplier's product brochure when only a page is required, should not be excluded. • 1 x Soft copy, original files and full searchable PDF copy, to be provided on CD, DVD or USB. • 2 x Hard copy:- Titled: - o Controlled copy - kept in the ISI archive and must include all originals - o Site copy – kept in building plant
Reports and Certificates	The consultants are required to provide all reports and certificates associated with the project and may include: • A certificate from an appropriately accredited private certifier as to whether the design and documentation comply with standard building regulations • Certification from each consultant that the scope of work they are responsible for has been designed in accordance with the USP Design Standards and Guidelines • Fire engineering reports • Acoustics reports • QFRS certificates
Document Register	Provide the details for all the documents (drawings, reports, certificates, manuals, etc.) as per the USP Documentation register excel file, supplied by the USP Project Coordinator, per project (generated through SARTRACK).

36.8 Transmittal Form

The final document delivery to the Infrastructure Systems & Information unit for archiving must be via a SARTRACK generated transmittal form.

36.9 Summary of Deliverables

The following list summarises the deliverables referred to in the Design Standard Guidelines. Items can only be excluded with prior USP approval and if they have been included on the DSG Compliance Certificate (FMP314).

Project Stage		
Document Set	Reference	Format
Design		
Functional Design Brief Strategic, Technical, ESD, Fire & Engineering	DSG 3.3	1x set
HVAC	DSG 24.3	1x set
Plumbing & Drainage	DSG 25.3 DSG 26.3	1x set
Fire	DSG 30.5	1x set
Evacuation Sign(s)	DSG 30.29	1x set
Landscape	DSG 39.18	1x set
Detailed design reports	DSG 40.2	1x set (min)
Schematic design docs	DSG 40.2	1x set (min)
Design review documents	DSG 40.2	1x set (min)
Finishes/colour boards	DSG 40.2	1x set
Presentations and Models	DSG 40.2	1x set if relevant
Basic floor plan to obtain Room Numbers	PM4093	1x soft copy
Tender		
Full set of documents for tender call	DSG 40.2	3x hard copy full size, 1x soft copy, 3x A3 size (Project Coordinator), 1x A3 size (for Archive)
Certificate of Compliance with DSG	PM6421	1 set

Stakeholder sign-off form	PM6331	1 set		
Detailed Commissioning Plan	DSG 40.2	1 set		
Construction	Reference	Softcopy on Disk (Qty.)	Hardcopy (Qty.)	
Detailed Commissioning Plan Sets (updated)	DSG 24.25		2x Set	
Fire	DSG 30.4		1x Set	
Communications	DSG 28.8	1x	1x	
Landscape	DSG 39.19	1x	1x	
Full set of documents for construction	DSG 40.2		2x Full size for Contractor	
			2x Full size for USPP Project Coordinator	
Shop drawings and detailed info as required for Construction	DSG 40.2		A3 size set for ISI Archive	
Basic floor plan with room numbers to specified AutoCAD format	DSG 40.5.2	1x	1x	
At Practical Completion	Reference	Drawing Softcopy on Disk (Qty.)	Drawing Hardcopy (Qty.)	Include in Operations & Maintenance Manual and PDF
Architectural Plans	DSG 40.4	1x DWG set & 1x PDF set		1x A3 drawing set
Engineering Plans	DSG 40.4	1x DWG set & 1x PDF set		1x A3 drawing set
Reports & Certificated including Certificate of Classification	DSG 40.4	1x PDF set		Included
Register (completed)	DSG 40.4	1x DWG set & 1x PDF set		Included
Equipment lists including all registered plant	DSG 40.6.10	1x DWG set & 1x PDF set		Included
Warranties	DSG 40.6.11			Included
For all services - Commissioning tests and reports	DSG 40.2			Included

Communications - Commissioning tests and reports to be sent to USP- ITS	DSG 28.8			Included
Communications	DSG 28.8	DWG & PDF		Included 1x A3 drawing set
Building Users Guide	Man - 55	1x DWG set & 1x PDF set		
Learning Resource (for projects aiming for a Green Star Rating)	Man - 55	1x DWG set & 1x PDF set		
Audio Visual	DSG 23.10	1x DWG set & 1x PDF set	1x A3 Set	Included 1x A3 drawing set
HVAC	DSG 24.27 & 28	1x DWG set & 1x PDF set	1x A3 Set	Included 1x A3 drawing set
Plumbing & Drainage	DSG 25.17 & 18 DSG 26.30 & 31	1x DWG set & 1x PDF set	1x A3 Set	Included 1x A3 drawing set
Electrical	DSG 27.24	1x DWG set & 1x PDF set	1x A3 Set 1x A3 Set in Switch Room or Switchboard	Included 1x A3 drawing set
Lifts	DSG 29.15 & 16	1x DWG set & 1x PDF set	1x A3 Set	Included 1x A3 drawing set
Fire	DSG 30.27 DSG 30.30 DSG 30.32	1x DWG set & 1x PDF set 1x A3 Hardcopy in Fire Panel	1x A3 Set	Included 1x A3 drawing set
Evacuation Sign(s)	DSG 30.29	DWG & PDF	Installed on Site	Included 1x A3 drawing set
BMS	DSG 32.24	DWG & PDF	1x A3 Set	Included 1x A3 drawing set
Landscape	DSG 39.20 & 21	DWG & PDF	1x A3 Set	Included 1x A3 drawing set

GIS - Site & Services	DSG 40.3	DWG & PDF	1x A3 Set	Included 1x A3 drawing set
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Part 5

Appendices

Appendices are separate documents that are referenced in this DSG.

Appendix	Title
14	CAD Drawing, Standard Acoustic Details, Dated 1 Oct. 2002
18.2	Wayfinding Signage Manual, Issue C, Dated 15.11.2012
19	Policy on Future Design of Teaching Space, Update 411, Aug. 2005, Issued Dec. 2005
23.1	Audiovisual Installation Standards and Guidelines, Dated 10.10.12
23.2	Audiovisual Installation Standards, Reviewed in 2012
32.4	BMS Examples of Standard Graphic Pages
32.5	BMS Specifications
32.6	BMS Programming Details
39.22	Landscape Maintenance
39.22	Landscape Protection Guidelines for USP Campuses