UTS DESIGN GUIDELINES

P-PO.01.15

MESSAGE FROM THE DIRECTORS

The University of Technology Sydney (UTS) has a large and diverse property portfolio. Decisions to refurbish, extend or construct new buildings pose unique challenges for both professional consultants and University staff, academics and administrators. This situation is made more demanding, as University projects often have to be designed and built under extremely tight time and cost constraints.

These Guidelines have been prepared to assist professional consultants in the design and documentation of UTS projects. They provide direction and guidance in regard to the University's requirements. The Guidelines will enable consultants to more efficiently translate UTS requirements into acceptable design solutions.

The Guidelines are not intended to replace the level of initiative, competence and care expected of consultants in the performance of their duties. Consultants are encouraged to carefully consider the merits of the Design Guidelines in the context of the needs of individual projects. If a consultant considers a guideline is not appropriate and that a more suitable solution is available, proposals to this effect should be raised for consideration by UTS. In the absence of express written approval for a deviation from these guidelines, UTS will however assume that the requirements contained in the Design Guidelines have been fully addressed and incorporated in the proposed design solution and specifications.

Any queries in regard to these Guidelines or UTS requirements on any project should be directed to the relevant UTS project manager. We trust that you will find the Guidelines of assistance in the execution of your professional duties on UTS projects.

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ACKNOWLEDGEMENT

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- Griffith University, Queensland
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- The University of the South Pacific
- The University of Newcastle
- Tertiary Section, NSW Department of Public Works & Services
- Policy Section, NSW Department of Public Works & Services
- NSW Police Service

UPGRADES TO THE UTS DESIGN GUIDELINES

To maintain the currency of the Guidelines the University is committed to periodically upgrading them to incorporate new industry practices, materials and information gained from Post Occupancy Evaluations.

Suggestions for improvements to the Guidelines are welcomed and consultants are encouraged to notify us immediately of any apparent inaccuracies or ambiguities.

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UTS CAPITAL WORKS CONCEPTIONAL FRAMEWORK

PHILOSOPHY

The university's built environment should enhance the UTS image, be imaginative, and embrace the philosophy of LONG LIFE/LOW ENERGY/LOW MAINTENANCE/LOOSE FIT. Buildings and fit-outs should not be extravagant and each project should represent value for money. For new buildings the aspirational target is 6 star green star.

LONG LIFE

It is necessary to carefully consider the projected life of the construction. This may not always result in the least expensive capital solution but a realistic assessment should be undertaken on the whole of life cycle costs. It is necessary for UTS to be purposeful in decision making, the requirements of a fit-out in rented premises will be different from that in owned buildings, particularly as rented accommodation is seen as short term by UTS, with a fundamental goal for the university to be housed in UTS owned premises.

LOW ENERGY

From an ecologically sustainable viewpoint this is an imperative. It does not always result in the least expensive capital solution, it is important again to also take account of life cycle costs. Buildings can be designed as low energy from a variety of standpoints: orientation and shape [not as much choice in CBD as a green field]; use of the ESD friendly materials [not always but usually not the cheapest cost material]; reusability of components or materials; and, efficient operation [running costs].

LOW MAINTENANCE

As a long term owner occupier UTS selects components and finishes which have low maintenance costs and consequently contribute to economical running costs over the life of the building.

LOOSE FIT

There has been a tendency in the past to customize fit-outs for particular users. The way forward is to move towards greater standardization of space, to not customize so that we move closer to requiring just to change the name on the door when a new user is to be housed in previously occupied space.

GENERIC STANDARD OF FINISHES AND TECHNICAL SERVICES

The generic standard of finishes and technical services that the University requires for new buildings and refurbishments is based on the Property Council of Australia (PCA) Design Specification for New Buildings.

The following PCA standards are required for the components noted:

Finishes	GRADE B
Heating, ventilation and air-conditioning system	GRADE A
Lifts	PREMIUM
Power	PREMIUM
Lighting	PREMIUM
Intelligence	PREMIUM
Standby power	GRADE A

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REGISTER AND REVISION STATUS OF UTS DESIGN GUIDELINES SECTIONS

	Section	Revision. No	Publication Date
1.	Introduction	09	August 2011
2.	Planning Considerations	15	June 2016
3.	Architectural Controls	14	December 2014
4.	External Walls and Windows	14	December 2014
5.	Internal Walls, Partitions and Finishes	07	December 2014
6.	Floors and Floor Finishes	15	June 2016
7.	Ceilings and Ceiling Finishes	15	June 2016
8.	Roofs	15	June 2016
9.	Furniture and Fittings	15	June 2016
10.	Doors, Hardware and Locks	10	September 2012
11.	Sanitary Plumbing and Drainage	08	September 2009
12.	Piped Services and Storage Tanks	15	June 2016
13.	Air Conditioning and Ventilation	15	June 2016
14.	Fume Exhaust and Fume Cupboards	15	June 2016
15.	Electrical Services	14	December 2014
16.	Fire Services	08	December 2014
17.	Security	15	June 2016
18.	Design of Vertical Transportation Services	14	December 2014
19.	Colour Schedule for Plant and Equipment	03	January 2002
20.	Painting	11	December 2012
21.	Signage	15	June 2016
22.	Special Requirements	15	June 2016
23.	Audio Visual Services	15	June 2016
24.	Accessible Environments Policy	15	June 2016
25.	Environmental Sustainability	15	June 2016
26.	Heritage Assets	13	December 2013
27.	Building Management Systems	15	June 2016
28.	Information Technology Division Communications Infrastructure Design Guidelines	15	June 2016
29.	Energy Management Systems	15	June 2016
30.	Student Accommodation	13	December 2013
Building Specific Design Guidelines			
CB01	Building 1	14	December 2014
CB02	Building 2	14	December 2014
CB03	Building 3	14	December 2014
CB04	Building 4	14	December 2014
CB05	Building 5	14	December 2014
CB06	Building 6	14	December 2014
CB10	Building 10	14	December 2014
	Appendix A Preliminaries		
	Appendix B CAD Drawing Standards		

List of Revisions		
15	**Section 2 PLANNING CONSIDERATIONS** • Clause 2.8 Safety in design, modified requirements **Section 6 FLOORS AND FLOOR FINISHES** • Sub clause 6.2.11 Access Floors, additional requirements **Section 7 CEILINGS** • Clause 7.4 Ceiling fixtures additional requirements **Section 8 ROOFS** • Clause 8.10 Roof Safety System, modified requirements **Section 9 FURNITURE** • Clause 9.6 Toilet Fixtures, modified requirements • Ergonomic furniture checklist deleted • Clause 9.20 Workstations, modified requirements • Clause 9.21 Office chairs, modified requirements **Section 12 PIPE SERVICES** • Clause 12.2.9 additional requirement in relation to cooling towers **Section 13 AIR CONDITIONING** • Clauses 13.1, 13.2, 13.3, 13.4, 13.5, 13.6, 13.8, modified requirements • Clause 13.12 Air Conditioning Control Systems & Building Management System (BMS) major deletion and cross reference to Section 27 **Section 14 FUME EXHAUST** • Clauses 14.1, 14.3, modified requirements **Section 15 ELECTRICAL SERVICES** • Clauses 15.1, 15.2, 15.4, 15.5, 15.6, 15.7 modified requirements • Clause 15.3 Lighting substantially revised and expanded **Section 17 SECURITY** • Clauses 17.3, 17.4, 17.5, modified requirements **Section 21 SIGNAGE** • Emergency Evacuation diagram samples removed • Clause 21.3 Numbering methodology revamped **Section 22 SPECIAL REQUIREMENTS** • Sub clause 22.4.6 cable channel configuration diagram deleted **Section 23 AUDIO VISUAL SERVICES** • Substantially revised, updated **Section 24 ACCESSIBLE ENVIRONMENTS POLICY** • Terminology corrected, updated	June 2016

	Section 27 BUILDING MANAGEMENT SYSTEMS (BMS) • Edited and updated **Section 28 ITD COMMUNICATIONS INFRASTRUCTURE** • Note added that the latest version of the "Information Technology Division Telecommunications Infrastructure Design Guidelines", which will be provided to all telecommunication contractors, shall supersede the information in this chapter. **Section 29 ENERGY MANAGEMENT SYSTEM (EMS)** • Clause 29.1 edited and references 11 and 12 added **Section KG** Guidelines removed	
14	**Section 2 PLANNING CONSIDERATIONS** • Clause 2.3.2 maintenance information added • Clause 2.7 Olympian Shopper Bins requirement added • Clause 2.8 Safety in Design added. **Section 3 ARCHITECTURAL CONSIDERATIONS** • Clause 3.9.7 eyewash in Chemical store added • Clause 3.9.16 people counters to GTS added **Section 4 EXTERNAL WALLS AND WINDOWS** • Clause 4.7 Window Cleaning Safety. **Section 6 FLOORS AND FLOOR FINISHES** • Schedule of Carpets information deleted from here and included in Building Specific Design Guidelines. **Section 7 CEILINGS AND CEILING FINISHES** • Clause 7.6 Specifications added to headroom • Ceiling types deleted from here and included in Building Specific Design Guidelines. **Section 8 ROOFS** • Clause 8.9 Roof Access new section added • Clause 8.10.1 Roof Safety System section added • Clause 8.10.2 Roof walkways section added • Clause 8.10.3 Fall arrestors section added • Clause 8.10.2 Roof walkways section removed • Clause 8.10.3 Roof Safety Balustrade section removed **Section 9 FURNITURE AND FITTINGS** • Clause 9.8 kitchen dual waste bin system introduced • Clause 9.21 Workstation height adjustment details provided. • Clause 9.21 Shelving screen details. **Section 12 PIPED SERVICES AND STORAGE TANKS** • Clause 12.12 Tanks additional access opening increase to 2. • Clause 12.12 access opening to include ladder access and testing space. **Section 13 AIR CONDITIONING AND VENTILATION** • Clause 13.3 Addition of "safe" access added	December 2014

	• Clause 13.3 Additional of “future maintenance” added for plant location **Section 15 ELECTRICAL SERVICES** • Clause 15.3.2 paragraph added on positioning of light fittings • Clause 15.3.6 Enclosed Fire Escape Stairs light fittings placement **Section 17 Security** • Honeywell system introduced **Section 18 DESIGN OF VERTICAL TRANSPORTATION SERVICES** • Clause 18.1 General number of lift increase amongst in city campuses. • Bullet point added on goods lift. **Section 21 SIGNAGE** • 21.2 Section added • 21.3 numbering methodology updated **Section 22 SPECIAL REQUIREMENTS** • Clause 22.2.12 eye wash **Section 23 AUDIO VISUAL SERVICES** • Clause 23.1.5 paragraph added on floor boxes. • Clause 23.2.1.5 paragraph added on floor boxes. • Clause 23.5.1 section on safety added. • Clause 23.5.1.2 clause on cleanliness added. **Section 24 ACCESSIBLE ENVIRONMENTS POLICY** • Clause 24.5.2 Specialist Facilities criteria work replacing occupation	
13	**Section 2 PLANNING CONSIDERATIONS** • Clause 2.1 Contact details • Clause 2.6 Cross reference to Section 29 added • Updated cross references to Workplace Health and Safety items **Section 3 ARCHITECTURAL CONSIDERATIONS** • Clause 3.3.3 Deleted reference to Drawing Laboratories and Studios • Updated cross references to Workplace Health and Safety items **Section 4 EXTERNAL WALLS AND WINDOWS** • Updated cross references to Workplace Health and Safety items **Section 8 ROOFS** • Updated cross references to Workplace Health and Safety items **Section 9 FURNITURE AND FITTINGS** • Updated cross references to Workplace Health and Safety items **Section 13 AIR CONDITIONING AND VENTILATION** • Updated cross references to Workplace Health and Safety items **Section 15 ELECTRICAL SERVICES** • Updated cross references to Workplace Health and Safety items **Section 21 SIGNAGE** • Clause 21.2 Numbering methodology altered and Buildings 13, 14 and 15 added **Section 23 AUDIO VISUAL SERVICES**	December 2013

	• Updated cross references to Workplace Health and Safety items **Section 24 ACCESIBLE ENVIRONMENTS POLICY** • Updated cross references to Workplace Health and Safety items **Section 26 HERITAGE ASSETS** • Building 15 details added **Section 27 BUILIDNG MANAGEMENT SYSTEMS** • New section added, former Section 27 renamed **Section 29 ENERGY MANGEMENT SYSTEMS** • New section added, former Section 29 renamed **Section 30 STUDENT ACCOMMODATION** • Formerly Section 29 **BUILDING SPECIFIC DESIGN GUIDELINES** **KG KURING-GAI CAMPUS INTERIOR DESIGN GUIDELINES** • Formerly Section 27	
12	**Section 3 ARCHITECTURAL CONTROLS:** • Reinstatement of version 09 changes 3.3.1 and 3.3.2 which were omitted in error in versions 10 & 11.	April 2013
11	**Section 3 ARCHITECTURAL CONTROLS:** • Clause 3.9.15 Building and Essential Services Spaces requirements added **Section 4 EXTERNAL WALLS AND WINDOWS** • Clause 4.6.3 Windows, minimum use life reference changed to economic life. • Clause 4.10 Balustrades, requirement for minimum height to raised to be above BCA requirements. For social spaces shall be by specific FMU determination. **Section 7 CEILINGS AND CEILING FINISHES** • Clause 7.2 Celling types, specification for Armstrong tiles revised to current range • Clause 7.7 Equipment Access, minimum access panel size specified **Section 9 FURNITURE AND FITTINGS** • Clause 9.1 whiteboard paint reference added • Clause 9.2 Bookshelves for Academic Staff or Support Staff, Tasmanian Myrtle added as an alternative to Tasmanian Oak • Clause 9.5 lecture theatre fittings, fixture and finishes requirements updated. • Clause 9.6 Toilet Fixtures, specifications updated • Clause 9.8 Kitchenette, requirements updated • Clause 9.9 Common Room Kitchens , requirements updated • Clause 9.22 Office chairs, Note on Gregory Chairs purchase agreement amended. • Clause 9.24 Fabrics, sustainable requirement added **Section 12 PIPED SERVICES AND STORAGE TANKS** • Clause 12.1 general. Recycled water, Toilet flushing water, Rainwater sections added. • Clause 12.2.3 Cold Water. Pump requirements updated.	December 2012

	• Clause 12.2.4 Recycled Water. New section added. • Clause 12.2.5 Fire Water. New section added • Clause 12.2.6 Hot Water. Updated to improve efficiency • Clause 12.2.9 Circulating Cooling Water Loop. Laboratory requirements updated • Clause 12.4 Natural Gas Metering. Section added. • Clause 12.11.2 Cold water Booster Pumps. Updated for pump load and BMS requirements • Clause 12.13 Water Meters. Updated for BMS requirements **Section 20 PAINTING** • Clause 20.2 White Board Paint. Section added • Clause 20.3 Colour schemes. Shade references updated to current supplier specification **Section 21 SIGNAGE** • Code numbering shown **Section 25 ENVIRONMENTAL SUSTAINABILITY** • Clause 25. Reference to UTS environmental sustainability policy added • Clause 25.1 Process. reference to FMU changed to FMO/PMO • Clause 25.4 Heritage. reference to FMU changed to FMO/PMO • Clause 25.8 Design and Build Energy Efficient Buildings. Sustainability requirements added • Clause 25.10 Air Quality. restrictions on use of toxic concrete sealants **Section 26 HERITAGE ASSETS** • Clause 26.5 Bradshaw Building removed from list	
10	**Section 8: ROOFS** • Clause 8 standard references amended, sustainable objectives added • Clause 8.1 Membrane roofs specification amended, green roof reference added • Clause 8.3 Restrictions on Box gutter use added • Clause 8.9 Roof access, permanent fixed access required • Clause 8.10 Roof Safety systems, safety provisions added • Clause 8.12 Roof Colour, preference for light coloured roofs to reduce heat gain **Section 10: DOORS , HARDWARE AND LOCKS** • Electronic locking guide reference, referred to separate section 17 • Clause 10.4 Locks, requirements simplified to Lockwood 3570 range **Section 17 SECURITY** • Door furniture assigned to electronic locking equipment referred to separate section 10 • Project provisions and responsibilities added • Clause 17.1 Security system design, sign off and stakeholder input requirements added • Clause 17.2 Access Control Cable Installation, new section added, specifications and requirements • Clause 17.2.1 Single Door Access Cabling, specification requirements added • Clause 17.2.2 Double Door Access Cabling, specification requirements added • Clause 17.2.3 Single/Double Door with Emergency Break Glass Switch	September 2012

	Cabling, specification requirements added • Clause 17.1.2 Cabling to Fixed Cameras, removed • Clause 17.1.3 Cabling to PTZ (Power Tilt Zoom) cameras, section removed • Clause 17.2.4 Reed Switch Cabling, amended specification • Clause 17.2.5 Space detection Cabling, amended specification • Clause 17.1.6 CCTV, section removed and replaced with new clauses • Clause 17.3 CCTV Cabling Installation, section added • Clause 17.3.1 CCTV Camera Cabling, reference to ITD specification added • Clause 17.4 Security Location Specification, updated • Clause 17.4.1 TSG Rooms, requirements added • Clause 17.4.2 Computer Laboratories, requirements added • Clause 17.4.3 Car parks, requirements added • Clause 17.4.4 Office and Reception areas, requirements added • Clause 17.4.5 Workshops, requirements added • Clause 17.4.6 Laboratories, requirements added • Clause 17.4.7 Main Entries to Buildings , requirements added • Clause 17.4.8 Fire Stair Access, requirements added • Clause 17.4.9 Lecture Theatres, requirements added • Clause 17.5 Security Equipment Hardware Specifications, updated • Clause 17.5.1 Access Control hardware Outline, specifications added • Clause 17.5.2 List of UTS Security Approved Electronic Access Control, specifications added • Clause 17.5.3 CCTV System Hardware Outline, specifications added • Clause 17.6 Security System Testing and Commissioning, requirements added • Clause 17.7 Mechanical doors, hardware and locks referred to separate section 10. **Section 21 SIGNAGE** • Clause 21.1 UTS Sign standards, reference to web link and advice that standard under review added • Clause 21.2.3 Campus and Site Location, St Leonards and Royal North Shore Hospital removed • Clause 21.2.4 Building Numbers, updated • Clause 21.2.5 Street Addresses, updated **Section 23 AUDIOVISUAL SERVICES** • Clause 23.1.3 Objectives, updated with more emphasis on teaching and learning spaces and AV input • Clause 23.1.5 Definitions, updated • Clause 23.1.6 Glossary , updated • Clause 23.2.1 Presentation environments, updated • Clause 23.2.1 Equity, requirements added • Clause 23.2.1.2 Teaching & Learning Spaces, requirements added • Clause 23.2.1.3 Special Purpose Spaces, requirements updated • Clause 23.2.1.5 Presentation area, requirements updated, Collaboration pods added. • Clause 23.2.22 FMU. Reference to PMO added • Clause 23.2.3 Flexible learning, updated • Clause 23.3.1 Project Initiation, Reference to PMO added • Clause 23.3.2 Consultation , updated	

