

Queensland University of Technology

Facilities Management DESIGN STANDARDS AND GUIDELINES

Edition 7 Amendment <mark>7</mark> – November <mark>2022</mark>

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Modifications and Approvals

Version	Issue Date	Modification Clause(s)	Comment	Approved By
E7A0	11 Nov 2016	1.8, 9.7, 11, 28.5 & 28.6	Updated Six Monthly edition. All additions and changes are in Yellow, deletions are not shown	Geoff Dennis
E7A1	7 June 2017	1.8, 28.5, 28.7, 28.8, 27.10 (New), 28.20, 40.1 & 40.6 (New)	Updated Six Monthly edition. All additions and changes are in Yellow, deletions are not shown	Steve Low
E7A2	3 Nov 2017	9.7, 11.16.3, 11.16.13, 11.16.16, 11.16.25, 24.21, 27.10, 32.1 to 7, 40.5, 40.5.2 & 40.5.6	Updated Six Monthly edition. All additions and changes are in Yellow, deletions are not shown.	Geoff Dennis
E7A3	29 May 2018	1.2, 1.4, 1.7, 1.8, 28.2, 28.5 to 7, 28.9, 28.10, 28.17, 28.19 & 40.5	Updated Six Monthly edition. All additions and changes are in Yellow, deletions are not shown.	Geoff Dennis
E7A4	May 2020	Sections: 1, 2, 3, 4, 6, 9, 10, 11, 14, 15, 17, 18, 19, 20, 24, 25, 26, 27, 29, 30, 31, 32, 37 (New), 40	Full review. All additions and changes are in Yellow in individual sections, deletions are not shown.	Geoff Dennis
E7A5	25 Sept 2020	3.7, 3.16, 8.1, 10.2, section 28, section 30	Updated Six Monthly edition. All additions and changes are in Yellow, deletions are not shown.	Geoff Dennis
E7A6	6 Oct 2021	Section 11, 23.7, 23.8, 24.15- 24.17, 27.7, 27.8	Updated annual edition. All additions and changes are in Yellow, deletions are not shown.	Nathan Richardson
E7A7		Section 1.8, 3, 11, 18, 28, 32, 40.4	Updated annual edition. All additions and changes are in Yellow, deletions are not shown.	Nathan Richardson

1 Introduction

The QUT 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 QUT 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 QUT 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 in the:

- QUT Digital Workplace for FM staff only <u>https://qutvirtual4.qut.edu.au/group/staff/technology-and-facilities/facilities-and-spaces/building-and-grounds-management/new-works/design-standards-and-guidelines</u>
- Public QUT website for contractors <u>https://www.qut.edu.au/additional/contractors</u>

The review process draws on the extensive knowledge and experience of Responsible QUT Officers (RQO) as listed in the table in section 1.8.

From 2011 a six monthly review process was established in March and September.

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 22 to 33
Part 3	External Design	Section 38 & 39
Part 4	Documentation Requirements	Section 40
Appendices	Appendices	Various

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

1.5 Legal Requirements

A key function of the QUT 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 QUT. 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 QUT Officers [RQOS] must occur. Refer to Table in this section.

Where Australian 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 QUT through the Director, Facilities Management, Victoria Park Road, Kelvin Grove, Queensland, 4059.

Construction Authority

The Construction Authority for all University projects shall be the Facilities Management Department.

Superintendent

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

Project Co-ordinator

Generally, communications with the University, requests for approvals etc., shall be addressed to the University's Project Co-ordinator in the first instance. The Project Co-ordinator shall arrange for subsequent internal approvals as required.

Definition of 'Approved'

Wherever the word approved or approved by QUT 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.

Initial Request and Recommendation

In some instances Responsible QUT Officers (Table 1.8) will need to consult with other University staff before being able to give a decision based on potential changes to risk levels amongst other considerations. These recommendations shall form a part of the 'Pre Tender Approval' process.

Final Approval

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

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 "Consultant Certification of Compliance" PM 642 must be completed for all projects that require FM Procurement Committee (FMPC) approval.

A request for approval of the variation must be made to the QUT Project Coordinator. Relevant *Responsible QUT Officers* (RQO) will be consulted and provide the necessary recommendations.

Table of Responsible QUT Officers (RQO) for non-compliance recommendation and reviews

Sect.	DSG Section name	QUT Position
1	Introduction	Associate Director, Estate Planning
2	Planning Controls	Associate Director, Estate Planning (Sam Dryhurst & Steve Low)
3	Architectural Design	Associate Director, Capital Works (Steve Low & <mark>Associate Director, Estate Planning</mark>)
4	External Walls and Windows	Manager, Maintenance Services (Peter Neale & Steve Low)
5	Internal Walls	Manager, Maintenance Services (Peter Neale & Andrew Reedman)
6	Floors	Manager, Maintenance Services (Peter Neale & Nancy Lee)
7	Ceilings	Manager, Maintenance Services (Peter Neale)
8	Roofs	Manager, Engineering Services (Nathan Richardson & Peter Neale)
9	Furniture and Fittings	Manager, Maintenance Services (Sam Dryhurst)
10	Doors, Hardware and Locks	Manager, Maintenance Services (Ian Waring) & Manager Security Services (Tracey Bartlett)
11	Building Security	Manager, Security Services (Andrew Drylie & Tracey Bartlett)
12	Structural Design	Manager, Maintenance Services (Kosta Meltzinitis)
14	Acoustics	Manager, Engineering Services (Geoff Woods)
15	Painting	Manager, Maintenance Services (Peter Neale & Peter Stegman)
16	Access for PWD	Associate Director, Estate Planning
17	Workplace Health and Safety	Manager, Maintenance Services (Derek Thomas)
18	Signage	Associate Director, Estate Planning (Sam Dryhurst & Peter Crossland)

19	Teaching Spaces	Manager, Space Planning (Emma Samuel)
20	Laboratories	Manager, Engineering Services (Geoff Woods & Kosta Melzinitis)
22	Videoconference Facilities	Associate Director, Learning Environments (Adrian Whitaker)
23	Audio Visual	Associate Director, Learning Environments (Adrian Whitaker)
24	Air Conditioning and Ventilation	Manager, Engineering Services (Geoff Woods & <mark>Adrian Rowe</mark>)
25	Water Supply etc.	Manager, Engineering Services (Nathan Richardson & Peter Kelly)
26	Other Piped Services	Manager, Engineering Services (Nathan Richardson & Peter Kelly)
27	Electrical Services	Manager, Engineering Services (Ai-leen Jenkins & Ross Benson)
28	Data & Communications	Associate Director, Infrastructure Services ITS (Dom Lacanau & David Pickworth)
29	Lifts	Manager, Engineering Services (Jaye Hamlet)
30	Fire Services	Manager, Engineering Services (Nathan Richardson & Steve Brett)
31	Fume Exhausts and fume Cupboards	Manager, Engineering Services (Geoff Woods & <mark>Adrian Rowe</mark>)
32	Building Management System	Manager, Engineering Services (Paul Thorn & Norm Higgins)
33	Colour schedules for Plant and Equipment	Manager, Engineering Services (Geoff Woods)
37	3D Models & Data (BIM)	Manager, Infrastructure Systems & Information (Cornelius Opperman)
38	Roads Footpaths and Car parks	Manager, Maintenance Services (Peter Neale)
39	Landscape	Manager, Facilities Services (Naomie Hewitt)
40	Documentation	Manager, Infrastructure Systems & Information (Cornelius Opperman)

Note the following sections are left blank intentionally: - 13, 21, 34, 35, and 36.

DSG Part 1 - Architectural

2 Planning and Development Controls

2.1 Governance

Planning and construction of new developments on the QUT estate, and the maintenance and improvements/renewal of existing developments, comply with QUT's legal obligations and standards. The term "development "has the same definition as in the Planning Act 2016, that is—

- (a) carrying out—
 - (i) building work; or
 - (ii) plumbing or drainage work; or
 - (iii) operational work; or
- (b) reconfiguring a lot; or
- (c) making a material change of use of premises.

QUT exercises its physical Estate planning, development, maintenance and improvement responsibilities in accordance with its strategic development priorities, its powers under the QUT Act 1998, and applicable provisions of Queensland's statutory planning framework.

It is very important to ensure the exercise of these responsibilities and powers remains consistent with and in accordance with statutory framework applicable at that time.

The funding arrangements for a particular development project may affect the scope of development controls. For example, a development project that has Commonwealth loan funding will likely result in the need for the development to comply with the planning and development standards and processes set by the Commonwealth government. The controls associated with these particular arrangements will need to be addressed on a case by case basis.

2.2 Procedures

Background

The Queensland University of Technology Act 1998 (The QUT Act) provides powers and responsibilities for QUT to manage and control its property for the functions of the University.

All development proposals on QUT land that is not freehold must be in accordance with the legal authority for QUT's occupancy (lease, licence or other agreement), and may require the landholder's consent.

The Planning Act 2016 (PA) is the statutory planning instrument for the State of Queensland which sets out, amongst other matters, how development is controlled. The PA provides for Infrastructure Designations that identify locations for the development of one or more types of community infrastructure, such as educational facilities, hospitals and transport, etc. Such development is Accepted Development, avoiding Development Assessment triggers in the local government planning scheme, although other state legislation and regulatory requirements, such as building, heritage places and environmental management, continue to apply.

All of the Gardens Point campus (except for the leased areas for the under-freeway car park and Old Government house) and a major part of the Kelvin Grove campus are covered by an Infrastructure Designation for Education Facility purposes. (Refer Figures 2.1 and 2.3)

As set out in the Estate Master Plan 2018, QUT does not seek to amend the existing Infrastructure Designations and will continue to exercise its relevant planning and development responsibilities in accordance with the current Infrastructure Designations and the Planning Act 2016.

None of QUT's distributed sites are within an Infrastructure Designation area.

If a proposed development project is not located within an Infrastructure Designation area or is inconsistent with the Infrastructure Designation Education Facility purpose, the proposed development will need to be assessed in accordance with the relevant local government planning scheme and may trigger the development assessment process.

If planning and designing a development project which may include land that is not within an Infrastructure Designation area, or that may not be consistent with the purpose of an Infrastructure Designation, an expert consultant experienced in the relevant local government planning scheme and the associated development assessment process should be appointed to provide town planning advice and guide QUT's development application strategy, preparation and coordination.

When planning and designing a new development or maintenance or improvement of an existing development that triggers other state legislation and regulatory requirements, such as building, heritage places and environmental management, expert consultants experienced in the relevant state legislation and regulatory requirements should be appointed to advise and assist in the planning and design.

For example as shown on Figures 1 and 3 both QUT campuses include significant areas with buildings and features that are listed on the State Heritage Register and the Brisbane City Council Local Heritage Register. Prior to planning or undertaking any building work, consult with the Estate Planning Team in Facilities Management for assistance and advice regarding obtaining expert consultant advice services. Activities in a heritage listed site will need to consider if they fall within general exemption provisions or an exemption certificate issued to QUT, and if not require heritage assessment and approval processes. Table 1 in the Attachments lists the current heritage management plans and protocols for each campus.

Gardens Point and Kelvin Grove Campuses

The planning and approval of proposed development on the Gardens Point and Kelvin Grove campuses is controlled by a number of components of the statutory planning framework. The extent of these controls over the campus is illustrated in Figure 2.1 for Gardens Point and Figure 2.3 for Kelvin Grove campus. The application and operation of these controls for planning and development on these campuses is outlined below:

Most of the Gardens Point campus and a large part of the Kelvin Grove campus are currently subject to an Infrastructure Designation under the Planning Act 2016. The Certificate of Designation for each campus is for a facility primarily intended as an Education Facility described as;

"A facility intended primarily as an Education Facility, described as: a place of higher education with the associated teaching, research, social and public support functions, including car parking, cultural and sporting facilities, residential and conference accommodation, together with a range of commercial activities allied with the university."

Both Certificates of Designation are subject to the following conditions;

- 1. The Brisbane City Council is involved as a stakeholder in the Gardens Point Campus' Master Plan.
- 2. An appropriate public consultation be undertaken on projects which have significant impact on the local community.
- 3. The University continues its practice of liaising with the EPA in relation to environmentally relevant activities.

Condition 1 has been met in regard to the Estate Master Plan 2018. Conditions 2 and 3 are to be followed for all "Education Facility" developments which may have significant impact on the local community e.g. for a development on or near to the campus boundary. Condition 3 is to be followed for all other 'Education Facility' developments.

Proposed development that is within the provisions of the Infrastructure Designation is assessed and approved through the University's own governance processes and powers as provided by the QUT Act, with no development assessment or approval required under the Planning Act, except for approvals required under other legislation where applicable such as for building, heritage places, and environmental management.

Where a proposed development on a campus is not within the provisions of the Infrastructure Designation, a development approval may be required from the local government authority, in this case the Brisbane City Council. The Brisbane City Plan 2014 (the City Plan) is the applicable local planning instrument. The development assessment process also has regard to state requirements, as outlined in the State Planning Policy, the South East Queensland Regional Plan and State Referral Triggers. The application of state and local planning requirements will depend on the nature and intensity of the proposed development and the subject site's locational characteristics in relation to public infrastructure and heritage places.

A proposed development may or may not attract infrastructure charges levied by the relevant local government and water services provider, and this will be influenced by whether the development is located with a designated area or not. Development not located in a designated area will likely attract infrastructure charges. Development on designated premises for the prescribed type of infrastructure that is carrying out plumbing work or operational work, reconfiguring a lot or making a material change of use is accepted development for which an infrastructure charges notice cannot be issued. Development on designated premises for the prescribed type of infrastructure that if the building work complies with relevant provisions of section 21 of the Building Act 1975 (Qld) (BA) in which case an infrastructure charges notice cannot be issued.

As shown in Figure 2.1 for Gardens Point campus and Figure 2.3 for Kelvin Grove campus, a major part of each campus' land and buildings is listed on the Queensland Heritage Register. Proposed developments in these areas are subject to controls provided for under the Queensland Heritage Act 1992. The Brisbane City Plan 2014 also notes the entire Gardens Point campus and large reserve lot containing A Block as Local Heritage Places.

The land tenure of both campuses includes state land reserve, freehold land, lease agreements and easements. As shown in Figures 2.2 and 2.4, a major part of the land on which the campuses are located is state reserve for educational purposes held in trust by QUT. A Trust Land Management Plan was developed for each campus in accordance with the Land Act 1994. The Trust Land Management Plan for Gardens Point campus was approved in December 2013 to have effect for 20 years to November 2033, and the Trust Land

Management Plan for Kelvin Grove campus was approved in March 2015 to have effect for 20 years to February 2034.

The Trust Land Management Plans are designed to ensure that the management, development and use of the reserve land is consistent with the relevant statutory guidelines and the education purpose of each campus. Development on each campus does not need the State Land Minister's landholder's consent to a new development provided the development is consistent with the education purpose of the reserve. QUT is able to issue leases for up to 100 years in a Land Management Plan Area provided QUT complies with the relevant Trust Land Management Plan and its powers under the QUT Act 1998.

Distributed Sites

QUT owns, leases, or otherwise invests in distributed sites that are located at places other than Gardens Point or Kelvin Grove campuses. Development controls for QUT's distributed sites vary from site to site, but none of the current distributed sites have an Infrastructure Designation, meaning that their use must be in accordance with the planning and development controls of the relevant local government and will be subject to infrastructure charges applying in the local government area. In addition, their use must be in accordance with the legal authority for QUT's occupancy (lease, licence or other agreement).

The planning and development of new distributed sites should always include a check on the relevant local government planning scheme to establish the development assessment process required for the proposed use. This should be done through obtaining expert advice from a town planning consultant before a commitment is made to QUT's occupancy of the site.

2.3 Other Legislation Controls

All work shall be designed and constructed to comply with statutory requirements including the Building Act, the Building Code of Australia, Local Government Ordinances, the Fire Safety Act, Anti-Discrimination Legislation, Environmental Protection Legislation and the Work Health & Safety Legislation. All approvals necessary shall be obtained before construction commences or during construction as appropriate such that progress of the works is not delayed. Evidence of all such approvals and the payment of associated fees shall be lodged with the University.

The QUT Act

QUT, as a statutory authority under the QUT Act in Queensland (see MOPP section A/1 and section H/1), must comply with the Building Act 1975 (including the Standard Building Regulation 1993 and the Building Code of Australia 2004). The University performs the duties of a local authority, as defined in the Building Act, for building works carried out for University purposes.

2.4 QUT Planning Controls

Estate Master Plan

The QUT Estate Master Plan 2018 covers the Gardens Point and Kelvin Grove Campuses. It should be consulted for all new capital, full refurbishment and major refurbishment projects.

Sustainability

- New Capital projects shall meet the targets outlined in any sustainability plans that QUT may produce.
- Full building refurbishment projects shall positively contribute to the targets outlined in any sustainability plans that QUT may produce.
- Major building refurbishments shall aim to positively contribute to the targets outlined in any sustainability plans that QUT may produce.

Design Approvals

The University has various levels of approval for project designs and these may include:

- Strategy Planning and Development Group
- Capital Development Group
- Design presentation to the Vice-Chancellor and/or QUT Council.

External Elements

Later sections of these Design Standards and Guidelines should be read in conjunction with the applicable Master Plan to determine what building controls apply including the following:

- Signage
- Cyclists access and facilities;
- Pedestrian traffic, paths and paving
- Vehicular traffic and traffic control
- External lighting
- Behavioural controls (CEPTED, skateboards, traffic)
- service or maintenance access
- entry locations and access for people with disabilities (PWD)
- external walls and windows
- roofs
- landscape elements

Building Relationships

Covered ways, links to adjoining buildings, building lines, levels, and entrance points will be *specified* for *each building*.

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 minimised 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 and safely accessed and expanded and to allow for future flexibility.

Role of the Equity Section

The key role of the Equity Section is to develop an organisational culture that values diversity and equal opportunity. The Equity section will advise on matters of access. Section 16 – Circulation of these Design Standards and Guidelines deals with the regulatory requirements for persons with disabilities. Where particular needs are identified in the briefing process, the University's Disability Officer/s must also be consulted.

For QUT policy see the Equity Section <u>https://www.qut.edu.au/about/equity</u>. The University recognises 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 recognised that in making buildings and facilities accessible to people with disabilities others will also benefit. The University has adopted a Disability Services policy which recognises 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.

2.5 Other Matters

Moral Rights

The Moral Rights of designers need to be acknowledged and acted on where necessary as per the Copyright Amendment (Moral Rights) Act 2000. Alteration and demolition projects will be reviewed by QUT at the project planning stage to determine necessary actions.

2.6 Resources

Further Advice

Further advice on this Procedure and on particular planning and development proposals should be sought from the Estate Planning Team in Facilities Management.

Figures 2.1, 2.2, 2.3, 2.4 – Campus Property Maps Table 2.1 - Heritage Management Plans and Protocols

Figure 2.1 - QUT Gardens Point Development Controls



- Property boundary
- Infrastructure Designation Area (Educational Facility) as designated 20.4.2000
- **////** State Heritage Listed Building
- State Heritage Listed Sites boundary

Figure 2.2 - QUT Gardens Point Tenure









- Property boundary
- Infrastructure Designation Area (Educational Facility) as designated 20.4.2000
- Infrastructure Designation and Queensland Heritage Register Listed Site (QUT Property)
- Brisbane Heritage Register listed building
- Queensland Heritage Register listed building
- Queensland Heritage Register listed site (QUT Property)
- Queensland Heritage Register listed site (BCC Property)

Figure 2.4 - QUT Kelvin Grove Tenure





Table 2.1

Gardens Point Campus

- QUT Buildings QH ID: 601728
 - o Conservation Management Plan, Allom Lovell Architects 1997
 - o Heritage Management Protocol, Allom Lovell Architects 2005
- Old Government House QH ID: 600118
 - Conservation management Plan including Appendices on maintenance, grounds and housekeeping, Andrew Ladlay Architects 2011 updated 2017

Kelvin Grove Campus

- A Block
 - Locally listed heritage place within the Heritage Overlay of Brisbane City Plan 2014.
 - Not State Heritage listed
- Former Gona Parade QH ID: 601966
 - Heritage Management Protocol, Allom Lovell Architects 2004 CIP 1 including Parer Place and Gona Parade ground north
 - o Heritage Management Protocol, Thom Blake 2017 CIP 2 (buildings only)
- Student Residences QH ID:602235
 - No completed heritage management plan or protocol

Exemptions

- General Exemption
 - All State listed Heritage places are subject to the General Exemption prepared by the Department of Environment and Science: https://www.qld.gov.au/__data/assets/pdf_file/0017/66212/genex_certificate.pdf

• Specific Exemptions

- There are two specific heritage exemptions, one for Gardens Point and one for CIP2 buildings, as follows:
 - Gardens Point QUT Buildings QH ID: 601728 Level 2 work in Heritage Management Protocol, Allom Lovell Architects 2005, Exemption valid to March 2020.

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.

Major projects will mean >\$3M or as directed.

3.2 Functional Design Brief (FDB)

For each major project a detailed Functional Design Brief is to be prepared by the Project Manager in consultation with the consultants and *Project Reference Group* (PRG). The Strategic brief section of the Functional Design Brief must be approved by the *Project Control Group* (PCG) and submitted to QUT prior to the development of sketch plans.

The Technical brief may form part of the Schematic design report and must be presented at sketch design stage.

The Schematic design report brief must incorporate the project specific requirements of the QUT stakeholders and be revised or updated as the project progresses.

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 QUT.

Strategic Brief

- Overview and Purpose
- QUT context (including Master Plan)
- Design aspiration and intent
- Building concept
- Design parameters
- Human Factors

Technical Brief

- Outline of the proposal
- QUT context (including Master Plan)
- Design aspiration and intent
- Urban design outcome
- Site position and connections
- Entries
- Circulation
- Foyers
- Space relationships
- Building Efficiency
- Environmentally Sustainable Design (ESD)
- Provision of Building Services
- Crime Prevention through Environmental Design (CPTED)

- Provisions for PWD
- Designed for Safety and health of users and occupants
- BCA and Performance based Assessment
- Site infrastructure changes
- Design Statements per Building Service
- Serviceability access for Maintenance
- Maintainability and life cycle costing
- Landscape
- Schedule of Areas

Programs and Budget Statements

Laboratory Design Briefs

Laboratory design briefs require particular care. The designer must be fully conversant with applicable legislative requirements. Further, in the briefing 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 AS2982.1 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.

Sustainable Design Brief

For each new project and for major refurbishment projects a detailed brief describing the project objectives responding to adopted Sustainability Action Plan (SAP) must be prepared. This brief should address the themes identified in the SAP as are relevant to the size and scale of the project.

Fire Engineering Design Brief (FEDB)

A Fire Engineering Design Brief (FEDB) shall be established by the design consultants at the "Sketch Plan 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 FEDB, liaise with the QUT Technical Officer Essential Services (Refer to Section 30 – Fire Services).

3.4 Safe Design Principles

Site design is a process of integrating hazard identification and assessment of risks early in the design process to eliminate or minimise the potential risks of injury or ill health throughout the life of the structure or building. Safe design begins from the earliest conceptual and planning stages and considers the whole lifecycle of the building or facility.

Safe design is only one of a number of other design objectives in any project - cost, aesthetics, practicality and function. However, it must be held foremost in the minds of designers and planners, in achieving an acceptable balance between all competing goals, that the health and safety of those who may be affected during the life span of the building is not compromised.

Eliminating significant building hazards at design and planning stages reduces downstream life cycle costs through reduced need for PPE, retrofitting of add-on safe guarding systems, extraction and ventilation systems, minimised testing and maintenance of equipment and added administrative workloads.

It provides opportunities for improved useability of work systems and facilities, increased efficiency, improved prediction and management of operational costs over extended periods, compliance with legislated standards and exciting innovations in safe design.

In particular, issues that affect occupants or users and their work-life health and safety quality, such as safe access, safe plant and equipment, layout and space, acoustics, choice of building materials, work systems and ergonomics of human interaction must be addressed throughout the project through consultative processes within QUT Facilities Management.

Flood Proofing Buildings

Following the 2011 Brisbane river floods a design directive was issued as follow:

- No water will enter the building for a flood of 0.1m above 1974 level.
- All critical infrastructure must be located a minimum of 1.3m above 1974 flood level.

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 CPTED considerations, it also relates to the convenience of users and effective way-finding on each campus. Entrances should be readily identifiable and easily identified. 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 QUT graphic standards (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 to 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 QUT.

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. All glazed walls must be clear glass with the exception of safety decal unless prior approval is obtained from the Director FM. (Also refer to 3.15 Enclosed Office Fitout and Services). In approved cases the film to be applied shall comply with the below standards:

- There are two approved QUT designs that can be chosen, the QUT Project Manager is to provide these designs.
- Transparency requirements: 60% dusted minimum white density for majority of print, contrasting print aspects should be 100% transparent.
- Minimum height from ground: 450mm (Diagram 3.7)
- Maximum width of film: 1220mm (Diagram 3.7)
- Maximum height from ground: 1850mm (Diagram 3.7)





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:

- 0.8 for ceilings
- 0.6 for walls
- 0.4 for floors
The reflectance schedule along with a draft colour and finishes schedule must be presented to QUT 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 – Acoustics.

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

Refer to Section 14 – Acoustics and Section 11 – Security

o 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 QUT.

\circ 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.

\circ Access to toilets

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

3.12

Foyers and Corridors

Circulation

Foyer size and width of corridors shall be commensurate with the needs of the building and its users, including being appropriately inviting and welcoming.

Vertical Transport

Vertical transport shall be provided in the design of all multi-level buildings. Lifts and escalators 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 QUT. 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 Director FM will advise of approval of all new campus names and their two digits letter abbreviations. For example; Gardens Point campus = GP, Kelvin Grove Campus = KG, etc.

Building Names

QUT Council has delegated authority to the Vice-Chancellor to approve the naming of University buildings (Refer to QUT Manual of Policies and Procedures, Chapter H, Section 3.3.1).

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.

- All significant buildings will have a unique alpha building letter that relate to that campus. For example KG-S block. But some limitations apply:
 - If the building is owned by QUT the alpha letter will be placed on the building entrance and it will be displayed on the campus maps.
 - 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.
- 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:
 - If the building is owned by QUT the alpha letter and number will be placed on the building entrance and it will be displayed on the campus maps.
 - 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 *QUT Wayfinding Signage Manual* (Refer to Section 18, Signage and Appendix 18.2 Wayfinding Signage Manual, Issue C, Dated 15.11.2012).

Room Numbers

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

The Principal Consultant must email to <u>fm_records@qut.edu.au</u> the architectural design floor plans (in AutoCAD format) and room type descriptions to Facilities Management, Infrastructure Systems & Information 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 QUT assigned room numbers.

Project Number

The QUT project number starts with the QUT 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 QUT. 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 legislation shall be complied with as a minimum.

Implementation of Work Space Planning at QUT

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* (Refer The University Manual of Policy and Procedures, Chapter H, Section 1.2.4, Work space planning policy).

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 Campus Services & Procurement 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 Campus Services & Procurement.

Work Space Planning Policy (Refer The University Manual of Policy and Procedures, Chapter H, Section 1.2.4, Work space planning policy)

The Work Space Planning Policy has been adopted by QUT 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:

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

Work Space Design Principles

The following design principles underpin QUT'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:

- 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 Campus Services & Procurement
- Locate "enclosed built fitout" to areas either adjacent to the building's core or away from the building's perimeter
- Use the building's perimeter for open, flexible work spaces to maximise natural light and outlook
- 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:

- Open plan, individual work points
- Informal breakout areas
- Meeting carrels and quiet zones
- Team tables
- Multi-purpose meeting and project rooms
- Enclosed offices (Refer Section 3.15 Enclosed Office Fitout and Workstation Services)
- 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):

- Effective consultation with students and other QUT stakeholders
- Quiet/focused individual tasks
- Storage for a range of resources and artefacts
- Adequate and appropriate levels of security and access for staff, students and other University stakeholders

Other design considerations may include:

- Relationships between functions and how that translates to the layout of offices, workstations, other support facilities and equipment
- Planning requirements for links to adjacent buildings
- Collocation of dual functions for spaces not occupied full time
- 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
- 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
- Providing ease of mobility and circulation
- 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
- 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:

- Plan work spaces in functional zones
- Plan for consistency with the base building (including the building's structural grid and mullions)
- Design layouts based on modular space standards (particularly with respect to "enclosed built fitout")
- Provide sufficient flexibility to support organisational and physical re-configuration
- Provide sufficient flexibility to adapt to new technologies and new ways of working
- Incorporate multi-purpose zones

- Avoid the use of custom designed furniture and built-in joinery/cabinetry. (Refer Section 9.9)
- 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:

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

Environment:

Design for environmental sustainability by considering the following:

- Materials and fittings selection
- Reduce material use
- Minimise embodied energy
- Reuse furniture and fittings
- Use recycled content
- Consider whole-of-life environmental impacts and management

Indoor environment

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

Shared conveniences

- Provide centralised waste receptacles
- Include adequate recycling facilities with intuitive design and/or signs to encourage recycling
- Allow for central printing stations with controls to minimise ink, paper and energy use
- 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 QUT:

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 Campus Services & Procurement.

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 Campus Services & Procurement.

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 $11m^2$ may be provided in accordance with Section 3.15 Enclosed Office Fitout and Workstation Services and subject to endorsement by the Director Campus Services & Procurement in consultation with the Vice-Chancellor, QUT.

b) Storage

QUT 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 QUT. 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 QUT 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, from 150 to 600 seats 1.3 m²/seat. (AV/Bio-Box rooms are additional to this provision)
- 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 $2.2m^2$ /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 QUT.

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. (Refer 3.7 Natural Light)
- 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 an approved translucent film may be applied to the shared partition to provide a level of visual privacy but maintain transfer of light (Refer 3.7 Natural 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 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



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



3.16 Workplace Furniture and Amenities

Workplace amenities requirements are defined in WHS 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 WHS Amenity requirements with the BCA and QDC for design and construction of buildings or workplaces. However, the intent of the WHS Regulations may require minor variations in some areas, to achieve health and safety performance outcomes.

The layout of workstations in unenclosed office areas should minimise unusable and secondary circulation areas through the use of design and furniture selection. Workstations will have a minimum surface area of 1800mm wide and 750mm deep.

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 QUT on the need for additional showers.

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 QUT 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 representative must be consulted for space requirements for the delivery of their services.

Parent Rooms

Parent facilities are spaces aimed at parents with babies and young children, and breastfeeding mothers. The space shall allow for private and comfortable breastfeeding and milk expression. New buildings shall incorporate one parent facility in their design. Spaces that allow for more than one occupant shall be suitably divided for privacy.

The facility shall have the following inclusions:

- A baby change table that is preferably a non-drop top if the space allows for it
- Small/bar fridge (frost-free and in consultation with the QUT Cleaning Department)
- Microwave
- Comfortable chair suitable to breastfeeding with fabric that can be wiped down
- Table
- Bench with: sink, plug, access to cold and boiling water. Refer Section 26.9 Hot Water
- GPO convenient to the chair
- Lockable room/area as per QUT standards relating to disabled toilet locks
- Provide external indication of whether the room is in use or not

Bicycle Parking

Minimum requirements for bicycle parking facilities are as per AS 2890.3:2015 Parking facilities Part 3: Bicycle parking. All bicycle parking should be accessible from a road, driveway or footpath via a bicycle friendly access path, away from the desired walking line of pedestrians and as close as possible to the cyclist's destination. Bicycle parking should be provided close to the entrance to a building or defined external space where possible. Parking should include lighting and shelter where appropriate.

End of Trip Facilities

Lockers

- Provide a minimum of one locker for each available bicycle parking space.
- Provide a Clothes Hanging Area with internal dimensions of at least 975mm high by 300mm wide by 400mm deep. No shelving should obstruct the hanging area. If shelving is incorporated, the size of the locker should be increased to preserve the minimum clear hanging are of 975mm high, 300mm wide, 400m deep. If space permits, more generous internal locker sizes should be considered 1000mm high x 400m high x 500mm deep.

- Limit the maximum height of hangers to 2100mm above finished floor level.
- Provide card access compatible with QUT's access management system. The locking mechanisms keypads should be wet area compatible.
- Provide a shoe storage area (separate from lockers) with dimensions of at least 200mm high x 300mm wide x 400mm deep per locker –i.e. at base of locker or on top of locker.
- Provide ventilation where shoes and garments are stored.
- Provide additional lockers should also be made available for pedestrian demand.

Drying area

- Provide an airing zone consisting of drying rails (not hooks) or ventilated cupboard so users can dry damp/wet clothes immediately adjacent to the showers or changing area. Recommended dimensions are 975mm high, 1200mm wide and 600mm deep per 5 showers.
- Provide towel rails separate to clothes drying areas. Rails should allow 600mm per towel, alternatively drying cupboards can be provided.
- Provide mechanical ventilation to the drying area.

Showers

- Provide a minimum of two shower cubicles with provision for both females and males and an additional 1 shower cubicle with ancillary change rooms per 10 bicycle parking spaces.
- Provide height adjustable shower heads adjustable to a height of below 1.5m to 2.1m or above. (i.e. on an arm rather than fixed to the wall)
- Provide a mirror in the shower cubicle.
- Shower cubicles shall be designed to maintain distinct wet and dry areas with minimum internal dimensions of 1200mm W and 1800mm L.
- Provide hanging space for garments and towels, a bench seat in the dry area and a shelf for toiletries in the wet area.
- Consider the ratio of male to female users where the facilities are separated. Where change is likely, consider using movable partitioning to allow reconfiguration of the space. Segregated facilities is preferred.
- Provide card access compatible with QUT's access management system to the shower and change room areas.

Changing area

- Provide a changing area immediately adjacent to lockers and in close proximity to showers.
- Provide adequate space for users to circulate and change. Approximately 2m2 for each predicted user at peak time.
- Provide bench seating with shoe storage integrated underneath.
- Provide full length mirrors in the changing areas.
- Provide built in ironing facilities including a board and an iron. Iron switch shall be on a timer.
- Provide a mirror with lighting suitable for personal grooming and hand basins with bench, power points and shaving plugs.
- Provide mechanical ventilation to the changing area.

- Provide a minimum of 1 bicycle parking space per 20 building occupants (5%)
- Bicycle parking racks shall be designed in accordance with AS2980.3 2015. All racks must enable the user to lock both of the bicycle wheels and the bicycle frame to the rack.
- Provide double racks where space permits.
- Provide power points for electric bikes.
- Provide for storage and locking of Electric Scooters.

Security Levels for bike storage area

- Provide facility access and egress using QUTs access management system.
- Direct surveillance for security reasons is required at the entrance/exit of and within the bicycle storage facility as per QUT security equipment requirements.

Signage

• Provide facility entrance door, and clear wayfinding signage in accordance with the QUT's Signage Design Guidelines for Bicycle Parking or with Integrated Transport Services signage requirements.

Proximity

- End of trip facilities should be located as close as possible to the bicycle parking area and allow an intuitive workflow.
- End of trip facilities should be integrated into the building allowing easy access and egress.

Access

- Ensure access points have sufficient overhead clearance for mounted bicycle riders.
- Avoid steep ramps, speed humps, channelling, drainage grates or other hazards not suitable for bicycle riders.
- Provide appropriate levels of surveillance and lighting.
- Provide non-slip surface treatments where a gradient is greater than 1 in 12 or where the floor surface is exposed to the weather.
- Ensure no interference with emergency access, loading bays or other infrastructure, if ramps are shared between service vehicles, cars and cyclists, particular consideration is to be given to cyclist safety.
- Avoid hazards to pedestrians.
- Provide hands free door access to the facility to allow easy access with a bike. (i.e. an automatic door should be installed with swipe card access or proximity access)
- Provide a door opening to the bicycle storage facility that allows for easy access for a person wheeling a bike.

Other considerations

- Provide and install a bicycle maintenance stand and maintenance tools in or near bicycle parking area.
- Provide a drinking fountain in or close to the end of trip facility.
- Provide non slip floor surfaces in all areas.

4 External Walls and Windows

4.1 General

This section should be read in conjunction with:

- Section 2 Planning Controls
- Section 7 Ceilings and Ceiling Finishes
- Section 11 Security
- Section 27 Electrical Services
- 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 QUT. 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.

The use of pre-finished metal-faced sandwich panel and metal/composite cladding systems may be considered with QUT approval and must be specified in accordance with the National Construction Code (NCC).

Factory pre-finished CFC cladding may be considered for approval by QUT Manager, Maintenance Services.

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

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

Façade 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 should generally open outwards. 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 open able 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 QUT 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, FLUOROSET FP 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 QUT 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 Facilities Management.

Exposure to Atmosphere

Steelwork to all stairs exposed to the atmosphere shall as a minimum requirement be prepared and hot dip galvanised (HDG) in entirety, in accordance with AS4680. Cutting and welding on-site is not allowed without permission of QUT. "Zinc stick" and cold galvanizing do not constitute acceptable practice without QUT approval.

Balustrade panels to all stairs exposed to the atmosphere shall be constructed of:

- steel HDG as per above
- perforated powder coated aluminium
- stainless steel mesh by approval QUT Manager, Maintenance Services
- glass
- other material with a high level of durability particularly with regard to resistance to deterioration and corrosion due to weathering and environmental effects (Only with approval from FM Operations Section!)

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.

Standard partitions and internal walls shall be 13mm painted plaster board on metal stud, installed to manufacturer's recommendations. Plasterboard level of finish to AS/NZS 2589:2007 shall be a minimum of Level 4. In specialised high quality areas, Level 5 may be required.

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

Non-full height walls shall be provided by the use of acoustic screens.

Partitions to the perimeters of plant rooms, service areas, risers, cleaner's rooms and the like may be concrete masonry or fibre cement sheeting as required by the application.

Plasterboard fixed to masonry walls to be installed using 28mm metal furring channel For security purposes, all primary corridor partitions shall extend to the underside of slab, and be sheeted on at least one side above the ceiling line.

Wet areas partitions are described in Section 5.11 – Toilet Partitioning.

Finish, trim, floor and wall construction in dietary and food preparation areas shall be free of spaces that can harbour rodents and insects. Details to comply with the relevant Public Health regulations are in force.

5.2 Partition Accessories

Full height anodised aluminium or 304 stainless steel angle (40 x 40) protections shall be provided to all external corners of partitions in main corridors.

5.3 Operable Walls

Operable walls may only be used with the express approval of the QUT Project Coordinator.

The use of operable walls is not favoured. Operable walls shall be a proprietary system equal or better to HUFCORE and have an acoustic rating equal to the other walls of the room.

Structural support of the tracking is to be overdesigned 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).

5.4 Acoustics

Particular attention shall be paid to acoustics and noise transmission - Refer Section 14 - Acoustic. Partitions requiring to be insulated shall only utilise 'Dacron' polyester fibre or natural wool batts of thickness and

density, 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 slab above if necessary and all penetrations shall be appropriately sealed to maintain the required sound rating.

5.5 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 Section 30 fire services.

5.6 Skirtings

Skirtings shall be black vinyl feather-edge or aluminium type of either 100mm or 150 mm 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 coved up.

Aluminium skirtings (either anodised or powder-coat finished) may be approved for example, as part of proprietary glazed partitioning systems or ducted skirting systems.

100 mm hardboard skirtings may be used in refurbishment works where appropriate and approved by QUT FM Operations or 3 channel duct as per Section 27 - Electrical Services.

5.7 Chair Rails

Provide a chair rail of ex 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 backs of chairs and tablet arms 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. Exceptions may be requested on a case by case basis by approval of Manager, Maintenance Services.

5.8 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 AS1428.

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 Building Code 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 Building Code of Australia.

5.9 Toilet & Shower Areas

Walls in toilet and shower areas shall be tiled from floor to ceiling. Wall lining shall be 9mm James Hardie Villaboard installed by mechanical fixings (not adhesive) to metal studwork in accordance with the current James Hardie Commercial Technical Manual (Fire & Acoustically rated Walls).

Provide control (expansion) joints to the substrate and carried through the tile work at all changes of direction and 3.0m maximum centres over double metal studs. Install tiles using flexible thin-bed adhesives suited to the applications. Tiles to be installed in accordance with AS3958.1:2007.

Wall tiles shall be glazed or semi-glazed with grouting in a non-white colour. Provide noggings etc. in walls and install a 600 x 150 shelf in all cubicles and adjacent to all wash basins.

Install approved waterproofing membranes in accordance with AS3740-2010. All wall frames to these areas shall be mounted on a concrete hob or similar up stand to ensure that the stud frame bottom track is not located between portions of screeded toppings to set down areas - refer also Section 6 - Floors and Floor Finishes.

5.10 Tiled Splashbacks

Where sink units, cleaners' sinks or hand basins exist in isolated locations, provide a tile or laminate splashback not less than $1m^2$ in area. The splashback shall extend to the bottom edge of the fixture, at least 200mm wide each side and at least 450mm above the fixture.

Paint backed glass splashbacks shall not be used under any circumstance.

5.11 Toilet Partitioning

Toilet Partitions

Toilet cubicle partitioning shall be either REALHOME RPFM-S (or similar) or HARDICOLOR (or similar) washroom partitioning systems. (Do not use HMR board carcass systems in areas exposed to water [showers and the like].

REALHOME system shall comprise laminate plastic faced 18mm HMR board carcass dividers and 35mm front blades with post-formed junctions with 35mm doors of similar construction with double bolt floor fixing and SS surround and with aluminium extrusion head-section and wall junction trim.

HARDICOLOR system shall comprise polyurethane 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.

Where number of cubicles exceeds three in one continuous line, refer to manufacturer for details for lateral stiffening of front gable wall.

2 Wet Area Partitions

For wet areas such as showers, partitions shall be REALHOME Type CF compressed fibre cement sheet construction, similar to RPFM-S or JAMES HARDIE HARDICOLOR equivalent toilet partitioning systems finished with polyurethane Satin or Stipple finish.

Toilet & Shower Partition Hardware

REALHOME or JAMES HARDIE or equivalent fully 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. Face block walls in selected locations may be unpainted where approved.

Services

No piped 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

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 the allowable tolerances as specified in the floor system's relevant Australian Standards.

6.2 Finished Floor Surface

General

The selection of floor finishes is very important. It has direct impact on safety of 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 consultants and specifiers are involved in the selection of products and responsibility must be undertaken.

Designers shall incorporate the principles & requirements established in NCC legislation, AS/NZ Standards and WHS legislation, to reduce the risk of persons slipping on pedestrian surfaces. The relevant documents would include but not be limited to the below:

- NCC
- HB 198:2014 Guide to the Specifiaction and Testing of Slip Resistance of Pedestrian Surfaces
- AS 4586: Slip Reisitance Classification of New Pedestrian Surface Materials
- AS 4663: Slip Resistance Measurement of Existing Pedestrian Surfaces
- AS 4049.4 Paints and Related materials Pavement marking materials High performance Pavement marking systems

Slip Resistance characteristics shall not be judged by the 'R' rating alone, but <u>must include</u> 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.

Considerations during selection must include:

- Functional needs
- Cleaning and maintenance
- Structural
- Footwear standards likely to be worn by students & staff
- 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, should have a very low slip resistance. 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.

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. Stainless steel mesh barriers which comply with the requirements 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.

In existing buildings, the presence of chemical barriers may necessitate the retention of the chemical method of subterranean termite control. The use of chemically impregnated barrier systems shall not be used without the specific approval of Facilities Management

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

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 QUT.

The Contractor shall provide the Superintendent with a Certificate of Installation in accordance with AS3660.1 Appendix A, from the installer of the termite management system.

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

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

6.4 Membranes

All ground slabs shall have, as a minimum, a membrane equivalent to 300 um High Impact 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	
Alternative 2	Ontera carpet tiles 500 x500	
Alternative 3	Alternatives and broadloom by approval Manager, Maintenance Services	

Other Carpet Tiles may be considered for approval by QUT 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 QUT.

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 QUT 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 QUT 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 QUT.

University Standard		
Alternative 1	Heterogeneous sheet vinyl manufactured by Tarkett Sommer, e.g. 'New	
	Eminent' 'Granit' 'Micra Premium'. In certain instances requiring a higher	
	degree of slip resistance Safetred and Safetred Plus may be considered	
	Select from manufacturer's standard colour range, however light colours	
	are not to be used.	
Alternative 2	Armstrong Accolade Plus, or Accolade Safe Plus as appropriate 2mm gauge	
	heterogenous sheet vinyl manufactured by Armstrong. Select from the	
	manufacturer's standard colour range.	
Alternative 3	Forbo Marmoleum, minimum thickness 2.5mm with 'Topshield'.	
Chemical Laboratories	Gerflor Teralay	

Vinyl / Linoleum Sheet adhered Floor Coverings

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 QUT Manager, Maintenance Services.

Ceramic Tiles & Quarry Tiles

Fully vitrified tiles shall be used on floors of all wet areas including toilet areas and showers, 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. Tiles shall be suitably sized to achieve required falls and minimum 200mm x 200mm size. Finish shall be unglazed or semi-glazed and meet Australian Standards of slip resistance. Porous unglazed tiles are not to be used in any new installation.

Floor tiles to toilet and shower areas shall be anti-slip with dark grout (charcoal or similar) and shall finish level with adjacent finishes.

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 the QUT Manager, Maintenance Services.

Stairs and Fire-isolated Passageways

Quarry or ceramic tiles to fire-rated passageways and stairs including stair treads and risers shall be unglazed and non-slip to suit the application. The tread riser and nosing tile shall be of a contrasting colour and matching grout. 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 AS1428.1 for stair tread nosings.

Any non-tiled 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 QUT Manager, Maintenance Services.

6.6 Joints

Joints of dissimilar floor finishes shall be achieved by utilisation of ramping using floor levelling compounds to achieve a constant finished floor surface height. Use of brass angles or strips set into the slab and fixed with epoxy cement may be considered where practicable however a constant floor height is to be achieved.

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 mats must not pose trip hazards.

Door mat shall be Signature Floors Mrine Stripe Matting, 100% Waterproff, fixed as recommended by manufacturer. Door mat extent: a least the width of the door opening x minimum 1m inside the door. For alternate solutions seek approval from QUT, Manager Maintenance Services.

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 QUT 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 Waterproofing

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 AS3740 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 perimeters on to the fibre cement wall lining substrate - refer Section 5 - Internal Walls.

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

6.12 Access Floors

Access floors where required by the Space Description Forms shall be a system as required for the room function and approved by QUT Manager Maintenance Services.

7 Ceilings and Ceiling Finishes

7.1 Suspended Ceilings

Suspended Ceilings shall generally be provided in all occupied areas in buildings.

7.2 Ceiling Types

Open Ceilings should be considered as a viable design option inconsideration 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 1200 x 600mm '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-airconditioned 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.

Accessibility

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 QUT Facilities Management Operations Section.

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

Accessibility

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 QUT Engineering Services Manager.

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

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 soffit 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 2700mm. The minimum clearance in the ceiling space to the underside of the slab or roof structure over shall be not less than 400mm.

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

There shall be close collaboration and coordination between the consultants and QUT's Project Engineer Building Services to ensure effective compliance to this design guideline on a project specific basis.

Consultants will be required to engage in project specific briefing discussions with the Project Engineer Building Services prior to commencing the design documentation phase of the project. This consultation is regarded as a mandatory project milestone and will be validated in the form of a project meeting minute by QUT.

The design of the roof drainage system is to be certified by the Hydraulic Consultant as compliant with these Design Guidelines and with relevant codes.

Visual Amenity

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

Height Safety

The issue of roof design for safe access both during construction and for maintenance purposes has been addressed in the QUT Facilities Management -Roof Hazard Assessment Register. While this register and supporting documents primarily addresses safe access to existing roofs, the principles are equally relevant to the design of new roofs. Under the WHS Act and Regulations, designers have specific legal obligations to design roofs and structures which minimise the risk of falling during both the construction phase and during ongoing maintenance activities. See also 8.13.

All height safety and associated installations are to comply with the required Australian Standards, State Government Regulations/Requirements as well as QUT design guidance.

Height Safety and personal protection equipment will specify 'Sayfa' or 'SafetyLink products' from which QUT will be provided full testing/certification, operational manuals, maintenance procedures and technical installation drawings. All information will be specific to the design and installation of the system i.e. not manufacturer generic information.

Consultation with QUT Facilities Management (Operations Maintenance) is required to ensure the selected system is in line with the existing standing offer agreement for height safety installations, maintenance, inspection and testing across other QUT facilities.

8.2 Roof Types

Pitched Roofs

Pitched metal deck or tile roofs shall generally be provided to all buildings. Minimum pitch shall be at least one degree greater than that recommended by manufacturer. 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.

Built-Up (Flat) Roofs

In general, membrane type roofs will not be approved.

8.3 Roof Deck Materials

Generally, metal pan roof decking and shall be 0.48mm BMT Colorbond profiled steel decking equivalent to "Bluescope Steel - Lysaght Klip-lok 700 Hi-Strength" fixed in accordance with manufacturer's written instructions. At Gardens Point campus, heritage considerations may require a rolled pan and rib design. The colour of roofing materials shall comply with QUT's Master Plan.

At Kelvin Grove campus, roofs shall be predominantly terracotta tiles for new buildings. The tiles shall match as nearly as possible the colour of the tiles on the campus's foundation building, A Block. Metal roofs, where approved for use, shall match as closely as possible the colour and profile of the existing terra cotta roof tiles. Alternatively, Custom Orb corrugated profile may be approved for use.

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, capping's 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 QUT - Eaves gutters should be used and be of a self-cleaning design. Oversized gutters should be considered. Gutter sizing shall be sized in accordance with AS3500.3.3.

For architectural applications of stainless steel, including roofing, technical advice can be sought from the Australian Stainless Steel Development Association.

Gutter and Valley Materials

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 AS2180. 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 falls to outlets. Suitable-sized overflows are to be provided to all gutters. All sizing shall be in accordance with AS3500 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 AS3500.3.3.

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 AS3500.3.3 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 open able 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 Section10 - 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 QUT. An installation plan must be provided by the designer /installer for QUT approval prior to installation.

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

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

Refer also 8.1. The QUT Roof Hazard Assessment Register 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

In the design and selection of furniture and fittings consider the requirements of people with disabilities. Refer to Section 16 - Circulation for further details.

Lifecycle costs are to be considered when designing and procuring furniture and fittings within capital works projects. Using local and Australian based suppliers should be prioritised when specifying furniture and fittings. Appropriate recycling of existing furniture and fittings must also be prioritised within the design and documentation of projects.

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 a capital works project. Special requirements will be determined for each particular project in conjunction with QUT.

Area	Description		
Offices	Establish the board requirements for the particular project		
Teaching Rooms	Whiteboards and pinboards as required - refer Section 19 - Teaching Spaces		
Laboratorios	Whiteboards and pinboards as required - refer Section 20 - Special Requirements		
Laboratories	for Laboratories		
Common areas &	Establish the board requirements for the particular project		
Meeting Rooms			

The following are generally applicable:

Whiteboards generally shall be either white colour back glass with bevelled edges and secure concealed or stand off fixings, or be white vitreous porcelain on 13mm caneite core with galvanised steel backing sheet and aluminium edge trim. Mounting must be to stud framed walls matching that for shelving refer Section 5 – Internal Walls, Partitions and Finishes.

Pinboards generally shall be either minimum 12mm Echopanel or equal approved alternative acoustic product, or constructed of 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 only where necessary to match existing.

Where projection surfaces, whiteboards and pinboards are present within the same space, each surface must be able to be used simultaneously.

9.3 Fixtures to General Offices

Departmental and Faculty 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.

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.

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:

- Vanity bench unit with full width mirror minimum 800mm wide above tiled or similar waterproof non-porous material as a splashback.
- Electric hand dryer with automatic operation only. Installation: one dryer for each three basins or less, with accessible electrical isolation switches provided for each dryer. Preference for Dyson Airblade dB or equal approved alternative with appropriate drip catching, subject to the type and use of adjacent spaces.
- GPO adjacent mirror.
- Soap dispensers shall be 'Regal liquid soap dispenser Bulk fill' Product code LIQSOAP-DSP
 - Procured from John S Hayes (07 3260 1991)
 - Installation: wall mounted, with one dispenser per two basins or less subject to occupant numbers.
 - o Dispenser must be fixed over a sink or bench to prevent soap dripping onto floors.



Toilet Cubicle

Provide in each cubicle:

Jumbo Toilet Roll Dispensers

- Toilet Roll Dispensers shall be **'ABC Twin Jumbo Toilet Roll Dispenser' Product code A45471,** in white / clear colour. Can be procured from Seton Australia <u>www.seton.net.au</u>
- PWD accessible toilets shall have standard 'Bradley Australia Double Toilet Tissue Dispenser' Model 5241. Procured from Bradley Australia <u>www.bradleyaustralia.com</u>
- Coat hook (c.p.), 1 No, to back of door
- Sanitary napkin disposal units are not required to be installed, but each female or unisex cubicle shall be sufficiently sized to accommodate a unit 300w x 220d x 850h and not obstruct the patron's space.
- Provide small shelf for handbag/papers above toilet cistern.

Unisex Toilet for People with Disabilities

Provide in each facility:

- Vanity Bench, sink, mixer and Grab rails in accordance with AS1428.
- Electric hand dryer with automatic operation only. Installation: one dryer for each three basins or less, with accessible electrical isolation switches provided for each dryer. Preference for Dyson V Blade or equal approved alternative, subject to the type and use of adjacent spaces.
- Wall mounted 'Tilt mirror' positioned in accordance with AS1428. Product shall be **Bradley Australia Tilt mirror - Product code - 740-1830, 1838 or 2438** or equivalent, subject to size of amenity.
- PWD accessible toilets shall have standard 'Bradley Australia Double Toilet Tissue Dispenser' Model 5241. Procured from Bradley Australia <u>www.bradleyaustralia.com</u>
- Coat hook (c.p.), 2 No, door mounted
- Wall mounted J & D MacDonald folding baby change table (Main building entrance level only, one per building)
- Allow space for sanitary napkin disposal units

Shower Cubicle

Provide in each cubicle:

- Built-in soap holder
- Coat hook (c.p.), 2 No, door mounted
- Fixed seat/bench for changing purposes

Shower for People with Disabilities

Provide in each facility:

- Folding seat in cubicle
- Grab rail(s) as required in accordance with AS1428
- Built-in soap holder
- Coat hook (c.p.), 2 No, door mounted
- Commercial-quality shower curtain and heavy duty stainless steel rail
- These facilities will usually be combined with a PWD unisex toilet.

9.8 Chilled Water Drinking Fountains Internal Drinking Fountains

Allow within building projects, the supply and installation of general access chilled water drinking fountains, at the rate of one (minimum) installation to each floor level. Fountains must be double bowl, with dual height bowls for PWD use, and include built-in bottle fillers. Vinyl or similar non-porous flooring with appropriate slip rating must be provided under each installation to ensure spills are easily controlled.

Product shall be **Elkay SwirlFlo Bi-Level Fountain, with Integral EZH20 Bottle Filling Station – Product code: LZWS-LRPBM28K**, or equal approved alternative. Available from Civiq Public-use Products -<u>www.civiq.com.au</u>

External Drinking Fountains

Where appropriate within building projects, or in consultation with Facilities Management Operations department, external chilled water drinking fountains may be desired on campus where deemed appropriate. Fountains must meet all relevant building code requirements, be mounted appropriately, with necessary water connections, isolation valves and drainage as required. Fountains must also include built-in bottle fillers.

Product shall be **Aquafil FlexiFountain – Product code: 2100BF**, or equal approved alternative. Available from Civiq Public-use Products - <u>www.civiq.com.au</u>

Associated customisable signage available for the Aquafil fountains is to be installed in consultation with Facilities Management's Manager for Campus Services.

9.9 Built-in Furniture

Standard loose furniture solutions are to be implemented in all cases except where there is a building code requirement or where fixed services, like plumbing, drainage, gas or electricity, are required. Use soft wiring strategies for general power and data services where possible to avoid the requirement for built-in joinery/cabinetry. (Refer Section 3.14 – Design Principles and Space Standards)

Built-in furniture should not be used in office areas. This is to assist with future reuse and flexibility of space. Specific written approval must be sought for any built-in furniture. If approval is granted, the Design Consultant must identify this amendment on the Consultant Certificate of Compliance. Designers must ensure that all access requirements, including access to services maintenance, functional outlets and windows are considered in the design.

Where built in furniture is approved, it shall be supplied as part of the building project. Finishes on all built in furniture/joinery shall be designed to be fit-for-purpose.

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 Project provision of Furniture & Equipment

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:

- Workstations, desks and returns
- Bookcases
- Filing Cabinets
- Refrigerators (should be frost free to avoid leaks)
- Stationery Cupboards
- Lockers
- General, Recycle and Organic Waste Bins (please refer to section 9.21 for detailed information)
- Tables (all types)
- Chairs (all types)
- Lateral Filing Units
- Screens (office)
- Storage Units (all types)
- Dishwashers (RW)

Where appropriate within smaller refurbishment projects, to maintain design continuity within large spaces, items must match existing furniture, subject to the project brief.

Equipment such as computers, printers, appliances, cutlery/crockery will generally not be provided as part of project.

9.12 Office Furniture

Open work space

Layouts shall minimise unusable and secondary circulation areas. The following loose furniture will be provided as part of the fitout:

- 1 x workstation minimum 1800mm wide by 750mm, sit-stand options should be considered
- 1 x mobile pedestal (under-bench)
- 1 x ergonomic office chair, in accordance with QUT HSE guidelines

HDR work space

Layouts shall minimise unusable and secondary circulation areas. The following loose furniture will be provided as part of the fitout:

- 1 x workstation minimum 1600mm wide by 750mm
- 1 x ergonomic office chair, in accordance with QUT HSE guidelines
- Allowance for personal storage within the fitout

Enclosed offices

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

- 1 x workstation
- 1 x mobile pedestal (under-bench)
- 1 x ergonomic office chair, in accordance with QUT HSE guidelines
- 2 x visitor chairs
- 4.5 lineal metres of shelving/storage (predominantly standalone and/or mobile). Additional storage (up to a maximum of 7 lineal metres) may be provided where there is a demonstrable need and is to be provided by way of loose furniture bookshelves. Personal storage will be further supplemented by shared storage and facility hubs throughout the work space.

All furniture should be free standing and/or mobile with no fixed joinery to be provided. (Refer section 9.9 – Built-in Furniture)

All workstations should be ergonomic in design according to 'AS4442:2018 Office desks, office workstations and tables intended to be used as office desks.

All chairs should meet the relevant certification level set by the Australasian Furnishing Research and Development Institute (AFRDI), or equivalent certifying agency, in accordance with the type of chair and its use. Refer to <u>http://www.furntech.org.au/</u> or equivalent certifying agency, for specific information. For more information on QUT's Health Safety and Environment Guidelines on chair selection, please contact your Facilities Management contact.

All office work chairs should have the features specified in <u>Ergonomic guide to computer based</u> <u>Workstations</u>.

All monitors should have height adjustable pedestals and no monitor arms.

If workstations have adjustable keyboard platforms, the platform should 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 QUT. All blinds shall be **Vertilux 1.04 Multilink BGS Roller System**, or equal approved alternative, subject to use and location. Where deemed appropriate for Teaching spaces, in consultation with Facilities Management, motorised blinds may be considered. If deemed appropriate, blinds shall be **Vertilux Motorised Roller Blind System 1.05, or Motorised Multilink Roller Blind System 1.06,** or equal approved alternative. Available at www.vertilux.com.au.

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 QUT.

9.15 Door Stops Refer Section 10.21 - Door Stops.

9.16 Cabin Hooks

Cabin hooks are only to be required where necessary to match existing hardware.

Provision of associated window hardware on Heritage buildings is to be specified in consultation with QUT Heritage Management Plans, which are available from QUT's Facilities Management Department.

9.17 Cupboard Accessories & Fittings

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, BLUM 230M (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

External Bins

The preferred design is a low maintenance enclosure of a 240 litre wheelie bin with a roof to prevent birds removing rubbish. Please provide the type below or submit alternative for approval by QUT.

Street Furniture Australia – 1300 027 799

- Code: WBE-F240Dual (must fit 240Litre bins) Dual
- Roof Curve
- Body Solid
- Frame Aluminum Powder Coated precious silver pearl GY184C
 - o General Waste Black (GN121A),
 - Recycle Yellow (MEO96A))
- Signage None, supplied by QUT
- Mounted Flat surface Free standing

Internal Bins

Within all building projects, designs must cater for General, Recycling and Organic Waste bins.

For small minor works projects, QUT Cleaning will supply and install bins upon completion of the project.

Within larger capital works projects where general circulation areas, common areas, kitchenettes and tea points are being created or refurbished, the project should allow to supply and install all bins, in consultation with QUT Cleaning.

Where joinery within kitchens and kitchenettes is being replaced, accommodating bins within new joinery is preferred. Bins must be minimum 45L, and include coloured identification lids to ensure appropriate separation of waste types. Sealed bins with a sliding function to facilitate easy change over are preferred, such as the **'Slide and Sort' system** from **Source Separation Systems**. Details available at www.sourceseparationsystems.com.au.

9.22 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 AS1288 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 door sets are preferred for all main automatic exit/entry doors. Automatic sliding doors shall be Abloy SL 500 or technically equivalent and approved by QUT, in accordance and compliant with AS507-2007 (Reconfirmed 2018), with electric open sliding door system, capable of Fail Safe Open and Fail Safe Closed integrated with the Gallagher system and fire alarm with an automatic reset. have an Electro mechanical locking system that secures all active door leaves separately and incorporated monitored emergency battery backup unit for failsafe operation as per NCC requirements. 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.

Any manual locking or overriding keying system included and / or installed with the electric door operator shall be of the Assa Abloy Brand with the key code designated by QUT Security.

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 door set to each building should be fitted with an automatic opening and closing device. This door or doors shall also be connected to Gallagher. (Refer to Section 11 Building Security for details of Electronic Access Control systems).

10.3 Fire Doors

Fire doors shall comply with AS1905.1 and generally shall be paint finished. Minimum thickness: 45mm. Minimum frame metal thickness: 1.4mm. Frame materials: Refer to Section 10.8 - Door Frames

Construction shall include edge stripping as specified by consultant if required.

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 QBCC. Provide certification of compliance in Operating Manual refer Section 40 - Documentation.

Maintenance of fire doors shall be specified in accordance with AS1851. (This is relevant to Defects Liability).

10.4 Smoke Doors

Where required, smoke doors may be or either

- o solid timber (Refer Section 10.7 External and Internal Aluminium-framed Glazed Doors) or
- o aluminium framed and glazed construction (Refer Section 10.6 External Timber Doors) and
- shall satisfy the requirements of the BCA (Specification C3.4). If fitted with hold-open devices (Refer Section 10.18 - Electro Magnetic Hold-Open Devices),
- o a selector for sequencing closing must also be fitted (Refer Section 10.19 Selectors),
- Fit Raven smoke seals appropriate to the application (Refer Section 10.24 Security Door Viewer)
- o shall comply with AS6905 with all applicable closing mechanisms and seals.

10.5 External Doors

Provide a suitable head flashing to external doors, where it is exposed to weather. Note: Raven RP67 is the preferred flashing where applicable.

If glazed doors are used, they shall comply with the requirements for Entrance Doors (Refer to Section 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 AS2688, external grade and sheeted with 4mm A bond select grade ply. A metal cap is to be installed on top of the door to prevent water ingress. Timber doors shall be painted with acrylic gloss 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 powder coat.

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

Powder coat 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 Fluoroset 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 Gallagher EAC/electric locks are fitted, the door midrail will be used for cable access.

Where an additional level of security is required for glass in aluminium frame sliding or swinging doors such as those fitted to shopfronts and commercial premises a Blocklok (see below) may be externally mounted on single or double doors.

10.8 Internal Timber Doors

All timber internal doors shall be blockboard solid core construction to AS2688, not less than 40mm thick and sheeted with 4mm a bond select grade ply. Edge strips are only to be specified when design requires it for special areas e.g. when using clear finish to door, by approval Manager, Maintenance Services. 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 Forms 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 Associate Director, Capital Works, and QUT.

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 AS1428.1 and shall open outward. Refer also Section 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:	1.1mm.
Factory finish:	Zincanneal (internal locations)
	Galvabond (all external locations)

Door frames shall be sufficiently rigid to avoid distortion by the door weight or the twisting action of the door closer. This is to include double studding to both sides of door frames in addition to any manufacturer's installation instructions.

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 Projects Officer (for projects) or the University's Security Client Services Officer (for general requests). Key coding will be determined by the Security Projects Officer or the Security Client Services Officer and John Barnes & Co. (Qld) Pty Ltd. The number of individual keys to be issued will be determined by the Security Projects Officer or the Security Client Services Officer, 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 identifier and with a sequential key number approved by the Security Projects Officer or the Security Client Services Officer.

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 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 QUT Security.

Maintenance, including the following sub groups:

- Electrical distribution boards,
- High voltage rooms and sub-stations,
- Plant rooms,
- Data communication boards,
- Plant alarm panels

Security, including a single key for:

- Alarm system cabinets,
- Electronic access control cabinets, and
- Key cabinets.

10.11 Locks

Except where otherwise scheduled:

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

- Locks shall be mounted such that the strike is 1000mm above finished floor level except the indicator bolt to toilet entry doors where fitted.
- No locks are to be mounted in the bottom rails of doors.
- All locks shall have "X" type cams where possible to prevent over 90° key rotation and are not to employ anti-lock out (kick off) function.
- Where the mortice lock requires a dead-latch function, ensure that the appropriate strike plate is fitted and installed correctly. Refer Section 10.27 Striker Plates.
- Deadbolting locks, Lockwood 3540 series locks shall only be used with written approval of the Manager Security and Emergency Management.
- Electric locks shall be Lockwood 3570 series in most instances or 3580 series narrow style, where limited space is available.
- Where the Gallagher installation is swipe in 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 Gallagher controlled building entry door shall be swipe in only in order that it may fail secure. All other building external entry perimeter doors are to be reed switch monitored.
- Where the Gallagher installation is swipe in / swipe out, 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.
- 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 1000mm and 1300mm above the finished floor level.
- 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. 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 of LOCKWOOD manufacture by Ogden Industries, unless otherwise noted. Furniture finish shall be SCP.

Stairs Locking	3572W-SP3572-5250 with 1801-70/1905-70			
Stairs Ground Floor Exits	3572X with 1801-70/1905-70			
Lecture & Seminar Rooms	3572W-SP3572-5250 with 1801-70/1905-70			
Offices	3572WT cylinder and "X" cam with SP3570 - 5250 adaptor and			
Offices	1801-70/1904-70 furniture			
Duct Doors (non-fire rated)	211 Nightlatch			
Duct Doors (fire rated)	EFCO 507			
Mortice Privacy Latch to PWD Toilet	Lockwood lock LW3574EA SC with furniture LW1814/70SC and			
Doors	LW1939/70SC			
Non Locking Door	Passage 3574 with 1805-70/1905-70			
Sub Stations & Specified Areas	Lock 3572X with 1801-70/1905-70			
Aluminium Clazad Entry (hingod)	3572XX with 3570-2402/2452 Hold Back Cylinder to inside with			
Aluminium Glazed Entry (ninged)	1800/1901-70			
Small Roller Shutter	PL330N padlock keyed to Abloy Protec			

Large 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
Lieutite Rey Switched	profile CNCYL to be included
Electronic Access Controlled Locks	See Section 11 - Building Security
Display Cases (high security)	Abloy Protec
	LOCKWOOD 780/880 or equivalent all keyed alike, or an
Window Locks	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 TS93GSR RF Hold open unit/ pair of doors

When mounting door closers in conjunction with acoustic seals, provide suitable mounting packers to keep the arm of the door closer clear of the seal. In all cases screws are not to penetrate glazing beads 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 central between top and bottom hinges. Where a door is fitted with a closer a fourth hinge shall be installed approximately 200mm below the top hinge.

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

Barrel Bolts	DALCO 1751 x 150mm with floor ferrules
Flush Bolts (Standard 2040 door height aluminium	
framed glazed doors only - except where acoustic	EFCO 841 x 150mm
seals fitted)	
Automatic Flush Bolts (to pairs of fire doors)	LOCKWOOD FOH00149
Fire Bolt (to pairs of fire doors)	LOCKWOOD 8530 - 102
Skeleton Bolts (Door ht 2100 and over)	DALCO 791 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 A3000 x 230mm 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, QUT.

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 an 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 enclosed office door (where possible).

10.23 Door Holdback

Door holdbacks shall be provided, as required, to doors without door closers. Fitting shall be Trio Magnetic Door Stop 75mm R12.

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 and Smoke Seals

Provide RAVEN 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 and Pull Handles (toilets and airlocks)

Provide on 1.6mm satin stainless steel *push plate* 300mm wide x 500mm high, fixed with countersunk stainless steel screws. engraved lettering "PUSH" will be Helvetica Neue Bold 32mm high Caps and Charcoal filled and 100mm down from top edge to the bottom of the lettering.

Pull plate size will be 500mm high X 150mm wide x 1.6mm satin stainless steel, fixed with countersunk stainless steel screws. Handle as EFCO 136 SCP 200mm "D" handle mounted 100mm above lowest edge of plate, engraved lettering "PULL" will be Helvetica Neue Bold 32mm high Caps and Charcoal filled and 100mm down from top edge to the bottom of the lettering.

Mount plates to opening edge of door with lowest edge 900mm AFFL.



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

Shall be as specified by the Maintenance Services Manager.

10.30 Blockloks

An additional level of security is available for glass in aluminium frame sliding or swinging doors such as those fitted to shopfronts and commercial premises. A Blocklok ADI 444 may be externally mounted on single doors and an ADI 444DD may be used on double doors.

11 Building Security

Section 11 of the QUT 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: Tracey Bartlett, QUT Senior Techinical Officer (Security), on 073138 5969 or email <u>t.bartlett@qut.edu.au</u>.

Section 11 was updated in September 2022.

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:

- Deterioration and corrosion due to weathering and environmental effects.
- Other factors which may increase long term maintenance
- Flexibility for potential changes in occupancy loadings.
- 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:

- Design superimposed dead loads
- Design live loads including special areas such as compactus storage
- Design wind loads
- 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 AS1170.1 for the proposed use or uses of the building. Some flexibility for future changes in occupancy should be considered and discussed with QUT (Refer 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 QUT,
- The size of the compactus shelving and the weight of materials to be stored shall be confirmed with QUT.

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 QUT.

12.5 Reinforced Concrete Members

Durability

All reinforced concrete members shall be designed to satisfy the requirements for durability in Section 4 of AS3600. 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 AS3600 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 Section 2 – Planning Controls).

Floor Slabs – Post Tensioning and Precast Floor Systems

Approval must be obtained from QUT 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 QUT. The location of tendons shall be accurately and clearly marked on the slab soffits.

Thermal resistance (R-values) of the floor is to be >1.0m2 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 Steelwork

Corrosion Protection

All 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 QUT. "Zinc stick" and cold galvanizing do not constitute acceptable practice without QUT approval.

12.7 Timber & Steel Framing

Steel framing is preferred over timber framing in order to achieve construction utilising termite resistant materials (Refer "termites" in Section 6.3 – Floor Finishes).

14 Acoustics

14.1 Regulatory Requirements

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

- EPA Environmental Protection Policy (Noise) 2019
- EPA Environmental Protection Amendment Regulation No 2 2018
- BCC Planning Policies
- Current Australian Standards including AS1035, AS1045, AS1296, AS2021, AS2822, AS2436, AS3671, AS1191, AS/ANZ1935, AS2253 and AS3671.
- 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:

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

14.3 External Noise Intrusion

Typical noise sources include:

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

These types of noise can be quantified as:

- Steady noise is measured as the equivalent continuous measurement: LAeq.
- 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	LAeq	LA01
Individual office, shared office		45dBA
Senior staff (individual) office		45dBA
Administrative/clerical office (open space), post graduate student areas		50dBA
Counselling Office		45dBA
Teaching Room		45dBA
Lecture Theatre		40dBA
Library		50dBA
Video-conferencing Room		40dBA

Corridors, Lobbies

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:

- Air-borne noise transmission
- 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			
Individual office, shared office	37dBA		
Senior staff (individual) office	37dBA		
Administrative/clerical office (open space), post graduate student areas	37dBA		
Counselling Office			
Teaching Room	37dBA		
Lecture Theatre	32dBA		
Library	40dBA		
Video-conferencing Room			
Corridors, Lobbies			

The intention is to achieve a balance between the noise generated by building services and the noise intruding form 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 AS2282. For University buildings, the requirements can be simplified to two parameters:

- The sound reduction between the spaces (Dntw)
- 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 PrivacyRating: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:

- Noise flanking paths via common ceiling voids, air-conditioning, ductwork and the like
- Noise leakage at services penetrations and unsealed gaps at window mullions, at partition heads etc.
- Weaker elements incorporated into the partition such as doors, windows, glazed highlights, glass fins etc.
- Poor workmanship and departures from the documented design
- 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 plant rooms 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.