	• Clause 23.3.4 Approvals, reference to PMO added • Clause 23.4.1 Categories, updated • Clause 23.4.1.1 (a) Basic AV 1-LCD, specifications and requirements updated • Clause 23.4.1(a) Basic AV1-IWB, new specification /section • Clause 23.4.2(a) Intermediate AV2, revised and updated • Clause 23.4.1.2(b) Intermediate AV2-F Computer Labs, new specification /section • Clause 23.4.1.2(c) Intermediate AV2-S Small Classroom, updated • Clause 23.4.1.2(d) Intermediate AV2-C Small Collaboration Classroom, new specification • Clause 23.4.1.3(a) Advanced AV3, updated • Clause 23.4.1.3(b) Advanced AV3-C Advanced Collaborative Classrooms, new section • Clause 23.4.1.3(c) Advanced AV3-L Lecture theatres, new section • Clause 23.4.1.3 (d) Advanced AV3-B Boardrooms & Special Purpose Spaces, new section • Clause 23.5.3.2 LCD Monitors, updated • Clause 25.5.3.4 Interactive whiteboard, updated **Section 24 ACCESSIBLE ENVIRONMENTS POLICY** • Clause 24 Add notes on DDA Complaints, add adoption of Access to Premises Standard (APS) and application of APS through Building Code of Australia, delete notes on FMU responsibility for implementation of Access Guidelines • Clause 24.2 Add external areas and public domains to criteria • Clause 24.3 Amend application of Access Guidelines and add unjustifiable hardship. Amend application of APS • Clause 24.4 Project Type 2, Type 3 amend extent of application and add Criteria 29, delete project types 4 and 5, amend Project Type number for Student Accommodation and Extension to Existing Student Accommodation, amend Extent of Application for Student Accommodation and Extension to Existing Student Accommodation • Clause 24.5.1 Component 1,3,8,11,15,16 amend Access Criteria • Clause 24.5.2 Component 24,25,26,27,28 amend Access Criteria • Clause 24.5.3 Component 30,31,33 amend Access Criteria **Section 28 ITD COMMUNICATIONS INFRASTRUCTURE** • information technology division**,** Telecommunications Infrastructure Design Guidelines- new version 4.1 dated 3rd March 2011 added	
09	**Section 1 INTRODUCTION** • Director names **Section 3 ARCHITECTURAL CONTROLS** • Clauses 3.3.1 and 3.3.2 area allocations	September 2011
08	**Section 1** • Clause 1.2 Additional Access Compliant note. • Section 2 • Clause 2.4 Title change to Access & Equity. • Section 6 • Clause 6.2.12 Updated information on Carpet colours & Tretford Broadloom. • Section 7 • Clause 7.7 Access panels. • Section 9 • Clause 9.1 Whiteboards new paragraph added. • Clause 9.15 LCD Monitor Arm. • Clause 9.16 – 9.19 re-numbered.	September 2009

	• Clause 9.20 Ergonomic Office Furniture Checklist added • Clause 9.21 – 9.22 re-numbered. • Clause 9.22 Office Chairs Additional Specification added • Clause 9.23 Warranties added. • Clause 9.24 Fabrics revised. • Section 10 • Clause 10.4 Lock Specification revised. • Section 11 • Clause 11.0 Sanitary Plumbing Codes & Standards updated. • Clause 11.1 Sanitary Plumbing Materials to be matched. Clearouts requirement added. • Clause 11.1.1 Food Preparation & Outlets requirements added. • Clause 11.1.2 Laboratories requirements updated. • Clause 11.2 Sewerage System requirements updated. • Clause 11.4 Taps & Faucets required WELS rating added. • Clause 11.6 Sanitary & Trade Waste vents updated with Air admittance valves. • Clause 11.7 Stormwater Drainage Storm event sizing added. Box gutters to be avoided. Pedestrian gratings added. • Section 12 • Clause 12.1 General commissioning requirements added. • Clause 12.2 Water supply codes updated. • Clause 12.2.1 Materials & Gal Mild Steel Cement Lined & HD Polyethylene Pipes added. • Clause 12.2.2 Valves requirements for resilient seated geared butterfly valves added and mini stop ball valves to all tap outlets. • Clause 12.2.3 Cold Water requirements for tanks & pumps added. requirements for vacuum breakers added. wash down hose tap adjacent to grease trap added. • Clause 12.2.4 Hot Water Back flow prevention devices added. • Clause 12.2.5 Fittings WELS Star ratings added. • Clause 12.2.6 Re-numbered • Reverse Osmosis & Demineralized Water requirements added. • Clause 12.2.7 Re- numbered. Circulated Cooling Water Loop requirements added. • Clause 12.3 Natural Gas metering requirements added. • Clause 12.5 Compressed Air Compressor specification deleted. Supplementary Compressor requirements added. • Clause 12.7 Identification of Pipework labelling of water supplies added. • Clause 12.9 Underground Pipework requirements for recovery wire added. Density of back fill requirement upgraded. • Clause 12.10 Pumps- Pump specification changed to variable speed drive. • Clause 12.10.2 Cold Water Booster Pumps requirement for dual water pumps removed. requirement for logic controller added. Connection to Building Management system added. • Clause 12.11 Tanks specification for materials changed to include Polyethylene, copper or re-inforced concrete. Overflow standards upgraded. Models changed. • Clause 12.12 Water Meters- sub meters now required. • Clause 12.13 BMS requirement for hot water heating elements to be wired to facilitate load shedding is deleted. • Clause 12.17 Pipework LPG changed to Natural Gas. PVC deleted.	

	• Section 13 • Clause 13.3 Add UTS targets for reduction in GHG emissions.Noise levels for plants in ceiling space. • Clause 13.4.3 Verify intended hours of operation for each plant. • Clause 13.4.5 Verify temperature reset of chillers if needed to run critical plant systems. • Clause 13.4.6 FCU noise breakout and ceiling construction to be considered for acoustic treatment. • Clause 13.5 Piping, Valve and Fittings specification changed. • Clause 13.8.6 Cooling Towers fixed ladders and platforms added for maintenance. • Clause 13.9 Deleted. • Clause 13.9.1 Renumbered to 13.8.12 and onward. • Clause 13.10 Air Conditioning Controls deleted and upgraded in 13.12 as Air Conditioning Control Systems and BMS.Including new standards and BAC-net based distribution logic control systems. • Clause 13.12.1 Air Conditioning Control strategies. • Clause 13.13 New BMS Graphics Specification added. • Clause 13.14 Electrical Sub-metering in all mechanical switchboards added. • Clause 13.15 Underground Services clause deleted. • Clause 13.14 Chilled Water Metering Renumbered to 13.15 • Clause 13.14 Renumbered from 13.15 • Clause 13.17 Renumbered to13.16. • Clause 13.17 BMS Control Points Renumbered but not changed. • Section 16 • Clause 16.1 General added clauses for acceptance testing of all systems and provision of signed installation and inspection Certificates. That with an Engineered Fire Solution that is must be Integrated into the existing Fire Safety Assessment Strategy. Clause includes Passive Fire Systems. Alarms when required should be placed in hose reel Cupboards with WIP phones. • Clause 16.2 Clarifies Standards for Alarms Allows for interfacing with Security. Notes added concerning Fire Indicator Panels • Clause 16.6 Special Systems Cause concerning very early smoke detection alarm system added. • Clause 16.8 Evacuation Systems deleted clause concerning secondary FIP.	
07	a) Section 3 • Clause 3.9.3 Provision of showers in buildings added • Clause 3.9.7 Delete minimum areas for cleaner rooms b) Section 4 • Subsection 4.1 Materials to be completed with all other finishes and forms of construction to be presented to UTS at an early stage. • Subsection 4.2 Concrete coffered ceilings to be retained where possible. • Clause 4.6.2 Update name of standard. Glazing tinting to match adjacent. • Clause 4.6.3 Window locks keyed alike to a master. • Subsection 4.8 Sealants not to be used as a primary barrier between dissimilar metals. c) Section 5 • Subsection 5.2 Update name of Standard • Subsection 5.3 Leaded vinyl baffles not to be used • Subsection 5.5 Toilet and Shower partitions 200mm above floor. • Subsection 5.6 Splashback to be 400 mm above fixture. d) Section 6	July 2008

	• Clause 6.1.3 Update of Standard names. • Clause 6.2.1 Update of warrantees. Spec for heavy duty carpet to be used in corridors. Provision of special heavy duty lift carpets to prevent dirt tracking into buildings. There are no current vinyl standards so changed laying 'to manufacturers instructions'. Suggested use of a more environmentally sustainable product selection where possible. • Clause 6.2.5 Surface of ceramic tiles to match base or fully vitrified. • Clause 6.2.12 Update carpet specs names of products and substitutions for discontinued lines. e) Section 7 • Subsection 7.4 Colour of fixtures to blend with ceiling. • Subsection 7.8 Delete reference to vertical blinds. f) Section 8 • Subsection 8.1 Update Standards. • Subsection 8.3 Box gutters not be used unless specifically authorised by FMU early in design process. • Subsection 8.4 Overflow not be across pedestrian accessways. • Subsection 8.7 Downpipes to blend with wall colour behind. g) Section 9 • Subsection 9.6 Hand dryer specifications added. Coat hooks and door stops added. Double toilet roll added. • Subsection 9.8 Dishwasher added. • Subsection 9.14 Dishwasher added. • Subsection 9.20 Australian standards updated for office panel systems. Workstation design requirements included. • Subsection 9.21 Update standards and requirements for office chairs added. • Subsection 9.22 Clause on Fabrics added h) Section 10 • Subsection 10.4 Note on electronic manual release added. • Subsection 10.5 Updated lock specification. • Subsection 10.7 Updated lock specification. • Subsection 10.9 Updated door closer specification. • Subsection 10.11 Manual door release added • Subsection 10.14 Updated door hardware specification. Raise height of doors from floor. • Subsection 10.16 Coat/hat hook specifications of fixing added i) Section 11 • Subsection 11.1 ESD compliance added • Subsection 11.3 Sanitary fixtures updated • Subsection 11.4 Taps and Faucets updated. • Subsection 11.6 Standard added. j) Section 12 • Subsection 12.1 Standards updated. • Clause 12.2.1 Standards updated. • Clause 12.2.2 Valve specification and standard updated. • Clause 12.2.5 Clarification of abbreviation added. • Subsection 12.5 Specification clarified. • Subsection 12.6 Specification clarified. • Subsection 12.11 Project updated. k) Section 13 • Subsection 13.1 Standards updated minimum energy performance added. • Clause 13.8.4 Specification of product updated. • Clause 13.8.8 Specification of product updated. • Clause 13.9.1 Standards updated. l) Section 14 • Subsection 14.1 Standards updated. • Subsection 14.7 Standards updated.	

	m) Section 15 • Subsection 15.1 Minimum energy performance added. • Clause 15.3.1 Standards updated. • Clause 15.3.2 Incandescent lighting to be used. • Clause 15.3.9 External solar powered lighting added. • Clause 15.4.1 Timer switch on water heating units. • Clause 15.4.2 Standards updated. Requirement for submetering added. • Subsection 15.5 Standards updated. n) Section 18 • Subsection 18.3 Standards updated. • Subsection 18.5 Standards updated. • Subsection 18.15 Lift car interiors added. o) Section 20 • Table 20.1 Paint Systems updated including warrantee period and low VOC paints • Subsection 20.2 Note on colour palette added. Kuring-gai standard colour scheme updated and Dulux colours substituted where a match is possible. • Subsection 20.1 Standards updated p) Section 21 • Alterations to building numbers. q) Section 22 • Clause 22.3.1 Standards updated. • Clause 22.3.3 Circuit breakers updated. • Clause 22.3.4 Standards updated. Epoxy product updated. • Clause 22.3.11 Energy efficiency rating added. • Clause 22.3.12 Standard updated. • Clause 22.5.3 Colours selected together with FMU added. • Clause 22.5.5 Standards updated. • Clause 22.5.6 Standard added. • Clause 22.5.8 Standard added. • Clause 22.5.13 To be approved by FMU added. r) Section 23 • Clause 23.1.2 Document owner address updated. • Clause 23.4.6 Chosen from ranges approved by FMU added. s) Section 25 • Subsection 25.1 Addition of requirement for an ESD (Environmental Sustainable Design) statement for projects over $10,000 and under $1m value or over 10,000 sqm. • Subsection 25.5 Addition of requirement for an ESD statement for projects over $1m or 10 ,000 sqm; and under $.5m value giving star rating and commitment agreement added. • Subsection 25.6 Archaeological significance to be reported to FMU. • Subsection 25.9 Relationship between artificial and natural lighting added. Solar powered lighting added. Greywater note added. Minimum energy performance note added. • Subsection 25.10 Note on VOCs added. • Subsection 25.11 Note on VOCs added. • Subsection 25.12 Water efficiency standards added. • Subsection 25.15 Notes on North facing glass, overshadowing, glare and solar powered external lighting added. • Subsection 25.16 Notes on implications of transport, prohibition on use of rainforest timber and use of untreated plantation timber; avoiding use of petrochemical based products, preference to local products added. • Subsection 25.19 Note on star rating of new office buildings added and preferred products. • Subsection 25.20 Monitoring and feedback – Green star accountability note added. t) Section 26	

	• Markets 9 removed. u) Section 27 • Subsection 27.2 Update of paint colours and upholstery fabric. • Subsection27.3 Update of paint colours, upholstery fabric, carpet, flooring, laminate colour etc.	
06	a) Section 1 • Abbreviations amended b) Section 2 • Subsection 2.3 Reference to ESD section added c) Section 3 • Reference to ESD section added • Clause 3.3.3 Utility rooms added • Clause 3.3.7 Research student areas added d) Section 6 • Reference to ESD section added e) Section 7 • Subsection 7.2 Standard ceiling tile changed • Subsection 7.2 Table added listing tiles to be used in buildings f) Section 9. • Subsection 9.6 Hand dryer selection requirements added • Subsection 9.10 Research student area requirements added • Subsection 9.11 Vanity unit requirement for female toilets added • Subsection 9.12 Provision of water fountain requirements amended • Subsection 9.15 Computer monitor arms requirements added • Subsection 9.16 Compactus requirements expanded • Subsection 9.20 AS reference updated • Subsection 9.20 Workstation requirements added • Subsection 9.21 Office chair requirements amended g) Section 22 • Clause 22.5.6 Lighting minimal level amended • Clause 22.5.7 Workstation cable management requirements amended l) Section 24 • Clause 24.4.1Dates removed from Australian Standards • Clause 24.4.2 Dates removed from Australian Standards • Clause 24.5.3 Dates removed from Australian Standards m) Section 25 • Subsection 25.1 Requirement for ESD statement added • Subsection 25.19 Requirement for ESD statement added • New section student accommodation added n) Section 28 • Subsection 1.4 deleted all references to cabling Co. • Subsection 1.6 updated AS/NZS standards • Subsection 1.7 documented selection and use of optical fibre backbone cabling • Subsection 1.8 revised standards for Student/Public access computer labs. • Subsection 1.10 added Fibre optic cable duct specs for TSG room enclosure suite. • Subsection 1.12 created specifications and design guidelines for server rooms.	August 2007
05	a) Forward: • UTS Capital Works Conceptual Framework added, Generic Standard of Finishes and Technical Services added	June 2006

	b) Section 2 • Subsection 2.7 Public Spaces added. c) Section 3 • Subsection 3.1 Standards for Area Measurement relocated from Appendix B. Appendix B deleted. • Subsection 3.2 Space Standards amended and Academic Levels added. • Subsection 3.3 Utilisation Factors amended • Clause 3.5.2 Noise Rating units changed from NR to dB(A). d) Section 5 • Clause 5.2.1 Requirements for wall finish in corridors added. Clause 5.2.2 Operable Walls added • Clause 5.2.3 Security and framing for glazed partition walls amended. e) Subsection 5.7 Security to corridors amended. Section 6 • Clause 6.2.2 Flooring to Computer Laboratories added. • Clause 6.2.4 Flooring to Laboratories amended and relocated from 6.2.3. • Clause 6.2.12 Standard Carpets for Building 2, 4 and 10 amended. f) Section 9 • Subsection 9.5 Requirements for supply and installation of UTS Lecterns amended. • Clause 9.17 Workstations amended. • Clause 9.18 Office Chairs added. g) Section 13 • Subsection 13.1 General requirements amended. • Subsection 13.2 Cooling Systems amended. • Subsection 13.3 Air Handling systems amended. h) Section 21 • Subsection 21.1 Web address for UTS Sign Standards added • Clause 21.2.9 Work station numbering system amended. • Clause 22.3.4 Laboratory Benching amended. i) Section 24 • Clause 24.4.1 Parents Room added • Clause 24.4.2 Shops added. j) Section 25 Reference to the UTS Sustainability Policy added. • Subsection 25.1 Requirements for ESD consultant added • Subsection 25.19 Requirements for ESD Statement and • Achievement Schedule added. k) Appendix A Reference to web address for list of Standard Preliminaries added, list and text of each preliminary deleted.	
04	a) Section 21: Clause 21.2 Numbering Methodology added b) Section 23: Instructional Technology Services (ITS) name changed to Audio Visual Services (AVS) c) Section 24: All clauses revised. Student Accommodation Access Guidelines added d) Section 28: Document No. ITD 1001 (22 August 2000) ITD Design and Implementation Procedure Design Guidelines deleted. New renamed and fully revised Document No. ITD 1001 (25 July 2002) ITD Communications Infrastructure Design Guidelines added e) Page numbering system revised	February 2003
03	a) Reference to Facilities Management Unit (FMU) in lieu of Property Development Unit (PDU) b) Format of Table of Contents revised c) Page Numbering system revised	January 2002

	d) Standard page format and headings hierarchy adjusted e) Appendix C text relocated to separate Web address f) Appendix D relocated to Section 28, text relocated to separate Web address	
02	a) Separate sections reformatted into one document with one Table of Contents and one page numbering system. b) The following new sections were added: • Section 23 – Audio Visual Services Guidelines • Section 24 – Access • Section 25 – Environmental Sustainability • Section 26 - Heritage • Section 27 – Kuring-gai Campus Interior Design Guidelines • Appendix B – Standards for Area Measurement • Appendix C- Cad Drawing Standards • Appendix D – ITD Design & Implementation Procedure Guidelines	November 2000
01	First Issue of UTS Design Guidelines	January 1997

1 INTRODUCTION

1.1 Purpose of these Guidelines

These Guidelines describe the general requirements of the University of Technology Sydney (UTS) for the design and construction of its facilities. This document is not intended to relieve any Consultant commissioned by the University from the responsibility to prepare comprehensive specifications for the inclusion in tender or construction documentation. While the information contained in the relevant section of these Standards may be reproduced within those specifications, no part of this document may be used as a substitute for those specifications. The provision of these Guidelines by UTS should in no circumstances be construed as relieving any Consultant of the duty of care owed to UTS by the Consultant.

These Guidelines must be read in conjunction with the Project Brief and any project specific design requirements provided by UTS. Where the requirements of the Project Brief appear to conflict with any requirement in these Guidelines, the Consultant must clarify the apparent ambiguity with the UTS Project Manager before proceeding.

1.2 Code Compliance and Reports

All work on UTS buildings must be designed and constructed to comply with the current requirements of all relevant State and Commonwealth legislation. This includes the Building Code of Australia and all applicable Local Government Ordinances to ensure that the Project is not delayed.

Where there is a conflict between UTS Design Guidelines and requirements of the BCA or statutory authorities, the higher requirement shall be deemed applicable.

A number of reports have been prepared for UTS in regard to the upgrading of facilities for code compliance purposes. Consultants should ensure that any upgrade requirements identified in relevant reports are incorporated in any designs and specifications produced.

1.3 Statutory Approvals

Unless otherwise agreed in writing, the responsibility for obtaining all the required Statutory and Local Authority approvals will remain with the Consultants appointed by UTS. Where approvals are to be obtained by a Builder, the responsibility for ensuring that the necessary approvals are obtained remains the responsibility of the Consultant Project Manager and the Principal Consultant.

1.4 Australian Standards

Wherever an Australian Standard exists in relation to any matter pertaining to the design, construction or maintenance of the facility, the current Australian Standards should be taken as being the minimum standard required by UTS for the project. Higher standards are required by the University in some instances, and assumptions as to acceptable standards should not be made without consulting the UTS Project Manager.

1.5 Product Brand Names

Reference is made in these Guidelines to product brand names, models and in some cases suppliers. Where this occurs the reference has been made in the interests of product continuity and efficiency of maintenance. UTS has no objection in principle to any Supplier or Consultant bringing new or alternative products to the attention of the University for possible use on its building projects. Any such product should however not be specified by Consultants without the prior written approval of the UTS Project Manager.

Where a product is referred to by brand name in these Guidelines, UTS will assume that in the absence of written approval to the contrary by the UTS Project Manager, the particular product will be specified in any Documentation prepared by the Consultant for Tender or Construction purposes.

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

1.6 Authority to Vary

It is the Consultant's responsibility to ensure that any approved departure from these Design Guidelines is confirmed in writing by the UTS Project Manager.

1.7 Abbreviations

Throughout the remainder of this document, the term FMU must be read as FMO/PMO i.e. Facilities Management Operations / Program Management Office of UTS. 'UTS' must be taken to be equivalent to 'University of Technology Sydney'.

Reference is made in these Guidelines to various operational Divisions and Units within UTS. The relevant references should be read as follows:

AVS	Audio Visual Services
ITD	Information Technology Division
TSG	Technical Services Group

The names and contact details of representatives from these interest groups for a particular project can be obtained from the UTS Project Manager.