Below: Privacy rating requirements for a range of spaces, set out in matrix form: **Table 14.3**.

Room Type	Individual/Shared	Senior Staff	Ad Min	Counselling	Teaching Room	Lecture Theatre	Library	Video Conf Room	Corridor
Individual office, shared office	80	85	80	90	90	90	90	90	70
Senior staff (individual) office		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	-
Video-conferencing Room		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	
Individual office, shared office	0.6 to 0.8 sec	
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:

- Rear wall echoes in lecture theatres
- Standing wave or room modes in recording or practice studios
- 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:

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

14.9 Minor Works Projects

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

- Consistent in colour, gloss level, texture, and dry film thickness
- Free of runs, sags, blisters, or other discontinuities
- Paint systems fully opaque

Clear finishes at the level of transparency consistent with the product fully adhered

- Resistant to expected impacts and damage from expected use
- Resistant to environmental degradation with the manufacturers stated life span
- Minimise the impact on the quality of indoor atmospheric health by using a low or no Volatile Organic Chemicals (VOCs) product where possible
- Minimise heat absorption and temperature in the surrounding area (e.g. by using highly reflective or low heat absorbing paint)
- Minimise impact on the environment through responsible manufacture and using lower amounts of oil, titanium dioxide and other chemicals potentially damaging to the environment
- 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. <u>http://www.apas.gov.au/</u>

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 <u>http://www.geca.org.au</u> and Ecospecifier <u>http://www.ecospecifier.com.au</u>

Standards

The following Australian / New Zealand standards are referred to in this section for compliance where appropriate:

Standard	Decription
AS1530	Methods for fire tests on building materials, components and structures
AS1627	Metal finishing - Preparation and pre-treatment of surfaces
AS1851.7	Fire Doors
AS/NZS2310	Glossary of paint and painting terms.
AS/NZS2311	Guide to the painting of buildings
AS2700	Colours for general purposes.

AS3750	Guide to Properties of Paints for Buildings - Introduction and list of Guides
AS3750	Paints for Steel Structures - Introduction & List of Standards
HB73.1	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 wellbeing, 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 – Paint Systems.

- 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.
- 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.
- 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
- 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 <u>http://www.anztpa.org</u>
- 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 QUT 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:

- Careful selection and assessment of safer paint products to minimise potential health effects. [Select Low VOC paints where available].
- Painting tasks scheduled out of hours
- Relocation of staff for duration of project [larger projects].
- Alter working arrangements for known sensitised or allergic individuals e.g. work from home, other non-affected area.
- Ensure all paint containers remain sealed and when brushes are soaking.
- Clean up any spills promptly to reduce vapour load in indoor environments.
- 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.
- 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:

- Minimise wash out of rollers by storing overnight in clean plastic bags or specially designed roller covers to continue use
- Store brushes in a bucket of water overnight, spin water out next day and continue use
- 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
- 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:

- Completion of preparation of surfaces
- After application of prime or sealer coats
- After application of undercoat
- 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 WHS Regulation 1997 and <u>National Code of Practice for Safe Removal of Asbestos</u>.

15.2 Paint Materials

Brands

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

- Dulux
- Taubmans
- Bristol
- Wattyl
- Resene

Intergrain 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 QUT.

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.

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 WHS 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 use, 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 / be 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 (immediately prior to over-coating) in accordance with the coating manufacturer's recommendations and to the Superintendent's approval.

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 AS1627, AS4025 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 AS1627.1, by solvent or alkaline cleaning.
- b) Hand or power tool cleaning: to AS1627.2 or .7 respectively. A final surface at least equal to preparation grade 'St2' of AS1627.9 shall be specified.
- c) Abrasive blast cleaning: to AS1627.4, 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

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.

Timber Surfaces

- Large resinous knots and decayed areas shall be cut out and replaced with sound timber.
- Remove any defective putty and punch nails.

- For painted surfaces, spot prime small knots, cracks, open joints, holes and bare timber with specified wood primer.
- Fill as necessary with polymeric fillers or oil-based putty, which in the case of clear or lightly pigmented finishes, shall match the substrate.
- Use appropriate inert filler if the finish is a two-pack epoxy or polyurethane.
- Dressed surfaces shall be lightly sanded in the direction of the wood grain with appropriate grade 'free cut paper' and powdery deposits removed.
- 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. <u>http://www.apas.gov.au/</u>

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

Oil based and alkyd paints may only be used internally to buildings with approval from Manager, Maintenance Services.
16 Circulation and Access for People with Disabilities

16.1 General

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 Building Code of Australia (BCA). The BCA prescribes a minimum standard of provision to be in accordance with Australian Standard AS1428.1 - 2009 (incorporating amendment no 1). Where appropriate, every effort should also be made to incorporate the requirements of AS1428.2 - 1992. In addition, some aspects of AS1428.4 noted herein and the Access Code for Buildings may be required to be complied with. QUT 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 QUT Disability Adviser and the Associate Director, Health and Safety Advisory Services.

Provisions for access and facilities for people with disabilities should be integrated, in almost all cases, with those for the non-disabled people, thus minimising feelings of segregation that may otherwise be experienced. Particular attention shall be paid to toilet facilities, lifts, door sizes and swings, floor finishes, hand rails, position of switches and card readers, services, access and parking. Building entrances shall normally be at ground level without steps or shall be accessible by way of ramps at the required gradient. Door threshold steps should ideally be avoided with the maximum permitted where necessary for weatherproofing being 20mm. Threshold steps will only be acceptable with the express approval of QUT.

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 AS1428.2 Clause 24. Refer Section 19 - Teaching Spaces.

New buildings and major building refurbishments are to endeavour to accommodate the non-statutory provisions as far as is practicable, minor works projects are to provide the statutory requirements as a minimum.

16.2 Vertical Circulation

Lifts

Lifts where provided shall comply with AS1735.12, AS1428.2 the BCA and QUT's DSG Section 29 for Lifts. For all new buildings lift cars are to be of a minimum size as stipulated in AS1428.2 - 1992 Section 6.2 - Circulation space for 180° wheel chair turn - 2070mm deep X 1540mm wide measured in accordance with AS1735.12-Section 2. Refurbished lift car sizes shall be considered on a case by case basis by Facilities Management in consultation with QUT Equity Services, 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 AS1735.12 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.

Stairs

Stairs for vertical circulation shall be provided with handrails to both sides of all flights and shall comply with Clause 11.2(b) of AS1428.1.

As recommended in AS1428.1 - 2009, provide a strip of contrasting colour or texture on the stair tread nosing. Tactile ground surface indicators should be installed in accordance with AS1428.4 also refer Section 6 - Floors and Floor Finishes on stair treads.

Ramps

The maximum gradient for ramps exceeding 1900mm in length shall be 1:14. Refer clause 10.3(a) in AS1428.1 - 2009. Tactile ground surface indicators should be installed in accordance with AS1428.4

See summary of specifications for walkways, ramps and landings at Table C in AS1428.1 - 2009.

16.3 Amenities

Toilets and Showers

On each level of each building where toilets are provided, at least one unisex accessible toilet shall be incorporated. In all toilet areas one (1) "ambulatory" WC is to be provided as per the BCA. Consideration should be given to installing power operated doors for one PWD toilet per building, refer clause 13.5 in AS1428.1 – 2009.

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.

Drinking fountains

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

Door Closers

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 kick plates - refer DSG Section 10 Doors. Ensure door grilles are not provided in PWD doors.

Switches

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

Tap Fittings

Provide CP Caroma Care Nordic basin mixer with 160mm extended lever option or Hansa Prado basin mixer with 160mm extended lever option.

Hand Basin and Cantilever Bench

Provide semi-recessed fitting Caroma Laser Basin with D251 heavy duty bracket with waste tie, or 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 Curved Arm Back Rest, 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)

Catheter Shelf

Provide Caroma "Bathmate" shelf fixed at min 900mm - max 1100mm above floor level. (AS1428.1 - 10.4.1)

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.

16.4 Teaching Facilities

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 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.

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 Equity Disability Officer.

Refer to Section 20 - Special requirements for Laboratories.

16.5 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 augmentation system.

The standard hearing augmentation system for use at QUT is the Williams WIR TX75 PRO infrared emitter, to be used in conjunction with the Williams WIR RX22-4N infrared receiver and neckloop.

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

16.6 Signage

Refer to AS1428.1, Section - 14 Acoustic and Section 18 – Signage.

16.7 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.

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

16.8 Lighting

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

- AS1680.1 2006 Interior and workplace lighting
- AS1680.0 1998 Interior lighting Safe movement
- AS1680.2.3 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 down lights and spotlights may present difficulties for people with vision impairment.

Any lighting controls connected to the QUT data network are required to be connected to a lighting control vlan approved by ITS. Any variation to the approved vlan will need approval from the Associate Director Infrastructure services.

16.9 Glass in Buildings

Glazing in buildings where the BCA requires access for people with disabilities, should be marked in accordance with AS1428.1.7.5 See also AS1228 - 2006 Glass in buildings - selection and installation Section 5.19 MAKING GLASS VISIBLE (MANIFESTATION)

16.10 Reception Counters

The design of reception counters must be considered from an access point of view and designs must be approved by the Equity Section.

16.11 Footpaths (External & Internal)

Footpaths should provide a continuous accessible path of travel to or within a building providing access to all facilities and should not incorporate barriers (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.

17 Health, Safety & Environment

17.1 Introduction

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

- Qld Work Health and Safety (WHS) Act 2011 & WHS Regulation 2011
- Building and Construction Industry (Portable Long Service Leave) Act 1991
- Electrical Safety Act 2002 & Regulation 2013
- Environmental Protection Act 1994 & Environmental Protection Policies and Regulations (various]
- Radiation Safety Act 1999 & Regulations 2010

17.2 Principal Contractor

The Contractor shall be appointed as the Principal Contractor within the meaning of the WHS legislation for Construction Projects with estimated contract value of \$250,000 or greater.

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 Work Health and Safety; Electrical Safety Environmental Protection 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 \$150,000 or more, the Principal shall ensure that Qleave are notified with the filing of approved forms and payment of appropriate fees as per Building and Construction Industry (Portable Long Service Leave) Act 1991 (Queensland).

17.5 WHS Management Plans

The Principal Contractor must ensure that:

- A WHS Management Plan is provided to the Principal as per the WHS Regulation (S309), and which addresses in particular, risks that may impact on University working environment
- Appropriate Safe Work Method Statements are received and maintained for all High Risk Construction Work activities to be undertaken by any Contractor as per the WHS Regulation (S312.)
- WHS Management Plans and Safe Work Method Statements are updated as required throughout the project, that information is disseminated and appropriate records are kept.

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

17.6 Workplace Health & Safety Officer/Advisor for Construction Site

The Principal Contractor shall appoint an appropriately qualified person to be the Workplace Health and Safety Advisor prior to work commencing. The Principal and appropriate QUT personnel must also be informed of the appointed person.

17.7 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 Principals representative shall be notified within 24 hours of any site incidents and a record must be available within 24 hours upon request by the Principal.

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

17.8 Notifiable Incidents

The Principal Contractor must ensure that all notifiable incidents on the work site are reported to Worksafe Queensland within the prescribed timeframe.

The Principal shall also be notified by 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 Executive Director, Health, Safety and Environment, 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.

17.9 QUT Specific Information and Induction

The Principal shall provide the Contractor with health, safety and environment information specific to Queensland University of Technology (QUT) and work activities that may impact on the project.

The QUT Facilities Management induction provides relevant information for contractors and is available through the QUT Facilities Management website <u>https://www.qut.edu.au/additional/contractors</u>

On Construction Projects where a Principal Contractor has been appointed, the Principal Contractor and key representatives must ensure that they are aware of any Health, Safety and Evnironment (HSE) information specific to working on QUT premises and this information is appropriately communicated to all Project workers.

ALL other contractors and their subcontractors, shall attend or complete the QUT Facilities Management induction, before commencement of work at any QUT premises.

Records will be maintained by the Principal.

17.10 Safe Design Principles

The Principal Consultant (or designer) must comply with their Safety in Design (SiD) duties in accordance with the QLD WHS Act 2011. The Principal Consultant (or designer) is to provide a SiD report in accordance with the QLD WHS Regulations 2011 (section 295) at the time of contract documentation and at other project phases when required. The outputs of the SiD report shall be used as inputs into the construction risk management process.

Safe Work Australia's Safe Design Principles shall be applied for all new building or structure projects, refurbishments, service works, external works etc.

The key principles are:

- 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
- Product Lifecycle safe design applies to every stage in the lifecycle from conception through to disposal -eliminating hazards or minimising risks as early in the lifecycle as possible.
- Systematic Risk Management the application of hazard identification, risk assessment and risk control processes to achieve safe design.
- Safe Design Knowledge and Capability -- should be either demonstrated or acquired by persons with control over the design.
- 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 WHS 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 minimises all HSE risks, in particular to University property, personnel and others.

17.11 Risk Management

Evidence shall be provided to QUT 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:

- the nature of the risk or hazard
- the likelihood of occurrence
- the likely frequency of occurrence given risk controls in place
- the severity of injury or damage
- Further risk control options available to minimise outcomes

17.12 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 Electrical Safety Act & Regulation and also in WHS legislation.

The Principal Contractor must fulfil the legal obligations as per the Electrical Safety Act 2002 and WHS Act 2011. They must also ensure all other Contractors meet their specific legal obligations as designers and installers.

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.

17.13 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 Workplace Health and Safety Queensland, 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 QUT Facilities Management department, Senior Technical Officer (M & E Contracts).

Please forward all relevant information to the appropriate QUT contact.

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 **QUT Wayfinding Signage Manual¹**

The **QUT Wayfinding Signage Manual** 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 Building Code 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 QUT 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 QUT Facilities Management 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 Management system. Secondly to assist with the yearly asset survey's 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 space@qut.edu.au

The Project Coordinator/Manager must request the door barcode labels from Estate Planning by emailing space@qut.edu.au

The responsibility for installation is as follow:

- 1. For a project involving maximum 10 spaces Estate Planning will produce the barcodes and Security will install the barcodes.
- 2. For a project involving more than 10 spaces Estate Planning will produce the barcodes and the Project Coordinator/Manager will arrange for the installation as part of the project signage work.

¹ Refer to Appendix 18.2 Wayfinding Signage Manual.

18.4 Other Specific Signage

Details of the following signs, where applicable, are to be obtained from QUT:

- Building project sign board
- Opening plaques for buildings

18.5 Digital Signage

QUT has implemented a digital enterprise signage solution to compliment the current physical signage across QUT campuses. The "Videro" digital signage solution provides a rich platform of functionality and capabilities enabling the delivery of general information, wayfinding and timetabling information across QUT. The aim of the digital signage is to provide key information to students, staff and visitors ensuring that all applications of digital signage meet quality standards of simplicity, uniformity and aesthetic appeal, while being highly functional. QUT has an enterprise corporate licence for Videro digital signage solution and all displays specified for signage must use and be compliant with the Videro solution. Any exemptions must be approved in the first instance by the Director of Learning Environments and Technology Services. Further details regarding Videro digital signage installations and specifications are available by emailing digitalsignage@qut.edu.au

19 Teaching Spaces

19.1 Introduction

A primary objective in the design of learning and teaching spaces should be to provide multi-use spaces that enable pedagogical flexibility. The briefing of each learning and teaching space should confirm that QUT's preferred pedagogical approaches are supported as well as supporting any specialist requirements.

Learning and teaching spaces must always ensure the safety of students and staff, be cost efficient, and designed to accommodate minor changes in use without significant costs.

QUT's Teaching and Learning Committee has developed a guide to the design of teaching space which is to inform the design of all new and refurbished learning and teaching spaces.²

QUT manages learning and teaching spaces in two ways; centrally managed and booked general teaching spaces, and specialist teaching spaces that are used and managed by specific Faculties.

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 learning and 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

² Appendix - 19 – Policy on Future Design of Teaching Space, Update 411, Aug. 2005, Issued Dec. 2005

General teaching spaces are those spaces available for use by all QUT and include lecture theatres and classrooms.

Classrooms are multipurpose rooms with flat floors and movable furniture. Lecture Theatres are centrally controlled specialist learning and 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 Facilities Management – Timetabling Office.

The technology component of general learning and teaching space is arranged by Learning Environments and Technology Service (LETS).

Computer Laboratories

Computer laboratories are a combination of centrally controlled spaces which are bookable and managed by the Timetabling Office and Faculty controlled spaces which are managed by the Faculty they are allocated to. They usually have a flat floor with fixed furniture.

Specialist Learning and Teaching Spaces

Specialist learning and teaching spaces are those controlled and bookable through the Faculty they are allocated to.

These include scientific laboratories, computer laboratories, workshops, performance rooms, kitchens, studios and language laboratories. These rooms are usually custom designed for a specific purpose.

Where any equipment connects to the QUT network (either directly or indirectly), approval of the design and equipment must be endorsed by the Director of LETS and the Associate Director of Service Operations.

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 Estate Planning. 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 Learning and Teaching Spaces Furniture - Classrooms

Provide standardised furniture, principally loose tables and chairs, for both the standard workstations and PWD workstation(s). (Note DSG Section 9.11 - All chairs to take a minimum 80Kg, and at least 25% of seats to be large seat pans. This applies also to tablet armchairs.)

In addition, provide PWD workstation furniture (suitable for use by people with disabilities and in conformity with AS1428.2) at a ratio as per Table 3.9 of the Access Code, 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 Disability Adviser.

Make provision for PWD, in general conformity with Clause 18 of AS1428.1-2009 and Access Code for seating spaces in auditoria, such as Lecture Theatres.

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 audio-visual 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 Learning and 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 be selected on life cycle costs, quality of construction, <u>functionality</u>, warranty, ability to withstand expected usage traits, and supply of spare parts. Selected seating shall be by approval of QUT Facilities Management.

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.

Audio-visual equipment accommodation shall be via a custom bench typically purchased by LETS. Any nonstandard 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.

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.

All chairs to be gas lift and on castors.

Specialist Learning and Teaching Spaces

Furniture, both fixed and loose in specialist teaching spaces may be designed to suit the particular teaching or research activities of the space. Determine these requirements as part of the FDB.

For laboratories refer to 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 tabletop, or in an approved 'pop-up' connection device similar to Extron HSA800. Liaison with Audio-visual 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 spaces in positions where they can be seen by all occupants.

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 Gallagher controlled.

Wireless computing

In consultation with the Associate Director of Service Operations, 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 selected in consultation with Associate Director of Service Operations and Estate Planning. 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. Audiovisual equipment in general teaching spaces will be specified by LETS. Refer Section 23 - AV Standards for Classrooms and Lecture Theatres.

LETS will act as the audiovisual consultant for any project involving the installation of AV equipment or facilities.

LETS will act as the installation contractor where applicable and appropriate. Level of Audio-visual facilities will be categorized as per below:

Abbreviation	Description
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	A dual-projector fully equipped Tiered Lecture Theatre with high definition wide screen
Theatre	projection capable of displaying two different images simultaneously
Studio	Studio Universal Design Space with a basic range of AV facilities

AV FACILITY	SMR	VCR	PBL	Tiered Theatre	Studio
Data Projector	Opt	Opt	Std	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	Std
Wireless (WiFi Coverage)	Std	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*1	Std	Std	-
Program Audio System	Std	Std	Std	Std	Std
Surround Audio System	-	-	-	Opt	-
Hearing Augmentation	Opt*2	Std	Std	Std	Opt* ²
Simple Button Panel (AMX)	Std	-	-	-	Std
Comprehensive Touch Panel (AMX)	-	Std	Std	Std	-
Lighting Controls at Bench	-	-	Opt	Std	-
Lecture Capture (Echo Software)*	Opt	Opt	Std	-	-
Lecture Capture (Echo Hardware)*	-	-	-	Std	-
Interactive Screen	Opt	-	-	-	-
Cable Cubby	Opt	Std	Std	Std	-
Collaborative Work Station (CoW)	Opt	-	-	-	-
Bio Box	-	-	-	Opt	-

- * Available with a lectern when managed by LETS
- *1 Voice reinforcement will be determined on an individual room basis
- *² LETS have hearing augmentation kits available for users of these spaces to borrow as required on an individual basis

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). However for specialised classrooms (i.e. biomedical 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. QUT preferred aspect ratio is 16:9.

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 Standards 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 Standards for Classrooms and Lecture Theatres. Details of AV cabling and documentation are also described in this Section.

19.8 Learning and 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. Lecture Theatres with exterior windows – LETS recommend motorised blinds to be controlled by the rooms AV control systems.

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. QUT 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 Learning and Teaching Spaces and Computer Laboratories Furniture provision has been described above in Clause 19.4.

In Lecture Theatres, podiums and stage areas shall comply with the requirements of AS1428.2 Clause 26.

Specialised Learning and 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. 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.

The extent of the provision, as set out in BCA Section D3.7, shall be applied to any general learning and teaching space in which voice reinforcement (sound amplification) is provided. 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 shall 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. All Tiered theatres with dual projectors shall have a Bio-box or approved alternative to house the greater quantity and complexity of audio-visual equipment.

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 QUT LETS design 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 bio-box.

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.

Bio-box Services

Refer *Section 23 AV Standards for Classrooms and Lecture Theatres* for the provision of power and lighting to a Bio-box.

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 and/or AS2243, AS1940, AS4332, AS or ASNZS60079.10.1, and referenced and related documents including the Queensland Workplace Health and Safety Act and regulations and the NCC (National Construction Code). 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 Act 2011
- Workplace Health and Safety Regulation 2011 (with regular amendments)
- Managing the Risks of Hazardous Chemicals in the Workplace Code of Practice 2013
- Queensland Health (Drugs and Poisons) Regulations 1996
- Radiation Safety Act 1999
- Radiation Safety Regulation 2010
- Radiation Safety Standards published by Queensland Health which set out the requirements for licensing radiation sources in use and in storage (e.g. PR100:2010).
- How to manage work health and safety risks Code of Practice 2011
- Gene Technology Act (2000) and Regulation (2001)
- AQIS

The Laboratory Brief

The laboratory design brief must clearly define the operational requirements of the laboratory and associated spaces. Appendix A of AS2982 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.

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 touches on chemical storage issues, Designers should comprehensively review standards referenced by AS/NZS 2982 for relevance.

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.

Design Items					
New Buildings	 slab to slab heights 				
	service voids/ ducts				
	external service spaces				
Existing Buildings	ceilings/ceiling heights				
General • fixed or removable joinery					
	• laboratory services ducted versus fixed joinery				

Address the following design items as applicable:

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.

20.2 Consultation

There shall be close collaboration and coordination between the consultants and QUT's Engineering Services Staff to ensure compliance with this design guideline on a project specific basis.

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 QUT'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 QUT'S technical contacts to consultants at the inaugural Project/ Consultants meeting.

20.3 Laboratory Furniture

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 tops to be approved by the University. All bench tops are to incorporate an approved drip mould.

Bench top 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 powder coated mild steel or stainless steel to suit the application. Where risk of corrosive exposure exists, ensure that any powder coat used is corrosion resistant, such as epoxy powder coat. 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 degrees Celsius) 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 set downs 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 floods. 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 water systems (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 tap ware. 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 QUT 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 QUT 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 to Section 27 - Electrical Services.

Note the particular requirements of laboratory-related codes with respect to outlet locations above benching, services isolation and proximity to flammable liquids 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 QUT Classrooms and Lecture Theatres).

20.10 Fume Exhaust Systems Refer to Section 24 - Air Conditioning and Ventilation.

20.11 Health & Safety Provisions

Typical minimum safety provisions to satisfy AS/NZS 2982.1may 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 Section 20.5 – Finishes.

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 the 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 to 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 tap ware 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. 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 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, or at least one per lab, should be designed to be easily manually 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.

Working Heights and Under Bench Clearance

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 AS1428.2 and Section 9 - 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 AS1428.1.

Reach Distances

Reach Distances for disabled workstations should comply with the provisions nominated in Section 22 of AS1428.2.

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 14.1 of AS1428.1-2009 for details on switches and controls.

Hearing Augmentation - Listening System

Provide an audio-frequency induction loop system in accordance with AS1428.2 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 cryogens (e.g. liquid nitrogen or helium).

Examples of 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. cryogens very low temperatures, oxygen displacement, delivery by lifts, special storage)
- Mechanical vibration or freedom from vibration.

21 For future use

DSG Part 2 - Services

22 Videoconference Facilities

22.1 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.

22.2 Definitions

To be read in conjunction with definitions in Section 23 - AV Standards 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. QUT LETS does not recommend the use of access grids.

22.3 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 0.6 seconds (RT60)
- Ambient noise NC30
- Isolation to STC50
- Windows to be avoided, otherwise acoustically treated

22.4 Lighting

Lighting must be carefully designed to ensure local participants can be clearly 'seem' 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.

22.5 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. Taubmans 'Blue Monet' T69-6A or approved equivalent is recommended.

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 QUT 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 should be in compliance with AS1428.2. Screen and Camera position to provide best viewing distances and angles for the local participants.

A clock clearly visible to the near-end participants (adjacent to the display wall) is required.

22.6 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.

22.7 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.

22.8 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.

22.9 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.

22.10 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

22.11 Meeting Rooms

Single or dual images. Dual preferred. All requirements in 22.10 apply equally to meeting rooms used for video conference applications.

22.12 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 QUT image quality should be VHS-quality or better - typically 2Mbps. Bandwidth for external connections should be 384Kbps or higher if possible.

23 AV Standards for QUT 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 Audiovisual 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 Audiovisual Installation Standards ³ (Reviewed in 2012) for detailed specification and installation guides.

23.1 Definitions

	Word or Short-form Definition			
Classroom	General purpose teaching space with a flat floor and loose furniture			
Lecture	A general purpose teaching space which has fixed seating and a tiered or sloping floor.			
Theatre	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			
XGA	Display image resolution of 1024 horizontal by 768 vertical picture elements (pixels)			
SXGA	A display resolution of 1280 by 1024 pixels			
WXGA	Resolution of 1366 by 768 pixels in 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 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			
РС	A personal computer running under a Microsoft Windows platform			
OHP	Overhead Projector – an optical device for projecting transparencies onto a screen			
Data	An electronic device capable of projecting an image from a computer or video source			
Projector	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			
QUT LETS	QUT's Learning Environments Section (LETS) is responsible for the design installation			
	and maintenance of Audiovisual facilities in general teaching spaces.			

³ Appendix - 23.1 - Audiovisual Installation Standards and Guidelines, Dated 10.10.12

23.2 Responsibilities

Audiovisual equipment in general teaching spaces will be specified by QUT LETS.

QUT LETS or nominated audiovisual contractor will act as the audiovisual consultant for any project involving the installation of AV equipment or facilities.

QUT LETS will act as the installation contractor where applicable and appropriate or nominate an approved audio visual contractor.

23.3 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 M	leeting Room; A typical Media equipped Meeting Room with a standard range ies
VCR Video Conf a comprehe	erence Room; A typical Media equipped high end Video Conference Room with ensive range of AV facilities for high end Meeting / Board Rooms
PBL Problem Ba projector a (standard f	sed Learning; A typical Media Equipped flat floor podium with a single data nd comprehensive range of AV facilities for Collaborative Learning Space at floor classroom)
Tiered A dual-proj	ector fully equipped Tiered Lecture Theatre with high definition wide screen
StudioUniversal d	esign space with basic AV facilities

23.4 Equipment Standards

Audio visual equipment standards will be determined by AVS. Current standards will be documented on the QUT LETS 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 QUT LETS.
- Data projectors shall have a minimum brightness according to screen size. Where possible solid state lamp projectors should be used. QUT recommend the use of Panasonic or Sony projectors
 - o PBL projectors shall produce no less than 3500 ANSI lumens
 - Tiered Theatres and rooms with images wider than 3 metres shall have projectors producing no less than 6000ANSI 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 BCA 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.

23.5 Projection Facilitation

Design requirements for the provision of projection facilities in teaching rooms are described in Section 19 - Teaching Spaces Clause 6.

23.6 Services & Environment

Identification of varying services requirements for the range of rooms. Level of AV Facilities:

AV FACILITY	SMR	VCR	PBL	Tiered Theatre	Studio
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		1	1	2	1
adjacent to data projector location)					
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 Port on Wall or in Floor Pit	1	1	1	2	1
Double Port in Bio-box				6+	1
Double Port in Ceiling for Data Projector (or		1	1	2	1
adjacent to data projector location)					
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

Audiovisual 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.

23.7 Specifications for Lighting Systems for Lecture Theatres

(This section should be read in conjunction with AS1680.2.3-2008 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 QUT Audio visual Services.

Introductory Comments

The importance of lighting design in lecture theatres used for video or data projection cannot be overemphasised. 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 QUT's audio visual Services 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 Audiovisual Services. This is achieved with contactor switching of lighting circuits and digitally controlled dimmers.
- e) Lighting systems must not cause interference to any other audiovisual 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 Dynalite DMC805 controller or equivalent Dynalite model.
- g) Alternatively light switching may be controlled by electronic relay controllers equivalent to Dynalite DRC320FRMOT or DDRC810MOT or equivalent Dynalite model. These units are software compatible with Dimtek/Dynalite 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 provde a dry contact closure signal to the AMX control system. QUT LETS recommend where possible the use of dynalite movement detectors connected to the Dynalite 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. Particular 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 QUT. (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) controlled from a

separate dimmer channel. 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. QUT 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 use 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 Audiovisual 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 Audiovisual 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 Dy-Net communication bus.

Variations (detailed specification)

There shall be no variations from the specifications and parameters outlined above without written approval from QUT LETS. This particularly applies to dimmers and the use of LED lights.

23.8 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 opening 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 LED lighting shall be required (manually switched).

23.9 AV Cabling

Responsibility

In any project involving the installation of AV facilities, the contractor will be responsible for installing cables as specified by QUT LETS.

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 QUT LETS.

Termination

Learning Environment or nominated AV installer will terminate all signal cables relating to AV equipment - with the exception of data network, telephone 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 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 Building Code 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 (Coaxial cable)	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	Shielded CAT6A colour to be determined in consultation with QUT LETS	
Multicore audio	Canare MR202-8AT	
Microphone	Canare L4E6S	
Optical fibres	Belden (core numbers shall be subject to individual system requirements)	
Video (Coaxial cable)	Belden 8241	

23.10 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. Any enquiries are to be communicated to Learning Environments.

23.11 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:

- QUT's Design Standards & Guidelines including all updates issued at the time
- National Construction Code and 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 Mechanical Engineer Building Services (HVAC) to ensure compliance with this design guideline on a project specific basis.

The Consultants will be required to attend documentation reviews with the Mechanical Engineer Building Services (HVAC) 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 Mechanical Engineer Building Services (HVAC) 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 QUT'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 Mechanical Engineer Building Services (HVAC). 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, fire services, data cabling etc. in the context of safe and practical operational and maintenance access to all HVAC elements eg. heater banks.

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 QUT Engineering Services when the architectural considerations have adverse consequences for the mechanical systems. 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 Mechanical Engineer Building Services (HVAC).

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. Ceiling space installed fan coil units shall not be used.

Constant volume systems with terminal reheat shall not be used, without approval from the Mechanical Engineer Building Services (HVAC).

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, Mechanical Engineer Building Services (HVAC) 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 ⁰ C DB

NB. The Design Conditions cover comfort air conditioning only. Process cooling/heating and humidification and special requirement processes shall be discussed with the Mechanical Engineer Building Services (HVAC) prior to concept design.

NB. Cooling tower design capacity to meet the project specific requirements shall be determined in liaison with the Mechanical Engineer Building Services (HVAC).

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 ± 1°C 50% RH ± 5%
Winter Internal Design Condition	21.0°C DB ±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 m2/ person
Library reading room		2.5 m2/ person
Laboratory	Undergraduate (1st year)	3.7 m2/ person
Laboratory	Undergraduate (other years)	4.7 m2/ person

Laboratory	Post Graduate	12 m2/person
Tutorial rooms		1.8 m2/ person
Lecture rooms		1.1 m2/ person
Computer Labs		2.5 m2/ person

24.10 Engineering Calculations

Engineering calculations shall be provided when requested by Mechanical Engineer Building Services (HVAC). Diversity factors shall be determined in consultation with Mechanical Engineer Building Services (HVAC). Heat load profiles will be calculated with a proven an accepted calculation program such as BSG-ACADS Camel 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, Mechanical Engineer Building Services (HVAC) 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 form 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. 50 mm 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.

Air Filters - shall comply with Australian Standard AS1324.1 – 2001 and be Email or approved equal. The following is a guide to the type of filters to be specified and is the minimum acceptable performance:

Air handling units and large fan coil units

Deep Bed Bag Filters		
AS1324.1 Efficiencies:-	F5	Туре
		1&2
		Class B
Fan coil units & fresh air intak	es	
V Form Panel Filters		
AS1324.1 Arrestance:-	G4	Type 1
		Class B

NB. Air filter performance design capacity to meet project specific requirements shall be determined in liaison with the QUT Mechanical Engineer Building Services (HVAC).

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.

Cooling Towers - shall comply with all relevant codes, standards, acts and regulations. Towers shall be designed and installed strictly in accordance with AS3666, AS1055 and AS1657 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 Mechanical Engineer Building Services (HVAC).

Cooling tower drift loss performance shall comply with AS4180.1

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).

Appropriate 'safety' signage to be installed at cooling tower sites.

Air handling units and fan coil units - shall comply fully with AS3666 and shall be approved by the QUT Mechanical Engineer Building Services (HVAC) prior to specifying.

Large AHU shall be built up sandwich panel or proprietary equipment manufactured by Air Design, 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 QUT 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 QUT Mechanical Engineer Building Services (HVAC).

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 loads from 0-100% to handle additional load increases. 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.



Additional Control requirements – Multiple Coil Arrangements - Optional

Confirm with the QUT Mechanical Engineer Building Services (HVAC) 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 dead bands 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 Mechanical Engineer Building Services (HVAC).

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 Mechanical Engineer Building Services (HVAC).
- 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 provide upon request plotted psychrometric charts of all associated air processes trough 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.

CHW Ceiling Cassette Units - Use of cassette units as an air conditioning solution is subject to the approval of the Mechanical Engineer Building Services (HVAC). If approved, 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/Johnson 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.

QUT Mechanical Engineer Building Services (HVAC) 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/Johnson 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 AS3666 & AS1657. Maintenance access shall be provided to all items of plant with particular attention being given to filters, drain trays and traps, bearings, motors, fan scrolls 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 all equipment. The following items shall be identified: - CHW isolation valves, CHW balancing valves, CHW air bleeds, VAV Boxes, heaters, 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.

Bunding - 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 ratting of light fittings for plant rooms shall be IP55. Where there is more the one entry lights shall be double switched. Provide maintenance lighting for internal AHU spaces as necessary for the performance of routine maintenance.

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 AS1677. 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 AS1668 and AS1677.

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 QUT Mechanical Engineer Building Services (HVAC).

*Stainless Steel- *Stainless steel pipework shall be spiral butt weld from 316 stainless steel sheet and shall comply with AS1449.

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 Normal	Intervals for Steel	Intervals for Steel	Intervals for Copper	Intervals for
	Pipe Horizontal	Pipe Vertical	Pipe Horizontal Runs	Copper Pipe
	Runs mm	Runs mm	mm	Vertical Runs mm
15	1500	2000	1250	2000
20	1500	2500	1500	2500
25	1500	3000	1500	3000
32	2500	3500	2000	3500
40	2500	3750	2000	3750
50	3000	3000	2500	3500
65	3000	3500	3000	3500
80	3000	4000	3000	3500
100	3000	4500	3000	4000
150 and above	3000	5000	3000	4000

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 AS1250.

Hanger rods shall be fabricated from galvanised 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 IMI Hydronic Engineering 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 QUT Mechanical Engineer Building Services (HVAC).

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 IMI Hydronic Engineering STAD
Over 50mm	Butterfly valves as for "Isolating valves"
	Balancing valve equal to IMI Hydronic Engineering 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 and QUT's Mechanical Engineer Building Services (HVAC).

Identification - all pipes shall be identified in accordance with AS1345 for the Identification of Piping, Conduits and Ducts and AS1318, 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 selfextinguishing 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 zincanneal 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 externally insultated 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 or Denso Vapour Seal embedded with reinforced glass cloth overlapped 50mm. Apply a second coat of Fosters or Denso Vapour Seal 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 500 mm 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

- 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 AS4254. The minimum pressure ratting 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
- 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 AS3666 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.
- I) All flex duct spigots with dampers shall incorporate a standoff locking quadrant.
- m) The flex duct fire smoke index ratting 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

- 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 swirl or 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 AS1668.1.