2 PLANNING CONSIDERATIONS

2.1 UTS Master Plan

UTS has adopted a Campus Development Enabling Plan and a Campus Development Plan. The Enabling Plan outlines the strategic principles that drive the Campus Development Plan. Consultants are required to acquaint themselves with the contents of these Plans as required for the effective execution of their duties. Enquiries should be directed to:

Manager, Campus Development, Planning and Design
Facilities Management Unit
University of Technology Sydney
Level 19, Building 1
15 Broadway
BROADWAY NSW 2007
Telephone: (02) 9514 3134
clive.gunton@uts.edu.au

2.2 Facility Management Plan

A Facility Management Plan is currently being prepared by UTS. The Plan must be read in conjunction with these Guidelines. Enquiries should be directed to Manager, Planning and Design as noted in Section 2.1.

2.3 General Approach

The planning of UTS projects should be based on the following policy guidelines and read in conjunction with Section 25 Environmental Sustainability

2.3.1 Aesthetic conditions

All new buildings, additions and refurbishments are to be designed with reference to their surrounding environment, function and potential visual impact. Due care must be given to enhancing and complementing the existing streetscape and environment. Selection of proposed materials and finishes is to be sympathetic to the surroundings, aesthetically pleasing and functional.

2.3.2 Maintenance

Buildings should be designed to be maintenance free as far as possible. Where periodic maintenance will be required, consideration should be given to issues such as safe access, working at heights, confined spaces and disruption to use and cost. Standard, established products with a known long life span and availability are to be specified.

Wherever possible services are to be located in service ducts with easy access through lockable doors. Piped services must not be built or chased into walls and partitions.

2.3.3 Amenity and Simplicity

Planning solutions should be approached with amenity and simplicity in mind. Considerations should include:

- provide an environment within which teaching, learning, research, administration and recreation can take place successfully and in accordance with sustainability principles
- all classrooms and seminar rooms must employ natural light and ventilation in preference to artificial systems, unless otherwise instructed by FMU
- avoidance of complex articulation and building footprints
- minimisation of building perimeters
- avoidance of complex roof forms and junctions
- build-ability issues including site access and trade sequencing.

2.3.4 Flexibility

All planning should seek to provide for the maximum degree of flexibility. This should include:

- sensible placement of toilets, stairs and plant rooms
- use of lightweight internal walls where security and acoustic requirements permit
- sensible fenestration design
- location of services and fixtures on external (rather than internal) walls wherever possible to provide maximum flexibility during subsequent refurbishments
- planning for possible future expansion, alteration or adaptation to new uses.

2.3.5 Efficiency and Economy

UTS projects should reflect the best 'value for dollar' obtainable. Initial construction, operating and life cycle costs should all be considered. Features of efficient design should include:

- use of simple, repetitive building structures
- use of standard rather than purpose made components

- double volume spaces and large circulation areas kept to functional minimum
- service areas concentrated in central locations.
- the location of high use facilities near entry levels to reduce requirements for lifts and escalators

2.3.6 Ventilation

UTS air conditioning and ventilation requirements are described in detail in Section 13. Site specific requirements may also be described in the Project Brief. The following general considerations should also be included in the planning process:

- maximisation of natural ventilation where appropriate.
- cross ventilation to be provided in double-loaded corridor situations wherever possible
- roof ventilators to be provided where appropriate (e.g. in industrial / workshop buildings); care to be taken to avoid introduction of dust to buildings
- eaves ventilation in association with roof ventilators to be considered

2.3.7 Weather Tightness

UTS buildings are to be designed to provide adequate protection from rain, hail and wind, and dust prevention. Design features should include:

- conservative detailing of elements involved in weather tightness so as to reduce the risk of penetration
- sealants not used as a primary barrier (e.g. where structure penetrates sheet metal walls)
- tanking kept to a minimum for below ground construction. Gravity drained cavities, large enough for inspection, are to be preferred wherever practical
- floor levels to be designed to be above flood levels and stormwater levels.

2.3.8 Functionality

All spaces must be designed to optimise their functionality and usefulness for academic and administration purposes.

Careful consideration must be given to ensure that undesirable noise from adjoining properties and spaces does not have a detrimental impact on the functionality of any space.

Particular care must be taken to avoid glare through windows as a result of either direct or indirect sunlight, and reflections from paving, roads or adjacent buildings.

2.3.9 Plant and Equipment

Sufficient space must be allocated to the provision of plant rooms at the design stage. Careful consideration should be given to providing adequate space for possible future expansion of the building and additional plant and equipment installation requirements. This must include access for additional plant installation.

2.4 Access & Equity

Refer to Section 24 Accessible Environments Policy

2.5 Crime Prevention

All buildings must be designed taking into consideration Crime Prevention Through Environmental Design (CPTED) concepts to achieve a positive working and learning environment, whilst promoting adequate security and loss prevention strategies.

In general applications, the aim of CPTED as a crime prevention strategy is to design and use physical space to affect human decisions and behaviour. The object of CPTED in educational institutions is to encourage staff and student achievement through a positive learning environment, whilst at the same time improving personal safety, loss prevention and loss reduction.

CPTED strategies aim to reduce opportunities for crime through integrating crime prevention strategies and include maximisation of natural surveillance, controlling access to buildings and surrounding areas, and the installation of target hardening and detection hardware.

Staff and student toilet facilities should be situated near the entrances to buildings or off high circulation areas such as lift lobbies to increase natural surveillance through increased use and flows of people entering and exiting the building. Double door or swing door entry systems to toilets create feelings of vulnerability to users because of the separate and enclosed spatial areas. A maze type entry position, and cubicle doors which are in a spring held open position will promote convenience and safety.

The strategic positioning of toilet facilities combined with improved entry mechanisms provides a deterrent to vandalism as well as attacks.

Computer laboratories or other facilities which are to be made available to staff and students outside of regular University hours should not be located in areas or floors which provide access to the remainder of the building, or are isolated from natural surveillance. They should be located as close to the main after hours access doors as possible. Security access technology must be suitably placed for persons using wheelchairs.

Courtyards, patios and footpath areas should be designed so that they are adequately lit if intended for night use, and should also be located in areas which are under natural surveillance. Areas not intended for night use should have access restrictions.

Bicycle racks should also be located in areas which are under natural surveillance.

CPTED strategies require that a building and the activity it generates not only be considered in isolation, but also in relation to other buildings and activities which occur within the site and overall crime risks.

2.6 Energy Management

Refer to Section 25 - Environmental Sustainability and Section 29 – Energy Management Systems.

2.7 Public Spaces

Public Spaces should be planned to provide students with the opportunity to experience student life and participate in the UTS Community.

The nature of Public Spaces will vary depending on their function.

Philosophically they should facilitate:

- a collegiate atmosphere
- student wellbeing
- socialising (and informal meetings)
- cultural appreciation
- the development of UTS's distinctiveness and identity

Physically they should**:**

- include a complimentary range of space types and users
- enhance and contribute to the creation of a vibrant campus
- be on primary circulation paths
- be accessible
- be secure
- be able to display parts of the University's art collection.

Space provision to be made for Olympian Shopper Bins in all public spaces. The bins should be procured within the project for new builidngs.

2.8 Safety in Design

UTS is committed to providing a safe workplace for staff, students, contractors and visitors. The Health, Safety & Sustainability Project Charter details our mission, objectives and responsibilities.

As a client UTS is a Person Conducting a Business or Undertaking (PCBU) UTS and as such has duties under the Work Health and Safety (WHS) Legislation:

- to ensure, so far as is reasonably practicable that any structure commissioned is installed, constructed, commissioned, maintained and used without risks to health and safety. This includes people who build the structure, those who maintain and demolish the structure as well as use the facilities;
- to provide the designer with any information that the client has in relation to the hazards and risks at the site where the construction work is to be carried out.

UTS will consult with the designers throughout the project to ensure that risks to health and safety are eliminated or if not reduced so far as is reasonably practicable with suitable control measures in place..

As part of the project's risk management process safety in design workshops will be undertaken and facilitated by the design team with the relevant UTS stakeholders as required. This process includes identifying hazards, assessing risks and implementing controls if the hazard cannot be eliminated.

3 ARCHITECTURAL CONTROLS

This section must be read in conjunction with Section 25 Environmental Sustainability and the remainder of guidelines where they are applicable.

3.1 Standards for Area Measurement

The following area measurements are to be used as the standards for the analysis of buildings to obtain comparative data:

- Gross Floor Area (GFA)
- Building Area (BA)
- Usable Floor Area (UFA)

The definitions are an extract from The Australian Institute of Quantity Surveyors Book of Areas (1992).

3.1.1 Gross Floor Area (GFA)

The sum of the 'Fully Enclosed Covered Area' and 'Unenclosed Covered Area' as defined.

Unit of Measurement: Square metres (m^2)

3.1.2 Fully Enclosed Covered Area (FECA)

The sum of all such areas at all building floor levels, including basement (except unexcavated portions), floored roof spaces and attics, garages, penthouses, enclosed porches and attached covered ways alongside buildings, equipment rooms, lift shafts, vertical ducts, staircases and any other fully enclosed spaces and useable areas of the building, computed by measuring from the normal inside face of exterior walls but ignoring any projections such as plinths, columns, piers and the like which project from the normal inside face of exterior walls. It shall not include open courts, light wells, connecting or isolated covered ways and net open areas of upper portions of rooms, lobbies, halls, interstitial spaces and the like which extend through the storey being computed.

Unit of Measurement Square metres (m^2)

3.1.3 Unenclosed Covered Area (UCA)

The sum of all such areas at all building floor levels, including roofed balconies, open verandahs porches and porticos, attached open covered ways alongside buildings, undercrofts and useable space under buildings, unenclosed access galleries (including ground floor) and any other trafficable covered areas of the building which are not totally enclosed by full height walls, computed by measuring the area between the enclosing walls or balustrade (i.e. from the inside face of the UCA excluding the wall or balustrade thickness). When the covering element (i.e. roof or upper floor) is supported by columns, is cantilevered or suspended, or any combination of these, the measurements shall be taken to the edge of the paving or to the edge of the cover, whichever is the lesser. UCA shall not include eaves overhangs, sun shading, awnings and the like where these do not relate to clearly defined trafficable covered areas, nor shall it include connecting or isolated covered ways.

Unit of Measurement: Square metres (m^2)

3.1.4 Building Area (BA) or Gross Building Area (GBA)

The total enclosed and unenclosed area of the building at all building floor levels measured between the normal outside face of any enclosing wall, balustrade and supports.

Unit of Measurement: Square metres (m^2)

3.1.5 Useable Floor Area (UFA)

The sum of the floor areas measured at floor level from the general inside face of the buildings walls of all interior space related to the primary function of the building. This will normally be computed by calculating the 'Fully Enclosed Covered Area' (FECA) and deducting all of the following areas supplementary to the primary function of the building:

Deductions

(a) Common Use Areas

All floored areas in the building for circulation and standard facilities provided for the common use of occupiers, tenants and/or the public such as lobbies and foyers to entrances, stairways and lifts, stairways, landings and fire escapes, verandahs and balconies, corridors and passages, toilet and rest room areas, cloak and locker areas, cleaner's rooms including stores and cupboards, tea making and similar amenities areas.

(b) Service Areas

All areas set aside for building plant supplying services and facilities common to the building for the use of occupants, tenants and/or public, such as mechanical plant and equipment rooms, electrical equipment and switch rooms, tank rooms, lift motor rooms, meter cupboards, telecommunications switch rooms, refuse collections areas, loading bays and all car parks including access ways thereto.

(c) Non-habitable Areas

All non-habitable building space such as that occupied by internal columns and other structural supports, internal walls and permanent partitions, lift shafts service ducts and the like.

Unit of Measurement: Square metres (m^2)

3.2 Office and Workstation Allocation Policy

New and existing offices and workstations should be allocated to individuals based on the criteria below. Any office or workstation accommodation surplus to the criteria below requires substantiation with agreed growth plans within a specific time frame. Space for growth should be planned near boundaries of groups of allocated spaces to allow for easy reclaim by the University should the space intended for growth be left vacant outside agreed timeframes.

The University always reserves the right to reclaim space from its Faculties and Divisions to take advantage of the space for its maximum benefit.

Offices are to be allocated to the following individuals as per sizes indicated in Subsection 3.3 Space Standards:

- All Full time Academic Staff, salary levels B-E, permanent or contract.
- All Full time Research Staff, salary levels B-E, permanent or contract
- Academic staff in the Senior Staff Group (SSG), (Managers, Directors, Deans, Chancellery).
- Support staff who require space for confidentiality reasons (Area Managers (those who manage areas such as Human Resources), Business Managers, Personnel Advisors, Student Advisors, Counsellors, and the like).
- Any other individual with a demonstrable high level contribution to University missions. (Honorary or Emeritus Professors, some Adjuncts, Visiting Academics, managerial level consultants and the like.)

Academic visitors are to take advantage of offices temporarily left vacant by those on PEP, maternity or other special extended leave. Allocations for offices dedicated to visitors only are rare, at a maximum of 2 for each of the University's larger faculties

Dedicated Workstations are to be allocated to the following individuals as per sizes indicated in Sub section 3.3 Space Standards:

- Full time Support Staff who require a desk to perform activities for which they were hired and are not mentioned above.
- Full time Academic Staff not mentioned above.
- Casual Academics, referred to formally as "Part-Time Lecturers" are to share workstations in a ratio roughly equivalent to 1 desk to 20 individuals.
- Any other Support or Academic Casual on the University payroll (hourly or contract) who requires a desk to perform activities for which they were hired. (Research Assistants, Temporary Administrative Staff)
- Any consulting member of staff that requires a desk for greater than 20 hours per week to perform duties for the Universities benefit and for which they were hired.
- Full-Time postgraduate students who are enrolled primarily in research activities.

Any individual not mentioned above is not automatically entitled to a University workspace, and will need to seek special permission of the Director of the Facilities Management Operations to be entitled to a workspace.

It is envisioned that grounds or shop workers, technical or coursework assistants, and many casuals do not require a traditional workstation to perform activities for which they were hired.

The University performs audits to ensure adherence to the above requirements.

3.3 Space Standards

The determination of space standards used for design purposes shall be based on the following:

- specific brief and functional requirements
- the minimum space standards described in this section.

For works in existing buildings the minimum space standards shall be adjusted if required to suit the set out of the existing structure. (All areas shown are useable floor area and exclude circulation space).

The efficiency of buildings should not be less than the following:

Science Buildings	65%
Humanities Buildings	70%
Library Facilities	80%
Administration	70%

3.3.1 Academic and Support Staff Offices

Offices at UTS have a standard space allocation of 9 – 10sqm. This may be varied in specific instances to meet approved academic and administrative purposes.

3.3.2 Workstations

Workstations at UTS have three categories: permanent staff workstations, casual/hot desk and higher degree research. The space allocation for these categories are identified below:

Permanent workstation	6sqm
Hot desk and casual	4sqm
Higher degree research	2.7-3sqm

3.3.3 Academic and Support Facilities

Senior Common Room	0.6m^2
Meeting Rooms	
Up to 6 person seating capacity	1.9m^2/person
8 -12 person seating capacity	1.6m^2/person
13 or more	1.4m^2/person
Utility Rooms	
Uses may include printing, file storage and stationery storage for general offices uses. This allocation is in addition to localised workstation printing and storage.	1.2m/person
Where the offices are specialized eg. Plan printing, or requiring higher file storage, requirements should be discussed with the Manager, Planning and Design Review as noted in Section 2.1	
Engineering Laboratories	
Bench type (all undergraduates except final years)	4.6m^2/person
Bench type (final years)	6.5m^2/person
Postgraduate Bench type	6.5m^2/person
Research Laboratories	
Student Laboratories (Biology, Physics and Chemistry)	9.5m^2/person
Staff Laboratories (Biology, Physics and Chemistry)	11.0m^2/person
Engineering	11.0m^2/person
Computing Science	9.8m^2/person

3.3.4 Lecture Theatres (tiered floor)

300 + person seating capacity	1.0m^2/student

80-300 person seating capacity	1.1m^2/student
20-80 person seating capacity	1.3m^2/student

3.3.5 Existing Flat Floor Teaching Rooms (Compliant with ESOS Act 2000[1])

All capacities	1.6m^2/student

3.3.6 New Flat Floor Teaching Rooms ((Compliant with ESOS Act 2000[1])

All capacities	2.0m^2/student

3.3.7 Research Facilities

Research Student Workstation	4.0m^2/student

Refer Subsection 9.10 Research Student Areas

3.3.8 Laboratories

Computer Laboratories

30-60 person seating capacity	3.0m^2/student
20-30 person seating capacity	4.0m^2/student

Note: additional space to be provided for instruction and demonstration purposes where there are activities that will be carried out in the room.

Science Laboratories

Chemistry	5.0m^2/student
Physics (Final year + Postgraduate)	5.0m^2/student
Physics (All years except final year)	3.7m^2/student
Biological Sciences (Undergraduate + Postgraduate)	5.0m^2/student

Nursing Laboratories

Nursing	4.0m^2/student
Preparation/Store (serving 2 labs)	0.6m^2/student
Scrub Up (serving 2 labs)	0.4m^2/student

3.4 Utilisation Factors

The following utilisation factors may be assumed in the absence of specific directions to the contrary:

Space Type	Target Room Frequency	Target Room Occupancy	Target Utilisation
Lecture Theatres - large (300 + seats) - medium (120 – 300) - small (<120 seats)	60%	75%	45%
Flat Floor Teaching - large 60+ seats - 30-60 - <30	60%	75%	45%
Computer Laboratories	75%	75%	56%
Laboratories	50%	75%	37.5%
Workshops - engineering, metalwork, woodwork, psychology, children's studies	50%	75%	37.5%

Studios - architecture, painting & drawing, sculpture, ceramics, textiles, printmaking, dance, drama	75%	75%	56%
Practice Rooms - dance and music	80%	75%	60%
Meeting Rooms	45%	75%	34%

Note: Business hours 9am – 9pm x 5 days/week = 60hr/2wk, during semester excluding VC week and public holidays.

3.5 Solar Control

Refer to Section 25 - Environmental Sustainability.

3.6 Wind Control

The design of individual buildings or groups of buildings must be in accordance with AS1170.2 Structural design actions - 'Wind actions' and must avoid the problems associated with wind turbulence, particularly at building entries and public spaces.

3.7 Acoustic Control

3.7.1 General Requirements

The ultimate utility and function of teaching, academic and staff support areas is highly dependent on the control of external and internal noise. Choice of special layout, construction, materials and finish should be carefully guided by the need to provide spaces with acceptable acoustic performance. Particular care should be given to the selection and detailing of external facades, windows and doors and ceilings. Special treatment may be required in the vicinity of high noise zones such as plant rooms. In general, the recommended Design Sound Levels and Reverberation Times for Building Interiors set out in AS2107 must be adopted.

The figures given in Table 3.7.1 are design objectives, not absolute minimum requirements. The materials and method of construction used must be capable of achieving these figures.

Table 3.7.1: Acoustic Performance Standards

Rw VALUES (SOUND REDUCTION INDEX)			SUBJECTIVE IMPRESSION OF SOUND REDUCTION (under normal conditions i.e. background noise level of 40 DBA)		
Privacy Classification	Rw through walls and ceilings	Rw through walls containing doors	Rw Loss* specification for doors only	Rw through walls and ceilings	Rw through doors
Class 1 Executive suites, Teaching areas, Seminar and Conference Rooms	50	35	25	High degree of privacy. Voices in next room may be just audible but not intelligible.	Voices audible but conversation generally unintelligible unless speaker or listener is close to door.
Class 2B Professor's Offices, Senior Lecturers offices, Common Rooms	40	33 (for 10mm laminated glass petition)	20	Voices audible and conversation intelligible. Although privacy is not good the reduction of office noise is well worthwhile.	Voices audible but conversation generally unintelligible unless speaker or listener is close to door.
Class 3 Tutors' Rooms, Stores	30	20	No specification	Voices audible and conversation intelligible unless persons speaking in subdued voices. Although privacy is not good the reduction of office noise is well worthwhile.	

* for the purpose of this specification, Sound Insertion Loss is defined as the difference in Sound Reduction, from room to corridor, when the door is wide open and when it is closed;

* if background noise is less than 40 dBA, greater performances may be required;

* RW values for any rooms not defined should be referred to the FMO/PMO Project Manager.

The class of insulation to be used between spaces of different Classes must, in general, be that of the higher Class. In addition to the general design objectives described above, partitions between specific high usage functional areas must achieve at least the following nominal sound ratings:

Location	Rw Partition	Rw Partition with door
Corridor to office	Rw 38	Rw 28
Corridor to meeting/conference rooms	Rw 42	Rw 32
Corridor to lecture rooms	Rw 50	Rw 28
Office to office	Rw 40	
Lecture room to lecture room	Rw 50	
Operable walls between lecture rooms	Rw 45	

The class of insulation to be used for Plant Rooms will depend on the type of plant in the rooms, the location of the rooms in the building and the nature of adjacent rooms. The Project Architect must give special consideration to sound insulation of Plant Rooms and discuss insulation proposals with the University at an early stage of documentation.

3.7.2 Ambient Sound Levels

The level of ambient sound from air-conditioning, ventilating and other mechanical equipment, traffic noise and any other intrusive noise, must be neither so high that it is objectionable nor so low that the resulting quiet causes intruding speech and other activity noise to be objectionable.

Table 3.7.2: Permissible Sound Levels

Type of Space	Recommended Design Sound Level dB(A)	Subjective Impression
Lecture Theatre Large Conference Rooms & Specially Designated Areas	30 35	Barely audible and very unobtrusive
Individual Offices Seminar and Tutorial Rooms Small Conference Rooms Library	35 35 35 40	Audible, not noticeable only in absence of activity noise.
General Offices Corridors	45	Audible, but noticeable only when there is little activity noise.
Laboratories Fume Cupboard without scrubber Fume Cupboard with scrubber	40 45	Sound level to be measured 1500mm from fume cupboard opening.

Notes: Where sound levels will increase at a later date due to conversion from heating and ventilating to full air-conditioning, the design objectives apply to that later time.

Ambient sound must be free from distinctive characteristics such as tones or fluctuations.

3.7.3 Acoustic Consultant

For all air-conditioning, ventilating and other mechanical services installations a report prepared by an Acoustic Consultant is required to verify that the Noise Ratings of all internal and external spaces adjacent to the installation are within acceptable design levels.

3.7.4 Reverberation Control

For Required Reverberation Times refer to AS2107 Acoustics – Recommended design sound levels and reverberation times for building interiors.

3.8 Sound and Vibration Controls

Mechanical equipment must be of such type, quality and condition of balance, and so supported and mounted, that there will be no perceptible vibration of the building.

The vibration transmitted into the building must not cause sound levels to exceed the requirements described elsewhere.

3.9 Infrastructure Requirements

A number of important infrastructure requirements must be addressed in addition to the specific user requirement contained in the project brief. These include:

3.9.1 Stairs

Stairs must be designed to conform to the requirements of all relevant Acts and Codes of Practice. In general treads and risers must be in accordance with the Building Code of Australia. The University will not accept, however, designs which combine maximum height risers with minimum width treads. The needs of people with disabilities should also be carefully considered. Refer to Section 24 – Accessible Environments Policy. Refer also to Subsection 4.10 - Balustrades.

3.9.2 Tea-making Facilities

The requirements for tea making facilities are to be confirmed with the FMO/PMO.

Tea-making facilities may be required in service cores, common rooms etc.

Refer to Subsection 9.8 and 9.9 for details.

3.9.3 Toilets and Showers

The number of WCs, urinals, showers and hand basins must be based on the expected population of the building in accordance with the Building Code of Australia, City of Sydney Council requirements and WorkCover Code of Practice on Managing the Work Environment and Facilities.

The distribution of anticipated students by sex must be clarified by the Consultant with the UTS Project Manager.

Toilet cubicle doors must have hold open spring hinges (doors to be in open position when cubicle not in use). Hinges must allow for the ability to remove shut doors (cubicle occupied) in an emergency situation where the occupant becomes incapacitated.

In female toilets, provision must be made for sanitary disposal units. These are supplied and installed by the University's Cleaning Manager. These units are free standing and are regularly serviced by a University Contractor.

A shelf must be provided in the wash-up area for books or bags.

Hooks and mirrors must also be provided. Mirrors must be properly copper-backed and ventilated. Hooks on doors to be fitted with rubber door stops.

Showers where not specifically required by the above for new buildings and buildings undergoing major refurbishment (more than 50%), provide as a minimum 1 male shower and change room area, 1 female shower and change room area. Each change room/shower area should be a minimum 5m2 and have 6 vertical lockable lockers. Refer also to Subsections 11.3 & 11.4 for specific UTS requirements on Sanitary Fittings and Fixtures. Also refer to Subsections 5.5 and 10.14.

3.9.4 Building Supervisor's Room

In a large building, or group of buildings (i.e., over 5,000m^2) a Building Supervisor's room must be provided. The room must be close to a main entrance and include storage space for minor items.

3.9.5 Valve Rooms

All main service isolation valves, meters, etc must be accessible from outside the building wherever possible. These should preferably be located at ground level in an accessible service duct.

3.9.6 Services Equipment Rooms, TSG Rooms, BMS, Services etc.

Refer to Section 17 – Security and Section 22 – Special Requirements.

3.9.7 Cleaners' Rooms and Stores

A small store must be positioned on each floor for the storage of cleaning materials and appliances. The room must contain a hopper sink with tiled splashback (refer to Subsection 5.6) cold water supply, and power point. Cupboard space sufficient to store reserve supplies of cleaning materials, overalls, etc must be provided. Floors must be finished in non-slip, low

maintenance finish. Consultation must be undertaken with Central Services Branch with regards to the requirements of an eye wash by chemical store.

3.9.8 Service Areas and Industrial Waste

Each building must be provided with an area for the location of a mobile industrial waste bin which is readily accessible from within the building, and also by road. The number of bins must be appropriate for the requirements of the building. 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. Provision should be made where appropriate for waste recycling.

Specific requirements for service areas and industrial waste must be confirmed with the UTS Project Manager.

3.9.9 Rubbish Removal

Easy removal of rubbish and waste from the building is mandatory. Storage space appropriate for the requirements of the building must be provided for refuse bins near the service entrance and for one on each floor if there is no lift.

The University has a separate system to collect waste paper for recycling. Specific requirements must be confirmed with the UTS Project Manager.

3.9.10 Maintenance Store

A store of $10m^2$ in area must be provided within the building for the specific use of Building Services. Finishes to this store must be as for Plant Rooms.

3.9.11 Gardeners' Store

A room of $12m^2$ in area must be provided at ground level with external access in each building. The room must have one General Power Outlet at a height of 1000mm, and cleaners' sink with 20mm cold water hose cock. The external door must have a clear opening width of 1000mm and must be outward opening. The gardeners' store must be accessible by vehicle at grade. A 50mm conduit from the floor level within the store to a suitably accessible external point must be provided. The possibility that poisonous chemicals may be stored in this space must be considered in the design.

3.9.12 Courtyards

The following requirements must be addressed in the design of external courtyards:

- one hose cock (20mm) must be installed in each courtyard and/or garden bed/planter box and at a spacing not exceeding 30m around the perimeter of the building.
- one adequately sized drain must be provided to service a surface area of $10m^2$ of garden. All drains must lead to an effective silt trap. All drains must have maximum fall to prevent silting and should have flushing connections. Drainage from garden beds must have a fall of 1:20 minimum between the bed and the manhole.
- minimum depth of planter boxes must at least be 1000mm.
- all courtyards' planter boxes, etc must be fully tanked and the tanking adequately protected, and properly drained. Overflow drainage facilities should also be installed in a manner which will not provide a nuisance to occupied areas or cause staining of building facade or finishes.
- 25mm diameter conduit must be installed complete with draw wire, from each courtyard or garden bed back to an adjacent plant room or gardener's store. A 24V irrigation control system must be installed as part of the Building Contract.

Where appropriate, the use of permaculture gardens should be considered.

3.9.13 External Spaces and Landscaping

Careful consideration must be given to the external spaces surrounding and including UTS buildings. Covered access between buildings is to be provided and aesthetically pleasing, non-slip paving and/or walkway finishes complying to AS/NZS 4586 slip resistance to be provided. All external spaces must be properly drained and connected to the stormwater system. Catchpits and sumps must be placed with aesthetic, functionality and safe maintenance considerations in mind.

Adequate external security lighting must also be provided. Refer Subsection 2.5 - Crime Prevention.

All external areas must be appropriately landscaped as part of the Building Contract and provision for landscaping works included in the project budget from the outset. Design of the landscaping must be presented as part of the sketch plans and approved by UTS at an early design stage.

Notice must be given to FMO at least one month before the proposed removal of any trees or shrubs so they can be relocated on Campus if possible.

3.9.14 Car Parking and Access

Adequate parking must be provided to comply with statutory requirements. Careful consideration must also be given to the provision of parking and access for people with disabilities. Refer to Section 24 – Accessible Environments Policy.

3.9.15 Building and Essential Services Spaces

The following spaces as applicable to the building shall comply with relevant Australian and other required Standards and provided for air conditioning, water supply, fire protection and environmental sustainability:

- Chiller room (generally in the basement level),
- Cooling tower (generally on or near the roof level),
- Fresh and conditioned air ducting throughout the conditioned spaces,
- Hot, cold, flushing and laboratory water supply storages and pumps (usually in a rooftop plant room)
- Rainwater storages and pumps.
- Fire control room (accessed from street frontage)
- Fire hydrant and sprinkler storages and pumps
- Hydraulic, electrical, fire, communications and mechanical services fire rated riser ducts (aligned above all floor levels to save cross-over space)
- Laboratory services isolation cubicles (located in passageway external to each laboratory)

3.9.16 General Teaching Spaces

All general teaching spaces must be provided with people counters.

4 EXTERNAL WALLS AND WINDOWS

This section should be read in conjunction with Section 25 Environmental Sustainability, Subsection 3.5 - Solar Control and all other relevant parts of the Guidelines.

4.1 Materials

Materials should as far as possible be selected to match existing forms of construction where existing buildings are being refurbished. Material selection must be compatible with all other finishes and facilitate future expansion or upgrading. All forms of construction should be presented to UTS at an early stage to ensure that the emerging design reflects materials and systems acceptable to UTS.

4.2 Finishes

Finishes which minimise future maintenance must be specified. UTS preference is that brickwork is not painted. Applied finishes, such as Granosite Coating Systems, may be used to obtain the required colouring and texture, but only if other methods are not achievable. All materials must be selected for their likely availability, low maintenance and colour consistency over a 20-year building period.

Paint finish to trims, downpipes, etc. may be used in specific areas, generally to blend in with adjacent wall colour, subject to approval by FMU.

All proposed finishes must be approved by FMU at an early stage of design development. Existing coffered concrete ceilings and decorative concrete walls to be retained where possible, unpainted

4.3 Colours

In certain areas, it may be useful to introduce primary colours to highlight features such as entrances or roof mounted equipment. All proposed colour schemes are to be approved by UTS prior to final inclusion in the final specifications.

4.4 Construction

Poured in-situ concrete external walls must be designed by a qualified engineer, in accordance with AS3600 Concrete Structures. All such designs will be critically examined and structural guarantees are required. Galvanizing to structural reinforcement shall be considered in locations exposed to salt water or chemical attack.

4.5 Façade Staining

Façade staining must be avoided by careful design and detailing to shed water clear of the building, clear of the lower projections and clear of pathways. Parapet cappings must be designed to ensure façade staining is avoided.

4.6 Windows

4.6.1 General

All materials used in the construction and installation of windows must comply with all relevant Australian Standards regarding the strength and performance of windows (including resistance to human impact).

4.6.2 Glazing

All glass must comply with the requirements of AS/NZS 1288 Glass in buildings – Selection and installation, and be free of blemishes and impurities that could affect its performance.

All toughened glass shall have a minimum level of surface compression of 120 Mpa measured using Grazing Angle Surface Polarimetry (GASP). Glazing tint must match adjacent glazing colour, and minimize reflectivity.

4.6.3 Windows

All external windows must be of commercial quality designed in accordance with all relevant codes, Australian Standards and be suitable for the site environmental conditions.

All windows must be designed for a wind velocity as specified in AS 1170.2 for a 1,000 year return period. Corner effects must be considered in determining the design wind pressure.

All windows must have a minimum economic life of 50 years.

All frames must be aluminium. Aluminium framed windows must meet the performance requirements of, and be installed in accordance with AS2047 Windows in buildings – selection and installation.

All windows must be designed to ensure no water permeation and they must have a drained frame system (pressure equalised framing system).

The use of louvre windows must be approved by the UTS Project Manager. All openable windows accessible from ground level must be factory fitted with window locks, all keyed alike, to a master.

All aluminium must be anodized or powder coated. The minimum thickness of anodizing must be not less than 20 microns. All exposed screw fixings, rivets and cut edges, etc must be coloured to match the frames. The design of the walls must 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. Appropriate drainage (and where required, insulation) of window sections and spandrels must be provided.

Aluminium windows must be installed in accordance with AS2047 Windows in buildings – selection and installation.

If windows require blinds for sun control or privacy, these must be specified for supply and installation under the building contract. Requirements for blinds are to be clarified at an early design stage with FMU, such that window frame and reveal detailing is compatible with optimum sun control or screening system. Also refer to Section 7 - Ceilings and Ceiling Finishes, Subsection 7.8 - Recessed Pelmets.

The required window system must be designed in accordance with Subsection 3.7 - Acoustic Control where the building, space or room is adjacent to an incompatible noise source.

Consideration is to be given to making windows openable to allow the option of natural ventilation where practical and appropriate.

4.7 Window Cleaning

All external surfaces of glass must be easily accessible for cleaning from the inside where possible. Cleaning and maintenance of windows should be discussed at the safety in design workshops before any system is decided.

4.8 Sealants

Sealants must be selected to be appropriate for their application and must be colour matched to the finished surface. Under no circumstances may sealants be used as the primary waterproofing barrier or as a primary buffer between dissimilar metals.

4.9 External Corner Protection

Provide approved protection to all corners susceptible to vehicle damage and in high traffic areas.

4.10 Balustrades

All balustrades to stairs (except fire stairs), ramps and level changes shall be stainless steel or powdercoat finish steel. Balustrades to fire stairs not used for general circulation shall be galvanized steel with paint finish. Proposed materials and finishes must be discussed with FMU.

External balustrades must comply with WHS requirements, Balustrades on trafficable roofs and balconies must be a minimum of 200mm above BCA requirements. Where the roof areas are to be used as social gathering spaces, the requirement will need to be discussed with FMU and Safety & Wellbeing.

5 INTERNAL WALLS, PARTITIONS AND FINISHES

5.1 Flexibility

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.

5.2 Materials

Partitions and internal walls may be plasterboard on metal stud, or equivalent as required by the application. Villaboard or equivalent must be used in wet areas. Partitions must be designed and installed to comply with AS 2589.1 Gypsum linings in residential and light commercial construction – Application and finishing. Where appropriate, the design of partitions and openings in partitions must also comply with the requirements of AS 1905.1-05 Components for the protection of openings in fire resistant walls.

5.2.1 Wall Finish in Corridors

The finish to stud framed walls in corridors subject to impact by trolleys or high use by students shall be 'villaboard' or equal to a height of 1200mm. The villaboard shall be 12mm thick, with recessed edges and finished flush using perforated paper reinforcing tape. The junction of the top of the villaboard and the finish above shall be finished with an appropriate trim.

5.2.2 Operable Walls

The use of operable walls is not favoured. Obtain approval for the use of all operable walls from the UTS Project Manager. 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. Refer also to Subsection 3.7 Acoustic Control.

5.2.3 Glazed Partition Walls

The framing to glazed partition walls incorporating doors and door frames that provide the point of security to a suite of offices or similar must be a 100x45mm minimum aluminium partition framing system. The mullions supporting door frames at the security point must be a heavy duty grade equal to Lidco section 700-421 (per. 477.40, $1x1140.00x10^3$ mm^4) screw fixed to head and sill sections. The head to the framing system must be fixed to a structural steel or concrete support member.

5.2.4 Plasterboard Lining to Existing Face Brick

Where it is required to fix plasterboard lining to existing face brickwork the plasterboard must be fixed to steel furring channels. The fixings for the furring channels must be located at brick joints. Fixing into face brickwork is not permitted

5.3 Acoustics

All internal walls and partitions must be designed in accordance with the requirements of Subsection 3.7 - Acoustic Control. Partitions must be insulated with 'Dacron' or wool batts and/or double sheeted on one or both sides as necessary to achieve the required sound transmission loss between spaces.

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

Partitions must extend from the floor slab to underside of slab above, when the partition is required to have a sound rating of Rw 41 or higher. Substitute details such as the installation of leaded vinyl sound baffles (e.g. wave bar) in ceiling spaces are not permitted in lieu of extending partitions to the underside of the floor slab over. In specific cases where a partition cannot be extended to the underside of the floor slab over refer to the UTS Project Manager for directions. For partitions required to have a sound rating index (Rw) of between 30-40 leaded vinyl sound baffles must not be used if they will be penetrated by service pipes during installation or in the future. All penetrations in partitions must be appropriately sealed to maintain the required sound rating.

5.4 Skirting

5.4.1 Vinyl Skirting

Black vinyl skirtings of 150mm height must be provided to all internal partitions irrespective of type except where metal skirting duct is used, where walls are tiled, or where other floor finishes are turned up walls. Painted skirtings are **not permitted** in any areas.

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5.4.2 Aluminium Ducted Skirtings

Ducted skirtings shall be 150 x 50mm 3 channel aluminium, black powder coat finish equal to Moduline Cat. No. T5150. Refer also to Section 28 ITD Communications Infrastructure Design Guidelines.

5.5 Toilet and Shower Areas

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

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

Refer also to Subsection 10.14 -Toilet Doors and Locks.

5.6 Other Wet Areas

Where sink units, tea-making facilities, cleaners' sinks or hand basins are specified, a tile splashback must be provided. The splashback must extend 400mm minimum above the fixture, to the bottom edge of the fixture and 200mm past each side or full return to depth of basin unit against side walls. All substrate material must be water resistant.

5.7 Corridors

For security purposes, all corridor partition framing must extend to the underside of slab over and be clad on at least one side above the ceiling line with galvanised weldmesh 5 mm thick with 50mmx75 apertures equal to Smorgon Steel. The mesh shall be firmly fixed to the partition framing and slab over and trimmed tightly around any service pipes to form an impenetrable barrier. .

5.8 Services

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

5.9 Sealants

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

5.10 Expansion Joints

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

5.11 Painting

Refer to Section 20 – Painting.

6 FLOORS AND FLOOR FINISHES

This section must be read in conjunction with Section25 Environmental Sustainability and the remainder of guidelines where they are applicable.

6.1 Floors

6.1.1 Design

Floor slabs must be designed for the most economical construction and flexibility of use, with due consideration given to long-term deflections and the need to provide for penetrations, both initially and during the course of the building's life.

Pre and Post Stressing may only be used if prior approval has been obtained from FMU. This aspect must be clarified early in the design stage.

The need to core holes up to 200mm diameter or to provide penetrations up to 1200mm square in selected areas at a later date should be taken into account during design. All floors are to be finished with a maximum tolerance of + 3mm in a 3000mm straight edge.

6.1.2 Floor Loads

All buildings must be designed for floor loadings generally in accordance with AS 1170 unless otherwise specified. Floor loads for special areas must be determined in consultation with the FMU and the end users.

Provision must be made for the installation of compactus shelving in areas specifically nominated in the Brief.

6.1.3 Termite Control

Anti-termite treatment must be provided to all new buildings. All workmanship and materials must conform to the requirements of AS3660.1 for protection of buildings from subterranean termites.

All tree roots which have been exposed during excavation, tree stumps, logs and timber must be removed from the area and taken from the campus.

Stainless steel mesh barriers. Stainless steel mesh as specified in Section 6 of AS3660.1 must be used to provide protection against termite entry. For slab constructions, stainless steel mesh is to be installed under the whole of the slab or may be used to form barriers over cracks, joints and imperfections in the concrete and around service pipes. Stainless steel mesh must also be used between the slab edge and the wall, and across wall cavities in masonry wall structures.

Termite caps or strip shielding must be installed on all foundation walls, piers, stumps and other substructures in such a manner that the structure is isolated by the barriers from the substructure. Details for the manufacture and installation of termite caps and strip shielding are given in Section 5 of AS3660.1.

The Builder is responsible for installing the physical barrier and must provide the Superintendent with a Certificate of Compliance with AS3660 Termite Management.

The certificate must include the following:

- details of termite prevention work undertaken, including a diagram where appropriate
- 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 or the requirements of UTS.