NB. 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 0.035W/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 25kg/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.

Internal Duct Insulation - 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 AS4254 - 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. 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 as approved by QUT's Mechanical Engineer Building Services (HVAC) 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: 0.05 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.

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 (e.g. 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, Subboards 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 AS3000.

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 (AS2700) 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 be 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.

Fault Level

The MSSB and each Mechanical Services Distribution Boards shall be provided with a traffolyte label indicating the fault level for 1 second. The label shall be screw fixed in position on the switchboard. Traffolyte labels shall have black lettering (5mm high) on white background.

Indicator Lights

MSSB indication lights mounted on the facia shall be "Schneider Electric Harmony XB5 (LED)" 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 LED lamp in each switchboard greater than 2m² in face area.

VSDs

Variable Speed Drives shall be "Danfoss HVAC" or approved equal.

Busbar

The busbar shall be "Schneider Electric Isobar PEV" or approved equal busbar chassis system.

Earth and Neutral Bar

The earth and neutral bar shall be sized to accommodate separately all earth and neutral cables. Multijoining 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 Schneider Electric Struxureware Building Operation (SBO) control system. The functional control shall be as per Section 32 - Building Management System.

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.

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 QUT 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 QUT 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.

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 QUT's Mechanical Engineer Building Services (HVAC) 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

Note: The Principal contractor is required to provide to QUT detailed information on all assets included in this project. All HVAC asset categories as per the list in 40.5.6 "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 QUT to ensure that adequate details for this requirement are entered into the Excel template files and produced at or before practical completion. Consult with QUT's Mechanical Engineer Building Services (HVAC).

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 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 AS1851.6, 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:

- QUT's Design Guidelines including all updates issued at the time.
- NCC (National Construction Code) and Local Building Regulations
- Workplace 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 QUT's Project Engineer Building Services 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 Building 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 QUT's Project Engineer Building 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 QUT'S technical contacts to consultants.

25.3 Design Documentation

The consultant shall develop and maintain design documentation available for review by QUT's Project Engineer Building Services.

25.4 Design Coordination

Particular care is to be taken to ensure coordination of all other aspects of the project e.g. fire services, electrical services, data cabling etc. in the context of safe and practical operational and maintenance access to all electrical elements. Some particular QUT 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.

25.5 Sanitary Plumbing

Materials for pipework above ground shall be UPVC, HDPE, Copper type B or Stainless steel subject to Building Act requirements and project specific requirements.

HDPE Pipe Fire Hazard – Where HDPE pipe is to be used and is located within 1.5m of an energy source, it must be fire rated to a FRL of -/30/30 to prevent the fire spread of ignited droplets to other fire compartments. This fire rating is in addition to fire collars at floor level. The reason for the fire rating is explained below:-

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

Contact QUT's Project Engineer Building Services 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 to the Authorities minimum requirements and the architectural layout. (Refer to Section 12 - Structural Design with this clause).

The installation shall be designed to gain full benefit of the systems as set out in the current Queensland Standard Sewerage Law, Standard Water Supply Law and AS3500.

25.6 Sewerage System

Design: Generally the system shall be designed in accordance with WSA 02.

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. (See also Section 26 - Piped Services and Storage Tanks).

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 AS2033. Neutralising traps shall be installed if required by Local Authority regulations.

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 QUT's Project Engineer Building Services for approval of the proposed fire rating method.

Grease traps shall be installed from all commercial kitchen areas. A hose tap with a RPZ 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 current Queensland Standard Water Supply Law, Queensland Sewerage Law and be subject to Local Authority approval.

25.7 Sanitary Fittings & Fixtures (Product Selection)

On a project specific basis alternative product options may be submitted to QUT's Project Engineer Building 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 QUT.

Vanity Basins	Caroma Centro vanity basin code: 664115W overflow with Galvin Clinilever pillar tap	
	Laminar flow with 80mm lever handles and ceramic disk. Operation cold water only.	

Disabled	Caroma Cosmo wall basin, 4L capacity to overflow, one tap hole. Nordic Care basin mixer.	
Vanity Basins	Operation cold water only.	
Wall Hung	Caroma Flora 500 Wall Basin in White (Code No. 641230) with WhiteBasin Button (Code	
Basins	No. 687084W) and D206 Concealed Hanger Bracket (Code No. 687014).	
WC Pans and	WC1 Caroma Profile 2 close coupled suite, colour: white. WC2 Caroma Caravelle easy	
Cisterns	height pan to ambulant toilet suite, colour white.	
Toilet Seats	Caroma Regal Toilet Seat (White - Code No. 301131GM)	
Disabled	New Caroma Toilet Care 800 Cleanflush wall faced suite with backrest and Pedigree II care	
Toilet Suite	single flap seat – sorrento blue. Code 01900BSB. Check height dimensions on site before	
	ordering and installation.	
Cleaner's	Caroma Cleaner's Sink (Code No. 811592) with D1520 Wall Bracket (Code No. 811594) and	
Sink	CP Bucket Grate to suit (Code No. 811593.)	
Urinals	Caroma Torres urinal, Zip brand, direct fed flushing system to be installed.	
Waterless	Waterless urinals are to be considered on a project specific basis and must be confirmed	
Urinals	with QUT's Project Engineer Building Services.	
Shower	New shower head and mixer shower head: Enware hand held shower with grab rail right	
	hand side. Cide SGR029CTL-RH (includes elbow and chrome head adjacent shower shower	
	head holder). Mixer: Galvin Clinilever single lever shower mixer with 180mm disabled lever	
	(TMSHWCPD).	
Drinking	To be considered on a project specific basis and must be confirmed with the Project	
Fountain	Engineer Building Services.	

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 the Project Engineer Building Services. All handles except hose cocks will be anti vandal. All taps shall be CP brass construction with jumper valves.

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.
Eyewash	Enware Model EE120 Eye and Face Wash Fountain, wall mounted.
Dishwashers	Refer Section 9 Furniture and Fittings

25.8 Floor Wastes

Floor wastes shall have a minimum 100 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.** Pressure drop activated trap seal primer devices 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 QUT's Project Engineer Building Services in regards to stormwater reuse. A feasibility and cost report listing storm water re-use opportunities must be provided to QUT's Project Engineer Building 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 National Plumbing and Drainage Code AS3500 and as otherwise amended by the Design Guidelines.

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. 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 QUT's Project Engineer Building Services for approval of the proposed fire rating method.

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 Technical Officer (Hydraulics). Provide a means of dispersal with water energy reduction.

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".

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 Gallagher alarm to be transmitted to QUT Central Monitoring Station.
- Pre-start and start-up check sheets

Subsequent to consultation and review by QUT 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 QUT Engineering Services and the Project Manager with an overview of the ascommissioned 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 40.5.6 "Equipment lists/asset registers" to be barcoded or signed as per the Asset Register ID numbers. It is the contractors' responsibility to liaise with QUT to ensure that adequate details for this requirement are entered into the Excel template files and produced at or before practical completion. Consult with QUT 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:

- QUT's Design Guidelines including all updates issued at the time
- NCC (National Construction Code) and Local Building Regulations
- Workplace 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.

26.2 Consultation

There shall be close collaboration and coordination between the consultants and QUT's Project Engineer Building Services 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 Building 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 QUT's Project Engineer Building 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 QUT'S technical contacts to consultants.

26.3 Design Documentation

The consultant will develop and maintain design documentation available for review by the Project Engineer Building Services.

26.4 Design Coordination

Particular care is to be taken to ensure coordination of all other aspects of the project in relation to it s 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 or stand-off "Abbey" clips. 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 copper tube to AS1432 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.

All mains within buildings shall be Type "B" copper. UPVC pipework shall be used for deionised and distilled water only. 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 QUT's Project Engineer Building Services.

Valves: Isolation valves shall be AVK resilient 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 AS2845.3 and AS3500.1. Use Watts, Conbraco, Febco or Tyco backflow prevention devices. 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 breaktank if required by the end user. All installation is to comply with AS3500.

Serving one outlet	15mm min not exceed 1.5m				
Serving two outlets	20mm min				
Serving three outlets	25mm min				
Above three outlets	as required				

Branch lines shall be of the following minimum sizes:

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 NB copper tube, type B to AS1432. Short branches up to 1.5m may be 15mm NB 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 plant rooms, 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 in 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:

- a) All Showers must be fitted with a tempering valve (Watts/RMC)
- b) Disabled showers and basins must be fitted with TMV Thermostatic Mixing Valve (HORNE or FM Mattsson thermostatic mixing device.
- c) 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.
- d) Toilet Hand Basins are not to be provided with hot water unless specifically called for in the Space Description Forms or required by AS1428.

Thermostatic mixing devices shall be HORNE brand or FM Mattsson and tempering valves shall be Watts/RMC.

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 by the use of a local quick recovery/instantaneous unit such as a "Stiebel Eltron" 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 Facilities Management, 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 AS3500.4.

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 AS3500.

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 QUT's Project Engineer Building Services.

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 unless alternative option has been reviewed and approved by QUT's Project Engineer Building Services. 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 "Dynavac" or "Nash" manufacture, 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 of Teflon-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 Page **184** of **384**

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 AS1345 for the Identification of Piping, Conduits and Ducts; and AS1318 - Industrial Safety Colour Code and AS2700 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 AS3000 and AS3500.

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.

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 in 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 AS3500.1. 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	
	compressor overload	
Compressed air alarms	low oil pressure	
	low air pressure	
	overload	
Vacuum alarms	high vacuum	
	water seal failure	

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 Act or 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 Superintendent. All work shall be completely installed and tested as required by this Section and the Code requirements and shall be leak tight before inspection of the particular work is requested.

Tests shall be repeated to the satisfaction of the authorities having jurisdiction.

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 GALLAGHER alarm to be transmitted to QUT Central Monitoring Station.
- Pre-start and start-up check sheets

Subsequent to consultation and review by QUT 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 QUT Engineering Services and the Project Manager with an overview of the ascommissioned 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 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 QUT to ensure that adequate details for this requirement are entered into the Excel template files and produced at or before practical completion. Consult with QUT 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:
 - QUT's Design Guidelines including all updates issued at the time
 - the Local Electricity Supply Utility Condition of supply
 - the Local Building Regulations and the Building Code of Australia
 - Queensland Electrical Safety Act 2002
 - AS3000, 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 QUT'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 QUT'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 QUT'S technical contacts to consultants at the inaugural Project/ Consultants meeting.

27.3 Electrical Design Documentation

The following will require consultation with QUT's Project Engineer (Electrical) for approval before design documentation is commenced:

- 1. USB charging outlets. Limited use will only be permitted.
- 2. Generators (e.g. solar or gas)

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 Building Code of Australia Part J6.
- I) 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 QUT 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.
- 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 previous 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

For new and larger projects (will be confirmed in the QUT 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.

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 0.5 or better.
- Reflectance for floors and furniture at least 0.2 or better.

Note Luminance contrast between floors and walledges to be at least 30% to assist with wayfinding.

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 QUT to determine lighting levels and preferred lighting concepts. Where QUT 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 AS4282 "Control of the obtrusive effects of outdoor lighting" are adhered to. Wherever possible, it is QUT's intention to avoid the adverse effects of skyglow.

Indoor lighting in all buildings shall generally be LED type.

All luminaries, lamps and control equipment used in the design shall be long-life and energy efficient type.

Alternative lamp and luminaries will be considered. QUT acceptance of these will be at the discretion of the Project Engineer (Electrical).

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).

Architectural Feature lighting in the foyer and high profile public spaces will be energy efficient, require minimum maintenance and can be easily accessed.

Dimming Control is only used in specialist applications.

LED luminaries are to be switched in strategic groups for energy management and lighting control purposes.

Specialist Application lighting will be nominated by the QUT stakeholder in the space design brief. Specialist Applications Lighting solutions will be presented to QUT Project Engineer (Electrical) for review.

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 Electrical Regulatory Authorities Council (ERAC) National certification scheme. All luminaries shall be supplied complete with lamps.

LED 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. All new Luminaires installed shall have the" Installation Date "permanently marked on the body of the light fitting.

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 LED luminaries are to be reused, or approval is required, the luminaries 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. In most situations, existing LED luminaires will be replaced by LED luminaires.

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. 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 of LED sources shall be 4000°K.

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 AS1158 and AS4282 as nominated above. Where paths run adjacent to, through or beneath buildings, the luminaire shall be mounted on the external wall of the building. For white light, preference is for LED then 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 luminaries 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, preference shall begiven to LED then Metal Halide, all with a CRI of greater than 80. 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 galvanised steel holding-down pole mounting and fixings into prepared excavated holes with in-situ concrete, direct buried poles are unacceptable. All external luminaries shall possess a suitable International Protection (IP) rating, to AS1939, 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

The contractor shall provide a drawing in pdf format to QUT detailing all pole locations to enable QUT to provide the contractor with the building area reference and pole number to be included on the pole label. Every light pole shall be labelled as follows - Pole Number / Building Area Reference / Distribution Board No. / Circuit No. / Lamp Details Thus pole number 10 installed between Buildings A and B, supplied from DB1 in building A from circuit breaker 23, with a 250 Watt metal Halide fitting installed on the pole would be labelled: **10/A-B/A-DB1/23/250MH.**

The above details shall be engraved on a narrow unbevelled brass plate, screw fixed to the pole in a vertical orientation on the kerb side. Mounting height shall be mounted on base of pole above ground level. Fixing screws shall be stainless steel vandal-proof type to prevent removal.

The contractor shall be responsible for updating a base campus drawing in dwg format provided by QUT to indicate the location of each new pole and pole numbering details. Once the drawing has been updated the dwg file & pdf shall be included as part of the as constructed documents. The drawing file and pdf shall be separately emailed back to QUT.

Where false fully accessible ceiling exists, luminaries 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 off other services or ceiling hangers is unacceptable.

Downlights shall not be used for general illumination unless they are of the compact LED 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

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 300 from the vertical. Works of Art display lighting shall be mounted on QUT approved proprietary type lighting track.
- Where LED lighting is used, such lighting shall use low UV LED 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.

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 skyglow. 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 QUT 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.

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.

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 40000K LED 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.

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.

Performance Guidelines LED Luminaires

LED Luminaires

The general requirements for the design and construction of LED luminaires shall include the following:

- prevention of entry of dust and insects except for open louvre fittings
- provided with suitable electronic control gear (see below)
- Specially designed heat dissipation to ensure the junction temperature of any LED does not exceed the manufacturer's recommended maximum operating temperature. Heat dissipation shall be designed for the installation conditions and wattage of the unit.
- be purpose built LED fittings designed for use with an integral LED module unless a retrofit style lamp is specified
- be photometered as a complete luminaire including driver and all attachments, at operating temperatures consistent with its intended installation by a NATA approved laboratory with resultant photometric data available in IES or Elumdat format.

Wiring of LED luminaires shall:

• be 105°C (minimum) 250V grade, PVC insulated cable of minimum 0.75 mm² cross sectional area

- be neatly secured within the luminaire clear of all control gear. Adhesive tape shall not be used for looming and securing cabling
- be terminated in a large bore, fixed, terminal block mounted adjacent to cable entry and of adequate size to accommodate three (3) off 2.5sq.mm conductors in each terminal
- be colour coded
- for recessed luminaires, be provided with 3 core PVC/PVC flexible cable fitted with a 3-pin plug top to enable the luminaire to be removed and replaced from beneath the ceiling. The cord shall be between 1.5 and 2.5 metres long. Conductors shall not be smaller than 0.75 mm²

Control gear for LED luminaires shall:

- Provide optimum and maximum currents to suit the luminaire operating requirements over the whole range of input voltages
- automatically reset in the event of a fault
- contain isolation between primary and secondary sides
- operate in temperatures between -20°C to +50°C
- where dimmable control gear is used, shall dim with linear characteristics without flicker to 30% of initial light output or lower
- be of low loss type with power consumption quoted as part of total luminaire wattage
- contain integral electronic overload protection circuitry
- contain integral electronic over-temperature protection circuitry
- contain integral electronic short circuit protection circuitry
- have an input power factor greater than 0.9 lagging
- Where a single driver is used to control multiple luminaires, the control gear shall be specifically designed for this purpose and necessary wiring instructions, maximum luminaire quantities and wiring lengths shall be provided.

LED modules shall:

- Be manufactured by a reputable manufacturer with proven experience in LED production such as Philips, Osram, CREE, Lumileds or Samsung
- Shall contain individual LED chips from a single colour bin in accordance with C78.377 2008 of no more than 5mm wide.
- LED batch bin number, recording luminous flux, wavelength/colour and forward voltage of LED shall be provided as part of the operation and maintenance manual and/or as part of the luminaire's order/serial number.
- Be rated to 70% initial lumen output (L70) for a minimum of 50,000 hours at the specified installation conditions and drive current.
- Colour temperature specified shall be measured at the specified drive current
- The colour variance between modules within all luminaires of the same type throughout the installation, initially and at 25% rated life shall fall within a 3 step MacAdams ellipse
- Have a colour rendering index (CRI) > 80
- Shall have a minimum module lumen efficacy measured for the following colour temperatures and CRI at the specified drive current with appropriate thermal management of:

2700K	CRI > 80 - 60lm/W	CRI > 90 - 50lm/W
3000K	CRI > 80 - 65lm/W	CRI > 90 - 55lm/W
4000K	CRI > 80 - 751m/W	CRI > 90 - 60lm/W
6500K	CRI > 80 - 80lm/W	

 Led luminaires installed for purely decorative purposes shall be exempt from the minimum efficacies above

LED Luminaires shall be provided with a warranty with the following minimum features:

- Minimum 5 year warranty period
- Warranty to be provided for the intended installation type (eg recessed, surface mounted, inground etc.) with ambient temperatures appropriate for such installations in Australian conditions.
- Warranty to be serviced for the period stated irrespective of the hours of luminaire usage within the period (ie no hours/day requirements).
- Warranty to cover both the luminaire and driver for full replacement of all parts required to achieve a fully functional luminaire
- For the purposes of administering the warranty a 'failure' of an LED module shall be defined as follows
- For back-lit 'panel' type luminaires, a failure shall consist of the failure of 10% of the LED chips across the entire luminaire OR the failure of 5% of the LED chips in a contiguous area so as to be noticeable when viewing the fitting.
- For edge-lit 'panel' type luminaires, a failure shall consist of the failure of a minimum of 5% of the LED chips in such a manner as to cause noticeable disturbances to the appearance or output of the luminaire.
- For 'diffused' LED downlights where individual chips are not visible, a failure shall consist of the failure of 10% of individual chips across the luminaire
- For LED downlights where individual chips are visible, a failure shall consist of the failure of any single LED chip
- For external decorative or wayfinding luminaires, a failure shall consist of the failure of 20% of the LED chips across the luminaire.
- For external street and area lighting luminaires, a failure shall consist of the failure of 10% of the LED chips across the entire luminaire OR the failure of 5% of the LED chips in a arrangement so as to affect the optical performance of the luminaire.
- In all instances including those mentioned above, a failure shall also consist of the light output falling below 120% of the stated 'end of life' light output (eg L70 + 20%) during the first half of the warranty period and the stated 'end of life' light output (eg L70) during the second half of the warranty period.

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.

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.

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 LED 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 AS1428.1-2001, with a 35mm min width toggle.

Motion Detection

Motion detection should be considered for all areas and discussed with QUT. 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 QUT 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 QUT's approved BEG detector types suitable 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 QUT 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 L&F 268 keyed. The type of key switch (L&F268) shall be nominated on consultants drawings and specification.

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

Contactor 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 28W LED luminaires. The contactor control box shall be mounted in the ceiling space above the lighting switch location for the room or space.

The standard installation configurations are as per the attached drawings:

- Standard Schematic Master Slave configuration iA20RM
- Standard Schematic Master Slave configuration iA20RM for greater than 10 2X36 W luminaries or multiple lighting circuits
- Lighting control contactor box (240Vac Coil)
- Lighting control contactor box (24Vac Coil)

Installation Commissioning notes are available on request from QUT.

TABLE A-	TABLE A- Offices, Meeting Rooms, Lecture Theatres, Laboratories, Teaching Space						
	and	other similar	areas (Presence Dete	ction)			
Detector	Detector Type	Mounting	Maximum Sensing Range	Mounting Type	Comment		
		Height Range			S		
iA20RM	Motion Sensor	2 - 3.5 metres	Maximum detector				
	- Master single		spacing based on Table 1	Surface mount or			
	channel			recessed			
iA20RS	Motion Sensor	2 - 3.5 metres	Maximum detector	Surface mount or			
	- Slave		spacing based on Table 1	recessed			
General Not	es:						

- 1) Use of other types of detectors proposed for these areas requires approval of QUT.
- 2) Two channel detectors shall be provided.

	TABLE B - Corridors & Car Parks (Motion Detection)						
Detector	Detector Type	Detector Mounting Maximum Sensing Range Type Height Range		Mounting Type	Comments		
iA20RM	Corridor Master Single	2 - 3 metres	- 3 Maximum detector spacing shall be tres based on walking toward distances only. <i>Maximum spacing between</i> detectors is 20 metres				
iA20RS	Corridor Slave	2 - 3 metres	Maximum detector spacing shall be based on walking toward distances only. <i>Maximum spacing between</i> <i>detectors is 20 metres</i>	Surface mount or recessed			
iA20RM	M Motion 2 - 5 Detector spacing based on Table 1 Sensor - metres (Maximum spacing 80% of walking across distance)		Surface mount or recessed				
iA20RS Motion 2 - 5 Detector spacing based on Table 1 Sensor - metres (Maximum spacing 80% of walking Slave across distance)		Surface mount or recessed					
iA20RM	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		

iA20RS	Great	2 - 10	Detector spacing based on Table 3	Surface	Use only for
Height metres		metres	(Maximum spacing 80% of walking	mount or	ceilings above 5
	Slave		across distance)	recessed	metres in height

General Notes:

- 1) Areas within corridors provided with seating shall be provided with presence detection for the seated areas utilising iA20RM and iA20RS 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 QUT.

TABLE C - Foyers and other General Areas (Motion Detection)						
Detector	Detector	Mounting	Maximum Sensing Range	Mounting	Comments	
	Туре	Height Range		Туре		
iA20RM	Motion	2 - 5 metres	Detector spacing based on	Surface		
	Sensor -		Table 1 (Maximum spacing	mount or		
	Master		80% of walking across	recessed		
			distance)			
iA20RS	Motion	2 - 5 metres	Detector spacing based on	Surface		
	Sensor -		Table 1 (Maximum spacing	mount or		
	Slave		80% of walking across	recessed		
			distance)			
iA20RM	iA20RM Great 2 - 10 metres Detector spacing based on		Detector spacing based on	Surface	Use only for	
Height			Table 3 (Maximum spacing	mount	ceilings above	
Master 80% of walking across		80% of walking across		5 metres in		
distance)			height			
iA20RS Great 2 - 10 metres Detector spacing ba		Detector spacing based on	Surface	Use only for		
Height Table 3 (Maximum spacing		mount	ceilings above			
	Slave		80% of walking across		5 metres in	
			distance)		height	

General Notes:

1) Areas within Foyers and General Areas provided with seating shall be provided with presence detection for the seated areas utilising iA20RM and iA20RS 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 QUT.

	TABLE D - Toilets, Air Locks & Locker Rooms (Motion Detection)						
Detector	Detector Type	Mounting Height Range	Maximum Sensing Range	Mounting Type	Comments		
iA20RM	Motion	2 - 5 metres	Detector spacing based on	Surface			
	Sensor -		Table 1. (Maximum spacing	mount or			
	Master		80% of walking across	recessed			
142005	Mation	2 E motros	Detector spacing based on	Surface			
IAZURS	Sonsor	2 - 5 metres	Table 1 (Maximum spacing	Surface			
	Sensor -			mount or			
	Slave		distance)	recessed			
iA20RM	Motion	2 - 5.0 metres	Detector spacing based on	Surface			
	Sensor -		Table 2 (Maximum spacing	mount or			
	Master		80% of walking across	recessed			
			distance)				
iA20RS	Motion	2 - 5.0 metres	Detector spacing based on	Surface			
	Sensor -		Table 2 (Maximum spacing	mount or			
	Slave		80% of walking across	recessed			
			distance)				
iA20RM	Great	2 - 10 metres	Detector spacing based on	Surface	Use only for		
	Height		Table 3 (Maximum spacing	mount	ceilings above		
	Master		80% of walking across		5 metres in		
			distance)		height		
iA20RS	Great	2 - 10 metres	Detector spacing based on	Surface	Use only for		
	Height		Table 3 (Maximum spacing	mount	ceilings above		
	Slave		80% of walking across		5 metres in		
			distance)		height		
General No	ites.			·			

neral Notes:

1) Areas provided with seating (locker rooms) shall be provided with presence detection for the seated areas utilising iA20RM and iA20RS detectors at spacings suitable for presence detection.

2) Use of other types of detectors proposed for these areas requires approval of QUT.

3) Two channel detectors shall be provided.

Installation Commissioning notes is available on request from QUT.

	Rar	nge (circular detectio	Presence detection	
Mounting height	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 1 - iA20 Occupancy Sensor

	Range (circular detection)				
Mounting height	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 2 - iA20 Occupancy Sensor

TABLE 3 - iA20 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



- A MAXIMUM DF 10 2x36W LUMINAIRES SHALL BE DIRECTLY ÷
- SWITCHED BY THE DETECTORS . ALL LIGHTING WILL OPERATE WHEN ANY SENSOR SENSES MOVEMENT AND THE LIGHTNG SWITCHES ARE TURNED ON. ~i
 - m
- THE LDCKABLE SWITCHES ALLOW FOR THE MOVEMENT SENSORS TO BE BYPASSED IF ANY SENSOR IS FAULTY.



LIGHTING CONTROL CONTACTOR BOX (24VAC COIL)

NOTES:

1. FOR AMX CONTROL PROVIDE A 1.5 METRE LEAD AND PLUG TOP TO SUPPLY THE CONTACTOR BOX. PROVIDE A GLAND ON THE CONTACTOR BOX TO FIX THE LEAD.

6 OFF SPRECHER SCHUH V7-W DIN RAIL MOUNTED THROUGH TERMINAL BLOCKS SUITABLE FOR 4.0mm ² CABLE & 1 OFF EARTH TERMINAL. EARTH THE METAL FIXING PLATE AND CONNECT TO THE EARTH TERMINAL	
METAL FIXING PLATE	
ALLOW SPACE FOR A FUTURE NO AUXILIARY CONTACT	
SPRECHER SCHUH CA7-23-M40-240VAC CONTACTOR AC3 RATED COMPLETE WITH 4 NO CONTACTS (23 AMP RATED) & 240V COIL. PREWIRE THE CONTACTOR COIL TO THE TERMINAL STRIP	
DIN RAIL	
PVC PLASTIC BOX COMPLETE WITH CLEAR COVER	
PROVIDE AN ENGRAVED LABEL SCREW FIXED TO THE FRONT COVER "MOVEMENT SENSOR LIGHTING CONTACTOR"	

LIGHTING CONTROL CONTACTOR BOX (240V COIL)

NOTES:

1. FOR AMX CONTROL PROVIDE A 1.5 METRE LEAD AND PLUG TOP TO SUPPLY THE CONTACTOR BOX. PROVIDE A GLAND ON THE CONTACTOR BOX TO FIX THE LEAD.

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 LED luminaries. Digitally controlled dimmable LED will also be considered, where applicable but kept to a minimum.

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

Refer to attached Lighting Design Schematics AC000 005 001E and AC000 005 002E when reading this section.

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 QUT.

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 QUT approval. Central Emergency Lighting Systems shall be replaced progressively during minor works. All redundant cabling and equipment associated with central battery systems or redundant systems shall be removed completely from the site.

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 QUT 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 QUT, 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 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 AS2293. 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, circuit failure component, and dc/ac inverter (in case of LED type). A 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 the 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 QUT approval. Examples of acceptable arrangements are as follows:

- a) "Quickfit, Slide Connect or similar" 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 and socket dropping through and from the luminaire cut-out. Sockets must be located so that they are acessable by hand through the Luminaire cutout. 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 QUT 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 QUT 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) - Refer Lighting Design Schematics AC000 005 002E for actual circuitry. 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 QUT approval. Refer to preferred luminaire types.

Luminaire Types

Use of a Photoluminescent Emergency exit luminaires are not permitted by QUT.

Unless otherwise approved by QUT, all luminaire types shall be only the **Premium range / quality** of the approved brands and as follows:

a) Emergency Exit Luminaries: 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, non-maintained, large head for non-tiled ceilings (for control gear access). Provide proprietary clear cover where mounting heights are less than

- (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 LED lamp or LED (batten) type lamp protection to suit the application (e.g. wire guard, diffuser).
- d) Battery Types: L10 Lithium is the preferred battery type, Nickel Cadmium can only be used with written approval of QUT Facilities Management. Lead acid types are not acceptable unless specifically approved by QUT (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 QUT shall be final regarding acceptance or otherwise of any alternative offered.

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 when not in the test mode) 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. **The test switch system must have a reset facility.**
- 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 except in the case of monitored systems.
- 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 QUT approval).
- g) Provide a Traffelolite label with white lettering on red background 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 2293.2 and QUT 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, end of line resistors (E.g. in Nexus Systems), 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 QUT. 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 QUT's current Emergency and Evacuation lighting maintenance Contractor, in conjunction with the electrical trade contractor, must complete the following tasks before the emergency lighting system will be accepted by QUT.
 - Inspect and test emergency lighting circuitry to confirm compliance with QUT's requirements. (Typical Emergency Lighting Design Schematics AC000 005 001E and AC000 005 002E in QUT's Design Standard and Guide line)
 - Supply and install QUT'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 electronic copy to comply with QUT's maintenance management system (Archibus). 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 QUT
- 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:





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 mm2 PVC wiring and shall not be loaded above 75% of the permissible values outlined in AS3000.
- 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-1

(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, QUT 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 servery area and other GPO's for vending machines. Allow separate supply for a Refrigerator, a Dishwasher and a ZIP 3to 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
- 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.
- Audio-Visual Equipment shall be provided with the appropriate power requirements as described in <u>Section 23 AV Stds for Classrooms and Lecture Theatres</u>. 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 Solar Power Systems (PV Arrays)

Solar Power systems at QUT campuses each comprise of

- 1. Roof mounted Photovoltaic array generation of DC power,
- 2. PV Inverters DC to AC power
- 3. all Inverters AC fed into Distribution board PV
- 4. protection system interconnections in the building or precinct Main Switchboard.

Both campuses are served by dedicated 11KV Energex network and metered at 11KV at network entry points. Each embedded PV solar generation system has an associated protection system to deactivate the PV Solar generation in the event of Mains power failure. This is required to maintain electrical safety whilst mains power failure is being investigated.

All equipment in each system are to adhere to CEC, Energex and Australian Standard requirements. For a more up to date briefing contact QUT FM Engineering services section Project Engineer (Electrical systems) before commencement of Solar system design.

Roof top PV Solar generators

PV panels shall be tier 1 with an efficiency greater than 15%. The PV panels are required to have a manufacturer's material and workmanship warranty of no less than 10 years and a performance warranty of no less than 80% of the rated output for 20 years.

The PV array design shall consider maintainability, safe access, shadowing and roof obstructions. As a minimum the PV arrays shall be two metres from the roof edge of buildings without edge protection.

All PV panels will be supported by a certified proprietary aluminium mounting system appropriate to each individual roofing system with a warranty of no less than 10 years. The mounting system shall be penetration free where practical. Any penetrations are to be sealed and weatherproofed.

Each string of panels shall be on an DC isolator within line of sight of the panels and protected from environmental damage.

DC Surge devices shall be provided in compliance with AS/NZS 5033.

All cabling shall be run within a cable management system be trays or ducts that will appropriately protect cable from mechanical and environmental damage. DC cable trays shall be colour coded yellow.

All existing roof systems will need to be structurally assessed before PV panels can be mounted on any roof.

DC/AC Solar inverters

All inverters are to be CEC certified, Energex and Australian Standard compliant.

Inverters are required to have a manufacturer's warranty of no less than 5 years

Each grouping of inverters shall be mounted as close to the solar panels as reasonably practical in a top floor well ventilated plant room. This to minimize DC cables lengths routed within QUT buildings.

An earth fault alarm with an indicator light and audio alarm is to be located at the inverter location and interfaced to the BMS.

DB-PV (consolidation point of all AC cabling from DC/AC Inverters)

Ideally this DB-PV will be mounted within line of site of the DC/AC inverters within the same plantroom. Where this is not possible it will have to be clearly signed to indicate the route of the AC cabling route.

Metering

Private metering of the DB-PV submain shall be provided and interfaced to the QUT metering system.

Other embedded generation

Hired generation connection and standby generation connection will deactivate the PV Solar generation on the roof. This is to ensure there will be no two sources of supply whilst standby and hired generators are powering the building.

Protection system at the Precinct MSB

Each precinct MSB may consist of a group of buildings served by the same Energex substation. The power generated by solar panels are to be contained within each Substation precinct.

Grid protection relay

A grid protection relay is to be installed in accordance with the requirements of the Energy Queensland Group – Standard for Connection of Embedded Generating Systems (>30 kW to 1,500 kW) to a Distribution's LV Network.

A current transformer and voltage reference shall be installed on the consumer mains cable to the main switchboard of the precinct MSB or building MSB where served by a dedicated transformer and connected to the grid protection relay.

The grid protection relay shall be connected to a contactor in series with the DB-PV submains to isolate the DB-PV supply should exporting of excess electricity occur.

In buildings serviced by a dedicated transformer the grid protection relay shall be connected to the inverters via a RS485 cable to ramp up and down the inverters to prevent exporting of excess generated electricity.

Labelling

All labels are required to be engraved type permanent labels.

Engraved labels must be provided to the following:

- At the connection to the inverters (visible without opening the inverter enclosure
- At the DC isolators
- At the surge diverters and string fuses

Labels shall detail the relevant inverter, distribution board and circuit breaker pole information (e.g. DB-PV CB 4/5/6)

A laminated as-built string configuration diagram is required to be mounted in the DC combiner box. Dual supply labels are required to be installed on the PV distribution board (if applicable) and main switch board.

Documentation

Documentation for the AC system shall comply with the requirements of Energex and Australian Standards. Drawings are required to show details and signature of RPEQ who has reviewed the drawings. The following schedules are required on the single line diagram schematic.

CUSTOMER DETAILS	
NMI	
BUILDING	
ADDRESS	
INSTALLER	
CUSTOMER	
APPROVED INVERTER RATING	
EXPORT LIMIT	

EQUIPMENT LIST		
ITEM	MANUFACTURER	ТҮРЕ
PV ARRAY		
INVERTER		
PROTECTION RELAY		

		IES SETTINGS	
SETTING PARAMETER	PICKUP	TRIP TIME DELAY	MAXIMUM DISCONNECTION TIME
OVER VOLTAGE 1 (V>)			
OVER VOLTAGE 2			
(V>>)			
UNDER VOLTAGE (V<)			

IES SETTINGS		
SETTING PARAMETER	DISSCONECTION TIME	THRESHOLD
OVER FREQUENCY (OF, f>)		
UNDER FREQUENCY (UF, f<)		

GRID PROTECTION RELAY SETTINGS			
PROTECTION FUNCTION DESCRIPTION	ANSI/IEEE C37.2 CODE	DEFAULT SETTING	TIME DELAY
UNDER VOLTAGE (UV)	27P		
OVER VOLTAGE (OV)	59P		
UNDER FREQUENCY (UF)	81U		
OVER FREQUENCY (OF)	810		
VOLTAGE VECTOR SHIFT (VVS)	78		
RATE OF CHANGE OF FREQUENCY (RCCOF)	81R		
DIRECTIONAL POWER	32		

See next page.



27.11 Switchboards & Sub-boards

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 (Form2 and Form3 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 by900mm 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.
- f) Cabinets shall have a minimum 2mm zinc anneal steel construction
- g) External switchboards shall be fabricated from 2mm marine grade stainless steel
- h) Perspex cover shall be provided over all live parts that are exposed when doors or escutcheons are opened. 2 off 10mm holes shall be provided in perspex covers over all bus bar joints. 10mm holes shall be provided in perspex over line and load side of terminals.
- The main switchboard shall be provided with a traffolyte or brass label indicating the fault level for 1 second. The label shall be screw fixed in position on the main switchboard. Traffolyte labels shall have black lettering (5mm high) on white background.