6.1.4 Membrane

All internal ground slabs must have an effective membrane complying with the appropriate Australian Standards turned up at the perimeter and with all joints taped in accordance with good building practice. Floors and walls must be fully tanked and/or drained where below ground or subject to hydrostatic pressure. Adequate provision for relief of hydrostatic pressure and subsoil drainage must be provided whenever required.

6.1.5 Floor Penetrations

All floor penetrations and associated service pipes must be sealed to control noise and water penetration between levels. Where floors are fire rated, the detail proposed must comply with the required rating.

Floor wastes must be provided within all wet areas (i.e. toilets, showers, plant rooms, service tunnels, laundries, etc.) and care must be taken to ensure that adequate falls to these points are specified and achieved. Where appropriate, a perimeter kerb must be installed to contain spillages and flooding. Floor wastes are not required in laboratories.

Penetrations of any surface must maintain the fire rating of the material being penetrated (i.e. sealants, fire collars and the like used must comply with the designed fire rating).

6.2 Floor Finishes

6.2.1 Carpet

Material selection and installation of all carpeting must comply with the applicable portions of the current Australian Standards. These include:

AS1385	Textile floor coverings - metric units and Commercial Tolerances for Measurements
AS2454	Textile floor coverings - Definitions, Terminology and structure clarification
AS/NZS455	Textile floor coverings - Laying Practice and maintained in accordance with AS 3733
ASNZS3733	Textile floor covering – cleaning and maintenance of residential and commercial carpeting

Carpet in new areas must be the nominated standard for the building or where appropriate match the existing in adjoining spaces. Refer to Clause 6.2.12 Schedule Of Standard Carpets For UTS Properties.

Suppliers of all materials must provide a written warranty stating that materials supplied and installed under this contract must remain in good condition, secure against faulty workmanship and/or defective materials for a period 7 years from the date of Practical Completion or from the laying of replacement as the case may be. It is UTS policy that carpeting should be laid continuously over full floor areas. Partitions should be fixed after the carpeting to retain maximum flexibility. A schedule of existing carpeting used on the various UTS campuses is contained in 6.2.12.

Carpet Tiles

All carpet tiles are to be manufactured under IS09001 and 14001 (Quality and Environment Management system) and have Mat-2 criteria. Preference will be given to injection dyed tiles with cut pile rather than loop. 26 oz. or corridors and high 22 oz. for wear other areas minimum. Warranty 10 years minimum.

Carpet Underlays

All carpet shall be laid on an underlay.

The underlay in all installations shall be 1,740gms / m^2 60/40 % animal hair jute equal to United Bonded Fabrics Pty Limited D/S CW70. AS 4288 soft underlays for textile floor coverings. Only use under broadloom not carpet tiles.

Lift Carpet

Generally all lift carpet to be Ontera Wombat “Blackbat” ref 880 carpet tiles or equal laid ¼ turn.

Stair Tread Nosings

Provide aluminium safety stair tread nosings to the following locations:

- all stairs with carpet finish
- all steps on circulation aisles in auditoriums and lecture theatres with carpet

Aluminium safety stair tread nosings shall be screw fixed equal to Latham Model No. 1005 ST-1VB 25 with buff coloured silicon carbide mineral slip resistant inserts. The leading insert shall be 25mm wide. Refer to the FMU Project Manager if the buff colour of the inserts is not in contrast to the carpet colour as required by AS1428.1-2003.

6.2.2 Flooring to Computer Laboratories

Computer laboratory floor shall be carpet tiles equal to Ontera Modula Carpets Pty Ltd.

6.2.3 Sheet Vinyl

All flooring must comply with the BCA and current Australian Standards.
Vinyl must only be used in those areas noted in the Space Description Forms and must be ‘Tarkett Acoustic Flooring (Tapiflex or Granit Acoustifloor), or equivalent subject to the approval of FMU. Flooring must be laid according to manufacturers’ written instructions.

Adhesives used in fixing sheet vinyl must be solvent free and compatible with the vinyl selected.

All joints must be welded. Vinyl to wet areas such as cleaners’ rooms, common rooms at servery counters and isolated basins must be an approved non-slip sheet vinyl coved up the walls to a height of 150mm. More sustainable sheet flooring like rubber or cork will be considered as preferred alternative finishes.

6.2.4 Flooring to Science Laboratories

Laboratory flooring shall be slip and chemical resistant sheet vinyl with a polyurethane reinforced surface. The flooring must be coved up all walls, plinths and service pipes to a height of 150mm. The vinyl is to be low maintenance and cleaned by mopping. It shall not require sealer, polishers, or residual detergents during its lifetime. The vinyl is to have fully welded seams.

6.2.5 Ceramic Tiles

Ceramic tiles must be used on floors of all toilet areas and showers including air-locks and in fire-rated stairs. Floor tiles to toilet and shower areas must be minimum 50mm x 50mm non-slip semi-glazed with matching grout and must finish level with adjacent finishes. Tiles to stair treads must be non-slip to suit the application with tread nosing tile of a contrasting colour and matching grout. Tiled stair landings must have a matching skirting tile, minimum 100mm high. Appropriate caulked expansion joints must be provided as required including at the junction of tile floors with walls. All base substrate and tile layout designs to be approved by FMU. All tiles to have surfaces that match in colour their base or to be fully vitrified

The selection and installation of all tiling must be in accordance with current Australian standards. These include:

AS3958.1 Installation
AS3958.2 Selection of tiling system
AS2358 Adhesives

Refer also to Section 24 – Accessible Environments Policy.

6.2.6 Junctions

Junctions of dissimilar floor finishes must be achieved using brass or aluminium angles fixed to the slab.

6.2.7 Laboratory Door Thresholds

A flush seamless threshold is to be provided to all laboratory doors.

6.2.8 Door Mats

Door mats must be provided in mat recesses at each external access to the building. Mat recesses must be formed by brass angles set into the concrete. Mat recesses for fire-isolated areas must be external and must be adequately drained if exposed to weather.

Mats must be rubber backed indoor/outdoor carpet or similar design approved by FMU. Mats made from rubber stripping are not acceptable.

6.2.9 Colour

Colour of all floor finishes must be selected in consultation with FMU and approved by UTS prior to tender invitation.

6.2.10 Sealants

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

6.2.11 Access Floors

Access floors where required by the Brief must be a ‘Unistrut MK.25A’ gridless system or equal approved. All access floors are to be designed and installed in accordance with the current Australian Standard on ‘General Access Floors’.

Access floors, where incorporated must be vermin proofed and have a floor waste installed to prevent flooding of the underfloor compartment in the event of pipe burst or sprinkler failure.

6.2.12 Schedule of Standard Carpets for UTS Properties

Refer Building Specific Design Guidelines.

7 CEILINGS AND CEILING FINISHES

7.1 Suspended Ceilings

Suspended ceilings must be provided in all occupied areas in buildings unless noted otherwise in the Brief, or instructed by FMU, or where, in existing buildings, suspended ceilings are deemed inappropriate by FMU. All suspended ceilings must be designed in accordance with current AS2785 Suspended Ceilings, Design and Installation' and 'Suspended ceilings, recessed lights and air diffusers - Interface requirements for physical compatibility'.

Suspended ceilings are not generally required in science laboratories and laboratory support areas. Where exposed, the services are to be appropriately designed and setout.

7.2 Ceiling Types

Refer Building Specific Design Guidelines.

7.3 Plasterboard Ceilings

Screw fixed plasterboard ceilings and bulkheads must be provided with an adequate number of access panels. This type of ceiling should be avoided unless required for specific purposes.

7.4 Ceiling Fixtures

Where fixtures or fittings such as light fittings, speakers, thermal alarms, are to be mounted on the ceiling tiles, approved backing pieces must be provided which must span the full width of the tile to provide bearing on the ceiling grid. Ceiling fixture should be easily accessible for maintenance purposes. Colour of fixtures should be chosen to blend in with ceiling colour.

Careful consideration must be given to the fixing of heavy equipment such as video monitors and projection equipment. Adequate structural support on the structure above the ceiling must be provided to facilitate secure installation.

7.5 Eaves Soffit Linings

Soffit linings must be pre-finished materials such as 'Colorbond' metal sheeting or 'Alumply'. Painted fibrous cement adequately fixed and sealed against the ingress of moisture and corrosion is acceptable only for soffits not more than eight metres above the ground.

7.6 Plantroom Ceilings

Ceilings are not to be provided in plant rooms unless required for a specific purpose. Structural elements and all piped services are to be painted and left exposed.

Minimum headroom 2000m as per AS 1657-2013. Where minimum headroom can not be achieved, other measures should be taken to protect the health and safety of users such as padding, highlighting, signage and additional lighting.

7.7 Equipment Access

Wherever access is required to the ceiling to service or remove equipment, the ceiling must be designed for easy removal including removal of tee-bars. In flush ceilings, access panels must be an approved proprietary hinged metal panel with concealed frame for flush set finish and square key lock, opening downward equal to Trafalgar Model No. APM/WW. Size of access panel shall suit the functional requirements but shall be not less than 450mm square. Fire rated ceilings shall be provided with fire rated access panels.
Access panels are required under fire baffled Air Conditioning units where they cross through fire rated partitions.

7.8 Recessed Pelmets

Recessed pelmets must be provided to all perimeter windows and wherever else required by the design to allow the installation of blinds or curtains. Pelmets must be ceiling recessed, formed from 1mm 'Colorbond' pre-finished metal sheet (or equal approved) and a minimum 100mm deep x 150mm wide. Timber drop-pelmets may be considered in special circumstances with the approval of FMU.

7.9 Ceiling Height and Ceiling Space

In general, the minimum acceptable ceiling height throughout University buildings must not be less than 2700mm. In existing buildings where the floor levels and structure do not allow a ceiling height of 2700mm, written approval must be obtained from the FMU Project Manager. The clearance between the top of the ceiling system and the underside of any slab or beams must be not less than 600 mm in new buildings.

8. ROOFS

All roofs must comply with the applicable current Australian Standards.

UTS may, sometimes, require some useable roof area for experiments, 'green' roof or other purposes. This aspect should be clarified with FMU early in the design process. Roofs should generally be kept neat if machinery has to be situated upon them, and not to be designed with feet acting as point loads that may puncture the roofing material.

8.1 Roof Types, Materials

Pitched roofs must be provided to all buildings as far as practicable. Minimum pitch must be not less than manufacturer's recommendations and an appropriate safety margin provided to suit prevailing conditions. Metal tray roofs must be continuous over ridging.

Membrane type, trafficable roofs will only be approved to suit specific functional requirements. Membranes to trafficable roofs where approved by FMU, must be guaranteed for a minimum of 10 years against faulty workmanship, materials and deterioration. Membrane roofs must be the water shedding type and be protected against penetration. Membrane roofs will also require UV protection as a surface or topping. A structural engineer must check current roof loadings before applying extra layers of membrane to an existing membrane roof.

Green Roofs laid over flat membrane roofs are encouraged subject to retaining roof drainage and to the structural integrity of the roof.

All roofing materials employed must be compatible to avoid electrolysis and shall not chemically contaminate harvested rainwater. The chemical reaction of metals interfacing with other metals in any exposed situation must be avoided. The isolation of dissimilar metals with silicon sealants can not to utilized as a lasting solution.

8.2 Roof Flashings

Roof flashings generally must be designed to minimize the reliance and use of sealants and must be fabricated and installed in accordance with the roof deck manufacturer's written instructions. All fixing types are to be in accordance with the roof deck manufacturer's written instructions.

Flashings to penetrations for roof access hatches, skylights and the like must incorporate a soaker flashing which must extend to the roof ridge whenever possible. Flashings to all roof penetrations must be designed to minimize the collection of leaves and debris. All box gutters must have over flashings taken up over the bottom purlin and folded down into the gutter.

8.3 Gutters

Eaves gutters should be used in preference to box gutters and be self-cleaning.

Box gutters are not to be utilised unless authorised by FMU, early in the design process. Internal and box gutter design must be considered only as a last option but if included must clearly demonstrate the inclusion of controlled overflow. Necessary joints must be first class quality in design and workmanship, with an inspection opening provided for cleaning. For maintenance purposes a minimum width of 450mm and a minimum depth of 200mm is required. Box Gutters and internal downpipes must generally be sized for a 100 year storm event, with no sharp twists and turns.

Box gutters, gutters and downpipes must be fabricated from stainless steel, 'Colorbond', copper, zinc or PVC. All gutters must be easily accessible for servicing.

All gutters must be fixed with hail and leaf guards to prevent blocking during storms and to provide quality rainwater when harvested for cooling tower / toilet flushing.

8.4 Overflows

Overflow relief outlets must be provided to all roofs and gutters 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 must be visible and horizontal outlets must discharge a minimum of 150mm from the face of the building.

Overflows must be designed so that the combined clear outlet area of the overflow exceeds the clear outlet area of downpipes serving the gutter. They must be positioned so that in the event of a gutter flooding the risk of flooding to the building is minimal, and they do not overflow directly onto pedestrian accessways.

8.5 Sumps in Concrete Roofs

The location of sumps in concrete roofs must be located so as to take account of slab deflections.

8.6 Hail and Leaf Guards

Hail and leaf guards must be provided on all sumps to gutters. Material must be stainless steel and or compatible with gutter and other roofing materials. All guards must be removable. Leaf guards must project above the top of the sump not less than half the depth of the gutter. Hinged hail guards must extend

for 1m each side of the sump. Safe access must be provided to maintenance points for clearance of blockages.

8.7 Downpipes

To avoid electrolysis, all exposed downpipes must generally be constructed of materials compatible with the gutters which they service. Downpipes to be painted to blend in with the colour of the wall immediately adjacent.

The location of all downpipes' discharges and sumps must be carefully planned to avoid inconvenience during operation and maintenance. Where downpipes discharge to rainwater capture storage, the hydraulic consultant shall ensure flow rates into the storages are not beyond the overflow capacity of the receiving tank or stormwater system.

8.8 Insulation

Where condensation on the exterior of downpipes located internally is likely to occur and cause nuisance, downpipes must be insulated. Sound insulation must also be provided to any downpipe where unacceptable water noise will result.

Insulation to roof spaces must be provided as required to achieve the required level of acoustic and thermal performance.

Insulation must be delivered to the site in sealed bags.

Refer also to Section 25 - Environmental Sustainability.

8.9 Roof Access

8.9.1 Internal Access

Preferred means of access to roof is an internal access door. Any deviation from this method of access requires consultation with FMU and Safety & Wellbeing.

8.9.2 Roof Spaces

All roof spaces must have permanent, fixed, adequate access. They must be provided with catwalks and be sufficiently lit to enable the roof space to be traversed without danger twenty-four (24) hours a day.

8.10 Roof Safety System

8.10.1 Roof Safety Balustrades

Balustrades or parapets are to be provided to all trafficable and non-trafficable roofs to ensure the safety of workers under the Work Health & Safety Act and associated Regulations., in lieu of less permanent measures, like roof anchors. Any deviation from this method of access requires consultation with FMU and Safety & Wellbeing.

8.10.2 Roof Walkways

Roof walkways of approved construction should be installed where required in accordance with t Work Health and Safety legislations and associated Australian Standards.

8.10.3 Fall Arrestors

As part of the safety in design process UTS strives to design out the need for fall restraint and fall arrest systems. If the hazard cannot be controlled by guardrails or a parapet, fall arrestors may be considered in consultation with FMU and Safety & Wellbeing.

8.11 Testing

Internal downpipes and all gutters must be hydrostatically tested to the maximum head possible prior to the issue of the Certificate of Practical Completion.

8.12 Roof Colour

Generally roofs should be of a lighter colour to reflect rather than absorb heat.

9 FURNITURE AND FITTINGS

This section must be read with careful reference to Section 22 - Special Requirements and the remainder of these Guidelines to the extent that they are applicable.

The University has a policy of standardizing items of furniture and fittings. Design Consultants must take into account existing policy in the selection and specification of all items of furniture and fittings. Consultants must ensure that any chairs and other furniture specifics comply with Workcover and Work Health and Safety Act and associated Regulations, requirements and recommendations. Documentation by the suppliers to this effect must be provided with supply.

9.1 Whiteboards and Pinboards

All whiteboards and pin boards of a fixed type and those of sliding, rotating or special nature required in the project must be installed under the Contract. Design Consultants must verify the specific requirements of individual users during the design development stage of the project. Unless specifically requested to the contrary, the following standards must apply:

Verify fixing heights prior to preparation of tender documentation.

Faculty/Admin Offices:	Pinboard 1200 x 1000mm. Whiteboard 1200 x 1000mm with pen rail. Lockable glass cabinet as requested. Noteboard 410mm x 410mm outside door adjacent to the doorframe
Academic Office:	Pin board 410x410mm outside door adjacent to door frame
All Teaching Spaces:	Pinboard 450 wide x 300mm high, 1500mm from floor to underside, adjacent main entry door to all teaching spaces.
Seminar Rooms and Computer Laboratories:	Whiteboard with pen rail to full width of front wall. Pinboard 1200 x 1000mm outside entrance door.
Laboratories:	Whiteboards and pin boards to full width of front wall. Pinboard 1200 x 1000mm outside entrance door.
Common Rooms:	Pinboards to available walls internal and external.
General Offices:	Whiteboards and pin boards to user requirements. Pinboard 1200 x 1000mm outside entrance door.
Lift Lobbies:	Pinboard 1200 x 1000mm to wall.
Other Occupied Areas:	Noteboard 410 x 410mm outside door adjacent to the doorframe.

Whiteboards must be sandwich panel of white vitreous porcelain with galvanized steel backing sheet and aluminium edge trim. Pin boards must be 6mm thick Krommenie on 4.8mm thick medium density fibreboard with slimline natural anodised aluminium frame 18mm with square mitred corners and concealed fixings. The colour of the Krommenie board must match the existing pin boards in the building (if any) and be approved by FMO/PMO. For pin boards required to be wider than 2400mm and in one piece, use a heavy duty frame as advised by the manufacturer.

All chalkboards and whiteboards must be provided with continuous rails for chalk and board marker pens. Rails must have smooth edges and rounded corners.

All boards must have concealed, secure fixings. These can be either ‘Ramset Hollow Wall’ or ‘Hilti Cavity’ anchors.

Whiteboards & Pinboards for notices and messages to be installed within the accessible height range of 230 to 1350 above FFL, in accordance with AS1428.2 Clause 22.

“Idea Paint” may be used as a white board instead of a framed whiteboard. Idea Paint must cover the entire section of wall, floor to ceiling and finish to an internal corner. Idea Paint is available from Baresque Australia Pty Limited. Refer to Section 20 Painting Clause 20.2.

9.2 Bookshelves for Academic Staff or Support Staff

Where bookshelves are to be fixed to steel studwork partitions, the design of the studwork frame must be reinforced to support the additional load. The minimum quantity of shelving to offices must be 18 linear metres unless noted otherwise. Design Consultants must verify specific user requirements before finalizing their documentation.

Book shelving must be fully adjustable. Heavy Duty keyhole stripping must be fixed into studs to walls and partitions at 450mm max centres with screws or ‘Ramset’ or ‘Hilti’ fixings. Shelving must be white melamine finished craftwood with glued edge strips all round 300mm wide unless otherwise noted in the Brief.

All shelving must match existing shelving. This includes situations where Tasmanian Oak or Tasmanian Myrtle shelving has been used in existing areas.

A quantity of spare shelves and brackets equivalent to 10% of the total must be provided as part of the Contract.

9.3 Directory Boards and Room Names

Provision must be made in the design to allow space for information and directional signage including directory boards in lobbies, etc. All signage is to be in accordance with the UTS Sign Standard (refer to Section 21 - Signage).

9.4 Notice Boards

All lockable and general notice boards are to be included in the Contract. At least one lockable noticeboard not less than 3m in length must be provided in each lobby. Lockable noticeboards must have two sliding laminated safety glass doors with a single, chrome plated lock in a heavy duty natural anodised aluminium frame with square corners 65mm deep. The notice board for lockable and general notice boards must be as noted for pin boards in Subsection 9.1 Whiteboards and Pinboards."

9.4.1 Holders for Temporary Notices

Holders for temporary notices must be a proprietary sleeve with sprung front formed from one piece of folded clear acrylic designed for the display of one A4 sized notice in vertical format. Holders must be fixed with flat head screws appropriate for the substrate.

9.5 Lecture Theatre Fittings

All benches, desks and fixed seating must be supplied and installed under the Contract.