QUT - Facilities Management

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) Busbar sections of distribution boards up to 250 Amp rating shall be of NHP Grizz-Bar or Schneider Isobar manufacture.

The bus bar shall incorporate the following features:

- A fully encapsulated bus bar system
- all live parts shall be shrouded
- bus bar shall be minimum 250A rated
- a busbar disconnection system shall be able to disconnect all insitu circuit breakers and unused circuit breaker spaces
- d) Minimum depth of distribution boards shall be 230mm
- e) Enclosures and cubicles shall be of unitary construction, fabricated from minimum 1.6 mm minimum bright mild steel. All joints of each enclosure shall be welded with continuous seam welds ground flush. Spot or tack welds shall not be accepted.
- f) 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.
- g) 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 QUT 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		
Installatio	n Contracto	or: XYZ Electrics P/L	Checking Electrician: A.Sparky	
Installatio	n Date:	15SEPT 2001		
Modificat	ion date:	20 MAY2002/ 5AUG2002)/	
Circuit	Neutral	Circuit Load Description Circuit Breaker		
ID No.	ID No.	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.

- h) All switchboards and distribution boards shall be designed to be vermin proof, dustproof and sprayproof to a minimum of IP54 to AS60529 with hinged lockabledoors.
- All escutcheon panels shall be hinged and secured with a minimum of 2 number slotted thumbscrews. Keys shall be included in the hardware schedule and be as per section 10.10 (see Keying System details). All switchboards and distribution boards shall be provided with an engraved traffolyte label indicating the fault level for 1 second at each switchboard and distribution board. The label shall be screw fixed in position on the distribution board. Traffolyte labels shall have black lettering (5mm high) on white background.
- j) Floor mounted distribution boards shall be provided with a 75mm hot dipped galvanised steel channel plinth.
- k) Distribution boards shall have a separate section within the cubicle for control equipment and accessories. This section shall be a minimum of 400mm high by the full width of the cubicle. Provide two full width DIN rails equally spaced within the section. A metal segregation barrier shall be installed between the mounting pan and the escutcheon to prevent inadvertent ingress of foreign material which may damage control equipment. Provide cable access for sub circuits to pass through separate section and out the bottom of the board. The cabling duct shall extend through this cubicle on both sides. The control section shall have a separate escutcheon and door.

Fuse Cartridges

All fuses shall be HRC cartridge type conforming to AS2005 and AS3135. 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 QUT private meter. Power Quality Meter IEC6100-4-30 Class A type. Refer to DSG Energy Metering System Appendix.

The CTs shall match main incoming supply switch size.

The Metering specification and wiring configuration is as per the DSG Energy Metering System Appendix, Hexeis Pty Ltd are to be engaged to commission on all these Schneider Meters. The meters are to be supplied with network connections capability.

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 (AS2700) 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 30mA Schneider, Merin Gerin and Terasaki 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 LED 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.

When the door or escutcheon of T-Off boxes are opened for access all exposed live parts shall be shielded with shrouds or perspex covers.

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	Cutler Hammer Quick-lag miniature circuit breakers, Terasaki, Schnieder
sub-circuits	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)

27.12 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.

27.13 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 wiring 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.

27.14 Underground Electrical Services

All underground electrical services shall be installed in accordance with the requirements of AS3000 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 AS3000 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 10 mm high. In unpaved areas, the marker 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/240Vconduits.

27.15 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 AS3000 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 o 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 QUT's Project Engineer (Electrical) or nominee to undertake random verification of commissioning tests.

27.16 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.

27.17 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 QUT security office. This key will be made available to ENERGEX.

27.18 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	

27.19 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.

27.20 Lightning Protection

- a) Lightning protection shall be provided to all buildings if recommended using risk assessment criteria specified by AS1768. 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 QUT 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 leaving a building.

27.21 Building Management System Interface (TAC) Refer Section 32 - Building Management System.

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.

27.22 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 QUT representative responsible for AV systems. Switching groups typically within such areas shall be controlled as follows:

Switching Group	Control
General LED 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 buttons shall be engraved with the words LIGHTS ON and LIGHTS OFF.

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 on. Buttons on the switch panel buttons 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 QUT. 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.

27.23 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 QUT to ensure that adequate details for this requirement are entered into the Excel template files and produced at or before practical completion. Consult with QUT 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 QUT Infrastructure and Operations - Network, Cloud and Infrastructure Systems team (QUT IO-NCIS), 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 QUT building.

The following wording contained within this section specifies the "minimum" requirements for communications cabling on all QUT 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 QUT IO-NCIS to ensure complete and thorough understanding of the QUT Communications Network and Infrastructure to ensure specific project requirements and specifications are understood and complied with.

28.2 Contacts

QUT IO-NCIS is responsible for QUT communications infrastructure and services. Contact the QUT Project Manager for more information.

28.3 Exclusions

QUT 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 QUT DSG for information pertaining to AV;
- Consult the QUT Facilities Management Project Coordinator for advice relating to Printing and Desktop Computing

Procurement and installation of QUT ICT equipment

Unless specifically instructed otherwise by QUT, all QUT ICT equipment will be procured by QUT and installed by contractors nominated by QUT.

28.4 Licenses, Certifications and Selection

ALL contractors and their employees working on QUT 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 QUT 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 QUT Facilities Management. QUT IO-NCIS 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, QUT reserves the right to appoint a preferred Cable Installer as recommended by QUT IO-NCIS for Quality Assurance and/or Quality Control reasons.

28.5 Abbreviations and Standards

Abbreviations used within this specification:

- ACMA : Australian Communications and Media Authority
- AS/CA: Australian Standard/ Communications Alliance Ltd
- CR : Communications Room
- DSG : Design Standards and Guidelines
- FM : QUT Facilities Management
- IEC : International Electrotechnical Commission
- ISO : International Organization for Standardization
- Molex : Molex Connected Enterprise Solutions
- MUTO : Multi User Telecommunications Outlet
- RU : Rack units
- TIA : Telecommunications Industry Association
- VOIP : Voice Over Internet Protocol
- WAP : Wireless Access Point
- •

Standards

All installation requirements for customer cabling shall comply with the following Standards:

- AS/NZS 3000 SAA Wiring Rules (latest edition)
- AS/CA S009 Customer Cabling Wiring Rules (latest edition)
- AS/NZS 11801.1:2019 Information Technology General cabling for customer premises, Part 1: General Requirements
- AS 11801.2:2019 Information Technology General cabling for customer premises, Part 2: Office Premises
- AS 11801.3:2019 Information Technology General cabling for customer premises, Part 3: Industrial Premises
- AS 11801.4:2019 Information Technology General cabling for customer premises, Part 4: Single Tenant Homes
- AS 11801.5:2019 Information Technology General cabling for customer premises, Part 5: Data Centres
- AS 11801.6:2019 Information Technology General cabling for customer premises, Part 6: Distributed Building Services

- AS 30129:2018 Information Technology Telecommunications bonding networks for buildings and other structures
- AS/NZS ISO/IEC 14763.2:2014Information Technology Implementation and Operation of Customer Premises Cabling - Planning and Installation
- AS/NZS 14763.3:2017Information technology Implementation and operation of customer premises cabling Testing of optical fibre cabling (ISO/IEC 14763-3:2017, MOD)
- AS/NZS 14763.4:2022 Information Technology Implementation and operation of customer premises cabling – Measurement of end-to-end (E2E) links, modular plug terminated links (MPTLs) and direct attach cabling
- AS/NZS 3084Telecommunications Installations Telecommunications Pathways and Spaces for Commercial Buildings (latest edition)
- AS/NZS 3085-1Telecommunications Installations Administration of Communications Cabling Systems (latest edition)

QUT

QUT has selected Molex Connected Enterprise Solutions as the "single system site" 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 & bt) to the desktop
- Wireless technology (802.11ac and developing standards)
- 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
- Facilities Management applications such as BMS, Digital Signage, EMS and Security systems

Dual OS2 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 & OM3 fibre tie cables between "Primary & Secondary" building Communications Rooms to support the 802.3 standards and systems above.

OM3/4 fibre may also be required in some buildings and therefore specified for the project.

28.6 Warranty

Require the successful Molex Certified Installer (CI), in association with Molex Connected Entrprise Solutions, 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 the QUT Project Manager which will be supplied to the NSDC representative.

28.7 Mandatory Communication and Site Inspections

By directly making contact by phone, the Contractor shall advise QUT IO-NCIS **before** entering and carrying out work within an existing QUT Communications Room as it may be necessary to meet with QUT IO-NCIS to confirm scope of work and impact on existing services.

Contact the QUT Project Manager to confirm the contact details of the NSDC representative.

During construction the Contractor shall maintain regular contact with QUT IO-NCIS and ADVISE QUT IO-NCIS when the specified site-inspection milestones are approaching to arrange inspection.

Minimum notice of 3 working days is required.

Both QUT IO-NCIS and a Queensland representative from Molex will be involved in site-inspections.

For Quality Assurance and Manufacturer Warranty purposes, an invitation from the Contractor shall be extended to Molex advising that milestones are reached (or approaching) to arrange inspection. Contact:

Molex Asia Pac Head Office Melbourne 03 9971 7111 <u>mpn.orders@molex.com</u>

Local contact: Mike Weger <u>Mike.Weger@Molex.com</u> Business Development Manager Main: 03 9971 7111 Mobile: 0400 149 197

Inspection	Inspection points
1	Prior to commencement of work to confirm details and specification.
2	No later than 75% through rough-in prior to sheeting walls and ceilings.
3	Prior to labelling and termination. Present an example of the outlet
	label to QUT-IT Networks for approval at this meeting.
4	2 weeks prior to Practical Completion.
5	Handover.

28.8 Mandatory Documentation

Provisional

Provisional "pre-handover" documentation SHALL be supplied directly to QUT IO-NCIS 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; include 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	OLD	NEW	NEW	Work-station	Comments
Outlet #	Location	Outlet #	Location	number	
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		Gallagher
		P404-C23-12	P522		Gallagher
		P404-C23-13	P500		Office
		P404-C23-14	P500		Office

"Example of UTP Test result summary"

LIV LINKW	ARE IANAGEMENT SOFTWA	\RE			
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 mex 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
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Final

Final as constructed documentation SHALL be supplied directly to QUT IO-NCIS **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)
 - o Test Standard
 - o 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) QUT 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) QUT 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 QUT IO-NCIS 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

Secondary campus distributors are marked with an *. These locations also contain QUT PABX systems and the campus "voice" distributors.

Contact the QUT Project Manager to confirm the NSDC representative for access.

28.10 Communications Room Functional Design

Depending upon cable density the standard QUT Communications Room will consist of, but not necessarily limited to the following requirements and functionality:

Data Communication Room

- A minimum of 12 sq metres in size for Primary and secondary CR's for a minimum installation of 2 racks. For larger installations there will be a minimum of 900mm access at both the front and back of the racks and a minimum 900mm on one end of the row of racks;
- The number of racks required and therefore the size of the room will be dependent on the number of outlets being installed.
- There shall be a minimum of 25% space left for expansion of patch panels and active network equipment within the room/racks
- Constructed for the sole purpose of housing both active and passive QUT communications infrastructure.
- The project shall consult with QUT IT Networks to confirm the size of the proposed room and placement of racks.

Air Conditioning

- Air Conditioning is required 24x7x365 (Temperature monitored by building BMS)
- Absolutely no running parts of the A/C unit shall be positioned above equipment racks.

Security

- Fully secured by Gallagher electronic access controlled system.
- Access to the services within a Communications Room shall be limited to QUT IO-NCIS only.

Room Numbering

The QUT 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

(Refer 28.13 Structured Cabling Distribution and 28.16 Voice Infrastructure)

Equipment Racks

(Refer 28.12 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 QUT IO-NCIS 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 QUT 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 QUT APPROVED Fireproofing and Weatherproofing materials and provide for spare capacity (see Penetrations and Fire Containment AND Spare Capacity).

Active QUT Communications Equipment

The room shall only house equipment managed by QUT IO-NCIS unless otherwise consulted in advance and approved by QUT IO-NCIS.

"Example of a fully operational QUT Communications Room"



28.11 Cable Management

Each equipment rack shall be supplied with Horizontal AND Vertical cable management.

Cable management shall be supplied and installed as per Rack-layout diagram:

- **a.** Horizontal cable management shall be:
 - i. Molex 1RU Horizontal Cable Manager (Part No: CMA-00085)
 - Dimensions mm (WxDxH): 482 x 136.6 x 48.9
 - ii. Molex 2RU Horizontal Cable Manager (*Part No: CMA-00087*)
 - Dimensions mm (WxDxH): 482 x 136.6 x 89
- **b.** Vertical cable management shall be:
 - i. Manufactured by "Rack Technologies" with single side assembly and T-Finger design which integrates with the B&R manufactured racks;
 - ii. Allow two (2) Vertical Finger Managers per cabinet to be installed on both left and right sides of rack (*Product code IQCM45100*).
 - iii. A B&R solution that matches the RT product above will also be considered

28.12 Equipment Racks

Equipment Racks shall be procured and installed by the Building Contractor and is included in the scope of works.

Where a Communications Room is allocated, provide and install a solution manufactured by B&R with the following dimensions and functionality. The building contractor shall submit proposed solution to QUT IO-NCIS for approval.

Dimensions (Height x Width x Depth): 45 RU / 600mm / 1100mm

- **a.** Meshed/Perforated Doors (front & back) to allow suitable air flow. Doors should be lockable and capable of being hung on either side of cabinet.
- b. Side cable zones (both sides) 200mm wide extending full height & depth of rack.
- c. Side panels shall be installed on the sides of the end racks.
- d. All doors and panels to be supplied with quick release spring pin hinges.
- **e.** Side rails inside rack shall be set back 150mm to allow for doors to be fitted without interfering with patch leads.

Clearances of 900mm shall be maintained between front and back walls and one side of the row of racks to provision suitable working space for service /support staff.

In existing buildings and active communications room, older racks may exist already or will need to be retained at the discretion of QUT IO-NCIS.

28.13 Structured Cabling Distribution

QUT 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-2 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 QUT.
- 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 Rooms 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 rooms shall service a maximum of 3 floors, providing all cable runs DO NOT exceed cable length limitations.
- Refer to the project specific "Communications Design Brief" supplied by QUT IO-NCIS.



"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 QUT IO-NCIS for site installation requirements.

- All cables shall be installed in a continuous run terminating in the Communications Room Equipment Racks
- A service loop of 0.5mtr shall be allowed for prior to termination at the Patch Panel, with spare length "secured to" cable tray located in the "cable zone" of the communications rack.
- The following approved Molex PowerCat 6A products shall be supplied & installed in the cabling system:
 - U/FTP LSOH violet cable (product code CAA-0322L-VL);
 - Patch panel, 568A/B Shielded with cable management, 1 rack unit (product code PID-00217); and
 - MOD-Clip Shielded Jack 8W, 568A/B (product code MMC-00017-02). Clipsal 2000 (or equivalent) Wall Plates without identification window.

- 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/trays 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 QUT 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 500 mm.
- Dedicated Communications cable tray to support communications and AV cable only shall be installed where possible.
- Communications cable tray shall be identified accordingly using White markings.
- Products to match the cable tray support for electrical wiring is acceptable throughout the remainder of building.
- Ensure appropriate clearances, bend radius, edge protection and cable support is maintained as per Molex installation standards.
- Cable trays to be bonded as per AS 30219:2018

Catenary Cable

- The option for Catenary wire is available ONLY where cable tray cannot be installed.
- 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.
- Catenary wires to be bonded as per AS 30219:2018

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 OS1/2 (9/125 Micron) Loose Tube Water Block Gel Filled Nylon
- Indoor/Outdoor application: Molex OS1/2 (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 QUT IO-NCIS.
- 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 QUT IO-NCIS 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 | OS2-24 | Nov2020 | 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 agreed Molex product.
- Building Distributor cables shall be terminated into an agreed Molex product.

Terminations shall be made as follows:

- Externally run fibre shall be terminated into BLUE LC UPC shuttered adaptor plates, (Molex part number AFR-00753-BL LC Quad 48 fibre adapter plate).
- Internally run fibre shall be terminated into AQUA LC UPC shuttered adaptor plates. (Molex part number AFR-00743-BL LC Duplex 24 fibre adapter plate)
- The adaptor plates shall be housed in a Molex enclosure (1 RU) (Molex Part number RFR-00311-BK).

All terminations shall be fitted with a plastic dust cap, where required, upon the completion of fibre termination.

Any cabinet housing Singlemode fibre shall be labelled with the correct Iser safety labels as per S009 requirements.

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 with cable management, 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 or 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

The contractor shall supply U/FTP patch leads 2 weeks BEFORE practical completion, with the following specifications:

- a. To attain Molex Channel Warranty, all patch leads shall be Molex Cat6A RJ45-RJ45;
- **b.** Quantities to be supplied shall be double the number of outlets installed (ie 200%);
- **c.** Colour to be white;
- d. Lengths

- i. 25% 1mtr (Molex part number PCD-00700-0W);
- ii. 55% 1.5mtr (Molex part number PCD-00731-0W);
- iii. 10% 2mtr (Molex part number PCD-00701-0W);
- iv. 5% 3mtr (Molex part number PCD-00702-0W);
- v. 5% 5mtr (Molex part number PCD-00703-0W);
- e. No patch lead shall be manufactured, assembled or fabricated on site;
- **f.** Patch lead boots shall be Molex "slim-line" so that the boots do not interfere with each other when installed into high-density switches.

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 QUT IO-NCIS 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 Connected Enterprise Solutions (as the cable manufacturer specified by QUT) 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, accessible and serviceable location at floor boxes or at service columns, NOT for example in the ceiling. The MUTO is typically positioned near the fixed GPO's and shall be labelled with the maximum allowable patch cord length.
- 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 QUT 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 support Consolidation Point architecture <mark>and requires an outlet and plug connection</mark> to ensure shield continuity.

Refer to the project specific "Communications Design Brief" supplied by QUT IO-NCIS.

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.

The following shall be the minimum testing requirements for copper cabling:

- 100% testing of all runs for continuity and polarity.
- \circ 100% testing of horizontal cabling with compliance to Class EA Permanent Link.
- The following parameters must be tested for copper installations;
 - Near-End Crosstalk (NEXT) (Both directions)
 - Power sum Near-End Crosstalk (PSNEXT) (Both directions)
 - Far-End Crosstalk (FEXT) (Both directions)
 - Power sum Far-End Crosstalk (PSFEXT) (Both directions)
 - Power sum Equal Level Far-End Crosstalk (PS ELFEXT) (Both directions)
 - Insertion Loss (Attenuation)
 - Return Loss (Both directions)
 - Delay Skew
 - Continuity
 - Wire Map
 - Characteristic Impedance
 - Length
 - DC Loop resistance
 - Attenuation to Crosstalk Ratio (ACR)
 - ARC @ remote
 - Power sum ACR
 - Propagation Delay

Additional recommended testing is to turn on the HDTDX/HDTDR analysis for all autotests. If PoE is possibly required, you will need to request the +PoE parameter when testing to test for DC Resistance unbalance compliance. NOTE this does not confirm full PoE compliance as mentioned previously. Optical Fibre Cabling shall be tested as follows:

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.

 After all fibre cables have been installed, terminated and labeled the Contractor shall perform "commissioning tests". The Contractor shall as minimum perform tests using a LSPM kit. Tests shall be performed on 100% of fibre cores.

28.16 Voice Infrastructure

The QUT Voice network consists of Analogue, Digital & Voice over IP (VoIP) technologies with many QUT buildings facilitating legacy (separate and parallel) voice specific infrastructure to carry Analogue & Digital signals.

The current university voice standard is VoIP connected across a single cable platform, that is, the structured (and integrated) CAT6 or CAT6A building wiring.

• DO NOT allocate (run/terminate) parallel voice specific infrastructure to QUT work-areas UNLESS otherwise instructed by QUT IO-NCIS.

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.





2000

Series

"Examples of Clipsal Wall Plates"

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- 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 QUT 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 hand written 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 QUT:

- 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;
- QUT Wireless service:
 - Up to 3m, One (1) CAT6/6A RJ45 outlet per Wireless Access Point (WAP)
 - Over 3m, Two (2) CAT6/6A RJ45 outlets per Wireless Access Point (WAP)
 - WAP location to be confirmed as per the survey recommendation to support RTLS. It is preferable that outlets are 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 or as detailed in Commnications Brief or AV Design;
- 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 UPPER CASE 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 QUT IO-NCIS.

UNIQUE IDENTIFIER

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
- **QUT IO-NCIS** 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 QUT IO-NCIS 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 QUT-Infrastructure Services for approval PRIOR TO labelling and termination of outlets.



"Example of FULL and unique Identifiers on a Triple Gang Plate"

28.18 Network Switchgear

QUT IO-NCIS shall procure and supply network switches and wireless access points.

Building Projects shall allow for the installation of all network switchgear, and should include:

- Installing of PDU's in the equipment racks
- Installing network switches in the equipment racks
- One to one patching from patch panels ports to switchports
- Provision of rack layout diagrams
- Labelling of switches

28.19 Wireless Local Area Networks (WLAN)

The following is applicable to Building Projects for BOTH internal and external areas.

The project shall liaise with QUT IO-NCIS to determine WAP locations and cabling requirements, based on a predictive survey performed by the vendor recommended by QUT IO-NCIS. This survey will determine the grade of service per area, based on detailed plans with area usage and expected person numbers supplied.

Additional surveys may be required based on the building requirements, at the discretion of QUT IO-NCIS. These may include:

- 1. Predictive survey(s) Used for "early mark-up" drawings. Identifies the "proposed" placement of access points.
- 2. Pre-install survey Used to validate the final numbers and placement of access points. Based on confirmed construction and functional requirements. To be done "prior to" the rough-in of cable. Changes to plan may be required following this survey.
- 3. Post-install survey Used to validate that the installed solution meets the required levels of coverage and service. Minor changes to positioning may be required.

Installation shall include the Labelling of access points so that it can be clearly read by support staff when near the access point. Labels must be strongly bonded and remain fixed to the access point.

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.



"Example of Wall mounted outlet"

28.20 Power

Each CR shall be provisioned with 10A & 32A power outlets as per Communications Room Layout diagrams:

a. To cater for dual power supplies on active equipment and RCD testing, (where available) power shall be distributed across dedicated circuits FROM separate switchboards;

- **b.** Equipment "Racks" shall be provisioned with a minimum of two (2) IP 56/66 rated 3 pin Combination Switched Socket that is safely supported ABOVE each rack (or min 2200mm above floor), with each circuit distinguished by grey and orange as shown below.
- c. Flat pin arrangement shall be supplied for 10A circuits.
- **d.** Round pin arrangement shall be supplied for 32A circuits.
- **e.** Two (2) Switched Power Distribution Units shall be provided for each equipment Rack. APC manufactured "switched" PDU's (Model: AP8953) shall be procured and depending upon project, the following minimum specification shall be supplied for 32A outlet:
 - 32A circuit PDU
 - o 10A Outlets: Twenty One (21) IEC320 C13 outlets
 - o 16A Outlets: Three (3) IEC320 C19 outlets
 - Protection: Two (2) 16 AMP Circuit Breakers
- f. 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 Appendix 4 below. Power cord shall be a minimum 3mtrs in length.
- **g.** Each PDU shall be installed into the equipment rack as instructed by QUT IT Networks.
- **h.** Each PDU shall be connected into mains power to ensure it is operational. Once tested working, leave connected.
- 2. Earthing of a shielded installation is required under AS/NZS 11801.1:2019 and AS 30129:2018
 - Each cabinet shall be connected to the CES as required under AS/NZS 3000
 - Each shielded patch panel shall be individually connected to the cabinet earth bar
 - Each panel shall be earthed with a minimum 2.5mm2 Yellow/Green earth cable
 - The earth cable should be included in the cable loom supplying the patch panel
 - This will ensure the panel can be removed for repairs/MACs without disturbing the earth connection
 - Daisy chaining of the earth cable between panels is not acceptable
 - Disconnection of the earth cable from the panel for any works is not acceptable

"Example of 3 pin Combination Switched Socket & Straight Captive Plug"



28.21 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 riser shall be identified "QUT 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 LED 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 QUT Security.

28.22 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 QUT IO-NCIS and accommodate QUT Communications cable only.

Conduits shall be labelled 'QUT 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.

28.23 Access Pits

A minimum of P5 sized pits shall be used to provide suitable accessibility to underground QUT 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 QUT regarding the total number and type of communications services required, and the location of the pit.

28.24 Penetrations and Fire Containment

To ensure that Structural or Heritage issues are not compromised ALL penetrations MUST be approved by QUT Facilities Management.

Penetrations shall allow for spare capacity (see Spare Capacity).

All penetrations MUST be sealed using QUT APPROVED Fire Proofing materials adhering to QUT Facilities Management 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 QUT'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.

28.25 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.

28.26 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 QUT Project.

The number of lifts required in a new building will be based on the result of a traffic study carried out by the consultant and submitted to QUT Facilities Management Engineering for approval, the final number will be based on a N+1 calculation approved by QUT Facilities management.

A satisfactory lift equipment offer will be based on:

- Supply of lift equipment with a demonstrated history of reliable operation at Australian commercial sites.
- A demonstrated capacity for lift equipment to be maintained post Defect Liability Period (DLP) by a recognised lift maintenance service provider other than the original supplier/ installer of the equipment.
- Capability to be connected to a non proprietary central monitoring system with remote access facility.

Standard range of Brand lifts will not be accepted unless they are modified to suit QUT's DSG.

Where a Standard range of Brand lift is accepted it must be accompanied by a list of deviations from QUT's DSG, and signed of as being accepted by QUT's Manager Engineering Services and QUT's Disability Officer.

The lift installation and associated facilities shall conform to the requirements of the latest issue of QUT's Project Specific "Lift Services" Specification.

QUT'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.

AS1735, including Parts 11 (or ISO3008-2 if and when adopted), 12, All with reference to latest Revisions of EN81-20, EN81-21, EN81-28 and, where relevant EN 81-3, EN81-13, EN81-22, EN81-40, EN81-41, EN81-42EN81-44, EN81-46, EN81-60, EN81-70, EN81-76 and EN-115 & AS1428 (More specifically for Lift car size refer to clause 29.3 and 29.4)

Local Building Regulations and National Construction Code (NCC), in particular Clause E3.1 (6).

The Electricity Authority and AS3000, Wiring Rules and other relevant Australian Standards

AS4431, Safe Working on new lift installations in new constructions

Safe Work Australia Legislation (SWA)

Workplace Health and Safety Requirements Act and Regulations

Queensland Fire and Rescue Service (QFRS)

QUT's DSG for People with Disability and AS1735.12 and AS1428.2

AS 1735.12, Section 8.3 Tactile Information as well as Access Code for Buildings. Schedule 1 in the Disability (Access to Premises –Buildings) Standards 2010 Part D4 Braille and tactile signs.

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.

General and miscellaneous associated works

The consultant shall document general and miscellaneous associated works, and shall detail who (which sub contractor) shall be responsible to carry out these works to ensure a complete and complying installation is achieved

Electrical items:

- Confirm adequacy and suitability of existing 415 volt 3 Phase Power Supply Mains and, where necessary, shorten/extend/relocate to any required new locations.
- Provide New Circuit Breaker Panels or upgrade Existing for full compliance, including configuration at the respective main Building Distribution Boards (originating from the Authority's supply side), mechanical protection & fire rating, adequate capacity to supply the new Machinery, as well as any new or existing LMR Air-Conditioning/Ventilation Equipment to be provided or retained, maximum Fault Levels at new Lift Board locations not exceeding 6KA, and Maximum Voltage Drops at new Lift Board locations not exceeding 5%.
- If unsuitable, supply and install new complying submains and/or breakers capable of satisfying these requirements.
- Disconnect, extend, reconnect and recommission existing Lift Emergency Telephone Block Cabling from the Lift Machine Rooms to any new required locations. If damaged or unsuitable for extension, replace with new cabling and termination blocks in their respective new required locations.
- Provide New or Disconnect, extend, reconnect and recommission existing Signal wiring, cabling and connections for Lift Alarm, Lift Common Fault, Lift Pit Sump Water Alarm and LMR high Temperature Alarms from LMR to QUT Gardens Point Maintenance Department and Central Monitoring Computer at Kelvin Grove Campus.

29.2 Consultation

There shall be close collaboration and coordination between the consultants and QUT's Senior Technical Officer (M & E Contracts) 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 (M & E Contracts) 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 QUT's Senior Technical Officer (M & E Contracts) 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 QUT'S technical contacts at the inaugural Project/ Consultants meeting

29.3 Lift Shafts

- a) 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 fastening substrate is available for landing entrances and guide rails. Other construction shall be water proof and to the approval of the project manager.
- b) The clearance between the lift car and the lift shaft walls shall be in accordance with the requirements of AS1735.
- c) 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.
- d) In general, the lift shaft shall not be pressurised.
- e) A weatherproof ten per cent (10%) of Shaft Plan Area ventilation aperture shall be provided, and or mechanical ventilation shall be provided, suitable to maintain the project specific lift manufacturers equipment within the manufacturers operating parameters (temperature and relative humidity), and suitable to provide an environment (temperature and relative humidity) within the health and safety parameters for lift technicians to be able to maintain the equipment.
- f) 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 analysed and the structure modified accordingly.
- g) Where glass panelled 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.
- h) 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 air conditioning of shafts to be given consideration where required.
- i) Provide floor level numbers and Braille on each side of the extended landing door jambs on each floor.
- j) The maximum allowable as constructed tolerance (deviation) from documented door jamb dimensions shall be 0mm + 10 mm

Liftwell detailed requirements

a) Where new fixings and support structures are required

All New Fixings shall be Structurally Certified, to approval and suitable for the new/existing shaft construction.

Take full responsibility for all Support Structures for Drive Machines, Sheave Assemblies, Beams, Counterweights, Controllers, Brackets, Sills, Door Tracks, Flex Hangers, Wiring Ducts and Conduits, Buffer Supports, Rail Bed Plates, Pit Access Ladders, Lift Well Sensing/Levelling Devices and any other Component making up the here-in Specified Lift Installation.

Tenderers should seek their own Structural Engineering advices and take full responsibility (Fixing Methods, Suitability and Structural integrity) for all new fixings proposed for each lift.

b) Guide rails

Provide New Guide Rails, or if retaining existing, clean, re-align (e.g. via Laser) and re-machine and/or replace as necessary existing car and counterweight guide rail systems.

Check, adjust and re-tension as necessary all guide rail support system and bracketing, install additional brackets and/or fixings as required to achieve the here-in specified ride quality performance criteria.

Any/All New or Retained Rail Sections shall be consistent with the Lift Design characteristics taking into Account all Normal, Emergency and Seismic Related Applied Loads.

Rail Systems shall be installed plumb and parallel to maximise final car ride quality - smooth, silent and vibration free.

Rail Clips shall be of the sliding type to permit Vertical Rail Movement, thus compensating for Building Settlement, expansion and contraction due to temperature change without rail distortion. Replace existing Rail Clips if not of the sliding type to permit Vertical Rail Movement.

Vertical spacing of rail fixings shall be no greater than 2000mm.

c) Well flushing

Provide approved perforated or sheet steel flushing panels between door tracks and sills, below the bottom landing and above the top landing in the path of travel of the car doors.

Panels shall be suitably stiffened and fixed such that they do not distort with building settlement or the effects of temperature change.

d) Well and pit screens

Provide all necessary screens due to equipment layout and configurations including flex protections.

e) Top of shaft MACHINE, and lifting beams/eyes

Provide new approved and Structurally Certified top of shaft Machine, and Lifting Beams/Eyes suitably supported and fixed.

Provide complying permanent Safe Working Load ("SWL") Notices to the new Beams/Eyes.

f) Well access devices

Provide new Complying Triangle well access devices, fully functional, at all floors for each lift.

g) **Grouting/fire proofing**

Grout in and make good to all Well Beams/Eyes, Support Structures, Landing Door Frames, Landing Sills, Landing Thresh-hold Plates and Landing Buttons, Landing Lanterns/Indicators.

Where necessary, to achieve fire-ratings, or for ease of application, fix steel plates to the Lift Well side.

h) Temporary hoardings/barricades

Provide and maintain temporary safety hoardings/barricades across all landing door openings until such time as new permanent Landing Doors have been installed.

i) Scaffolding or false cars

Provide whatever scaffolding, rigging, hoisting and false car equipment required for the Installation of Lift Well equipment.

Lift machinery enclosure (LMR's or lift shaft for MRL type lifts) requirements

a) Liftwell access devices

Provide a suitably labelled complete set of Liftwell Access Devices and Keys in an approved location for permanent retention within the Top Floor Control Cabinet.

b) Signage to overhead lifting beams and eyes

Obtain Engineering Certification and provide clear permanent Safe Working Load (SWL) notices to any/all LMR and Top of Shaft overhead lifting beams and eyes.

c) Traction machines and motors

Provide complete new hoist machines, motors, and drives, complete with bedplates supports and effective isolation from the building structure.

The new/modernized system shall have a power factor of not less than 0.98.

d) Lift overspeed in the up direction and uncontrolled lift movement

Provide approved and compliant means to prevent lift car overspeed in the up direction of travel. For example, provide approved Rope Brakes to each lift. Also provide compliant means to prevent Unintended Lift Movements of each lift.

Tenderers to confirm their inclusions in their tender return.

e) Machine isolating switches

Provide local electrical isolating switches clearly designated on each new/retained machine.

f) Reset and pin brakes

Adjust, re-line as necessary, reset and pin existing/new machine brakes.

g) Machine drive and divertor sheaves and governor guarding

Provide all necessary guarding to all rotating equipment in the Machinery Enclosure, including Machine Drive & Divertor Sheaves and Speed Governors, in accordance with Section 19.5 of AS1735.2.

29.4 Lift Cars

- a) 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 panelling 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 Senior Technical Officer (M & E Contracts)
- b) Lifts shall be designed for use by people with disabilities and shall be constructed such that operating controls etc. are easily accessible (refer AS1735 Part 12) and QUT's Disabled Access Requirements Check List. QUT's disability officer is to be requested to review and approve the lift size on a project specific basis.

The minimum size of lift cars for all new buildings is to be the minimum size as stipulated in AS1428 section 6.2 "Circulation space for 180° wheel chair turn" - 2070mm deep X 1540mm wide, measured in accordance with AS1735.12 - Section 2.

The car sizes of refurbished lifts shall be considered on a case by case basis by Facilities Management in consultation with QUT Equity Services, Stakeholders and Consultants. Handrails to be disabled compliant round stainless steel, bolted (not screwed) to through the walls and removable from within the lift car. Hand rails shall be provided along the length of all side and rear walls. Proprietary Bump rails shall be provided in all goods lifts. Where lifts are designed for dual purposes such as the transport of passengers and goods, hand rails and bump rails shall be provided. Fastenings for bumprails shall be bolted (not screwed) through the walls and removeable from within the lift car. In all cases, we recommend that suitable "Bump Rails" be provided inside the lift car as follows, and that finally agreed lift car internal dimensions be measured as the clearance to such "Bump Rails":

Location of "Bump Rails"	To Rear and Both Side Walls of Lift Car
Number of "Bump Rails"	3 per Wall
Vertical Height of "Bump Rails"	 1 @ Skirting Level (nominal 50 mm from underside to lift car floor to accommodate car ventilation) 1 @ Nominal 350mm from underside to lift car floor 1@ Nominal 650mm from underside to lift car floor Note, DDA Compliant Handrails to be above and in addition to these Recommended "Bump Rails"
Recommended "Bump	Solid, Chamfered Hard Wood Timber, Flush Bolted to lift car frame
Rail" Materials and	Nominal 150mm Wide x 25mm Thick, one piece and continuous on
details	each wall

Audible floor announcements in Australian female voice shall be provided to all passenger lifts.

- c) The maximum allowable as constructed tolerance (deviation) from documented lift car size shall be 0 mm + 10 mm
- d) All wall panels shall be removable from within the lift car.