Fixed benches must be designed to match existing lecture theatre benching. Bases are to be powdercoated to the Dulux standard powdercoat range. Desk tops to be constructed of high pressure laminate with vinyl edging Fixed seating tablet arms shall be Sebel 'Griffin' or equally approved style with upholstered seat pad and back pad, as selected and approved. All seating covers are to be easily replaceable in a standard Australian wool range upholstery weight fabric. All seating and benches are to comply with current Australian Standards. All tablet arms are to be fitted with A3 tablets sufficient to accommodate laptop computers. Provision must also be made to accommodate people with disabilities by provision of wheelchair spaces. Where writing tablets are provided, the wheelchair spaces shall have access to similar facilities designed to suit – comprising a post, winder adjustment for height and writing tablet. Provision must also be made for at least two seats in each Lecture Theatre to be fitted without writing tablets.

UTS lecterns and Presenter's AV desks are supplied by UTS. The UTS lectern is installed by UTS, the contractor shall provide the necessary floor penetrations and/or floorbox to facilitate cable entry into the base of the lectern. The 'Presenter's AV desk' is, unless otherwise specifically stated, installed by an approved AV Sub Contractor under the main Contract. These must include all controls for adjusting lighting levels, overhead projectors, screens, computer projection, and audiovisual displays. The requirements for these facilities must be clarified with FMO/PMO early in the design stage.

Refer to Subsection 23.2 – The UTS Environment for special requirements for Lecture Theatres and to Section 24 – Accessible Environments Policy.

9.6 Toilet Fixtures

The following must be provided in all toilet washbasin areas:

- Vanity bench unit with full width mirror. Basins to be semi recessed into vanity bench. Men's toilets may have free standing basins but vanity is preferred. Do not use laminate benchtops
- Soap Dispenser over each basin, type to be advised by FMO Central Services.
- SCP Coat Hooks with rubber stop end if behind each cubicle door.
- General Power Outlet adjacent mirror
- Provide 1 hand drier per 2 basins (or part thereof). Minimum 250W motor. 2.0KW heating element. Equal or equivalent to Air dryer E88A with automatic sensor by Andom Pty Limited, or Dyson.
- Tap for Cleaner to be positioned over floor waste where practical

In each toilet cubicle, provide:

- Toilet roll holder, (Kimberly Clark toilet tissue dispenser type 4402), and to toilets for people with disability, two open type roll holders
- Coat Hook (chrome-plated) with door stop
- Sanitary Napkin Disposal Units (Provided by UTS under contract).

In each unisex toilet for people with disabilities provide:

- Grab rails as required by AS 1428.1
- Mirror 400 x 1500mm high
- Basin
- Double toilet roll holder
- Coat Hook (chrome-plated) with rubber door stop if mounted behind door
- Wall mounted folding baby change table

In each shower recess provide:

- Soap holder to match wall tiles

- 2 Coat hooks (chrome-plated)
- Fixed bench seat minimum 600mm wide made from timber slats for changing clothes.
- Shower screen door (Shower Curtains are not permitted)

Note that cloth and paper hand towels are not permitted. Refer also to Subsection 11.3 - Sanitary Fittings and Fixtures, and Section 24 – Accessible Environments Policy.

9.7 Coat Hooks

In addition to those required in toilet areas, a combination coat hook/doorstop must be provided on the back of all doors to individual offices in the building and coat hooks to all laboratories, at 1800mm above the floor.

9.8 Kitchenettes

In addition to any kitchen provided in a Common Room a small kitchenette must be provided on each floor. This must contain a sink cupboard with sink, drainer and splashback, space for a refrigerator, microwave, dishwasher and a continuous boiling hot water unit under the sink equal to Zip Hydrotap, a towel rail and one set of drawers 450mm wide with top utensil drawer, 120mm deep, lockable. Space must be allocated under or adjacent to the bench for two garbage bins:

- Co-mingled General Waste Bin (grey with red lid) 70 litre (673mmH, 495mmW, 412mmD) or 90 litres (820mmH, 495mmW, 412mmD)
- Food Waste Bin (grey with green lid) 30 litres (435mmH, 410mmW, 398mmD).

No built in garbage drawers or cupboards (these pedal bins don't fit in them).

Allow floor space in all office kitchens for the bins to be easily accessible with space around them for ease of use. (Pedal bins are not suited to going under benches as the lids hit the overhanging bench.

Visibility: the latest research into waste and recycling behaviours clearly shows that bins should be visible and easily accessible to increase compliance and recycling rates.

9.9 Common Room Kitchens

Common Room kitchens must include the same fittings as Kitchenettes. Refer to Subsection 9.8.

Common Room bench tops and service counters must have laminated bench tops and coved splashbacks. When provided in carpeted rooms, the kitchen bench must be fronted by impervious flooring, preferably non slip rubber.

9.10 Research Student Areas

Research or post graduate student areas accommodating 10 students or more, provide a communal area comprising the following:

- Storage cabinet 550Dx3600Lx870mm H, cabinet top can be used as a layout/photocopy area
- Kitchenette bench to be maximum 3600mm length, refer to Sub section 9.8 and 9.9 above for other requirements. Refrigerator to be maximum 210L.

Kitchenette to be located adjacent to room entry and a meeting area where possible.

9.11 Vanity Units

For new buildings and refurbishment of existing toilet facilities provide vanity units for female toilets only.

9.12 Chilled Water Drinking Fountains

For new buildings and major refurbishments provide the following for every floor, locations to be publicly accessible and as determined by project architect:

- One chilled water drinking fountain with cup filter
- One accessible chilled water drinking fountain. Refer to Section 24-Accesible Environments Policy.

Refer also to Subsection 11.3 Sanitary Fittings and Fixtures

9.13 Built-in Furniture

UTS has a general preference for the use of 'non built-in' furniture to provide for future flexibility. The use of built-in furniture should therefore be approved by UTS at an early stage of the design and must allow for cable reticulation where required.

Built-in furniture such as cupboards and laboratory benches must be supplied as part of the Contract. All built-in furniture units must have a recessed base finished in black, satin laminate.

Where abutting walls, provide an integral splashback not less than 150mm high caulked to the wall. All cupboards and drawer units where required must be lockable and master keyed (not keyed alike). The finish for all built-in furniture, must be approved by FMU. The use of European Beech Veneer as a finish is not permitted.

Laboratory Furniture must comply with the relevant Australian Standard for the type of Laboratory Usage.

9.14 Furniture and Equipment provided by UTS

The following items of loose furniture will be provided by the University unless otherwise required in the Brief:

- Desks
- Returns
- Coffee Tables
- Laboratory Stools
- Filing Cabinets
- Refrigerators
- Stationery Cupboards
- Drafting Tables
- Lockers
- Projectors
- Chairs (all types)
- Lateral Filing Units
- Light Desks
- Beds
- General Purpose Tables
- General Purpose Metal Shelving
- Screens (office)
- Hat and Coat Cupboards
- Microwave Ovens
- Clocks
- Dishwashers

Equipment such as computers, percolators, cutlery/crockery, and scientific equipment will also be provided by the University unless otherwise stated in the Brief. Consultant design drawings must clearly identify all furniture and equipment requirements.

Schedules listing types, finishes and quantities required must be produced to enable UTS to purchase the required items.

Where appropriate, the Contract must include the taking delivery of and placement of the furniture and fittings as the Builder's responsibility.

All other loose furniture must be supplied under the Contract unless instructed otherwise by FMU. Adequate provision must however be made in the project budget for the provision of loose furniture provided by UTS and required to furnish the new or refurbished spaces.

European Beech Veneer is not permitted as a finish.

All electrical or electronic equipment housed inside joinery units must be adequately ventilated.

9.15 LCD Monitor Arms

Shall be height adjustable, fully rotatable, Screen tiltable up/down and swing left/right. Movement should be easily adjustable by user without use of tools.

9.16 Compactus

Compactus units, incorporating shelving or hanging rails, must be supplied and installed under the Contract when required by the Brief. Consideration must be given to the structural design and capacity of the floor required to support compactus storage units. Should this type of storage be required, requirements should be discussed with the Manager, Planning and Design as noted in Section 2.1 Generally record storage should be kept to a minimum.

9.17 Curtains and Blinds

Confirm requirements for blinds and if they are to be supplied and fitted under the Contract with the FMU Project Manager. Curtains will be provided by the University. Provision must be made in the Contract for all battens, pelmets, curtain tracks, etc. required for fixing.

9.18 Projection Screens

Projection screens for slides, overhead projection or film must be provided in all seminar, classroom and lecture theatres as part of the Contract. Projection screens must be installed such that the concurrent use of a whiteboard in the room is not unduly impeded. Installation and specifications shall be determined by AVS. Refer to Section 23 – Audio Visual Services.

9.19 Works of Art

The design of all public areas and meeting rooms must be suitable for the display of the University's Art Collection. Liaison should occur at an early date in the development of the plans with the UTS Curator to designate 'gallery' areas.

The following requirements apply to such areas:

- Designated walls in display or gallery areas should receive no direct sunlight.
- Walls generally should be free from obstructions, switches, ducts and the like to maximize the available surface area and be finished in an appropriate surface and colour.
- Lighting in designated gallery areas should provide an even illumination of walls where artworks will be displayed. Where lighting such as 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. Where spotlights are used, they must be at least 2 metres from walls. Where fluorescent lighting is used, such lighting must use low UV fluorescent lamps or have lamps fitted with UV absorbing polyester sleeves.

- Where UTS art works are to be located, provide hanging tracks to the length of the wall. The track must be Alcan H7644 extruded aluminium section with clear anodised finish fixed to the wall with appropriate screw fixings, wall plugs, etc.

The UTS Curator must be consulted at an early stage on all projects where UTS artworks are proposed or located. This is essential to ensure that adequate arrangements are made to place artworks appropriately and to protect and/or relocate any affected artworks.

9.20 Workstations

Where workstations are required in the Brief they must be supplied under the Contract, together with all required services including adequate lighting, power and data and communication connections. Workstations must be designed and installed in compliance with the following standards. These include:

AS/NZ4443 Office panel systems - workstations
AS 1680.2.2 Interior Lighting and the Visual Environment for Screen Based Tasks
AS 3000 Electrical Installations - Buildings, Structure and Premises
AS 3080 Telecommunications installations and Cabling for Commercial Premises
AS 3084 Telecommunications Installations - Telecommunications, pathways and Spaces for Commercial Buildings

All workstations must comply with all current Work Health and Safety Legislation and associated Australian Standards and should include the following features:-

- A minimum desk size of 1800mm x 800mm for standard workstations and 1200mm x 800mm for HRDs and hot desks
- the capacity for the height to be adjusted up or down by an adjustable leg with a minimum travel of 150mm and set at a height of 710-720mm
- The top of the workstation shall include a range of movement between 610 and 760mm from the floor
- non adjustable keyboard section
- the ability to change the workstation layout if required
- for L shaped workstations one side of the work station shall be 2100x800mm minimum to perform mixed tasks.
- Internal angles to L shaped work stations to be curved or radial, 90 degree or rectilinear internal corners not to be used

Minimum 10% of workstations in each area to be manually adjustable by the user.

Where shelving is added to the screen this must also be adjustable by the user and provide a minimum 600mm clear space above the desk surface for ensure the computer height can be adjusted.

9.21 Office Chairs

Chairs to be used at workstations must be height adjustable swivel chairs and;

- comply with AS/NZ 4438:1997:Height adjustable swivel chairs and have a Service Durability Level of at least 4 but preferably 6, determined by Table 2.2 of this standard
- have a Blue Tick Certification for the Australian Furnishing Research and Development Institute Standards (AFRDI) (also known as Furntech) endorsing that the chair has been tested as meeting AS/NZS 4438 and the nominated Service Durability Level.
- where the Furntech – AFRDI certification does not cover fabric, the purchaser must have confirmation that seat fabric meets the flammability requirements of AS/NZS 4088.1
- Castors: chairs on carpet to use hard castors, chairs on hard surfaces to use soft castors and semi lock mechanism, when user gets up from chair castors automatically half lock and the chairs must have 5 point castor bases.
- Chairs that are required for heavy persons must comply with AS/NZS 4438 level 6 and BS5459.2 which subjects these chairs to be more stringent requirements for strength and durability. Chair must be selected for a weight capacity suitable for the user.
- Seats must have 360 degree swivel and be easily adjusted from the seated position. Seats to have adequate padding, height adjustment and angle adjustment, but with a backward slope of no more than 5 degrees. Seat pan must be wide enough to accommodate the hips of the user and deep enough so there is no pressure to the underside of thighs and knees, with a height adjustment range that allows work surface to be at elbow height.
- Arm rests are not to be added to task chairs.
- A trial should be undertaken of new chairs by proposed users.
- Any proposed chair that deviates from the guidelines must be referred to the Health & Wellbeing team for assessment prior to purchase.

9.22 Warranties

- 10 Year warranty is required.
- A warranty sticker to be affixed to the underside of the seat of all chairs with date of warranty expiration, model number and supplier, and upholstery fabric and supplier.

9.23 Fabrics

Fabrics selected to be suitable for the purpose for which they are specified i.e. light weight fabrics for screens, heavy weight commercial upholstery fabrics for chairs.

- Patterns, jacquards and textures should be chosen over plain fabrics.
- Midrange colours rather than lighter or dark
- Preference to be given for use of sustainable natural fabrics over synthetics.
- Mix and match for recycling and reuse.
- Breathable fabrics are preferred.
- If vinyl is envisaged to be used, please substitute with leather from an Australian source.

10 DOORS, HARDWARE AND LOCKS

This section must be read in conjunction with Section 24 – Accessible Environments Policy and other relevant parts of these Guidelines where applicable.

All Electronic Locking Guidelines Refer Section 17.

10.1 Door frames

Doorframes must be metal with hinges and specification to suit the particular application required in the Brief.

For door frames to doors providing the point of security to a suite of offices or similar refer to Clause 5.2.3 – Glazed Partition Walls.

10.2 External Doors

External doors may be anodised aluminium with mid-rail not less than 200mm wide glazed with safety glass. Alternatively, timber external doors must be sheeted in marine grade ply with edge strips to top and vertical edges unless required to be fire doors. All timber external doors must be solid core. All trafficable external doors must open in the direction of egress and have a 'Pull' sign on the outside and a 'Push' sign on the inside.

The use of double action swing doors must be approved by the FMU. Sliding doors (other than automatic entrance doors) must not be used unless specifically requested by FMU.

In trafficable areas where doors are not fully glazed and are not required to be a fire door, provide a clear glazed viewing panel of a minimum size of 600 x 600mm to each leaf.

10.3 Internal Doors

Internal doors must be plywood faced solid core not less than 38mm thick, edge stripped all round. Doors in high traffic areas and where allowed by fire regulations, must have a 150mm wide x 800mm high viewing panel centred at a height of 1400mm from floor level and 175mm from latch edge of the door. Provide a viewing panel to all laboratory doors in laboratories including fire doors to comply with the requirements of the relevant Australian Standards.

Doors to lecture theatres, seminar rooms and similar teaching spaces and plant-rooms must be designed to match the acoustics of the room and must include seals and double-glazing where required.

Return air grilles in doors must be fixed with concealed screw fixings. Particular attention must be given to acoustic requirements to ensure that the acoustic integrity of the door is not compromised.

10.4 Locks

Locks must generally be Lockwood 3570 Series except where nominated otherwise, with construction cylinders, and keyed to the University's grand master key system. Locks in external aluminium glazed doors must be Lockwood 3582 Series. Locks must be mounted such that strike is 1000mm above finished floor level. No locks are to be mounted in the bottom rails of doors.

Locks must not have any form of anti-lockout functionality. Refer to Section 17.

10.5 Keys

All keying is to use specific UTS Restricted 105 'U' profile Series Bi-Lock under the University key plan. The keying schedule is to be agreed with the Manager Security Services through the Project Manager. Key coding will be determined by the Manager Security Services and Hildebrandt Locksmiths Pty Ltd as per University Key Control Policy and University Key Plan. The number of keys required is normally two per lock.

Only master keying must be used. Maison keying will not be approved under any circumstances.

Construction cylinders will be used during the construction of any new buildings. At Practical Completion of the construction, the construction cylinders will be removed and replaced by the bi-lock system. This will be done by the University Locksmith and arranged for separately by UTS. Key cylinders must be stamped with a numbering system by the manufacturer.

10.6 Door Furniture

Furniture for each lock must be selected to match each application. Lever type handles only may be used and the implications of electronic security access where required must also be considered.

Door furniture must be Lockwood 4800 Series or an approved equivalent, SCP or to match door finish.

Refer also to AS1428.1 - Design for Access and Mobility.

10.7 Push / Pull Plates and Handles

Push/pull plates and handles must be installed on all main access doors, where single lever handles are not employed.

10.8 Door Closers

Door closers must be provided to entrance doors, doors with keypads, external doors, internal doors from general office space to public corridors, lecture theatre doors and doors to all teaching spaces, plant-rooms, toilets, air-locks and fire doors. Type must be Dorma TS83 easy action door closer or equal approved by FMU. Door closures must be provided between all air-conditioned spaces.

Refer also to AS1428.1 - Design for Access and Mobility.

10.9 Kick Plates

Kick plates must be 150 high x 0.9mm satin stainless steel, screw fixed to the outside face of all inward opening heavy duty doors. Where timber doors are subject to excessive damage from trolleys, etc, the stainless steel kick plate must extend to the mid-rail.

10.10 Electro Magnetic Hold-Open Devices

Electro magnetic hold-open devices and sequence closures must be provided to all fire or smoke barrier doors in high traffic areas which must automatically release the door, allowing closure, in the event of any smoke or fire alarm activated at the Fire Indicator Board. Emergency exit security controlled doors to be triggered from a building common fire trip (not via air conditioning) and a manual operation door release with to be included in the door release circuit on F.I.P.

10.11 Door Size and Swing

All plant-room lecture theatre and laboratory doors must be minimum leaf and one-half construction and must open outwards taking care not to swing across traffic paths. Doors to cleaners' rooms, service ducts and small storage cupboards must open outwards.

Door sizes must generally be of a standard size, not less than 2040mm high x width as required unless required to be larger for particular purposes or to meet statutory requirements.

Refer also to Section 24 – Accessible Environments Policy.

All doors in faculty offices must as far as possible be right-hand hinged when viewed from the outside.

10.12 Door Stops

To any door where the door or furniture may strike a wall or other object, and where a combination coat hook/door stop is not provided, provide an aluminium/rubber doorstop.

10.13 Toilet Doors and Locks

Cubicle doors must be faced both sides and on all edges with laminate to match proprietary cubicle partitions. Hardware must be Lockwood 55 5 “hold open” unless otherwise required.’ or approved equivalent with stainless steel spring hinges. Toilet bolts to Lockwood 800 series SCP surface mounted.

Doors to fully enclosed sanitary compartments for people with disabilities must comply with the relevant parts of the Building Code of Australia & applicable Australian Standards. In the event that the clear space between the closet pan and the nearest part of the doorway is less than 1.2m, then a readily removable door is required.

The removal of the door is to be achieved by means of a 25mm gap between the top of the door and the head of the frame, lift-off hinges and two lifting handles mounted on the outside of the door. Doors to cubicles must be 200 mm off finished floor level to facilitate maintenance.

10.14 Acoustic Seals

Where acoustic seals are required they must be recessed into the door jambs, head and the bottom of the door wherever possible.

10.15 Coat and Hat Hooks

For rear of toilet doors provide Lockwood L432 door bumper and hook SCP. Where other hat and coat hooks are specified in toilet and change areas use either Lockwood L1310 (4 screws) L45 (2 screws) Depending on surface for fixing and usage. Robe hooks to be Lockwood L825 SCP or similar.

11 SANITARY PLUMBING AND DRAINAGE

All water reticulation, sanitary plumbing, drainage and stormwater must be designed in accordance with NSW Code of Practice Plumbing and Drainage requirements.

Products to comply with National Water Efficiency Labelling Scheme (WELS)

Ratings as listed herein shall apply.

This section must be read in conjunction with Clause 3.9.3 – Toilets and Showers, and the remainder of these

Guidelines to the extent that they are applicable.

11.1 Sanitary Plumbing

Materials for pipework above ground shall be UPVC, high density polyethylene, cast iron or copper.

Existing buildings pipework material shall be maintained to match those materials originally installed.