- e) The following shall be provided for in all lift cars and lift landings:
 - 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 fans in accordance with AS1735, and designed to achieve minimum air changes of 25 times per hour at a sound rating not exceeding 50 dBA. as measured at 1.5 metres above Floor Level with car stationary and doors closed.
 - Locks and Keys for Isolation, Exclusive Use and Security shall be the ABLOY brand with the key designation Number supplied by QUT Security.
 - Control panels for MRL lifts shall be lockable using an ABLOY brand lock with the key designation number supplied by QUT security.
 - All lifts shall have flush mounted keyed switches located in the main COP for the control of lights and ventilation fans.
 - Each car shall have an appropriate Load Notice displayed on the front wall, which will include the telephone number of the QUT Helpdesk (3138 3000) to call in an emergency, and also the Number of the lift which should be obtained from the Senior Technical Officer (M & E Contracts)
 - Each car shall have an emergency alarm and intercom in accordance with AS1735.
 - Each lift shall have its own separate telephone line and QUT Extension number.
 - Each lift shall have a multi messaging screen installed in each car and on each landing, capable of being programed to dispay information as specified by QUT Engineering. The project specific messaging must be approved by QUT's Senior Technical Officer (M & E Contractors). Messages shall include but not be limited to :- Direction of travel, Floor Position, Lift Out of Service, Lift under Maintenance, Special operating mode etc.
 - Where required, a complying Fire Warden Intercom System shall be provided in each 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 LED 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 AS1735.2, illuminate all normal car lights, provide compliant lux levels and be battery backed up to operate for a minimum 4 hour period.
 - Protective blankets shall be provided for each installed lift in a building with notice to indicate where a glass panel is protected.

Lift car detailed requirements

a) Top of car safe working zones

Provide/Signwrite "Safe Working Zones" on top of each lift car.

b) Top of car guardrails

Provide all necessary top of car safety guardrails and kickplates to comply with AS1735 and WH&S requirements.

c) Top of car inspection controls lighting

Provide new or upgrade existing Top of Car Inspection Controls and fixed and/or portable top of car Lighting and GPO power outlets to full compliance with AS1735.

d) Car frames and platforms

Construct Car Frames of structural steel members designed to suit the specified duty and application.

Car Platforms shall be of robust construction, free from flexing or drumming and effectively isolated from the Main Car Frame.

e) Car superstructure and fitout

Superstructures shall be suitably braced and stiffened to eliminate flexing or drumming and designed to accept removable internal wall panels.

Interior finishes and fitout details shall be **High Quality Vandal Resistant** and generally as detailed below, all works by the Lift Contractor:

- Selected "Pirelli" or equal synthetic rubber flooring.
- Stainless steel chequer plate skirtings and lower side walls panelling.
- "Rimex 5WL" or equal patterned stainless steel Car Doors and panelling to upper side walls.
- Selected Dark Tinted Glass Mirror Panelling to upper rear wall.
- Car operating/indicator panels, jambs, corners and header sections in satin stainless steel.
- Selected AS1735.12 compliant handrails, 50 dia. round stainless steel, to all side and rear walls.
- Handrails to be bolted through the lift car walls and removeable from inside the car.
- One side wall and one front car operating panel, AS1735 part 12 compliant.

All finishes shall be new and be of the highest standards of materials and finish, and subject to the approval of fully detailed shop drawings, samples of materials and components, and prototype assemblies, sub-assemblies and/or working models, prior to final construction on Site.

Superstructures and interior fitouts shall be fully protected until accepted and practical completion status is granted.

Superstructures shall be effectively isolated from the car frame and shall be free of any racking, rattles, or squeaks under all loading, unloading and operating conditions.

Provide one complete set of protective curtains, hangers & clips for protection of each lift, complete with warning signs with respect to any glass/mirror wall finishes including the rear wall Mirrors. The protective curtains to be supplied in suitably labelled bags and stored as instructed by QUT, e.g. inside former LMR.

f) Car ventilation

Provide statutory natural ventilation of Lift Car, so arranged as to be out of sight from within the Car.

Provide silent running mechanical exhaust fans to achieve minimum air changes of 25 times per hour at a sound rating not exceeding 50 dBA. as measured at 1.5 metres above Floor Level with car stationary and doors closed.

Fans shall be mounted on anti-vibration mountings and connected to Plenums via flexible ducts.

g) Car light and power

Normal and Emergency car lighting - High Efficiency Low Power Consumption Indirect LED Strip Lighting to achieve Code Compliant Lux Levels, mounted above a specified false ceiling with all wiring and components out of sight. (ensure easy access for maintenance, replacement and testing is provided)

Emergency lighting shall be in accordance with AS1735.22, and illuminate All Normal Car Lights, provide compliant lux levels and be battery backed up to operate for a minimum 4 hour period.

Flush mounted single phase GPO shall be mounted in the lift car.

h) Car control button panels

Provide two car control button panels, one on each car side wall, both to function as "Main" Car Button Panels, each positioned and configured to approval.

Provide the following on **each** Control Button Panel:

- Vandal Resistant "Dewhurst US95 16 Braille" or equal Buttons with dual White/Blue LED
- Illumination (Separate Buttons for each Front and Rear Landing Entrance shall be provided)
- Alarm/Communications Button, Microphone and Speaker
- Door Open and Door Close Buttons
- Flush mounted Load Notice
- Provision for QUT Security Swipe Card (Card supplied by QUT)
- Independent Key Switch ("Abloy") (One Panel only) (Key designation No supplied by QUT Security)
- Fire Service Key Switch Controls ("Abloy") (One Panel only) (Key designation No supplied by QUT Security)
- Approved voice (Female Australian Accent) announcing system with Voice Messages for all functional and emergency announcements.
- Maintenance Panel/Section containing Fan Switch, Light Switch, Telephone Jack and Maintenance Controls (One Panel only)

The Car Control Button Panels shall be **Vandal Resistant** hinged access type with secret fixings, and finished in satin stainless steel.

All buttons and controls shall be arranged to comply with AS1735.12.

Final setout, features, finishes and details are subject to approval of detailed shop drawings and relevant samples/prototypes.

i) Displays and programming of LCD screens

Each Lift Car and Landing (1 per Lift per Level, Front and Rear) Display Screen shall be set up and programmed strictly in accordance with QUT instructions prior to final set up and commissioning of the respective New/Replacement Lifts.

j) Independent service controls

Each lift car shall be provided with a 3 position (normal, start, park) key switch for exclusive operation/control of the respective lift. Each key switch and lock shall have a unique key combination/code.

The key shall be removable in the "automatic" and "park" positions only.

Key switches shall be of restricted high security switches "abloy" sourced and supplied by QUT Security with a unique combination as selected by QUT – liaise closely with QUT's appointed project manager.

k) Emergency fireman's service controls

The lift car, and the respective main entry level landing button units and shall include fire service key switches, the function of which shall comply with the requirements of as1735.2.

Key switches shall be of restricted high security "abloy" sourced and supplied by QUT Security with a unique combination as selected by QUT – liaise closely with QUT's appointed project manager.

One key shall be issued to QFRS for their exclusive use.

I) Security operation and CCTV cameras

Retain and make fully operable any existing electronic security system including readers in lift cars.

Make full provisions (power supplies & communications cabling, including co-axial) for future new qut security readers in each lift car.

Make full provisions (power supplies & communications cabling, including co-axial) for future lift car CCTV cameras in each lift car.

m) Overload operation

Provide approved type loadweighing systems such that when a Lift is loaded in excess of 100% of its rated load, the Lift will be prevented from starting, Lift doors shall remain open, a warning buzzer shall sound, and the "Lift Overloaded" illuminating signs integral with each car control button panel shall illuminate and remain illuminated until the load is reduced to an acceptable level.

n) Communications LMR, lift cars, top of cars and lift pits

Provide Complying Fixed Communications Systems between each Top Floor Landing Control Panel, Top of Lift Car, Inside Lift Car and Lift Pit for the respective Systems (emfone "CD-LX8/M" or equal).

o) Car guide shoes

Pursuant to compliance with the Ride Quality Criteria here-in specified, provide new approved spring loaded/applied, adjustable Roller Guide Shoes to top and bottom of each lift car.

Shoes shall be located at maximum vertical centres consistent with available over-runs.

Shoes shall deliver smooth and silent operation consistent with overall Lift Ride Characteristics specified.

p) New or extended toe guards

Provide New Compliant Toe Guards, or, if retaining existing, extend, as required, to not less than the minimum length in accordance with Section 23.28 of AS1735.2.

q) Safety gear

Provide New Safety Gear and carry out full load safety gear tests prior to Practical Completion.

r) Door operators, tracks, locks and hanging systems

- Provide a Tender Option for New "Wittur AMD Supra" or equal intensive duty, high efficiency power door operator systems to each lift car.
- Replace existing car and landing doors, locks, tracks and hanger systems with New matching Wittur AMD Systems for optimum long term performance and reliability.
- Doors systems shall be fully automatic and smooth and silent in operation.
- Door movements shall be cushioned at both limits of travel.
- Opening and closing speeds as well as door open dwell times shall be fully adjustable.
- Door open dwell times shall reduce to 0.5 sec or less after breaking of door protection devices.
- Re-opening of doors shall be achieved without appreciable noise or jerking.
- Pre-opening of doors shall be provided.
- Front and Rear Door Sets shall be fully selective in operation.

s) Door protection devices

Door passenger protection devices shall be of the three-dimensional "T L Jones Microscan 300SL" or "Memco Panaforty 3D Plus" or equal approved multiple light beam type and AS1735.12 Compliant.

A door "nudging" feature shall be incorporated to sound an audible buzzer and commence closing doors at a reduced speed after continued door obstruction over an adjustable pre-set time.

The door open button shall remain operable at all times and reset "nudging" time delays

29.5 Lift-Well Pits

Lift pits must always extend to solid earth, in accordance with AS1735.

Lift pits must be kept dry at all times and a 300mm square sump pit must be supplied in the lift pit to a depth of 300mm, and have a high water level alarm connected to the Central Monitoring Station through Gallagher with QUT standard alarm messages.

For any situation where problems with considerable water seepage and collection is an issue and can occur, the 300mm square sump pit shall be connected to an external pit that shall be supplied with a pump which shall be located externally to the lift well along with its associated controls, the controls shall be in a secure location that is keyed to the QUT GMKS system.

On lift systems using Hydraulic oil, the 300mm square sump pit shall be connected to a blind pit that is external to the lift well and accessible to mobile pumping services (E.g. Contaminated liquid disposal vehicles).

Pit sump water sensor and alarm

Retain existing or provide new float switch, local alarm and wiring and voltage-free contacts for lift well sump high level water alarm for connection to QUT Maintenance Department and Central Monitoring Computer at Kelvin Grove Campus.

Retain existing or provide new suitably labelled local alarm for the water sensors in approved locations.

Pit egress devices

Provide approved bottom terminal floor door unlocking devices within easy reach of retained/new Pit access Ladder to assist with safe Pit egress.

Pit safety switches

Provide approved safety switches at the top and bottom of retained/new Pit Access Ladder.

Pit and well lighting and power

Retain any existing, upgrade for Compliance and rewire from new Lift Distribution Board, or provide new Pit and Well Lighting in accordance with AS1735.2.

Power Supply shall be from a separate circuit breaker on the new Lift Distribution Board and switching shall be 3-way, i.e. from the LMR/Top Floor Landing Control Panel, and at each of the bottom and top terminal landings.

Switches in the LMR/Top Floor Landing Control Panel shall be accompanied by an indicator lamp, suitably labelled and which illuminates when the Pit and Well Lights are switched on.

A failed or disconnected lamp shall not affect the operation of other lamps.

A high impact, weatherproof, IP54 rated single 240 Volt G.P.O. outlet shall be provided in each Lift Pit.

Pit safe working zones

Provide/Signwrite "Safe Working Zones" in each Pit.

Well and pit screens and guarding

Provide all necessary screens and guarding due to equipment layout and configurations including counterweight screens, pit governor wheel covers and flex protections.

Pit governor tension/broken rope safety switches

Provide complying pit Governor Tension/Broken Rope Safety Switches for each Lift in accordance with Section 34.10 of AS1735.2.

Pit governor bottom wheel guarding

Provide complying Pit Governor Bottom Wheel Guarding of Nip Points in each Lift Pit in accordance with Section 34.9 of AS1735.2.

Oil buffer return safety switches

Where Oil Buffers are provided, provide complying pit oil buffer return safety switches to all car and Counterweight Oil Buffers in each lift pit in accordance with Sections 9.6.6 and 30.24 of AS1735.2.

29.6 Lift Control Systems

Consideration should be given to the use of Destination Control Systems where such application would provide cost effective operational efficiencies.

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.

Provide New signals, wiring, programming and commissioning and re-connection of any/all New or Existing signals to the QUT "Gallagher", including all cabling, contacts and functionality for the continued lift fault messaging and monitoring by QUT Security, including but not limited to Lift Alarm, Lift Common Fault, Lift Pit Sump Water Alarm and LMR high Temperature Alarms etc.

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, interrogation 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 QUT immediately upon expiry of the Project Defects Liability Period.

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.

Control systems

Provide New Approved latest technology efficient Microprocessor based Closed Loop Group Demand type Supervisory Control Systems, fully compatible and matched to Drives.

Preference will be given to Non-Proprietary Control Systems offering Full International Engineering Support and Back-up to any/all Major Lift Manufacturers/Suppliers.

Irrespective, the Control Systems Offered shall NOT be subject to any software locks or require special tools to allow effective on-going maintenance, interrogation, re-setting and adjusting of system settings and parameters.

All control equipment shall be designed to suit the duty and application and function effectively without excess noise or vibration.

Protect against under voltage, overload, phase failure and phase reversal.

Equipment shall generally be mounted in QUT approve IP rated robust metal cabinets with close fitting hinged doors.

Components shall be located to allow adequate ventilation and avoid overheating.

All equipment shall be suitably labelled in an approved manner.

Floor finding shall be obtained positively and maintained consistently regardless of prevailing load conditions.

Self-Checking and reference points shall be a feature of the floor finding system employed.

Floor levelling shall be consistently accurate regardless of load and travel direction and shall be achieved in a stepless direct to floor manner.

Relevelling devices shall be imperceptible in operation.

Flight profiles shall feature smooth and stepless acceleration and deceleration and a soft final stop with brakes not applied until the Lift has become stationary.

Lifts shall automatically restart on resumption of power supply following a power failure.

Control Systems shall also incorporate/support the following:

- Levelling of + 4mm
- Pre Door Opening
- Fully Adjustable Door Dwell Times
- Door Nudging
- Load Weighing with Anti-Nuisance, Landing Call By-Pass & Car Overloaded Features
- Electronic Security Systems
- Fire Service
- Independent Service
- Lift Out of Service Illuminating Messages on All Landing Indicator Screens

Reprogramming of control systems

The Lift Control System shall be fully reprogrammable, without rewriting of software, to suit any specific patterns or peculiarities of the Building Traffic demands.

Control system locks/passwords

Tenderers are to confirm the control systems offered are not subject to any software locks, passwords or the use of proprietary tools for on-going maintenance and/or re-setting, and/or re-programming of system parameters.

29.7 Microprocessor Based Lift Control Systems

QUT 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 QUT; 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 QUT, the Original Equipment Manufacturer/Supplier shall make available the Application Software and shall train QUT's staff/representatives in its use.

Where the Original Equipment Manufacturer/Supplier makes revisions to the functionality of the software, this shall be immediately advised in writing to QUT.

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 QUT's approval.

Where functionality upgrades of software are approved by QUT, 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 QUT 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 via manual operation of the fire recall key switch.

Landing equipment detailed requirements

a) Landing entrances

Retain/modify existing landing entrances and re-confirm, via duly Qualified and Specialist Expert opinion, the post modernization compliance with the one hour Fire Test Requirements of AS1735.11.

Alternatively, cut out and remove existing landing entrances and provide new landing entrances in their entirety in compliance with the one hour Fire Test Requirements of AS1735.11.

Provide copies of Fire Test Certificates confirming such compliance.

Landing door panels (retained/new) are to be finished in satin stainless steel to match existing retained landing door jambs.

Retain existing/provide new landing door locks, and new/modified existing hangars and tracks complete with automatic spring closers.

Provide new/re-finish existing landing door sills in aluminium or equal approved material/finish.

Provide new landing door slippers irrespective of whether new sills are provided.

Protect all Landing Doors and Frames up to achievement of practical completion status.

New Landing Door Frames, if provided, shall be fully grouted, made good and lobby finishes returned to pre-upgrade condition including any re-finishing and/or painting which may be required.

b) Retained stainless steel finishes

All retained Stainless Steel finishes shall be thoroughly cleaned, scratches and/or indentations removed, polished and hand re-linshed on site.

Any retained Stainless Steel finishes not meeting acceptable standards wil be rejected and be required to be replaced with new materials.

c) Floor designations

Landing door sight guards, where provided, shall be finished in the same material as the doors and full height.

On each sight guard or landing door jambs, provide 60mm high tactile floor designation characters with Braille at a height of 1200mm above finished floor level.

d) Landing door sills and thresh-hold plates

Retain existing or provide new Landing Door Sills and Thresh-hold Plates flush with finished Floor Levels at each Floor.

Provide all necessary supports, brackets, fixings, bolts and hardware for landing door sills and thresh-hold plates and grout up and make good at each Floor Level.

e) Landing button units

Provide one new riser of Vandal Resistant Landing Button Units for each Lift arranged for Disabled Compliance (AS1735.12 and the National Building Code) and covering all removed panels/penetrations.

Face Plates shall be satin finish stainless steel and feature vandal-resistant fixings.

Buttons shall be "Dewhurst US95 – 16 Braille" or equal type with Dual White/Blue LED illumination.

The respective Main Entry Level Landing Button Units shall be extended to incorporate the Emergency Fireman's Service Recall Key Switch ("Abloy" keyed alike with Car Fireman's key).

All units shall be designed/extended to accept a QUT Security Swipe Card (Cards supplied by QUT).

Provide all required new/expanded penetrations, grout in and/or fit metal plates behind, flush, finish and make good up to all landing call button panel boxes to achieve effective Fire Ratings.

Final setout, features, finishes and details are subject to approval of detailed shop drawings and relevant samples/prototypes.

f) Landing LCD screens and arrival chimes

Provide new fully programmable landing display screens, high resolution colour LCD digital display screens adjacent to each landing entrance at all floors, front and rear, in place of the existing lanterns/indicators.

Provide new up/down distinguishing lift arrival chimes at each landing entrance at all levels.

All chimes shall have adjustable volume control.

Provide all necessary penetrations required for these new new screens and panels.

New screens and their mountings shall fully cover the existing removed panels.

Grout in and fit metal plates behind all removed and new landing indicator boxes to achieve effective fire ratings.

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 AS1979.
- 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 AS1735 and be air-conditioned with a refrigeration type cooling system.

All hydraulic oil tanks shall be fitted with thermostat controlled cooling heat exchangers.

Lift Machine Room doors shall open outward in all cases.

Where Machine room less lifts are specified provide space for storage of specialised lift maintenance tools and wall protection blankets.

29.11 Power

All power to lifts shall comply with AS3000. 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) Safety gear shall be installed on counterweights if access space is provided under the lift pit.
- e) All lifts shall comply with AS1735 with respect to safety, operational and design requirements.
- f) 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 QUT'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 Senior Technical Officer (M & E Contracts), and compatible with the QUT security system.

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 QUT.

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 QUT'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 QUT (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 QUT'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 with the Division of Workplace Health and Safety.
- Registration of the Lift Design with the relevant authority
- Installation approval with the Division of Workplace Health and Safety.

The Contractor shall obtain the relevant details especially the unique QUT lift numbering and address for registering the lift from QUT's Senior Technical Officer (M & E Contracts).

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 QUT to ensure that adequate details for this requirement are entered into the Excel template files and produced at or before practical completion. Consult with QUT as to sign size, material etc.

The Contractor shall obtain the relevant details especially the unique QUT lift numbering and **Asset Register details** and address for registering the lift from QUT's Senior Technical Officer (M & E Contracts).

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 relevant requirements of the latest issue of:

- QUT's Design Standards and Guidelines
- Fire and Emergency Services Act (1990) and relevant regulations
- State and Local Building Regulations and the NCC (National Construction Code)
- Relevant Australian Standards
- Workplace Health and Safety Act and Regulations

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 mandtatory collaboration and coordination between the consultants and QUT'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 QUT'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 QUT'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:

- All works must be conducted by a QUT approved Contractor who is a licensed to install and certify under the QBCC requirements. This requires the certifier to hold a license in the appropriate field and hold current Public Indemnity Insurance. Evidence of both must be provided to QUT prior to commencement of site works.
- 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. QUT 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 QUT's 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/NCC 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 e.g. plumbing, data cabling etc. in the context of safe and practical operational and maintenance access to all fire services elements.

Some particular QUT 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.
 - E.g. sanitary plumbing pipes are not to run within switch rooms and electrical riser shafts.
 - 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 the 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 QUT'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. All building FIP's are connected via University communications to the Site Main Fire indication panel. QFES independently monitors/ responds to Gardens Point Campus fire alarms.

QUT's Central Monitoring Station located at Block Y1 Kelvin Grove Campus utilises University communications cabling to monitor the Gardens Point Campus fire alarm network.

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 under croft area at A block near the main entry to the campus. With the exceptipon of "J, X Block and Creative Industries Precinct" which has independent monitoring, all buildings FIP's are connected via University communications to the Site Main Fire indication board. QFES independently monitors/ responds to Kelvin Grove Campus fire alarms.

QUT's Central Monitoring Station located at Block Y1 Kelvin Grove Campus utilises University communications cabling to monitor the Kelvin Grove Campus fire alarm network.

Creative Industries precinct (Kelvin Grove Campus)

The Site Fire Indication Panel is a Simplex 4100 Series FIP. It is situated within building Z1 adjacent to the La Botte Theatre. All Creative Industry precinct buildings FIP's are connected via University communications to the Creative Industries precinct Site Main Fire indication panel. QFES independently monitors/ responds to Creative Industries precinct fire alarms.

QUT's Central Monitoring Station located at Block Y1 Kelvin Grove Campus utilises University communications cabling to monitor the Creative Industries Precinct fire alarm network.

30.8 Design Concepts

All Fire Alarm Systems shall be Fully Addressable and fully Networked into the QUT fire alarm system. Fibre optic network and associated equipment is to be utilised as QUT's preferred option.

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.

- Transmit relevant point data to any applicable available network facility for any zone's status and control as applicable.
- 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 AS1670 including warden inter communications points and public address facilities, or a single zone two tone fire warning system to AS7240 and ISO 8201 tones along with auto position and PA facility with microphone. The type of system selected shall be Quintrex QE90 or equivalent as approved by QUT's Senior Technical Officer (Essential Services).

30.9 Equipment Selection & System Design Requirements

Preferred Equipment

QUT's Senior Technical Officer (Essential Services) shall be consulted regarding equipment selections. QUT 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 Quintrex QE 90 or approved equivalent
- Detectors (Simplex True Alarm)
- Addressable Manual Call Points simplex addressable
- Bells
- Systems for Hazardous Locations
- Fire Hose Reels Australian Standard compliant
- Fire Extinguishers Australian Standard compliant

Panel Equipment Allowance should be made for surface mounted or semi-recessed panels especially refurbishment jobs. Panels shall comply with AS4428.1, or to AS7240 as applicable to scope, in addition to AS1670.

Clearance A newly installed fire panel must comply with AS1670.1 and also be mounted a minimum of 50 mm above a floor.

Adequate storage facilities shall be provided within the FIP for storage of minor spare parts including 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 Project Engineer Building 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, (with test facility) 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 QFES.

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 QUT 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 AS1670 and AS4428/AS7240 as applicable.
- All wiring shall be colour coded and outgoing cables shall be made off to a terminal strip.
- An indicator shall also be provided on the brigade side of the brigade alarm transmitter to show that an alarm would be transmitted as alarm routing.
- 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 including high level network.
- 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 (ASE Alarm Signalling Equipment). End of line equipment will operate in conjunction with the fire brigade centre's watch room equipment.

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 Project Engineer Building Services and 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 and if nominated as part of the project scope returned to QUT's Senior Techinical Officer (Essential Services).

• The inline jointing of cables will not be permitted within cable runs unless for purpose, maintainable and nominated per project specific construction documentation.

30.10 Preferred Contractors

The following companies are listed as preferred contractors who may be employed by the Queensland University of Technology to undertake fire protection installations:

- Wormald Australia (Fire) Pty Ltd (Tyco)
- Diligent Fire Protection
- Johnson Controls
- FVS

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 contactors registered and approved to these Boards shall be permitted to work on fire systems throughout QUT.

Other contractors being considered for the installation /modification of any fire system within QUT must have the approval of QUT prior to any contact being awarded.

30.11 Emergency Warning & Communication Systems

All emergency warning and communication systems shall comply with AS1670.

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 Building Code of Australia and the Fire Safety Act and applicable Regulations.
- WIP Telephones shall be installed within a steel cabinet (example provided by QUT) when installed within foyer areas or corridors. Wherever possible WIP telephones should be installed within secure areas e.g. Hose Reel Cabinets.
- Provide full network capability for use with remote control.

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.
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 AS3000 - 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 AS3013. Insulation shall be V-75 grade.

MIMS cables shall be copper conductor sheathed in accordance with AS3187.

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 QUT shall be the preferred option throughout QUT buildings. The preferred smoke detector is the Simplex True Alarm. NB QUT is progressively upgrading detectors to the addressable type. Consequently, all new project works/ refurbishments shall include addressable devices.

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.

NB QUT is progressively upgrading detectors to the addressable type. Consequently, all new project works/ refurbishments shall include addressable devices.

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. Remote indicators shall be installed for all concealed space detectors.

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 AS2444, AS2982, the Building Code of Australia and also at the discretion of the University's Project Engineer Building 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 AS2444). Provide sufficient extinguishers of an appropriate type, and signage, 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	Туре	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 AS1668 must be applied as appropriate.

Control and indicating facilities

All applicable control and indicating equipment for mechanical interface such as Fans, shall be installed as required at or inclusive to the Fire Indicating Panel as per AS1670. Any such control and indicating equipment must also include a permently engraved diagram and matrix for intervension information purposes.

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 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 AS1668 Part 1 Section 6, Rules 6.2 to 6.4.

Fire Dampers

Shall be installed in accordance to AS1682.2 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 AS2118 (2017) and AS2941 (2013). 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 QUT. 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 AS2419.1. 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 to Section 18 – 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 QUT 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 QUT. 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 warning system.

30.23 Passive Fire Protection

QUT'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 a approved fire barrier. The QUT approved product for use within QUT buildings is KBS Mortar Seal or similar. No other product may be used without the written approval of the University's Project Engineer Building 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 Project Engineer Building Services for approval of the proposed fire rating method.

Applicable Codes and Standards

- All work to be completed in accordance to AS4072.1 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 AS1530 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 QUT 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 QUT 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 QUT, 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 QUT.
- 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. 300 x 300 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) QUT must be informed immediately.

THE USE OF FIRE PILLOWS IS NOT PERMITTED BY QUT.

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 QBCC 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 QUT 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 QUT 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 QUT

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 QUT 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 QUT.

- 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.
- QUT 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 QBCC 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 QUT 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 QUT stating that 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 bought to the attention of QUT as soon as it becomes evident this is the case.

On completion of each area of work submit to QUT (to QUT format on disc in auto cad 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 QUT.

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 QUT's incumbent maintenance service provider will be nominated for this activity.

In the event that QUT's maintenance service provider becomes the installer of the fire system, another service provider may be selected by QUT to provide commissioning services.

30.29 Emergency Evacuation Information

Evacuation Sign Standard

The QUT Evacuation Sign Standard ensures a consistent "look and feel" for all QUT 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 <u>fm_records@qut.edu.au</u>

Responsibility for Evacuation Sign Design and Installation

"The principal consultant will prepare Evacuation Plans for the project in accordance with the QUT standard formatting available from; fm_records@qut.edu.au and will liaise directly with the QUT 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 QUT to ensure that adequate details for this requirement are entered into the Excel template files and produced at or before practical completion. Consult with QUT 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/NZS 2243.8 incorporating project specific/ user defined options as noted:

- Materials of construction chosen in consultation with the Users
- Fume cupboard sizes chosen in consultation with the Users
- Services within the fume cupboards shall be as nominated by the Users
- 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.

Exhaust fan motors to be variable speed controlled via VSD.

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 31A - PVC Ductwork Construction

Circular Duct	Rectangular	Minimum PVC	Stiffening of Rectangular	Flanges (mm)
Dia.	Duct Longest	Thickness	Ducts (mm)	
(mm)	Side (mm)	(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 QUT.

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

31.10 Auto Sash Controller

Subject to a user risk assessment and approval by QUT (on a per project basis), fume cupboards are to be fitted with an auto sash controller to maximise energy efficiency of the installation.

32 Building Management System (BMS)

32.1 Scope and Intent

This section of the Design Standard outlines the University's minimum requirements for the Building Management System (BMS). They shall be used in conjunction with any project specific requirements. The intent is to provide a simple, coherent, robust and maintainable control system.

Alterations and additions to the BMS shall be fully compatible with the Struxureware 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, Facilities Management or nominee.

The Standard Control Strategies described below must be used as far as possible, together with the standard graphic design and other detailed recommendations. Deviation from the Guidelines will require specific permission from QUT.

Consultation

There shall be close collaboration and coordination between the consultants and QUT's Facilities Management 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 'Engineering 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 form 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 QUT's technical contacts to consultants at the inaugural Project/Consultants meeting.

Installation Practice

Consideration of all sections of the QUT 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 QUT Classrooms and Lecture Theatres
- Section 24 Air Conditioning and Ventilation
- Section 27 Electrical Services
- 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 professional manner by suitably qualified personnel and must comply with AS3000, the ACA Cabling Provider Rules and QUT Electrical guidelines.

Struxureware engineering must be undertaken by staff who have successfully completed the Struxureware Training Modules(s).

All cables are to be identified at the field and controller as per the standard Struxureware system cable numbering system using QUT approved cable numbering materials. Only cables that are compatible with the Struxureware system shall be used in the installation. Adequate space must be provided into new enclosures for future cable entry and hardware.

All redundant control equipment, cabling, graphics and software code must be removed on refurbishment projects.

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 at be available at controller enclosures and PDF copied onto the relevant Struxureware Building Operation (SBO) Enterprise Server.

Network enabled equipment

Any BMS 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. BMS equipment must utilise existing BMS Virtual Lan addressing as directed by Infrastructure Services ITS.

Functional Descriptions

A link shall be supplied on the <mark>relevant</mark> BMS graphics to the latest version of the corresponding BMS Functional Specification.

If there is modification or refurbishment, then the Functional document and link must be upgraded.

BMS Commissioning and BMS Commissioning Documentation

The system shall be fully commissioned. All physical points shall be checked through to their corresponding graphics points, as shall virtual points (virtual points are not physical input/outputs e.g. setpoints and parameters). All control loops shall be reasonably stable and accurate. The controls shall function as described in the current Functional Description.

At the end of commissioning, "As Commissioned" settings must be recorded. All controllers and equipment must be added to the current QUT BMS Controller and Equipment list. Document control of the QUT BMS Controller and Equipment list shall be managed by the relevant Schneider Electric Engineer and updates provided to the QUT Engineering Department. The "As-commissioned" information provides an important fall-back position for QUT in case of trouble. This may be in PDF format, and should include the following:

a) VAV Controllers

Ref	Address	Vmin	Vmax	Duct Area	PF

The supply pressure setpoint required to achieve the Design Airflow of the VAV system shall be recorded, together with the diversity factor applied to the VAVs for that scenario.

b) Controllers on IP Network

IP Address, Subnet mask, Default Gateway Address.

c) Communications Topology

Diagram for each network from Automation Level to Enterprise Level. Diagram to show correct physical connection sequence of communicating devices, location of terminators, protocol (e.g. BACnet) and physical layer (e.g. Ethernet).

d) HLI

Third party HLI shall not be used without specific permission from the QUT Engineering Department. Where a third party device has been integrated, clearly state the protocol used, referring uniquely to the third party protocol definition e.g. via Release Number or Release Date. Integrated datapoints should match the Functional. Where the third party interface requires configuration, e.g. VSD-MODBUS/RS485, then the required parameters must be documented. The preferred HLI protocol is BACnet, any other protocol shall require written permission from QUT's Facilities Management Department technical staff (Engineering Services Section).

e) In-Panel Documents

Each control panel shall have an up-to-date points list and wiring diagram. This shall show all physical input and output points, including their wire numbers. Item names must correspond to the names used in the BMS, e.g. on the graphics.

Electrical Power Consumption Monitoring

Monitoring of the outputs of Electric Power Meters will be detailed on a project specific basis. All power meters must have a communications interface that is compatible with the Struxureware Power Monitoring Expert (PME) application. Monitoring of power consumption shall be direct to the EMS interface (PME) and not be direct to BMS unless approved by the QUT Engineering Department.

Sensor Labels

All BMS field devices including temperature sensors and push buttons shall be labelled to identify the specific control operation, unit and/or zone.

Input/ Output Schedules

All controller enclosures shall be fitted with a rigid internal document holder to house the controller points list. A PDF copy of the Input/ Output schedule shall be added/updated via the BMS graphic link on each campus main page. See also " In-Panel **Documents**".

Panel Keys

All controller enclosures shall be keyed alike to 'L & F CL 331'.

Documentation in the form of revisions to the QUT BMS Controller and Equipment List, Combined BMS Operation and Maintenance Manuals and BMS section for the mechanical Operation and Maintenance Manuals shall be part of all new works or modifications to existing systems. Refer to DSG Section 40 -Documentation for the Combined Operation and Maintenance Manual structure. 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 and electrical diagrams for all of the following:
 - DDC Enclosures,
 - Mechanical O&M and the
 - Combined BMS O&M.
- As Commissioned Data see Sect. "BMS Commissioning and BMS Commissioning Documentation"

Global System Variables

The following Objects are available globally for use by any Struxureware controller:

- Global PE Cell
 Ambient Light Level, Lux
- Global Setpoint Reset Setpoint shift, °C
- Global Outside Air Enthalpy Ambient enthalpy, kJ/kg
- Global Wet Bulb Ambient Wet Bulb temperature (calculated from DB and RH)
- Global Dry Bulb
 Ambient Dry Bulb temperature
- Global Humidity Ambient relative humidity, % rh

Depending on the Campus, the obove objects are available from the below AS-Ps

- Kelvin Grove KG-Q-BMS-03-02
- Gardens Point GP-V-BMS-03-01

The first AS-P in each building is to include the above Global Variables directly bound to the AS-Ps listed above. Every other AS-P in the associated building should also include the above Global Variables, however the Variables should be bound to the first AS-P in the associated building.

32.2 Plant Descriptions

New plant should be engineered in accordance with the minimum standards set out below. Any modes of operation such as Economy Mode or Purge Mode shall have isolation control (On/Off) via the BMS Graphics. Each scenario requires approval from QUT's Facilities Management Department technical staff (Engineering Services Section).

32.2.1 Variable Flow Primary Chilled Water System



Figure 1 Typical Primary System



Figure 1Typical chiller plant system, CHW side only

Start – Stop

The lead CHW pump shall be started first as stage 1 of any chiller plant start sequence. Once chilled water flow has been established and common supply water temperature has reached a defined set point only then can the start enable request be sent to a chiller. A chiller is enabled once both CW and CHW flows have been confirmed for a minimum length of time.

The chiller plant is shut down when there is no longer a demand for cooling, typically when there is no CHW valve more than a given opening for a minimum length of time.

In this case the stop sequence shall be commenced. The chiller(s) are disabled and stage 1 CHW pump(s) only shall continue to run.

Chiller Staging

Chiller staging up is based upon rise in common supply water temperature and staging down on return water temperature or chilled water energy (Kwr). The idea is to run the most efficient chiller or chiller combination to meet the cooling load. The peak efficiency for a chiller set will vary with the technical plant design. Chiller staging by chiller load is easier to manipulate to achieve optimal individual chiller loading (e.g. 80% of RLA). The guidelines are general, and will require alteration in the case of dissimilar chiller sizes, high and low efficiency chillers in same plant, absorption chillers etc. Each scenario requires approval from QUT's Facilities Management Department technical staff (Engineering Services Section).

a) Staging up

When the common supply CHW temperature exceeds the Stage Up set point and the Stage Up Delay Timer has timed out as well as the settle timer has timed out (see settle timer) then the next Stage (Up) is started.

b) Staging down

When the mixed return CHW temperature falls below the Stage Down set point or when the operating chiller CHW KW falls below a threshold of a particular stage and the Stage Down Delay Timer has timed out as well as the settle timer has timed out (see settle timer) then the next Stage (Down) is started. Settle Timer: in the case of a change of Stage (up or down) the Stage Down is started. This allows the runningchillers(s) time to adjust to the step change. Stage Up and Stage Down is disabled until this timer times out.

CHW Flow Control

Provide a DP transducer at the end of each CHW index leg. Low signal select the pressures to control CHW pump speed to achieve DP setpoint. Reset setpoint based on load. Monitor flow through each chiller and open bypass valve/ valves when minimum flow is approached.

c) Supply CHW Setpoint Reset

The nominal CHW setpoint is 6°C. A CHW Setpoint reset strategy shall be employed where there is no critical air handling plant. This may be adjusted upwards based upon ambient conditions.

The reset is then calculated based on ambient enthalpy see below. A setpoint rate limit is applied of 0.1°C per minute.

QUT - Facilities Management



Figure 2 CHW setpoint reset

Condenser Water Pump Control

Condenser Water Pumps shall be operable from the BMS. Pump demand shall be determined by the Chiller.

Condenser Water Pump Hygiene Cycling

Condenser water pumps shall be provided with a system to ensure that each CDW pump is operated for at least **1** hour per **48** hours. This ensures distribution of chemical dosing. The time of pump operation shall be outside of normal hours. Should this pump exercise fail then an alarm shall be generated.

Refrigerant Monitoring

Mechanical Contractor shall supply and install Refrigerant Leak Monitoring, installed according to the latest Australian Standard. The measured refrigerant concentration in the plant room (as ppm – parts per million) shall be displayed on the BMS, as well as the status (Working/Normal, pre-alarm, alarm). Action in the event of a non-normal status is defined on a per-plant basis. Provide Modbus or Bacnet HLI to BMS.

Cooling Towers

Cooling Towers shall be arranged for a common supply header and a common return header. Provide weatherproof motorised isolation valves, with position monitoring on the inlet and outlet of each cooling tower.Each cooling tower fan shall have variable speed (VSD) fans, controlling the cooling tower fans to maintain CW temperature setpoint entering chiller. Allow for running multiple towers to achieve efficiency of operation, modulating fans simultaneously. Provide motorised bypass across the common flow and return lines to maintain a minimum CCW entering temperature to the operational chillers, as defined by the Chiller Manufacturer.

For reciprocating and screw chillers, control fans shall maintain CW entering the chiller at 28°C unless otherwise instructed. For centrifugal chillers, calculate ambient wet bulb temperature from the ambient dry bulb temperature and ambient relative humidity. Use ambient wet bulb plus 3°C as the set point for CW entering the chiller, within the range of 29°C to 20°C (or a figure recommended by the chiller manufacturer). Each scenario requires approval from QUT's Facilities Management Department technical staff (Engineering Services Section).

Chiller Plant Points Lists

Description	DI	DO	ΑΙ	AO	Comment
Per Chiller					
Chiller start-stop		1			
Chiller running status	1				
Chiller fault	1				Common alarm from chiller
Chiller electrical current			1		Or use HLI data or smart meter data
Chiller CHW Temperature in			1		Must be physical sensor in addition to HLI data
Chiller CHW Temperature out			1		Must be physical sensor in addition to HLI data
Chiller CW Temperature in			1		Must be physical sensor in addition to HLI data
Chiller CW Temperature out			1		Must be physical sensor in addition to HLI data
Chiller <mark>CHW Flow</mark>			1		Flow meter
Chiller condenser DP			1		Use Magflo
Totals	2	1	7	0	

See also Chiller HLI points, below.

Description	DI	DO	ΑΙ	AO	Comment
Per CHW Pump					
VSD HLI					VSD status, fault, power, speed
VSD start-stop		1			
Pump running status	1				From DPS
Pump VSD Command				1	
Pump VSD fault	1				
Totals	2	1	0	1	

Description	DI	DO	AI	AO	Comment
Per CW Pump					
VSD HLI					VSD status, fault, power, speed
VSD start-stop		1			
Pump running status	1				From DPS
Pump VSD Command				1	
Pump VSD fault	1				
Totals	2	1	0	1	

Chiller HLI Points List

Provide Bacnet over IP HLI for each chiller to pass a minimum of fifteen (15) chiller parameters to the BMS. Each scenario requires approval from QUT's Facilities Management Department technical staff (Engineering Services Section).

The following should be presented as a minimum to the BMS user.

Description	VD	VA	Byte	Comment
Per Chiller				
Chiller start-stop	1			
Chiller running status	1		1	Note 1
Chiller fault	1		1	Note 1
Chiller electrical current		1		Total current
Chiller electrical power		1		Total power not just compressor(s)
Chiller load		1		As %RLA
Chiller CHW Temperature in		1		

Chiller CHW Temperature out		1		
Chiller CW Temperature in		1		
Chiller CW Temperature out		1		
Chiller water cooler flow	1			Flow/no flow
Chiller condenser flow	1			Flow/no flow
Condensing temperature		1		Saturation value
Evaporating temperature		1		Saturation value
CHW basic setpoint		1		
CHW setpoint		1		Including any setpoint offset
Totals	1	7	1	

Fluid temperatures to be measured using immersion probes; contact sensors are not acceptable unless explicitly allowed by the Project Manager. Follow installation guidelines in this document.

Cooling Tower Points list

Description	DI	DO	ΑΙ	AO	Comment
Ambient DB Temperature			1		May use global data
Ambient WB Temperature			1		May use global data
Per cooling tower cell					
Fan VSD HLI					VSD status, fault, power, speed
Fan VSD start stop		<mark>1</mark>			
Fan VSD speed				<mark>1</mark>	
Isolating valve control		<mark>1</mark>			
Isolating valve position	<mark>1</mark>				
Per System					
Common CT entering temperature			<mark>1</mark>		Before CT Bypass
CommonCT leaving temperature			1		After CT Bypass
Fan start-stop		1			
Fan running status	1				
Fan VSD Command				1	Where VSD installed
Fan VSD fault	1				Where VSD installed

32.2.2 Primary/Secondary Chilled Water System



Figure 3 Typical Primary/Secondary Chilled Water System

The requirements for a primary/secondary system are similar to those specified for a variable flow primary system with the following modifications:

a) Staging up

Stage Up: When the common flow CHW temperature exceeds the Stage Up set point for at least the Stage Up Delay Timer, and the flow through the decoupling line is negative for a period of time, then the next Stage (Up) is started.

Settle Timer: in the case of a change of Stage (up or down) then a Settle Timer is started. This allows the running chillers(s) to adjust to the step change. Stage Up and Stage Down is disabled until this timer times out.

b) Staging down

Staging down of the system is triggered by either of the two following conditions:

- Total calculated CHW Energy (kWr) falls below the setpoint of the capacity of the next chiller sequence (chiller load is measured by calculation of CHW energy from temperature difference across the chiller and flow through the chiller)
- 2. Decoupling line flow is greater than the minimum flow of any running chiller.

Settle Timer: in the case of a change of stage down, then a Settle Timer is started. This allows the running chillers(s) to adjust to the step change. Stage Up and Stage Down is disabled until this timer times out.

Primary CHW Flow Control

Monitor flow through the decoupling line and control primary pump speed/s to ensure that decoupling flow is slightly positive, to maximise temperature drop across the chiller. Install a flow meter for each chiller to ensure that flow through each chiller does not drop below minimum allowable.

Secondary CHW Flow Control

Provide a DP transducer at the end of each CHW index leg. Low signal select the pressures to control Secondary CHW pump speed to achieve DP setpoint. Reset set point based on load

Common Points List for Primary/Secondary Pumping CHW System

Description	DI	DO	AI	AO	Comment
Common CHW Leaving Temp			<mark>1</mark>		Common Leaving Chiller Temp
Common CHW Supply Temp			1		Common Supply to SCHW Pumps
Common CHW Return Temp			<mark>1</mark>		
Common CHW Entering Temp			<mark>1</mark>		Common Entering Chiller Temp
Decoupling Line Temp			1		
Decoupling Line flow			1		
Decoupling Line Direction			1		
Field DP			N		Located on index runs



Overview



Figure 3 Typical face-bypass AHU control schematic

The AHU shall include a pressure independent control valve (PICV) for CHW flow control.

Start-stop

The supply fan is started and stopped according to the time schedule and Occupancy Button(s) working in combination. The supply fan shall be capable of variable speed control to modulate according to supply pressure control.

The basic time schedule is set to be active from 08:00 to 17:00 Monday to Friday except public holidays and where the zones have an unusual occupancy pattern.

When shut-down is required then the cooling valve is fully closed and any heating signals – usually zone reheaters – are disabled. The supply air fan and return air fan (where installed) are "run-on" for 3 minutes (adjustable).

Damper Control

Each Zone shall have two modulating dampers. One damper for face control and one for bypass control. This is to allow any unoccupied zone to completely close off air flow. In Occupied mode the dampers operate together with inverse proportional control to maintain zone setpoint.

When shut-down is required the zone supply air shall "run-on" for 3 minutes (adjustable) after any heating signals are disabled to dissipate residual duct heat.

Pressure Control

The AHU modulates the supply air pressure according to the pressure measured approximately 2/3 of the longest duct away from the AHU.

The pressure setpoint is to be confirmed during commissioning.

The measured pressure should be filtered to avoid turbulence causing control instability.

The control loop shall reside in the BMS, not in the corresponding VSD.

Zone Modes

Each zone is either in Occupied or Off Mode. The Time Schedule is either in Day or After Hours State. The zone Occupied Mode is triggered when the zone push button has been pressed: if the Time Schedule is in Day Mode then the zone occupied mode runs for 180 minutes (3 hours) before reverting to Off Mode. If the Time Schedule is in After Hours Mode then the zone occupied mode runs for 120 minutes (2 hours) before reverting to Off Mode.

Once the Occupied Mode has been started in "Day" time, then the Mode will continue until the end of the timer (3 or 2 hours) irrespective of the state of the Time Schedule.

Repeated operation of the push button(s) once the AHU is running will have no effect.

The indicator at the push button will be illuminated as soon as the request to run has been received, whether the AHU starts or not. It will be extinguished at the end of the 3 or 2-hour period as appropriate.

Table 1 Face-Bypass Zone Modes

Time Schedule	Push Button press gives
Day	3 Hours Occupied Mode
After Hours	2 Hours Occupied Mode

Zone Temperature Control

Each Face-Bypass Zone has a zone setpoint; this is used to modulate the corresponding Face-Bypass dampers. The nominal zone setpoint is 23°C. This may be adjusted by the Global Setpoint Reset system. If the zone changes to Off Mode, the corresponding zone dampers shall close in accordance with damper control strategy.

Each Face-Bypass zone generates a cooling demand signal by comparing the zone temperature with the zone setpoint. The damper change rate is limited to 10%/minute (adjustable).



Figure 4 Face-Bypass AHU face bypass control

In the case that individual electric reheaters are provided for each face bypass zone, then the reheater shall be controlled as follows.

When the supply AHU fan is confirmed to be running, then the reheater control is enabled. As the zone temperature falls below setpoint then a heating demand is created. The heating demand is used to modulate the output of the electric reheater. Typically, this will be done by varying the "on" time of the heater.

The supply air shall have a run-on time after shutdown to dissipate residual heat in the heater.

AHU Supply Air Temperature Control

The CHW valve is modulated to achieve the supply air setpoint, where the temperature measured in the supply air duct near to the AHU. A separate PI control block is required for this loop. The temperature setpoint is variable depending upon the cooling demand of the connected face-bypass zones.



Figure 5 Face-bypass AHU supply air temperature setpoint reset

The face bypass zone cooling demand is generated individually.

The maximum or average demand may be used for the AHU supply air temperature setpoint reset, selectable by a software switch on the BMS Graphic page.

The rate of change of the setpoint is to be limited by a rate limit function, to 1°C/20 minutes (adjustable). The initial setpoint for AHU start-up shall be mid-range i.e. 18°C.

High Temperature A/C Enable

This may be applied where a zone(s) has temperature sensitive equipment installed, see "High Temperature A/C Enable". Each scenario requires approval from QUT's Facilities Management Department technical staff (Engineering Services Section).

Points List

Description	DI	DO	AI	AO	Comment	
Fan Start-Stop		1				
Fan status	1				DPS or VSD/Fan Status	

Off-coil Air Temperature			1		Use averaging sensor
Room temperature			Ν		Typically wall mounted
Zone damper				Ν	
Zone heater		Ν			
zone supply temperature			Ν		
After-hours button	Ν				Standard design
Alter-hours "neon"		Ν			Standard design
Totals	1+N	1+2N	1+N	N	

32.2.4 Learning Area VAV AHU Control Type R3

Overview



Figure 6 Typical VAV AHU control schematic

The AHU shall include a pressure independent control valve (PICV) for CHW flow control.

Start-stop

The supply fan is started and stopped according to the time schedule and Occupancy Button(s) working in combination. The basic time schedule is set to be active from 08:00 to 17:00 Monday to Friday except public holidays and where the zones have an unusual occupancy pattern.

When shut-down is required then the cooling valve is fully closed and any heating signals – usually at VAVs – are disabled. The supply air fan and return air fan (where installed) are then "run-on" for 3 minutes (adjustable).

Zone Modes

Each VAV zone is either in Occupied or Off Mode. In Off Mode the VAV damper shall be fully closed. The Time Schedule is either in Day or After Hours State. The VAV Zone Occupied Mode is triggered when the zone push button has been pressed: if the Time Schedule is in Day Mode then the VAV Zone occupied mode runs for 180 minutes (3 hours) before reverting to Off Mode. If the Time Schedule is in After Hours Mode then the VAV Zone occupied mode runs for 120 minutes (2 hours) before reverting to Off Mode.

Once the Occupied Mode has been started in "Day" time, then the Mode will continue until the end of the timer (3 or 2 hours) irrespective of the state of the Time Schedule.

Repeated operation of the push button(s) once the AHU is running will have no effect.

The indicator at the push button will be illuminated as soon as the request to run has been received, whether the AHU starts or not. It will be extinguished at the end of the 3 or 2-hour period as appropriate.

Table 2 VAV Zone Modes

Time Schedule State	Push Button press gives
Day	3 Hours Occupied Mode
After Hours	2 Hours Occupied Mode

AHU Supply Air Temperature Control

The CHW valve is modulated to achieve the supply air setpoint, where the temperature measured in the supply air duct near to the AHU. The temperature setpoint is variable depending upon the cooling demand of the connected VAVs. Where dual coil systems are installed the smaller coil shall incrementally open up to 100% to meet the load demand. Increase in load will cause the second larger coil to open while maintaining the small coil fully open.



Figure 7 VAV AHU supply air temperature setpoint reset

The cooling demand is generated by each individual VAV controller, to be collated by the AHU controller. The maximum or average demand may be used for the setpoint reset, selectable by a software switch on the BMS Graphic page.

The rate of change of the setpoint is to be limited by a rate limit function, to 1°C/20 minutes (adjustable). The initial setpoint for AHU start-up shall be mid-range i.e. 18°C.

Pressure Control

The AHU modulates the supply air pressure according to the pressure measured approximately 2/3 of the longest duct away from the AHU.

The pressure setpoint is to be confirmed during commissioning.

The measured pressure should be filtered to avoid turbulence causing control instability.

The control loop shall reside in the BMS, not in the corresponding VSD.

High Temperature A/C Enable

This may be applied where a zone has temperature sensitive equipment installed, see Sect. "High Temperature A/C Enable". Each scenario requires approval from QUT's Facilities Management Department technical staff (Engineering Services Section).

Fire Mode

In the case that the air conditioning controller receives a Fire Alarm then it will shut down the air conditioning system. After the fire alarm has reverted to normal then the air conditioning will restart after the push button has been pressed, behaving as per Table 1.

Points List

Description	DI	DO	AI	AO	Comment
HLI to VSD or ECM					Bacnet or Modbus
Fan Start-Stop		1			
Fan status	1				DPS or VSD/Fan Status
Supply Air Temperature			1		Measured at AHU
Cooling valve				1	
Supply air pressure			1		
Fan speed command				1	To VSD or ECM system
Totals	1	1	2	2	

Comments

Fan start-stop and status shall be via physical inputs and outputs.

32.2.5 Lecture Theatre AHU Control Type R1

Overview

The Lecture Theatre AHU mechanical design varies according to the application.

The AHU shall include a pressure independent control valve (PICV) for CHW flow control.

Start-stop

The supply fan is started and stopped according to the time schedule and Occupancy Button(s) working in combination.

The basic time schedule is set to be active from 08:00 to 21:00 Monday to Friday except public holidays. When shut-down is required then the cooling valve is fully closed and any heating signals are disabled. The supply air fan and return air fan (where installed) are "run-on" for 3 minutes (adjustable).

Zone Modes

The Theatre Zone is either in Occupied or Off Mode. The Time Schedule is either in Day or After Hours State. The zone Occupied Mode is triggered when the zone push button has been pressed: if the Time Schedule is in Day Mode then the zone occupied mode runs for 240 minutes (4 hours) before reverting to Off Mode. if the Time Schedule is in After Hours Mode then the zone occupied mode runs for 120 minutes (2 hours) before reverting to Off Mode.

Once the Occupied Mode has been started in "Day" time, then the Mode will continue until the end of the timer (4 or 2 hours) irrespective of the state of the Time Schedule.

Repeated operation of the push button(s) once the AHU is running will have no effect.

The indicator at the push button will be illuminated as soon as the request to run has been received, whether the AHU starts or not. It will be extinguished at the end of the 3 or 2-hour period as appropriate.

The push button is located near the entrance door; more than one button may be installed where there is more than one door.

Table 3 Lecture Theatre Modes

Time Schedule State	Push Button press gives
Day	4 Hours Occupied Mode
After Hours	2 Hours Occupied Mode

Fire Mode

In the case that the air conditioning controller receives a Fire Alarm then it will shut down the air conditioning system. After the fire alarm has reverted to normal then the air conditioning will restart after the push button has been pressed, behaving as per *Table 3*.

Points List

Description	DI	DO	ΑΙ	AO	Comment
Fan Start-Stop		1			
HLI to VSD or ECM					Bacnet or Modbus
Fan status	1				DPS or VSD/Fan Status
Supply Air Temperature			1		Install after heater where installed
Heater		Ν			N = Number of steps
Cooling valve				1	
Room temperature			1		Typically wall mounted
After-hours button	1				Standard design
After-hours "neon"		1			Standard design
Totals	2	2+N	2	1	

Comments

Fan start-stop and status may be via physical inputs and outputs or via communication signals to a VSD where installed.

32.2.6 Office Area AHU Control Type R2

The AHU shall include a pressure independent control valve (PICV) for CHW flow control.

Start-stop

The supply fan is started and stopped according to the time schedule and Occupancy Button(s) working in combination.

The basic time schedule is set to be active from 07:30 to 18:00 Monday to Friday except public holidays and where the zone has an unusual occupancy pattern.

When shut-down is required then the cooling valve is fully closed and any heating signals – usually at VAVs – are disabled. The supply air fan and return air fan (where installed) are "run-on" for 3 minutes (adjustable).

Zone Modes

Each Office Area is either in Occupied or Off Mode. The Time Schedule is either in Day or After Hours State. The Office Area Occupied Mode is triggered when the zone push button has been pressed: if the Time Schedule is in Day Mode then the Occupied Mode runs until the Time Schedule changes to After Hours state. If the Time Schedule is in After Hours Mode, then the VAV Zone occupied mode runs for 120 minutes (2 hours) before reverting to Off Mode.

Once the Occupied Mode has been started in "Day" time, then the Mode will continue until the end of the timer (3 or 2 hours) irrespective of the state of the Time Schedule.

Repeated operation of the push button(s) once the AHU is running will have no effect.

The indicator at the push button will be illuminated as soon as the request to run has been received, whether the AHU starts or not. It will be extinguished at the end of the 3 or 2-hour period as appropriate.

Table 4 Office Modes

Time Schedule State	Push Button press gives
Day	Occupied Mode until end of Day
After Hours	2 Hours Occupied Mode

High Temperature A/C Enable

This may be applied where a zone(s) has temperature sensitive equipment installed, see "High Temperature A/C Enable".

Fire Mode

In the case that the air conditioning controller receives a Fire Alarm then it will shut down the air conditioning system. After the fire alarm has reverted to normal then the air conditioning will restart after the push button has been pressed, behaving as per Table 4.

Points List

Description	DI	DO	ΑΙ	AO	Comment
Fan Start-Stop		1			
HLI to VSD or ECM					Bacnet or Modbus
Fan status	1				DPS or VSD/Fan Status
Supply Air Temperature			1		Install after heater
Heater		Ν			N = Number of steps
Cooling valve				1	
Room temperature			1		Typically wall mounted
After-hours button	1				Standard design
Alter-hours "neon"		1			Standard design
Totals	2	2+N	2	1	

32.2.7 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 enable signal.

Thermostatic Ventilation Fan

Cycle fan to maintain room temperature within the specified band.

Refrigeration Plant Room Fan

Fan shall run continuously and can be overridden via a local ON/OFF switch. Monitor the status via a Current Switch and raise an alarm if the fan fails.

Points List for DOL Ventilation fans

Description	DI	DO	AI	AO	Comment
Fan Start-Stop		1			
Fan status	1				Current Switch
Room temperature					Thermostatic fan application only
Totals	1	1	0	0	

Points List for VSD controlled Ventilation fan-non critical

Description	DI	DO	AI	AO	Comment		
<mark>VSD HLI</mark>					Control & monitor via HLI		
<mark>Fan status</mark>	1				<mark>Current Switch</mark>		
Room temperature					Thermostatic fan application only		

Points List for VSD controlled Ventilation fan- critical, eg Lab

Description	DI	DO	AI	AO	Comment
<mark>VSD HLI</mark>					Monitor only
<mark>VSD enable</mark>		1			
<mark>Fan status</mark>	<mark>1</mark>				Current Switch
VSD speed control				1	

32.2.8 Under Ceiling FCU & CHW Ceiling Cassettes

Fan coil units (FCUs) shall be supplied with a 0-10 Volt DC modulating Chilled Water Valve and integral 24 Volt controls for the BMS interface. 240 Volt contacts for the unit heater and fan shall be wired to a separated terminal strip in the unit.

A 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, but start the unit only when the local push button is pressed. When the push button is depressed outside of the time schedule, run the unit for two hours. Sense room temperature and control the chilled water valve and heater to maintain set point. Modulating chilled water valves must be used where the CHW flow is greater than 0.21/s.

Points List for all under ceiling FCU

Description	DI	DO	ΑΙ	AO	Comment
Fan Start-Stop		1			
Fan status	1				DPS
Room Temperature			1		
Heater				1	Or DO as required
Cooling valve				1	
After-hours button	1				Standard design
Alter-hours "neon"		1			Standard design
Totals	2	2	1	2	

32.2.9 Variable Air Volume (VAV)



Figure 8 VAV System general schematic

The VAV controller shall generally be Pressure Independent, that is, volume flow is measured. Where duct size permits this should be done using a "flow cross" i.e. velocity measurement grid. Where the duct size is too small a single point Pitot tube may be used. The electric heater shall be interlocked according to Australian Standards. The VAV controller shall additionally inhibit the heating output whenever the measured flow volume is less than the minimum VAV heating volume flow. Provide monitoring of heater status and generate a software VAV heater fault when HPT trips. Provide a single fault light per AHU on the MSSB, generated by the BMS, to indicate when a VAV served by that AHU has a heater fault.

VAV Control Details

a) Operating Mode

The VAV shall be in either Occupied Mode or Off Mode. Mode changes are made according to zone occupancy as required by the application.

If the heating cycle is active (zone temperature less than effective heating setpoint including Global Reset) when a change from Occupied to Off mode is commanded, then the Vmin flow setpoint will be maintained for a "run on time" of 3 minute (adjustable). This is to dissipate residual heat.

The VAV damper is closed in the Off mode unless specific application requirements dictate otherwise (e.g. for Fire/Smoke control requirements)

Each VAV shall have a Zone Setpoint, nominally set at 22.5°C. This is interpreted as shown the figure below.

VAV Volume Flow and Heater Control Vmax Air flow On Heater Off Vmin Air tfow Vmin 21.5 22.75 23.0 23.25 22.5 Zone Temperature, Deg C Zone Setpoint Hysteresis Deadband Volume 1 Deg C 0.25 Deg C PB 0.5 Deg C

Figure 9 VAV <mark>Temperature Control</mark>
b) Global Setpoint Shift

The Global Setpoint Shift can move the cooling volume control line up in summer (See Figure 10) or the heating switch points down in winter (see Figure 11)



Figure 10 VAV Control strategy under summer Global Setpoint Reset



Figure 11 VAV Control strategy under winter Global Setpoint Reset

c) Energy Demand

An Energy Demand is needed per VAV, to allow efficient supply AHU control. It is used in the supply air temperature reset.

A single temperature based energy demand shall be available per VAV as follows:



Figure 12 VAV Energy Demand vs zone temperature and control actions

The energy demand is locked into the effective temperature setpoint: if the setpoint is shifted by the Global Setpoint Shift then the Energy Demand will shift by the same amount.

Each VAV shall also report the VAV damper position VAV HPT Trip Monitoring

The BMS is to monitor VAV HPT trip via the associated VAV controller. Refer to Figure 11 Example VAV Wiring Diagram below for details.

A VAV Common HPT Trip Fault light is to be provided on the associated MSSB by the mechanical contractor. The fault light is to be switched on and off by the BMS. The mechanical contractor is to allow a provision for BMS switching of the fault light including terminals for BMS connection.



Figure 11 MSSB VAV Common Fault Light

Points List

Description	DI	DO	ΑΙ	AO	Comment
Zone temperature			1		Typically wall mounted
Airflow			1		Airflow velocity grid or single Pitot tube
VAV damper				1	May be integral to controller
Heater		Ν			
Heater Status	1				Used to generate fault
After-hours button	1				Standard design
Alter-hours "neon"		1			Standard design
Totals	<mark>2</mark>	1	2	1	



Figure 13 Example VAV wiring diagram

32.2.10 Fan Coil Unit with DX Coil



Figure 14 Fan Coil Unit with DX coil general schematic

The FCU shall generally be equipped with its own controller which controls the main FCU functions (dotted line box of Figure 13). The BMS shall monitor the additional points as described below.

For simple applications, consideration to be given to using a self contained sensor/controller such as the SE8300, discuss with QUT's Facility Management.

Points List

Description	DI	DO	AI	AO	Comment
Unit Start-Stop		1			
<mark>Unit Status</mark>	<mark>1</mark>				DPS
Supply Air Temperature			1		
Return Air Temperature			1		Mount at air inlet to FCU
After-hours button	1				Standard design
Alter-hours "neon"		1			Standard design
Totals	1	2	2	0	

32.2.11 VRV/VRF

Provide Bacnet IP interface to VR systems.

32.2.12 Variable Speed Drives (Danfoss or approved equivalent)

Provide VSD's with Bacnet RS485 HLI. Any other protocol requires approval from QUT's Facilities Management Department technical staff (Engineering Services Section). The following points shall be integrated into the BMS.

Points List

Description	VD	VA	Byte	Comment
Start command	1			Either hard-wired or HLI triggered command
HLI to VSD				Bacnet
Running status			1	
Alarm status			1	
Power consumption		1		As kW
Power consumption		1		As kWh
Heatsink temperature		1		Where available
Manual override	1			Has keypad been used to override VSD?

Commanded speed		1		E.g. command from BMS
Actual speed, Hz		1		
Totals	2	5	2	



Figure 15 VSD Control Wiring



Figure 17 EC Fan Wiring Diagram

32.3 Common Control Functions

The following functions are used across many control applications.

High Temperature A/C Enable

The "High Temperature A/C Enable" is to be used where critical equipment sensitive to high temperatures is located. When the Zone Temperature exceeds 32°C, the local controller (VAV, FCU etc.) is enabled and the corresponding supply AHU started. The system will remain enabled until the Zone Temperature falls to below 28° C.



Figure 13 Outside air control schematic

Computer Lab High Temperature Override

This operates in a similar way to the "High Temperature A/C Enable".



Figure 14 Computer Lab over temperature control

A Test Point is included, allowing the BMS user to change the value of a "Test Temperature" so that it will trigger the High Temperature Override response.

Carbon Dioxide Control



Figure 15 Outside air control schematic

In the case of carbon dioxide (CO2) control, then the return and outside air dampers are modulated in sequence as follows. The CO2 in the zone is used to set the Outside Air and Return Air Damper positions, as a simple proportional action (No Integral action).



Figure 16 CO2 Control of outside air

The OA Damper may be reduced to a minimum level, to be set at commissioning according to current Australian Standards, or to 0% where a separate minimum Outside Air Damper has been installed.

a) Global Setpoint Reset

This function saves energy by reducing the effective zone temperature setpoint in the winter and raising it in summer.

The outside air temperature is measured at the local QUT Weather station according to the plant location. The reset is calculated at the Station and transmitted to all QUT air conditioning controls that require it. The calculation of the reset is as shown below:



Figure 17 Winter and Summer reset based upon outside air temperature

The value is negative for a reduction in setpoint (Winter) and positive for an increase in setpoint (Summer). The shift is limited to +/-4°C.

b) Global Setpoint Reset Implementation at Fan Coil Units

Fan Coil Units shall have an individual enable/disable point for the Global Reset. The effective zone setpoint is calculated by:

Effective Setpoint (Heating) = Base Setpoint (Heating) + Local Setpoint Adjustment* - Winter Reset

* E.g. from a wall mounted setpoint adjuster, where installed

c) Global Setpoint Reset Implementation at VAV Units

The VAV units shall have an individual enable/disable point for the Global Reset. The effective zone setpoint is calculated by:

Effective Setpoint (Heating) = Base Setpoint (Heating) + Local Setpoint Adjustment* - Winter Reset

* E.g. wall mounted setpoint adjuster, where installed

d) Global Setpoint Reset Implementation at Face Bypass AHUs

The individual zones of the face-bypass AHUs shall have an individual enable/disable point for the Global Reset. The effective zone setpoint is calculated by:

Effective Setpoint (Heating) = Base Setpoint (Heating) + Local Setpoint Adjustment* - Winter Reset

* E.g. wall mounted setpoint adjuster, where installed

e) Global Setpoint Reset Implementation at VAV Supply AHUs

The reset is not to be used at the VAV supply AHU: the existing supply air temperature reset system will accommodate the new effective VAV zone setpoint temperature without any global reset.

Electric Heater Control

Electric heaters are typical controlled by a digital system, e.g. contactor or Solid State Relay (SSR). The analogue heating demand signal is converted to a low frequency pulsed output, typical with discrete steps of 10 secs, as illustrated below:



Figure 18 heater control based upon cooling demand, with discrete steps of 10 seconds

Note that the minimum "On" time is 10 seconds (per 100 seconds), and the maximum 90 seconds (per 100 seconds).

The heating output is interlocked with the AHU supply fan status, the status of the local thermal trip (HPT) and the run-on status of the supply AHU. In the latter case, the AHU supply fan shall "run-on" before shutting down during which time all reheaters are disabled.

Internal Lighting

BMS control of internal lighting may be applied on a project specific basis.

Where specified, for common areas such as foyers, corridors etc. provide motion detector and pushbutton control and a daily time schedule to enable and disable lighting. Start internal lighting during normal hours with time schedule, after hours with motion detector or local pushbutton. When the push button or motion detector is activated outside of the time schedule, switch the internal lights on for two hours. The local distribution board will be provided with an 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 the ambient Lux level is below the project specific minimum setpoint. Turn off the lights when it is above the maximum Lux set point. 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 continue light switching until the Global Lux Point is restored. The Local Electrical Switch Board will be provided with an AUTO / OFF / TEST switch for maintenance.

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Lift Motor Rooms

A simple exhaust fan shall ventilate the room, based upon a wall-mounted temperature sensor. The switch on and off temperature setpoints are set on a per-project basis. Raise an alarm when the temperature exceeds the upper setpoint plus 3°C. Mechanical Contractor to provide LMR thermostat and alarm wiring.

32.4 Standard Control Algorithms

A set of Standard Control Algorithms shall be maintained at a standard folder location (To Be Confirmed). This shall generally be a Struxureware Function Block Standard Project. The Project shall contain standard "HFB" blocks with sufficient input and output points to achieve the required functions. Each HFB shall contain the programmers' name, and the last update date. Script programming shall not be permitted unless specifically approved by the QUT Engineering Department.

Alarm System

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Alarms shall be viewable and acknowledgeable via each individual BMS graphic page. An alarm bell icon shall be placed on each graphic page linking related alarms for ease of acknowledgement.

alarm delay time, are configured according to the local requiremer	ent.
All Struxureware alarms should comply with the following categori	ries. Other alarm parameters, such as

... ..

Priority Level	Alarm types	Comments
10	Fire/safety alarms	Including refrigerant leak alarms
20	Critical CHW Plant	
30	Critical AHU or ventilation plant	
40	Critical other plant	
50	General CHW Plant	
60	General AHU or ventilation plant	
70	General other plant	
80-100	Spare	Project specific alarms

Critical Alarms will always appear on the corresponding plant graphic page. Critical alarms require acknowledgement and reset by a BMS user. Critical alarms shall generate an email to bms@qut.edu.au.

32.5 BMS Sensor Installation

Fluid Temperatures

Where a fluid temperature is required, then a "Thermowell" shall be installed. Each Thermowell should have a Binder Point nearby to allow calibration checks. The Thermowell length shall be appropriate to the pipe diameter. Thermal paste must be used in the Thermowell. Try to avoid installing the Thermowell underneath pipes, especially CHW pipes, as this can lead to accumulation of condensate in the sensor head.

Fluid Absolute Pressure

Install pressure sensors where possible on a horizontal diametric position of the pipe (see sketch). This avoids bubble and fluid debris pick-up. Where possible install the sensor below the pipe connection so that air bubbles do not collect in the sensor. Provide a coil in the copper connection pipe to help suppress pressure fluctuations.

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Figure 19 Two acceptable locations for fluid pipe pressure, pressure sensor below tapping point to avoid air trap at the sensor

Room Air Temperature

Room air temperature should be measured away from draughts from doorways and supply air grilles. The sensor should not be in sunlight at any time. The penetration of the wall behind the sensor should be sealed to prevent downdraughts. The sensor must be mounted on a vertical surface (not on the ceiling), and marked with a unique identifier pertaining the AHU/VAV/FCU as appropriate. It should be 1.8m above floor level.

Duct Temperature

Specifically design duct sensors must be used with a probe length appropriate to the duct diameter. The sensor should avoid "dead zones", and preferably in a well-mixed zone of the duct. Each sensor shall be marked with a unique identifier pertaining the appropriate device operation.

Room Humidity

This should be measured at the same point as the room temperature, using the same provisos as described above. Each sensor shall be marked with a unique identifier pertaining the appropriate device operation.

Duct Pressure Sensor For VAV AHU

This should be mounted approximately 2/3 along the main duct length. It should be upstream of flow disturbances such as bends, dampers and heaters. Use a specifically designed static pressure measurement pipe for the duct mounting. Each sensor shall be marked with a unique identifier pertaining the appropriate device operation.

Duct CO2 Sensors

The sensor requires airflow from the probe tip, through to the sensor head, and then back to the duct. This is done using the velocity pressure of the airflow in the duct. The sensor head should be aligned with the duct airflow to promote this (see figure). The cable connection to the head must be airtight for the same reason. Each sensor shall be marked with a unique identifier pertaining the appropriate device operation.



Siemens Magflo Flow Sensors

This device should be installed in accordance with the Siemens advice. Avoid installation at the highest point in the plant room, as the Magflo does not tolerate air pockets or large bubbles in the fluid flow. Sensor head units with displays shall be remote type mounted at ground level. Each sensor shall be marked with a unique identifier pertaining the appropriate device operation.

32.6 Trend Log System

Trend data is typically logged in the AS (Automation Server). If existing Inet points are to be used trending shall be interval only.