All pipework must be concealed where possible in accessible ducts and ceiling spaces. Where piping is concealed adequate access for maintenance and inspection is to be provided. Provide clearouts at every branch connection, immediately before entry to stack and at the upstream end. Locate clearouts in ablutions floors with screwed chromed brass caps set at finished floor level.

11.1.1 Food Preparation and Outlets

Provide the following:

- Grease trap complying with Sydney Water Trade Waste Agreement with UTS (Refer to Building Services Branch)
- Hot and cold water outlets adjacent to grease traps to enable cleaning. Provide backflow prevention
- In-sink dry basket arresters.
- Floor waste basket arresters
- Garbage disposal units are not to be installed.
- Plate rinsing spray with trigger control.

11.1.2 Laboratories

Provide the following:

- Trade waste drainage system in welded HDPE
- Plaster traps, dilution tanks, pH correction treatment, trash baskets as required by the processes.
- Silver recovery units in photographic laboratories complying with Sydney Water Trade Waste Agreement.

11.2 Sewerage System

All sewerage pipes and fittings shall be UPVC ,cast iron or vitrified clay as determined by site conditions. Install recovery tape with wire trace in.

For pipelines up to 2m deep, provide clearouts with riser shafts to 80mm above finished surface level at each change in direction and junctions. Riser shafts shall be 100mm for 100mm pipework and 150mm for larger sewer sizes. Encase top of riser shafts in 100mm thick x 100mm deep concrete surround and finish shaft with screw down gas tight brass cover engraved with “S”.

For deeper pipelines, provide water-tight inspection pits over pipeline clearouts. Provide 50mm slotted pipe drain wrapped in geotextile from the base of the pit downhill into the sewer bedding to prevent seepage flooding the pit. Locate pits away from grassed areas where possible.

11.3 Sanitary Fittings and Fixtures

The following sanitary fittings (or the approved equivalent in other brands) are to be specified:

Vanity Basins:	Caroma Concord or Laser semi recessed basin Caroma Integra 500 for accessible vanity units.
Wall Hung Basins:	Caroma Integra 500 wall basin Basin Brackets D250.
WC Pans and Cisterns:	Caroma Trident Sovereign or Caroma Leda 2000 (All cisterns to be dual flush).
Toilet Seat:	Contour Trident double flap white plastic or Caroma Pedigree II care seat.
Cleaner's Sink:	Caroma Cleaner's Sink

	Caroma CP Bucket Grate with Caroma 152 brackets.
Urinals: (New Work)	Uridan HH – 2 or Caroma H2 zero. (white ceramic, waterfree), wall hung
Shower Base:	Acrylic Caroma Caravelle 900 x 900 or 1200 x 900 with non-slip surface.
Drinking Fountain:	Zip Chill Fountain CFB 140F WA wheelchair adult complete with 5 micron filtration, chrome plated, brass stainless steel bubblers for wheel chair adult bump action, electronic controls, stainless steel bowls, splash panels, lockable front panels, includes ¼ HP compressor recessed in wall cabinet.
Drinking Fountain for People with Disabilities:	Drinking Fountain must comply with AS1428.2. Refer also to Section 24 – Accessible Environments Policy.
Soap Dispensers	Benfield spray soap 800 (push type) unless provided by supplier of soap.
Grab rails	Stainless steel grab rails JD McDonald gros left and right handed.

11.4 Taps and Faucets

Shower heads and tap fittings to be WELS rated as specified elsewhere

The following taps and faucets (or the approved equivalent in other brands) are to be specified:

Basins:	Caroma Nordic chrome plated mixer. or Enware Anti-Vandal School Pattern
Cisterns:	Enware CS Series brass, chrome plated, vandal proof right angle stop cock.
Cleaners Sink:	Enware CS Series brass chrome plated vandal proof bib cock with aerated spout and 50mm BIB extension.
Emergency Showers:	Enware model EW1050 Safety Deluge shower wall mounted with 304SS tube and drench head, pull on, push off through rod and ring. Provide a bracket on the wall to hold the rod clear in access ways.
Shower Heads:	Energy saving water efficient type, Enware CS Series brass chrome plated heavy duty directional.
Shower Taps:	Caroma, Nordic chrome plated shower mixer without diverter. .

Consideration should be given to the inclusion of timers to limit water usage where appropriate.

11.5 Floor Wastes

Floor wastes must have a minimum 100mm diameter inlet with chrome-plated screw in gratings. Penetrations for floor wastes in suspended concrete slabs must be cored after the slab is cast at the lowest point of the area to be drained. The floor wastes, complete with puddle flanges, must be epoxy grouted into the penetration. Floor wastes must not be cast into concrete slabs.

11.6 Sanitary and Trade Waste Vents

Venting shall be designed to the current version of AS 3500,except that air admittance valves (AAV) shall only be installed as follows:

- In accessible locations for servicing. Do not build into walls, ceilings or confined spaces.
- To provide a back-vent for tea or kitchen sinks, cleaners sinks, single showers, basins and tundishes.
- Buildings 1 and 2 – Only on new sink drainage, which would have otherwise required an additional fixture vent.
- Do not use AAVs in place of group vents in main toilet or ablutions areas, or for any physics or chemistry laboratories where acids, solvents or other reagents are likely to be used.

In Buildings 1, 2 and 10, vent pipes shall not be removed for any reason. They may be relocated, provided the relocated pipe size is retained and bends and pipe slopes comply with AS 3500.

11.7 Stormwater Drainage

Generally to conform with AS3500. 3.2 Stormwater Drainage Background information from FMU must be sought regarding Stormwater Management Plans on a campus-by-campus basis to determine the most appropriate design method.

Flooding frequency shall comply with the Relevant Local Government Council requirements. These would normally require the following frequencies:

Roof box gutters & downpipes:	100 year ARI
Roof box gutter overflows:	100 year ARI

NOTE; Box gutters are to be avoided under all circumstances.

Roof eaves gutters & downpipes:	20 year ARI (Where overflow will not enter the building)
Buried stormwater drainage generally:	20 year ARI (Dependent on nuisance caused)

Buried stormwater drainage

(subject to detention requirements): 100 year ARI

On-site detention: as required by Council.

Overflow from roofs shall be piped away from pedestrian traffic. Overflow shall not be directed to lower roofs where noise from discharging water is likely to interrupt building teaching activities .Flooding frequency must generally be determined for each project on the recommendation of the Consultant after careful consideration of the damage and inconvenience flooding would cause.

Inspection pits must be provided at major changes of direction and junctions, with 'S-W' stamped into covers. Provide light duty covers except in roadways where medium duty covers must be used. Brass edged covers are to be used internally where particular floor or paving finishes are used. Covers to pits installed internally must be the watertight bolt down type. Tops of pits in landscaped areas must be installed to match finished landscape levels. Pits in forest areas must be locatable by means of a white painted hardwood post 600mm high above ground with the top 100mm painted grey.

Generally, sumps with silt traps must be located so as to avoid the use of pits or fittings. Overflow gutters and sumps must be provided. No new box gutters are to be permitted..

All stormwater lines must discharge directly into the closest existing pits or lines or useable major natural watercourse. The route, point of outlet and method of discharge is to be approved by FMU and the Local Authority.

All grated drains for the collection of surface run-off must 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. In pedestrian areas, gratings shall be Heelguard. In roadways gratings shall be so designed to prevent cycle wheels entering the slots.

Agricultural drains must be of a minimum 100mm diameter, slotted, tested UPVC pipe and fittings, with lines extended to the surface. Brass clear outs to be provided at ground level or flush with finished paving.

Careful consideration must be given to ensure that stormwater detention basins are installed where required to meet Local Authority requirements.

11.8 Installation

Refer also to Section 12 - Piped Services and Storage Tanks.

12 PIPED SERVICES AND STORAGE TANKS

12.1 General

This section of the Guidelines outlines the minimum requirements for the following services:

- Cold water
- Hot water
- Recycled Water
- Toilet flushing water
- Rainwater
- Reverse Osmosis treated water
- Circulated cooling water
- Natural Gas
- Laboratory gases
- Compressed air
- Tanks and hot water systems.

In general, each riser must be isolated at the bottom (or top in cases of downfeeds) and at each Level to facilitate cross-connection testing. Branch lines must 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 must be readily accessible. In cases of water supply, compressed air and gas, ring main distribution pipes should be used wherever possible. Groups of fixtures and single fixtures are to be isolated adjacent to the units.

Where required by Statutory Authorities, all plumbing fittings must comply with the minimum requirements of SAA MP52:2005/AS5200 and must have AS markings and manufacturer's Licence No. stamped into the fitting.

Brackets for all pipe supports must be 'Unistrut' with threaded rod hangers and appropriate saddles or stand-off Abbey clips. In all cases, the pipework is to be separated from the hanging bracket by the use of 'Uni-cush' tape or approved equal.

No pipework is to be supported from other service installations and must be independently supported from the structure.

Note: The consultant is responsible for obtaining full details of liquids and gases to be reticulated and selecting appropriate piping materials for each service, taking into account the chemical nature of the piped medium and requirements of relevant Codes and Authorities.

The minimum default materials for pipework and fittings are set out below. Include a Pipework Schedule in the specification showing requirements for each service (guide schedule attached).

All systems shall be commissioned by the installing Contractor in the presence of the Design Consultant. Provide design documentation with a full description of commissioning procedures to ensure the system is fully tested over all expected operating conditions prior to acceptance.

12.2 Water Supply

The water supply installation shall be designed in accordance with all relevant Codes and Authorities, in particular New South Wales Code of Practice Plumbing and Drainage.

Specify ball stop valves where new systems are cut into existing systems.

12.2.1 Materials

Pipework reticulation within buildings must be:

- Copper tubes Type B
- PVC Pressure Pipe to AS1477
- AS 1627 metal finishes
- AS 3894 site testing of protective coatings
- TS29 protection of ductile Iron and cast Iron pipework.
- Galvanised Mild Steel Cement Lined
- Polyethylene PN12.5 or above
- Existing buildings pipework material shall be maintained to match those materials originally installed.

Mains greater than 100mm diameter buried in the ground must be:

- Class K9 concrete lined ductile cast iron in polythene wrapping; Type B copper
- 'Blue Brute™' PVC for mains 100mm diameter or above, to AS1477 with dimensions to Series 2 pipes.
- High Density Polyethylene Type PE100 PN12.5 or above

In copper piping, compression fittings must not be used under any circumstances.

12.2.2 Valves

Isolation valves must be either gate valves or resilient-seated geared butterfly valves where service exceeds 65mm diameter. Ball valves must be used on services less than 80mm diameter. In ground valves 100mm diameter and larger shall be cast iron resilient-seated gate. Balance valves must be globe valves conforming to AS1628, of the calibrated adjustable graduated limited stop type, equivalent to STA-F. All screwed valves must have unions for easy removal without cutting pipework. Brass stop cocks, chrome plated where exposed, must only be used to isolate sanitary fixtures. All internal control valves are to be readily accessible in plumbing ducts. Where plumbing ducts are not provided, the locations of the valves are to be in locked recesses no higher than 1800 above the floor approved by FMO/PMO. Valves must be tagged to identify areas served.

Taps must be of DR brass construction with jumper valves .

Handles must be vandal-proof. All standard taps and fittings other than laboratory outlets must be of Enware CS Series, CP or SCP. Use ball valves for isolation of small branch lines and provide mini-stop ball valves on each and every tap outlet for hot and cold water.

Provide drain valves piped to waste at the bottom of all risers and downfeeds.

Valves in the ground must be provided with valve pits, adequately sized for easy removal and servicing of valves. Wherever possible, non-return and building isolation valves must be located within the building readily accessible from outside.

All bolts, nuts, washers, etc. located in the ground or in pits must be Grade 316 stainless steel. Any brackets located in pits must be hot dipped galvanised.

Water filters, equivalent to CUNO APS117, with 1S0 9001 certification must be installed prior to equipment such as auto boilers, coffee machines, ice machines, etc.

All water systems must be designed to include a nominated back flow prevention device to meet NSW Code of Practice and Local Authority requirements.

12.2.3 Cold Water

Supply each building for potable water uses (other than toilet flushing) directly from mains pressure. Where insufficient mains pressure exists use multiple variable speed drive pumps. Where the pumping installation serves total building pressure requirements, provide a triple-pump installation on a single base, designed to allow the full load to the spread across any two pumps controlled electronically by a Hydrovar or equal controller mounted on each pump and interlinked to provide a fully automatically driven and controlled system with 150% total capacity. Size each pump for 50% of the load at the required pressure. Provide a signal terminal out from the pump fail signal to connect to the BMS.

They shall be capable of matching the full range of demands from a single tap to the peak demand based on an assessment of building population and fixtures served. Do not oversize pump flow rate, but allow for additional pumps to be added in the future, as demand may grow. Unless there is a specific water demand for processes within the building, provide less rather than more flow rate to ensure pumps operate within their design parameters.

All pump motors shall be High Efficiency electric.

Multi-storey buildings shall be provided with roof-mounted toilet flushing water storage with pressure booster pumps and separate reticulation. This will allow rainwater or other second quality water to be used for toilet flushing either as designed or at a later date as such water becomes available.

Laboratory buildings shall be provided with tanks and booster pumps for all laboratory water supplies, including non-potable lab water, reverse osmosis water and any other special water supplies. Safety showers, eye washes and hand wash basins within laboratories shall be supplied with potable cold water.

In new buildings, where possible, use different pipe material for different types of fluid being carried.

Minimum outlet pressure must be 100kpa.

All external hose cocks must be 20mm nominal, brass, finishing 600mm above ground when located away from the building facade. All hose cocks or groups of hose cocks must be capable of isolation for servicing. External hose cocks must be not more than 30m apart and shall be fitted with vacuum breakers. Final locations must be determined in consultation with FMO/PMO. In circumstances where hose cocks are mounted on the face of the building, these must be stood off the face by not less than 50mm with an aluminium bracket.

A wash down hose tap with RPZ backflow prevention device shall be provided adjacent to a grease trap.

12.2.4 Recycled Water

UTS uses treated recycled water from sources such as rainwater collection, recycled grey water from showers and baths, and the cooling tower bleed. Recycled water is used mainly for toilet flushing and gardening purposes. The plumbing for recycled water must meet the requirements of NSW Code of Practice for Plumbing and Drainage. Further, specific attention must be given to pipe identification, labelling of pipes and user contact point instruction and avoidance of cross connection and contamination.

12.2.5 Fire Water

Water supplies for fire protection shall be taken from the nearest available adequate supply. This may result in the extension from supply to an existing building in the case of the City Campus to ensure the most economical and practical solution is adopted. Sydney water require double detector check valve backflow protection on all fire services directly connected to their mains. Install this valve between the mains connection and the feed hydrants to the fire brigade booster. Fire pump supply shall be taken from a tee between the DCVA and the feed hydrants to protect the fire pumps from over-pumping resulting in their failure. This installation is visually impacting and requires architectural consideration as to its location and configuration, whilst complying with the Fire Hydrant Code requirements for location.

12.2.6 Hot Water

Hot water services must be minimum of 20mm NB (nominal bore). Short branches up to 1.5m may be 15mm NB if serving only one outlet.

Hot water system designs should be selected on the basis of economical life cycle costing and taking into account any negative operational affects on existing building infrastructure. Gas fired hot water heating is usually more economical, more environmentally sustainable than electric.

With small hot water satellite demands remote to the centralised flow and return system, small electric hot water heating units may prove more suitable than extending the hot water loop.

The hot water service to laboratories must 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 must come from the non-potable supply, except in single storey buildings where reduced pressure zone mechanical backflow prevention devices shall be used to separate potentially contaminated zones from the supply and from building potable services.

All hot water pipes must be insulated with Thermotec 4-0 or approved equal closed cell polyethylene foam. In plant rooms and where exposed to view, the pipework and insulation must be metal sheathed with zinc annealed sheathing, edges swaged and overlapped. Timber blocks must be used at all supports.

The minimum insulation thickness to hot water piping must 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, wall thickness must be increased to allow for the insulation as specified to be installed.

In addition to areas specifically mentioned, hot water must be provided to the following points:

- showers
- common room kitchen
- provide an additional hot water outlet for a dishwasher of 20mm diameter copper, 200 litres/hour. Common rooms must have their own hot water system of not less than 315 litre capacity where high turnover dishwashing facilities are required by the Brief, or be supplied from a central flow and return system.
- toilet hand basins are to be provided with warm water via thermostatic mixing valves unless specifically requested otherwise in the Brief.
- A hot water wash down hose tap with RPZ backflow prevention device shall be provided adjacent to a grease trap.

Minimum outlet pressure must be 35kPa unless otherwise required.

The design of the hot water system should include consideration of the following issues:

- the installation of gas boosted ‘solar’ hot water units. In all cases, the consultant should check that the flows and temperatures available are suitable to the application. Acceptable designs would include Rotex Sanicube heat sinks with automatically controlled pre-heat from solar cells.
- the use of single or multiple electric mains pressure hot water units similar to ‘Rheem’ with a stainless steel tank and 3.6kw elements.
- space requirements outside of unit for removal of elements and above the unit for the withdrawal of anodes.
- the preferred use of gas hot water systems where natural gas is available. Gas fired hot water units must be similar to ‘Rheem’ mains pressure units in single or multiple installations.

- Mains pressure flow through instantaneous hot water units may be useful in some circumstances.
- overflows to hot water units must discharge over stainless steel safe trays under all units. Units must be mounted within the safe tray and the tray drained in accordance with AS3500.4.

Refer to Subsection 11.4 for details of Tap Requirements to Sanitary Fittings.

12.2.7 Fittings WELS Star Rating

Taps and fittings shall be WELS rated as follows:

- Hand basins - 5 star (Equivalent to 5L/min)
- Shower head - 3 star (Equivalent to 8L/min)
- Shower taps - 4star (Equivalent to 8L/min)
- Toilet suites - 3 star (Equivalent to 6/3 flush)
- Dishwasher - 3 star (Equivalent to 15L/wash)

12.2.8 Reverse Osmosis and Demineralized Water

The consultant should be pro-active in the design process to determine the preference of reticulated laboratory water supplies versus localised reverse osmosis (RO) units, to suit the particular user requirements. The following is a list of general criteria to be met by the plant.

- Filtrate to be Grade 2 for General Laboratory uses
- Water meter on raw water supply
- RPZD backflow prevention device on raw water supply
- Activated carbon filter with backwash facilities
- Ultraviolet disinfection
- Staged reverse osmosis treatment with 80% water efficiency.
- Ion exchange resin canisters for demineralisation
- Local resistivity meter after ion exchange
- 24 hour's supply storage in translucent non-metallic tank
- Dual PLC controlled variable speed drive circulating pumping installation.
- Branch connection with isolating valve to each laboratory requiring RO.
- Ultraviolet disinfection of return water.
- 12 months' supply of consumables

Filtration / demineralization units shall be provided with differential pressure gauges to determine backwashing requirements.

Wastewater from clear water polishing treatment plants such as RO plants shall be re-used wherever possible for toilet flushing make-up.

Grade 3 Analytical quality water shall be provided using point-of-use treatment as briefed and as funded by the user

12.2.9 Circulated Cooling Water Loop

Provide a cooling loop to each laboratory as required by the brief. Cooling loop shall generally be a pressurized supply and gravity return to pump suction / make-up tank. Gravity return shall be sized and vented to atmosphere ensuring that all equipment cooling outlet pressures are at atmospheric pressure. This allows all different types of equipment to be cooled regardless of their pressure differential requirements.

Drainage inlet points shall not be tundishes, but shall be screwed end, valved pipes equal in size to valved supply pipes.

Provide cooling loop outlets and circulated drainage inlet points to wet fume cupboards, furnaces, distillation plants, etc.

Effect cooling using cooling towers or chilled water depending on temperature requirements of the equipment to be cooled. Note that general laboratory cooling can be achieved by cooling towers (either air or water). However equipment requiring to be maintained below 25˚ C must be cooled using chilled water via a heat exchanger.

Cooling towers may be favourable environments for Legionella bacteria if they are not properly designed and maintained. Cooling towers should be designed, installed and maintained in accordance with the AS/NZS 3666 – Air handling and water systems of buildings.

Running of laboratory cooling water to waste must be avoided. Where low vacuum is required for laboratory purposes using water aspiration methods, air vacuum aspiration methods must be provided without the need to run water to waste..

Provide pressure / temperature binder points before and after equipment to be cooled and balance flow rates with adjustable balancing valves and pressure reducing valves as required.