Trend Log Configuration By Plant Type

The following logging configurations are recommended.

a) Face Bypass AHU

Face-bypass AHU				
Object	Frequency	Maximum	Effective	Comment
	or COV	records	duration,	
			days	
Off coil temperature	5 mins	50,000	174	
Off coil temperature setpoint	5 mins	50,000	174	
CHW Valve command	1 min	50,000	33	
Supply air temperature zone x	5 mins	50,000	174	Where installed, 1 per zone
Zone x FB damper command	5 mins	50,000	174	
Zone x temperature	5 mins	50,000	174	
Zone x temperature setpoint	5 mins	50,000	174	
Zone x heater output	5 mins	50,000	174	Use heating demand (0-
				100%) not corresponding
				digital output (1/0)
Return air temperature	5 mins	50,000	174	Where installed
Return air humidity	5 mins	50,000	174	Where installed
Fan status	5 mins	50,000	174	
Out of hours request	5 mins	50,000	174	

b) VAV AHU

VAV AHU				
Object	Frequency	Maximum	Effective	Comment
	or COV	records	duration, days	
Off coil temperature	5 mins	50,000	174	
Off coil temperature setpoint	5 mins	50,000	174	
CHW Valve command	1 min	50,000	33	
Maximum zone cooling demand	5 mins	50,000	174	
Supply air pressure	5 mins	50,000	174	
Supply fan VSD command	5 mins	50,000	174	
Supply fan VSD actual Hz	5 mins	50,000	174	
Return air temperature	5 mins	50,000	174	Where installed
Return air humidity	5 mins	50,000	174	Where installed
Fan status	5 mins	50,000	174	
Out of hours request	5 mins	50,000	174	

c) VAV Controller

VAV				
Object	Frequency or COV	Maximum records	Effective duration, days	Comment
Zone temperature setpoint	5 mins	50,000	174	
Zone temperature actual	5 min	50,000	174	
Damper position, %	5 mins	50,000	174	
Airflow, L/s	5 mins	50,000	174	
Airflow active setpoint, L/s	5 mins	50,000	174	
Heating Demand, %	5 mins	50,000	174	
Cooling Demand, %	5 mins	50,000	174	

d) Chiller Plant

Chiller Plant				
Object	Frequency or COV	Maximum records	Effective duration, days	Comment
Per Plant:				
Common return temperature	5 mins	50,000	174	
Common flow temperature	5 min	50,000	174	
Common flow, L/s	5 mins	50,000	174	Where installed, e.g. Magflo
System pressure, kPa	5 mins	50,000	174	Where installed, one log per sensor
System pressure setpoint, kPa	5 mins	50,000	174	Where used
Bypass Valve command	1 min	50,000	33	
Per Chiller:				
CHW Return temperature	5 mins	50,000	174	May use HLI data
CHW Flow temperature	5 min	50,000	174	May use HLI data
CW Return temperature	5 mins	50,000	174	May use HLI data
CW Flow temperature	5 min	50,000	174	May use HLI data
CHW Flow through chiller, L/s	5 mins	50,000	174	Where installed, e.g. Magflo
CW Flow through chiller, L/s	5 mins	50,000	174	Where installed, e.g. Magflo

Chiller CHW differential	5 mins	50,000	174	Where installed
pressure, kPa				
Chiller CW differential	5 mins	50,000	174	Where installed
pressure, kPa				
Chiller running status	5 mins	50,000	174	Where installed
Chiller power consumption	5 mins	50,000	174	HLI or from MSSB
Chiller condensing pressure	5 mins	50,000	174	HLI data
Chiller power consumption	5 mins	50,000	174	HLI data or Struxreware
kWh				calculated
Cooling Towers				
Per Tower:				
Fan status	5 mins	50,000	174	
Fan speed command	5 mins	50,000	174	Where used
Fan speed actual, Hz	5 mins	50,000	174	Where available, via HLI
Tower exit temperature	5 mins	50,000	174	Where available
Tower water consumption,	5 mins	50,000	174	E.g. via pulse counter
Litres				
Tower blow-down. Litres	5 mins	50,000	174	E.g. via pulse counter

Trend Chart Presentation

To facilitate interpretation of Trends, the following standard presentation should generally be used.



Figure 21 General Trend presentation

This is achieved using the following parameters:

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Basic References					
General Information					
X-axis Configuration Settings					
Time mode		Relative (to c	urrent tir	me)	•
Start time		7/03/2016	11:27	:43 AM	* *
Time span (s)		Days O _l	Hours 12 ₁	Minutes 0 ₁	Seconds 0
Time zone		Local time			•
Show nearest information for all	series	False			•
Show gridlines for X-axis		True			•
Y-axis Configuration Settings					
Auto scale left Y-axis	False			•	
Left Y-axis minimum	10	×			
Left Y-axis maximum	35	*			
Auto scale right Y-axis	False			•	
Right Y-axis minimum	-5	*			
Right Y-axis maximum	105	*			
Show gridlines for left Y-axis	True			•	
Show gridlines for right Y-axis	False			•	

Figure 22 Basic configuration for Trend Chart

Struxureware System File and Folder Structure

The following structure should be used:



Figure 23 Recommended Struxureware file structure

a) Folder usage

<plant name="">\Trend Logs</plant>	Individual logged data points
<plant name="">\Trend Charts</plant>	Charts assembled from individually logged points within the same plant
General Folder\Trend Logs	Individual logged data points not directly associated with a single plant
General Folder\Trend	Charts assembled from individually logged points from more than one
Charts	plant

The following colours should be used:



CHWV if there is only one, Or Larger one if there are two







Basic	color	s:	_		
					\Box









Figure 24 Trend line colours



Standard VAV Trend Chart



Figure 25 VAV Standard chart appearance and configuration settings

32.7 Graphics

The BMS graphics should generally comply with the following. The intention is the same appearance and operating functions across the Campus. Use the standard Template located on either of the Struxureware servers on Campus, so that all of the graphic pages have the same "Look and feel" across the Campus, e.g.

- Same fonts, font sizes and colours
- Same general colour scheme
- Same data for the same AC system type
- Same zone temperature colour indication (see below)
- Same style Main Header (see diagram below) buttons, logo, date and time
- Same style Sub-header (see diagram below) Building buttons (in order), global data points
- Same style building Floor Plan Browser (see diagram below)

Floor Plans

Each Building shall have floor plans set out as follows. All floors should be included, occupied or not.

a) Zone Temperature Colour Scale

Each zone shall be colour coded according to the error from the active setpoint. Colours and corresponding temperatures as per Template Drawing.

b) Zone Temperature Sensors and Push Buttons

These are shown as per Figure 28. Colours, font and size as per Template Drawing.

c) Occupancy Toggle

The HVAC Zone Occupancy Status shall be displayed, using a toggle radio button. Legend to be as Template Drawing.

d) Room Names Toggle

The Room Names shall be displayed /hidden using a toggle radio button. Fonts and colours as per Template Drawing.

e) AHU Zone Highlight

The zone and AHU association is displayed using a highlight effect as illustrated in Figure 28.

f) Ducts

The Floor Plan shall display/hide the ductwork installation via a toggle radio button, as per drawings supplied by QUT. See Figure 29



Figure 26 Graphics floor plan schematic



Figure 27 Zone highlight effect, zone sensors, push buttons and jump to plant

C Block GP (128) - Level 7

TOOGLE TO VIEW — Room Names (V) — AHU Ducts (V) — Push Button (



Figure 28 Radio Buttons for graphic details and duct/grille overlay

Air Handling Units

The Frame for the AHU display is the standard frame (Main and sub-header, floor browser) as per Figur31.

a) Override

Where any BMS object has been overridden, an override symbol must appear beside the graphic object:



Figure 29 Valve in override (hand symbol)

b) Setpoint and Measured Values

Where practical the two values should appear adjacent to each other as in Figure 31

c) Advanced/Compact Display

The schematic may show full control details or basic details, as selected by button (see Figure 31).



Figure 30 AHU Schematic features

VAV Information Page



									Air Fle	100				Evolution		
Chart	Serving An	ea.	Base SP	Cooling SP	Heating SP	Zone Temp	Occ. Mode	SP	Act.	Min	Max	Damper	VAV Load	Term. Load	Heater	HPT Alarm
3	Rm 101E, 111, 1	12, 195	23.0 °C	23.6 °C	22.5 °C	23.8 °C	Occupied	109 I/s	110 U/s	75 I/s	220 I/s	94 %	23 %		ŧ	Disabled
2	Rm107, 107A,	, 108	23.0 °C	23.6 °C	22.5 °C	24.5 °C	Occupied	553 I/s	599 Vs	250 I/s	620 I/s	92 %	82 %		Off	Disabled
0	Dcc. Mode Pus	th Button	Neon	Motion	Timer	Nml Hrs Timer SP	Ahrs Timer SP	Time Sche Control Or	pa							
	Occupied	통	NO	uo	0 min	15 min	120 min	o								
	Occupied	Off	On	o vo	0 min	15 min	120 min	N								
rride	Damper Ov	verride	Override Pos	VAV Override	/											
	84%	Off	100 %	No Override	/	/										
	92 %	MO	100 %	No Override		/										
						/		(
							Read-on	y data								
ji l	8	Occupied 0	Occupied Off de Damper Override o 92 % Off	Occupied Off On de Damper Override Pos 94 % Off 100 % 92 % Off 100 %	Occupied Off On On On M <	Occupied Or On Ormin de Damper Override Override Override 34 % Off 100 % No Override 92 % Off 100 % No Override	Occupied Or On Time 15 min de Damper Override Override Modentide 94 % Off 100 % No Override 92 % Off 100 % No Override	Occupied Ort On On 15 min 120 min de Damper Override Override VAV Override No 120 min 120 min ge Damper Override Override No <	Occupied Ort On On 150 min 120 min 0 On No	Occupied Of On Or Isomin 120 min On On de Damper Override Override VAV Override Macde Pass VAV Override Pass	Occupied Of On On IS min IS min On de Damper Override Override VAV Override No Made No	Occupied Of On On Is min 120 min On de Damper Override Override Override No Mode 92 % On 100 % No On On Para <t< td=""><td>Occupied Off On On Tomin 120 min On de Dumper Override Override Override NA Override 94 % Off 100 % No Override No Override 92 % Off 100 % No Override</td><td>Occupied Of On On Is min Is min On 4e Damper Override Override No Mode No Mode 92 % Off 100 % No Override Read-only data</td><td>Occupied Of On Or 120 min 120 min On 4e Dumper Override Variance 120 min 120 min On 94 % Orf 100 % No Mode Prevende Prevende</td><td>Occupied Of On Or 120 min 120 min 0 min 0</td></t<>	Occupied Off On On Tomin 120 min On de Dumper Override Override Override NA Override 94 % Off 100 % No Override No Override 92 % Off 100 % No Override	Occupied Of On On Is min Is min On 4e Damper Override Override No Mode No Mode 92 % Off 100 % No Override Read-only data	Occupied Of On Or 120 min 120 min On 4e Dumper Override Variance 120 min 120 min On 94 % Orf 100 % No Mode Prevende	Occupied Of On Or 120 min 120 min 0

Figure 31 VAV Data Page

The Below Key operators shall be made available on relevant graphic pages:

Кеу	Operation
"Chart"	Jumps to standard VAV Chart, see Sect 32.6. "
	Standard VAV Trend Chart"
"Exclude Term. Load"	Will include/exclude from the calculation of supply air temperature from VAV
	terminal load see Sect. "AHU Supply Air Temperature Control"
"SP"	Setpoint. BMS User adjustable. Operates together with "Act." – Actual Measured
	Value
"Notes"	Opens dialogue box for BMS user to make notes on operation
"Functional"	Jumps to Building functional control manual and Mechanical drawings
<mark>Floor Plan</mark>	Toggle View must provide Room Details, AHU Ducts and Occupancy

Abbreviations

AHU	Air Handling Unit
AI	Analogue Input
AO	Analogue Output
CHW	Chilled Water
CO2	Carbon Dioxide
CW	Cooling Water (or CDW Condenser Water)
DI	Digital Input
DO	Digital Output
DP	Differential Pressure
DPS	Differential Pressure Switch
FCU	Fan Coil Unit
HLI	High Level Interface
OA	Outside Air
PF	Pick-up Factor: the ratio of the actual flow in a duct and the flow measured by the BMS
	device, usually a VAV controller
VI	Virtual Analogue point (internal analogue point, not a direct physical input or output)
VD	Virtual Digital point (internal digital point, not a direct physical input or output)
VAV	Variable Air Volume
Vmin	Minimum VAV flow volume
Vmax	Maximum VAV flow volume
VSD	Variable Speed Drive (Or VFD Variable Frequency Drive)

33 Identification Schedule for Plant & Equipment

33.1 General

Where colours are not specified for particular items of plant, the University shall be consulted before colours 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. Colours are selected from:

- AS2700 Colours for General Purposes
- AS1345 The identification of Piping Conduits and Ducts.

In occupied spaces and where pipework, duct or equipment is exposed externally, the Architect shall select colours in conjunction with the University.

33.2	Pumps
------	-------

Domestic Cold Water Pumps	AS2700 Colour 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 the	ose 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:	Manufacture s Colours
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	Ріре	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 &	Identification & flow direction sticker	
Stormwater		

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 colour code shall be as follows:

Service	Colour
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.

- 34 For future use
- 35 For future use
- 36 For future use

37 3D Models & Data (BIM)

37.1 Introduction

This section of the DSG applies to:

- All Major Projects at QUT.
- All **Capital Works**, projects at QUT, where the building was delivered as a 3D BIM modelled building or where a comprehensive building model exist. Facilities Management must protect QUT's investment in 3D models and data, by protecting the integrity of any existing 3D model and data information (digital twin).
- Minor Works and Maintenance projects where the building exists as a 3D model and data or where a comprehensive building model exist. Each project must provide all the required information to enable Facilities Management to update/ maintain the existing 3D model and data. Facilities Management must protect QUT's investment in 3D models and data, by protecting the integrity of any existing 3D model and data information (digital twin).

37.2 Project documentation

This Section 37 - 3D Models & data (BIM) does <u>not</u> replace or cancel any requirements in <u>Section 40</u> – Project Documentation.

The intention is for the project to use the 3D model and data to produce the required 2D documentation as specified in Section 40 – Project Documentation. Refer to Section 40 – Project Documentation, for the 2D CAD drawings, O&M standards and requirements.

37.3 Information to be provided

The project must provide to the Infrastructure Records Coordinator the 3D models and data as specified in the projects Digital Engineering Execution Plan (DEEP) and Project Information Register (PIR).

37.4 Existing BIM information

QUT may have existing 3D models and data for some buildings. The project can request copies by emailing the Infrastructure Records Coordinator at <u>fm_records@qut.edu.au</u>

37.5 Autodesk - Revit & BIM360

QUT is an Autodesk shop with ongoing licenses and extensive DWG records in place. QUT selected Autodesk Revit and Autodesk BIM360 as our standards.

All 3D models and datasets must be delivered to QUT in Revit and BIM360, with all the required additional files to ensure it is a complete representation of the project works.

37.6 dRofus or other project information tools

If dRofus or any other project information tool is used in the project. Then the project must provide a copy of all the data from that system(s) to Facilities Management as specified in the projects Digital Engineering Execution Plan (DEEP) and Project Information Register (PIR).

37.7 Coordinate system

Facilities Management uses the MGA Zone 56, using GDA94 datum, Geographical Information System to accurately capture site and infrastructure data for the two main QUT campuses. When it is available - the project must use GDA2020/MGA56.

All 3D models must use this coordinate system, to ensure the 3D building models align with the future 3D campus models and datasets.

37.8 Point cloud surveys

All point cloud survey information must be provided to the Infrastructure Records Coordinator by the project.

37.9 Projects that includes multiple buildings

Projects that include multiple buildings or parts thereof, must provide independent 3D models and datasets for each building.

QUT archives and maintains the 3D models and datasets for each building separately. This also enables QUT to provide the independent 3D models and datasets to future projects. Also see Section 40.5 – Full as built documentation within 90 days of practical completion.

DSG Part 3 - External

38 Roads, Footpaths and Car Parks

38.1 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.

38.2 Standards

The design standards are based on:

- Road Design Manual Volume 1, Queensland Main Roads Dept.
- Urban Design Manual Volume 1, Queensland Main Roads Dept.
- Manual of Uniform Traffic control Devices, Queensland Main Roads Dept. 1989.
- Town Plan for the City of Brisbane.

Additional information on standards can be gained from:

- AS2890.1. Off-Street Parking, Part 1 Car Parking Facilities.
- AS2890.2. Off-Street Parking, Part 2 Commercial Vehicle Facilities.
- Design Standards for Subdivisional Roadworks Brisbane City Council.
- Design Manual Volume 1, Roads and Drainage Pine River Shire Council.
- Design Guidelines for on-site Car Parking Facilities. Brisbane City Council 1989. (use as reference only)

38.3 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.

BCC Standards - Where campus roads join to existing BCC roads, BCC road standards should be used.

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.

38.4 Road Layout & Geometrical Design

Kerbs

All roads on campuses are generally to be provided with kerb and channel.

Profiles

Kerb profiles are to be as per standard Brisbane City Council types.

Type E Vertical Face

Type E "vertical face" barrier kerbs must be used on all campus roads unless alternative profiles are to be matched. Layback kerbs will not be used unless approved in writing by the project manager.

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 BCC 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 is 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 BCC 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 BCC 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.

38.5 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 BCC Standard Car template may be used, but the swept path of the BCC 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 BCC 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 QUDM (Qld Urban Drainage Manual):
- 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 QUDM.
- 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 Brisbane River.

Inlets

- a) Gully Pits These shall be 900 x 600 BCC Type A gullies designed to accept full rainwater flows as above, when 50% blocked.
- b) Field Inlets These shall have a minimum size of 600m x 600mm with full size parallel bar heavy service grates [Webforge (Ph: 3260 1064) or equal]. 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 backcatchments and low risk of blockage.
- d) Major Field Inlet These shall be of a type as shown on Figure 14 in the BCC manual and 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) BCC Type Access holes shall be BCC standard type (refer BCC manual details Fig.B6.5 (2), (3), (4) + (5)) 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 QUT.

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.

39 Landscape

39.1 Introduction

These guidelines relate to the QUT 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 QUT Maintenance Manual prepared by Tract Consultants.

39.2 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 contaminations such as for Red Fire Ants.

39.3 Reference Material

Material produced for the QUT to be referenced for each campus project:

- Current Landscape Master Plans and Site Planning Reports Kelvin Grove and Gardens Point
- QUT 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.

39.4 Site Appreciation & Investigations

Investigation of the site for each proposed project needs to be undertaken and include:

- An appreciation of site conditions with:
 - o 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
- On site consultation with QUT Facilities personnel for special considerations, existing services, future maintenance.

39.5 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.

39.6 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.

39.7 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.

39.8 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:

	Minimum Width						
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 planting 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

QUT 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 QUT.

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.

39.9 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.

39.10 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.

39.11 Irrigation

Any irrigation installation involving trenching were 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 QUT 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 constructed 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.

39.12 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.

39.13 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

39.14 Plants

Please Refer to Appendix - 39.22 Landscape Protection Guidelines for QUT 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 2mX2m planting space, mulched/maintained free of grass.

Proposed new plantings

For Agriform

- 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 QUT 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:

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 25 mm 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.

39.15 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.

39.16 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 QUT Facilities Maintenance personnel.

39.17 Defects Liability

All hard landscape work is to have a warranty period for 12 months after practical completion.

39.18 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.

39.19 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.

39.20 Obligation at Completion of Establishment and Period

It is the obligation of the landscape architectural consultant to provide to the relevant personnel:

- As constructed drawings
- Warranties for equipment and workmanship
- Commission of the irrigation system
- Handover to the landscape maintenance staff

39.21 Details in Drawings

- 1. Planting Details Refer QUT 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)

39.22 Additional information for Landscape Architects and Contractors Refer to Appendix - 39.22 Landscape Design Standards & Guidlines, Edition 4, July 2008 Refer to Appendix - 39.22 Landscape Protection Guidelines for QUT Campuses

DSG Part 4 - Documentation

40 Project Documentation

40.1 General

This section details the required Technical Project documentation, contents and formats that must be provided to QUT. Link to full DSG Document <u>https://www.qut.edu.au/additional/contractors</u>

Required Technical Project Documentation Overview									
	Project to Provide	Category	Specification	Sub Sec.	Responsibil ity				
1	Schematic Design	Sketches and Design Documents	Digital PDF in colour	40.3	Design Consultant				
2	Design Development	Documentation	Design & Approval	40.3	Design Consultant				
2	Design Development	Design Floor plans	Floor Plans with QUT assigned room numbers	40.2	Design Consultant				
3	For Tender Documentation	Documents & Drawings	Digital PDF in colour	40.3	Principal Consultant				
4	For Construction	Drawings	Individual digital PDF drawing files in colour	40.3	Principal Consultant				
4	Documents		Digital PDF in colour	40.3	Principal Consultant				
5	Floor plans prior to PC	Drawings	Latest DWG floorplans	40.6	Principal Contractor				
6	Telecommunication Documentation at Practical Completion	Documentation to liven network ports	Floor plan Layouts and Test Results for Port Patching	40.4	Principal Contractor				
	Full As Built Documentation Within 90 Days after Practical Completion	Drawings	Individual digital PDF drawings in colour AutoCAD DWG files with all reference files & images	40.5.1-3					
7		O&M Manuals	Digital PDF O&M manual including colour A3 drawings Original digital files used to produce the O&M Manual	40.5.5	Principal Contractor				
		3D CAD Building Model (If available)	Final 3D CAD Building Model	40.5.4					

Existing Records

Facilities Management, Infrastructure Systems & Information (ISI) unit maintains a comprehensive archive of building records. This is to fulfil obligations under the 'Public Records Act' 2002 and Health and Safety Requirements. It is also required for the ongoing maintenance and development of QUT's physical facilities. Existing information can be requested by emailing <u>fm_records@qut.edu.au</u>

Digital PDF Records

QUT uses two types of PDF documents, a digital PDF document and a scanned PDF. The *scanned PDF* file is only an image file and is not editable or searchable in Adobe Acrobat software. A scanned PDF can be made searchable by processing it through Optical Character Recognition (OCR) software which converts scanned PDF and other images into editable Word, Text, Excel output formats. This still requires extensive auditing post OCR to ensure correct conversions.

A *Digital PDF* is normally compiled by converting existing Word, Excel, Visio or DWG files into PDF documents by using Adobe Acrobat software. This creates a searchable and high quality PDF document.

A full Operations and Maintenance manual can be created by combining PDF documents, drawings and images (in the correct sequence) into one PDF manual using the Adobe Acrobat software. The end result is a digital manual that looks, feels and works the same as the hard copy manual. It is then also available to multiple resources at the same time in different locations.

Note – All PDF files delivered to QUT shall not be limited, locked or restricted in any way.

40.2 Design Floor Plans and QUT Room Numbers

The QUT floor plans must be updated whenever a project causes a building floor plan to change or a new floor plan to be created. The process is as follow:

- The Design Consultant must email the architectural design floor plans in PDF format to Facilities Management, Infrastructure Systems & Information Unit by emailing fm_records@qut.edu.au.
- The Infrastructure Systems & Information unit will then assign the QUT room numbers as per the QUT standards and email the updated room numbers in scanned PDF format back to the Principal Consultant.
- Any subsequent design changes that affect the floor plans must follow the same process to ensure that the room numbers continue to comply with QUTs Space Management System.

The QUT assigned room numbers must be used and visible in and on all as constructed Drawings and in all QUT Operations & Maintenance Manuals (refer to DSG Section 3.13 - Identification of Campus, Building, Level, Room and Project). No other room numbering system can be used.

40.3 Design, Tender and Construction Documentation

The Design Consultant must provide the Schematic and Design development documentation to QUT in PDF. The Principal Consultant must provide the Tender and Construction documentation to QUT in PDF. (See DSG Section 3.3 - Contents of Functional Design Brief (FDB))

The following documents are required in PDF depending on the scope of the projects:

- A copy of the Signed Contract Document
- Certificate of Compliance with DSG (See FMP314)
- Stakeholder Signoff form (See FMP313)
- All documents necessary for authority approvals, including drawings, specifications, certificates, etc.
- All documents including drawings, specifications, certificates, reports, etc. necessary to provide the contractor with complete and detailed instructions for the execution of the project.
- Depending on the size and nature of the project, the consultant will also be required to provide the following documents:
 - Functional Design Brief
 - o Schematic Design Documents

- Detailed Design Report (relating to any discipline)
- o Finishes and Colour boards in electronic format or photo
- Model and or digital images of model
- 3-D presentations
- o Architectural Perspectives
- Detailed Commissioning Plans (for details see DSG Sections 11, 24, 25, 26, 27, 28 29, 30, 31 and 32)
- All shop drawings, legible in A3, 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 action shall be taken to ensure that adequate material is provided to the University without additional cost to the University.
- All digital drawings in PDF format (AutoCAD drawings are not required).

40.4 Telecommunications Documentation at Practical Completion

QUT IO-NCIS, Information Technology Services requires "as constructed" data documentation and test results prior to PC in order to configure, patch and activate the data outlets for staff, student and building services. QUT utilises nearly 1000 sub networks and therefore pre-practical completion documentation is imperative to ensuring the correct configuration of data outlets for the intended purpose. (See DSG Section 28.8)

The Principal Contractor must supply documentation directly to QUT IO-NCIS AT LEAST 1 WEEK PRIOR TO practical completion. This documentation shall contain the following:

- "Marked up" drawings that identify outlet number in each room.
 - o (See format and examples, DSG Section 28.8 Mandatory Documentation Provisional)
- Microsoft Excel Spreadsheet (in original .xls or .xlsx spreadsheet format).
 - o (See format and example, DSG Section 28.8 Mandatory Documentation Provisional)
- Test results are desirable but not mandatory at the Pre-Practical completion stage.
 - o (See format and example, DSG Section 28.8 Mandatory Documentation Final)

40.5 Full As Built Documentation within 90 Days of Practical Completion

Multi building projects

Where a project covers more than one building, the built drawings and manuals must be provided separately for each building. This will enable QUT to archive the project information, under the correct buildings.

40.5.1 As Built Definition

QUT built drawings definition is to be read in conjunction with QUT Design Standards and any requirements contained within the contract document.

- 1. An as built drawing details precisely and accurately what has physically been built on the ground and can be segregated according to service area.
- 2. Services areas are, but not limited to, Architectural, Structural, Drainage, Plumbing (including Gas), Mechanical, Electrical, Communications, Security and Landscape.
- 3. Each service areas as built drawings 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 A3 As Built plans. Any incorrect information that may exist on any base plan must not be shown as part of the as builtdrawing.

- 4. Relevant information, but not limited to, service type, material type, diameters, connection positions to existing infrastructure and invert elevations are to be clearly annotated.
- 5. 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.
- 6. The accuracy should always be to within 0.1 meter.

It is important to note that as built drawings will be subject to internal audit and this could involve conventional survey methods by a licensed Surveyor.

All as built drawings are to be supplied in DWG and digital PDF format as detailed above in Digital PDF Records.

40.5.2 Master Site & Services Information (GIS)

Surveys

QUT maintains Master Site and Services CAD Information for the Gardens Point and Kelvin Grove Campuses. The site & services CAD Information is a combination of AutoCAD Map3D drawings and two MS Access databases which is based on the National Map Grid of Australia 1994 (zone 56) coordinate system (MGA56). It is of utmost importance to QUT that all new site and external services works are **accurately** surveyed as per **MGA56** and incorporated into the existing site information drawings and database.

Contour Changes

Where a project changes the existing contours, the project must provide on completion, a new site surface survey in DWG format for the affected area, to FM as part of the as built documentation. This includes **new contour lines to 0.25 meter** to the extent where the new contour lines matches the existing contour lines in the QUT Site & Site Services Information set.

Exposed Services

Therefore it is the **Contractors responsibility** to notify the QUT Infrastructure Systems & Information, GIS Administrator (<u>fm_records@qut.edu.au</u>) of any exposed or newly placed underground services, at least two full QUT working days (Monday to Friday) prior to backfilling or covering it.

The GIS Administrator will decide if surveying or photos and measurements by him are required:

- If surveying is required The GIS Administrator will engage a surveyor to carry out and provide the surveyed information
- If not required The GIS Administrator will visit the site and take measurements and photos and update the QUT site and services information.
- The GIS Administrator will then give the Contractor permission to cover the exposed or new underground services.

The above requirement for QUT site and services information do not in any way diminish the requirements for accurate and detailed as built drawings and documents. The as built drawings also form a valuable archive resource for Facilities Management and for future maintenance and improvement projects. Special attention should be given to QUT's Definition of "as built drawings" (refer section 40.5.1).

Flood Water Information

(Refer to Section 3.4 - Safe Design Principles)

40.5.3 Full As Built Drawings

The Principal Contractor must provide the projects as built DWG & PDF drawings covering all relevant building disciplines within 90 days of Practical Completion.

Typical Drawings expected by QUT

- A set of floor plans including roof plans relevant to the project with dimensions, floor finishes, walls, doors, partition types and furniture layouts. All floor plans must show the QUT room numbers (Refer section 40.2 – Design Floor Plans).
- Major elevations relevant to the project (exclude detailed internal elevations)
- Major sections relevant to the project (exclude detailed sections)
- Reflected Ceiling Plans relevant to the project
- Evacuation Signs
- All civil, structural, mechanical, electrical, lift, hydraulics, data and communication, fire services and any other services drawings relevant to the project.
- 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 Section 30 Fire Services Clause 23.4d.
- Submit a record or the as built 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 the commissioning period.
- Include schematic/diagrammatic drawings of each system showing piping and wiring, and principal items of equipment.

As Built DWG and PDF Drawing Requirements

- All DWG & PDF drawings *files provided to QUT shall not be limited, locked or restricted in any way*
- CAD drawings must be AutoCAD compatible DWG format
- For every CAD drawing layout there must also be a digital colour PDF file *and it must be an exact print of the final CAD drawing layout* in colour. Avoid using colours like yellow, light blue, light green, etc. that does not produce high quality images or information when converted to colour PDF.
- Where an AutoCAD file contains more than one layout, a separate PDF drawing file must be produced for each layout and the filename should represent the drawing and layout numbering
- Use only the Consultant or Contractor drawing number system
- The DWG and PDF drawing file names must be the Consultant or Contractors drawing number
- The full CAD drawing file structure must be provided to QUT and the structure must include

- all Xref and image files to view, plot and edit the drawings as drawn by the Consultant or Contractor
- \circ $\;$ the colour plot style and any other files used in creating the CAD drawings
- Use only standard AutoCAD font styles and line types
- 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.
- All entity colours and line types must be drawn BYLAYER
- Blocks & symbols must be created on layer 0 and then inserted onto the desired layer
- All Internal and/ or building drawings at a scale of 1:1
- Survey or external drawings are scaled to 1:1000
- All drawings and their details must:
 - Be legible when printed in A3 size
 - o Use a Standard Title Block
 - Include the QUT logo and the QUT project number on each drawing sheet

40.5.4 3D Models and data (BIM)

Refer Section 37 – 3D Models and Data (BIM)

40.5.5 Operating & Maintenance Manuals

Digital PDF Document

The Principal Contractor must provide the Operations and Maintenance Manuals as a **digital PDF** document (refer to Section 40.1 Digital PDF Records). The digital PDF Operations and Maintenance Manual must also include a full A3 size drawing set, in colour and with an index and it shall be placed at the back of the PDF Manual.

Note – All PDF files delivered to QUT shall not be limited, locked or restricted in any way.

Original Digital Files

The Principal Contractor must also provide the original Word, Excel, Visio, etc. files (not limited, locked or restricted in any way) that were used to produce the PDF manual to QUT. These original documents are required for any future information updates by QUT.

Reports and Certificates

The Principal Contractor must provide all reports and certificates (with actual signature and then scanned to PDF – no digital signatures) 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 QUT Design Standards and Guidelines

QUT Operations & Maintenance manual Template

The actual range and content of manuals provided will be dependent on the range and complexity of elements incorporated in the as built facility. QUT maintains an Operations and Maintenance Manual template document in Microsoft Word, to assist Consultants working for QUT.

- It provides a consistent structure and conformity to the sequence and layout of the PDF Operations and Maintenance manuals.
- The document is a template and can also be used as a guide.
- Larger projects will require additional sections to be inserted by the Consultant as required and smaller projects can remove the irrelevant sections.
- The QUT Operations and Maintenance Manual template can be requested by emailing fm_records@qut.edu.au or the template MS Word file is available to FM project Coordinators in the FM home folder - I:\FM Procedures\Design Standards & Guidelines\Current\O&M Manual Template.docx
- The typical QUT PDF Operations and Maintenance manual has a cover page and the following sections:
 - Project Details
 - List of Contractors and Sub-contractors
 - List of Guarantees provided with copies
 - List of Certificates of Approval with copies
 - Copy of Site and Building Survey (refer DSG Section 40.5.2 Master Site & Services Information (GIS))
 - List of 'as built' drawings supplied (refer DSG Section 40.5.1 As Built Definition)
 - o List of Specifications supplied
 - Warranty Schedule
 - Warranties
 - General: Name the principal as warranty. 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

• Architectural Section

- o As built drawings or final drawing set
- Hardware (refer DSG Section 10 Doors, Hardware & Locks)
- o Complete schedule and description
- o Manufacturer's Literature for all hardware
- Keying schedule
- Keying diagram (tree)
- Maintenance advice
- Furniture/joinery (refer DSG Section 9 Furniture & Fittings)

- Where fitted by the contractor supply manufactures literature and warranties (refer DSG Sections 4, 5, 6 & 7)
- o Finishes Schedule and Description for all internal and external finishes
- Maintenance advice on:
 - Roofing (refer DSG Section 8 Roofs)
 - External wall treatments (refer DSG Section 4 External Walls & Windows)
 - Windows and doors (refer DSG Sections 4 & 5)
 - Internal wall treatments (refer DSG Section 5 Internal Walls, Partitions & Finishes)
 - Floor finishes (refer DSG Section 6 Floors & Floor Finishes)
- Colour Scheme Description, Manufacturer and Colour Name
 - Internal (refer DSG Section 5 Internal Walls, Partitions & Finishes) Paint, Laminates, Carpet, Vinyl & Tiles
 - External (refer DSG Section 4 External Walls & Windows) Paint, Pre-finished materials, Tiles & Other external features
- Structural
 - As built drawings or final drawing set (refer DSG Section 12- Structural Design)
- For the other main sections refer to table 40.5.5

The following sections are also required, inclusive of the sections in table 40.5.5:

- Light & Power Description & circuitry diagrams, Details of switchboard, Distribution boards circuit ID/load, Description Schedules, Schedule of light fittings
- Audio Visual Acoustics reports (refer DSG Section 14 Acoustics)
- Building Management System (BMS) (refer DSG Section 32- Building Management Systems (BMS))
- o Evacuation Signs (refer DSG Section 30.29 Emergency Evacuation Information)
- Fire System Fire engineering reports, QFRS certificates, Fire Alarm Systems Approved drawings (i.e. Approved from Qld. Fire Services Dept.), Fire Alarm Systems - Austal lining details
- Landscaping Including Roads Footpaths & Car parks Schedule of all planting, Maintenance advice on Lawns, vines, ground covers, shrubs, trees, Landscape lighting.

Table 40.5.5 – Operations and Maintenance Manual Required Information																
	DS	G Seo	tion	S												
	Mecha					anica	al		Elect	rical						
Documents	Drainage	Plumbing	Water Services	Air Conditioning	Lifts	Emergency Power Plant	Pumps & Fans	Light & Power	Telecommunications	Audio visual	Electrical Equipment	Fire Alarm System	Fire hydraulics (Sprinklers & Hydrants)	Security & Access System	Landscape – Incl. Roads, Footpaths & Car parks	Irrigation System
As Commissioned Performance Tests	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y
Manufacturer's Literature	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
As Built Drawings	Υ	Y	Y	Υ	Y	Υ	Υ	Υ	Y	Υ	Y			Υ	Y	Υ
Location Diagrams												Y	Y	Y		
Location drawing for all control valves		Y	Y													Y
Location of Drawings									Y	Y						
Installation Diagrams									Y	Y						
Description of System/Operation	Y	Y	Y	Y		Y	Y		Y	Y	Y	Y	Y	Y		Y
Operating Instructions	Y	Y	Y	Y	Y									Y	Y	
Operation/Service & Maintenance Advice & Schedule	Y	Y		Y	Y	Y	Y		Y	Y	Y	Y	Y			Y
Equipment Schedule & Suppliers				Y		Y										
List of Replacement Fittings		Y														Y
Emergency Procedure												Y	Y			
Installer Certificate									Y			Y	Y			
Certificate of Compliance												Y	Y			
Cause and Effect Matrix												Y	Y			
For more information see DSG Section	25	26	26	24	29			27	28	22 & 23		30	30	10	38 & 39	

40.5.6 Equipment Lists/Asset Registers

The Principal Contractor is required to provide to QUT detailed information on all assets included in this project. The information must be in the required Asset Register format which can be obtained from <u>fm_records@qut.edu.au</u>.

The assets must be bar-coded and signed with the ID matching the register ID. QUT will provide Excel template files and numbering conventions.

DSG Part 5 – Appendices

Appendices are separate documents that are referenced in this DSG.

Title
14 - CAD Drawing, Standard Acoustic Details, Dated 1 Oct. 2002
18.2 - Wayfinding Signage Manual, Issue D, Dated 07.09.2022
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 2016
27 – QUT Energy Metering System 2020, Dated March 2020
39.22 - Landscape Maintenance, Dated 2008

39.22 - Landscape Protection Guidelines for QUT Campuses, Dated ?