12.3 Natural Gas

Pipework shall be either Type B copper or steel. The following minimum sizes are required:

Servicing one outlet	-	20mm min
Servicing three outlets	-	25mm min
Above three outlets	-	as required

All joints shall be brazed. Isolation valves must be of the ball type. A meter for natural gas must be provided to the building main supply, and also to separately tenanted areas, "UTS Union" areas and cafes.

Provide a main gas supply meter for each building in addition to pulse capable sub-meter on any appliance or process which consumes in the order of 20% of the total building consumption.

Diaphragm meters shall be used wherever possible due to their reliability and accuracy. Where gas pressures are low with high usage provide turbine meters, sized to suit the demands. Do not over-size meters. Where possible meter the gas before it is regulated to low pressure to reduce the physical size of the meter required. Provide pulse output wiring terminated outside any hazardous area with an intrinsically-safe barrier and ready for connection to UTS energy management system. Pulse value shall be $1m^3$ /pulse. Meters shall be provided with automatic temperature and pressure correction as well as upstream and downstream pressure test points.

Regulators shall be provided with pressure test points upstream and downstream.

Automatic gas shut-off valves shall be provided on all buildings with fire sprinklers where open unregulated flame is possible. Such valves shall be activated by water flow through

All gas installations must comply with AS 5601 Gas Installations and relevant authorities.

Metering: Natural gas usage in equipment consuming over 500 GJ per annum must be metered to capture the consumption. This would normally include space heater boilers, kitchens, large hot water storage heater banks, laboratory boilers and other experimental heating uses.

Communication links to the UTS Metering systems must be installed either wirelessly or wired. The communication protocol must satisfy the UTS Metering system's currently adopted protocols of - ModBus or native BacNet. The system should be commissioned to read live data of the meter at the metering head end for cubic metres, MJ and flow rates in MJ per sec. The meter register reading in cubic meters need to be recorded at the head end with a facility to synchronise at a later date if needed..

12.4 Laboratory Gases

Gases must be supplied from bottles located within a ventilated storage space located external to the building which is easily accessible by a service road.

Cylinders must be manifolded with non-return valves in such a way that any cylinder can be removed and still allow the effective operation of the pressure manifold.

Pipework and valves must be of a material or type appropriate to the particular gas. Pressure regulator is to be at the cylinder manifold not at the point of use.

All gas installations must comply with all current Australian Standards and relevant Authorities.

12.5 Compressed Air

Compressed air for laboratory purposes must 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.

Where compressed air is readily available, extend that service. In the event that it will not supply the total load, then supplement that installation with more or larger compressors.

Compressors must be effectively isolated from the building structure. Tank mounted compressors are acceptable.

Compressors must be effectively silenced. Unless otherwise required, compressed air must be reticulated at 700kPa and regulated at each laboratory.

Provide refrigerated driers and filters in the compressed air discharge pipework.

12.6 Services Outlets

All laboratory outlets must be Enware LF Series laboratory fittings to suit user requirements. Water outlets shall have jumper valves. They must be epoxy coated finished with colour coded handles to international colour coding, except for hot water.

Demineralised deionized distilled water outlets must be Ryan Herco R-300, PVC Needle Valve gooseneck dispenser assemblies.

Gas turrets on benches must be epoxy coated.

Unless required otherwise, allow one outlet of each service per person or workstation.

12.7 Identification of Pipework

All pipes must be identified in accordance with Australian Standard AS1345 - Identification of the Contents of Pipes, Conduits and Ducts; and AS1318 - Industrial Safety Colour Code and AS2700 - Colour Standards for General Purposes.

It is essential that different laboratory water supplies are specifically labelled to match the contained fluid to prevent cross-connections. Labelling must be provided at no more than 3m centres in concealed as well as exposed locations.

The ground colour must be applied to the full length of the pipeline where exposed and to a length of not less than 300mm in other areas where the ground colour must be used in conjunction with adhesive labels for identification. The location of identification marking must be at intervals of not more than 3m and adjacent to branches, junctions, valves, both sides of walls and control points. Such markings must be placed so that they are easily seen from all approaches.

Safety colours where applied must be over a length of not less than 75mm at locations and intervals as nominated for ground colours. Ground colours used in conjunction with safety colours must be applied to each side of the safety colour.

The direction of the flow must be indicated by an arrow adjacent each colour band. 'Safetyman' adhesive labels must be used for identification and indication of the direction of flow of pipework.

12.8 Floor Penetrations

Floor penetrations for groups of pipes in wet areas must have a cast concrete upstand or bund. In all locations metal pipes must be sleeved. The sleeve must be copper, standing 30mm above the finished floor. Appropriate fire ratings must be maintained by the use of fire collars and caulking where PVC pipes are used.

Where a group of pipes penetrate the floor, it is preferable to create a concrete upstand around the group of penetrations with appropriate fire rating.

12.9 Underground Pipework

All underground pipework must have a minimum of 600mm cover to topmost surface of pipe or pipes. Pipes must be installed in sand with a minimum of 75mm sand below, and 150mm sand above and to side of pipe. Pipes must be laid side by side and not one above the other. Pipes laid in the same trench as electrical or data conduits must be separated in accordance with the minimum requirements of AS3000 and AS3500.

All underground pipework must be identified by laying continuous PVC marker tape not less than 300mm above the pipe. The marker tape must be colour coded and be printed with the identification of the pipe contents. Include in all marker tape a recovery wire to allow detection by an electro-magnetic pipe locating device.

Trenches must be backfilled only with selected fill and compacted in layers not exceeding 200mm to a relative density of 90% in other than pavements and 95% in roads and sealed pavements.

All valves must be accessible in concrete pits which must all be drained. All bolts, washers, etc. must be stainless steel. Thrust brackets in pits must be hot dipped galvanised. Pipes must be sleeved where they pass through the pit wall.

All underground services are to be identified on the surface to the approval of FMO/PMO.

12.10 Pumps

12.10.1 General

Provide pumps to suit the expected maximum daily duty and do not oversize in case of future or spurious unsubstantiated requirements. Use multiple variable speed drive "smart" pumping installations and provide space for additional pumps for future additional loads. Select pumps to provide high efficiency at normal operating conditions and fit pumps with High Efficiency motors to minimise energy consumption. All pumps in a pump set shall be pre-assembled and installed on a common base-plate with integral electronic controls mounted on each individual pump.

12.10.2 Cold Water Booster Pumps

Where booster pumps are provided on the incoming water supply, design pumps to provide maximum design flows and pressures at normal water main pressures. Do not use the supply authority's guaranteed minimum pressure to select the pump, otherwise the pump will be oversized for normal duty.

Where the pumping installation serves total building pressure requirements, provide a triple-pump installation on a single base, designed to allow the full load to the spread across any two pumps controlled electronically by a Hydrovar or equal controller mounted on each pump and interlinked to provide a fully automatically driven and controlled system with 150% total capacity. Size each pump for 50% of the load at the required pressure. Provide a signal terminal out from the pump fail signal to connect to the BMS.

The programmable logic controller shall be able to be interrogated for the at least the following parameters: Hours-run, flow rate, current discharge pressure, set pressure, fault record and type of fault.

Glycerine-filled pressure gauges with a nominal 75mm diameter face of the bourdon-tube type complete with an isolation cock must be provided on each side of the pumps. Pumps must be controlled by discharge system pressure.

Stop pumps on low inlet pressure to protect pump from dry running with automatic re-start once supply pressure is reinstated. Shut down pumps in the event of a 'broken pipe' high flow situation.

Connect each pump to the Building Management System.

12.10.3 Hot Water Pumps

Hot water circulating pumps must be provided in hot water loops to minimise dead legs, where a central system is installed.

The hot water circulating pump must be installed in the return water loop. Care must be taken to ensure that pressure in the hot water circuit is not greater than the pressure in the cold water main. Pumps must be of the Grundfos 'in line' type with totally enclosed single phase motor. Pump casings must be bronze with bronze impellers and mechanical seals. Open motors are not acceptable. Hot water circulating pumps must be controlled by the Building Management System (BMS) for hours of operation. 240V contactors must be provided on the pump control panel for the purpose. Control via the BMS must be 24V a.c.

12.11 Tanks

Storage tanks other than those associated with hot water systems shall be manufactured from either of the following materials: Grade 316 Stainless Steel, polyethylene, copper or reinforced concrete appropriate to the duty. Minimum tank size must 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 of 2000 litres capacity. Tanks shall be provided with at least two access openings with appropriate ladder access and space for testing. All tanks must be fitted with strainer and water meter to the inlet.

Overflows shall be sized to the requirements of the supply authority, but not less than those set out in AS3500 to take the maximum inlet flows assuming an open inlet valve orifice. Drains to waste and non-corrosive safety trays must be provided to all tanks and tanks must be mounted within the tray in accordance with AS3500.1.

All tanks must be provided with high, low and extra low level alarms. Float switches shall be of 'Mobrey' or approved equal). In addition, a pressure switch must be provided to sound an alarm should the system pressure fail. Both tank and pressure alarms are to be connected via a Data Gathering Panel to the BMS, when installed (see Subsection 12.12 - Water Meters, below). Pressure pumps must be de-energised when the extra low level alarm is activated or loss of suction occurs.

12.12 Water Meters

Provide water meters to the following systems, as deemed appropriate:

- Cold water supply to building (Normally provided by supply authority)
- Cold water supply to water storage tanks
- Cold water supply to hot water systems
- Cold water supply sub-meters to high water demand users such as: food outlets, laboratories, cooling towers, Reverse Osmosis units, cooling water systems, banks of ablutions such as toilets, showers, etc.
- Any high demand activities with design water usage of 20% of the domestic component of the building demand.

Water meters shall be Elster pulse type PSM or other approved equivalent meters.. Communication links to the UTS Metering systems must be installed either wirelessly or wired. The communication protocol must satisfy the UTS Metering system's currently adopted protocols of - ModBus or native BacNet. The system should be commissioned to read live data of the meter at the metering head end in litres or kilolitres, flow rates in litres per sec, The meter register reading in litres or kilolitres need to be recorded at the head end with a facility to synchronise at a later date if needed.

12.13 UTS Metering System or UTS Building Management System (BMS) Alarm and Control Points

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

- Cold water tank - high, low and extra low level alarms
- Demineralised water tank - high and low alarms
- Booster pump(s) alarms - failure and low pressure
- Compressed air alarms (option) - compressor overload
  - low oil pressure
  - low air pressure
- Hot water circulating pumps (option) - failure
- Hot water temperature (option) - analogue point

12.14 Inspection and Testing

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

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

12.15 Test Pressures

Tests for the adequacy of any reticulation design and installation must include the following:

- All pipework must be tested to a minimum of twice working pressure for twenty-four (24) hours where no other testing standard exists.
- Water supply pipelines including Fire Mains and Services: 2.1 Mpa for twelve (12) hours and generally kept charged thereafter.
- Fire Hydrants and Hose Reels must be tested for pressure of flow as required by the relevant code. Such tests to be witnessed by the Hydraulic Engineer.
- Fixtures to be filled to spill level with water after installation and visually checked for leaks.
- Pipework for gases must be tested in accordance with the relevant code or standard or twice the working pressure, whichever is greater.

12.16 As-Built Drawings

Copies of all shop drawings and as-built drawings are to be provided to UTS at Practical Completion by the Contractor. The as-built drawings are to be provided in accordance with the UTS Facilities Management Unit CAD Drawing Standards and to be a format fully compatible with the UTS CAD Record Keeping System. An electronic copy on CD is also required.

12.17 Pipework Schedule

Default requirement for piping materials. Consultants to specify materials to suit the particular application.

Service	Piping Material	Grade	SAA Standard	Comments
Hot and Cold Water	Copper	Type B	AS1432 (pipe) AS3688 (fittings)	
Hot and Cold Water (Laboratories)	Copper	Type B	AS1432 (pipe) AS3688 (fittings)	Provide break tank system
Compressed Air	Copper	Type B	AS1432 (pipe) AS3688 (fittings)	
Natural Gas	Copper	Type B	AS1432 (pipe) AS3688 (fittings)	
RO (reverse osmosis)	PB		AS3518	
Demineralised and Distilled Water	PB		AS/NZS1477	
Laboratory gases	To suit service			

13 AIR CONDITIONING AND VENTILATION

13.1 General

This section of the Guidelines outlines the University's minimum requirements for air conditioning and ventilation. The Section must be read in conjunction with Section 27 Building Management Systems (BMS). Other relevant Sections that should be read in conjunction with this Section are: Section 22 - Special Requirements, Section 23 – Audio Visual Services, Section 25 Environmental sustainability and Section 29 Energy Monitoring System (EMS) where applicable.

All air conditioning systems must be designed to meet the requirements of AS/NZS 1668:1 and1668:2, , the AS/NZS 3666 series, the Building Code of Australia energy efficiency requirements in Section J, and any other applicable Standard, Regulation or Act.

Where work on existing systems is to be undertaken, all work should comply with the latest version of the applicable codes and standards.

The University has a diversity of air conditioning systems in place throughout its Campuses and does not wish to limit the Consultant's choice of system selection. Each system design should be placed in the context of the existing systems within the building, the scale of the new proposal or upgrade project proposal, and the University's master planning requirements. System selection should only be undertaken following consideration of all these factors and after discussion with Building Services, FMU, who are able to advise on the current condition of the existing services, any new plant proposals and master planning requirements.

Consultants are to advise if modifications to existing plant cannot achieve compliance with current codes or standards. However any new electrical equipment installed which is covered by minimum energy performance standards should exceed the minimum standard by at least 10%.

It is essential that the consultant examine any air conditioning system either within or adjacent to the area of the proposed works and assess the suitability and functionality of these systems for extension, or modification, or to determine if supplementary plant is required. To this end, testing of existing systems may need to be undertaken at the design stage to determine actual system performance. Any proposed upgrades must be in line with the master planning scenario of the building in question.

The consultant is reminded of the fact that this document is a guideline only and it is recognised that it will not cover every circumstance or eventuality. Consultants are expected to use sound engineering judgement in developing appropriate solutions and should keep UTS informed of any departures from these guidelines.

13.2 Cooling Systems

Air conditioning should normally be provided by the use of large air-handling units or small fan coil units using chilled water fed from either the City Campus Main Central Plant located in Building 1 or the respective building's own central chilled water plant Additional self-contained chiller plant may be required in particular situations, backed up by the Central Chiller Plant. Heating hot water would also be either provided by the City Campus Main Central Boiler Plant located in Building 1 or the respective building's own boiler plant. Where considered cost effective on a life cycle cost basis for smaller installations, electric duct heater may be considered.

As a general principle, where practical and cost effective, the preferred method of air conditioning is by extension of the existing chilled water systems. Where large projects are contemplated and the central chilled water system has insufficient capacity to cater for the increase load, consideration should be given to upgrading the capacity of the existing system central chilled water system. Where the project is remotely located from these systems, consideration should be given to the provision of a localised chilled water system. The preferred method of heat rejection is air cooled for smaller plant, however for large systems cooling towers may be contemplated provided that the cooling towers can be suitably located to avoid cross contamination of cooling tower discharges with outside air intake or areas accessible by staff or the general public.

The use of direct-expansion (DX) refrigeration systems is discouraged unless it can be demonstrated that it is not practical or cost effective to connect to the central chilled water system. Consideration should be given to the use of dx systems for areas requiring air conditioning 24/7 where significant energy savings can be made when the rest of the building can be shut down over night. The use of Variable Refrigerant Volume systems should also be considered in such circumstances, however consideration should be given as to how the system components can be isolation under failure of components. For areas requiring 24/7 consideration should be given to the used of chilled water for normal hours of operation with a separate dx system for out of hours operation.

The use of direct expansion window mounted or through the wall room air conditioners (RACs) is prohibited, except in unusual circumstances.

13.3 Air Handling Systems

Air handling systems should be selected to address a number of apparently conflicting design criteria, with a strong preference for the solution that offers the least life cycle cost, i.e. capital, running and maintenance

costs. Note that the University has set targets in relation to GHG emissions and actively supports designs that will reduce GHG. The design will be influenced by such factors as zoning, the configuration of like spaces, space occupancy and usage patterns, air conditioning zoning and control issues, ease and practicality of maintenance and maintenance access requirements. The Consultant's attention is drawn to the requirements of the Work Health and Safety Act 2011 and enabling Regulations and must ensure all issues as "Working at Height", "Confined Spaces" and "Electrical Safety" are fully addressed in any design solution proposed and where possible are engineered out of the design. All designs submitted shall demonstrate safe access and service requirements for maintenance.

Plant located in ceiling spaces generally should be avoided due to Work Health and Safety access issues for future maintenance and the disruption caused to occupied spaces for routine servicing, breakdown maintenance, particularly where components or units are required to be replaced. FCUs should be located in cupboard areas adjacent to the occupied space, preferable with access from the rear in corridor areas to avoid any disturbance to the space when undertaking routine inspection and maintenance. It is recognised however that occasionally circumstances may dictate that some minor plant is required to be installed in ceiling spaces. Where plant is located in ceiling spaces, the consultant shall ensure that noise levels generated from the FCU complies with the appropriate noise criteria set for the room, taking into account ceiling construction etc.

All FCUs shall be drained directly to waste via a tundish. Slabs should be core drilled as necessary in order to provide appropriate falls and to access appropriate waste pipes. The use of condensate pumps in FCUs is not permitted.

All air-handling systems must have adequate fresh air drawn from outside the building via ductwork at locations well away from discharges from cooling towers, fume exhausts or traffic.

13.4 Design Criteria

13.4.1 General

Careful consideration should be given to the design conditions for various areas. Design Consultants are expressly advised to fully acquaint themselves with the location and any other factors which may impact on either design assumptions or performance of the system. It is the Consultant's responsibility to ensure that efficient installations are designed for particular locations.

It is also the Consultant's responsibility to establish acceptable performance criteria for each project at an early stage. Final recommendation regarding design criteria and system performance must be approved and signed off by the FMU Project Manager prior to finalization of any system design and cost estimate. The design solution should be justified on a life cycle basis that incorporates capital maintenance and running costs, while taking into account the University's need for operational flexibility and the University's commitment to reducing Greenhouse Gases (GHGs)

13.4.2 Conditions

Unless specifically otherwise requested, the air conditioning plant must be designed to satisfy the following criteria under the most adverse combination of external solar loading and the following conditions:

External Design Conditions

	Comfort	**Critical**
Summer:	34°C DB, 23°C WB	36.1°CDB/24°C WB
Winter:	6.3°C DB	6.3°C DB

Internal Design Conditions

Summer:	23°C DB +/- 1.5°C 55% RH nominal
Winter:	22.5°C +/- 1.5°C

Internal conditions are subject to FMU brief requirements and/or consultant back brief requirements.

The consultant must liaise with the FMU during the design period regarding the thermal zoning arrangements.

Humidity Control

Humidity control will not be provided unless specifically called for or where special circumstances dictate. Where special conditions are required these will be nominated by the user and agreed to by the Director, FMU.

13.4.3 Operation

The University has a variety of operating hours across its sites. The consultant shall verify with the Project Manager the intended hours of operation for each plant. The design of the systems

shall be such as to minimise the energy impact of any 24 hour systems to avoid having to run plant in adjacent areas or the entire building for extended operating hours.

13.4.4 Population Densities

Unless otherwise indicated in the Project Brief, or as clarified through the design development phase, population densities can be taken to be approximately equal to those shown below:

- General Office 5.0 m^2/person
- Library Reading Rooms 2.5 m^2/person
- Laboratory - Undergraduate (1st year) 3.7 m^2/person
- Laboratory - Undergraduate (other years) 4.7 m^2/person
- Laboratory - Postgraduate 12.0 m^2/person
- Flat Floor Teaching Rooms 1.8 m^2/person
- Lecture Theatres 1.1 m^2/person

Refer to Subsection 3.3 - Space Standards for additional details.

Submit details of population densities used in design criteria for approval by the FMU project manager prior to finalization of system design.

13.4.5 Chilled Water Temperatures

The anticipated supply and return water temperatures must be clarified by the Design Consultant and approved by UTS at an early stage of the design process. The Consultant's attention is drawn to the fact that floating of chilled water supply temperatures to higher temperatures may occur during winter to reduce chiller running currents. If it is proposed to run critical plant systems from the central chiller plant this should be bought to the attention of Building Services to ensure the proposed design is not impacted by chilled water temperature reset.

13.4.6 Noise and Vibration Control

The system must be designed to minimise the transmission of noise and vibration from air conditioning and mechanical equipment. Sound attenuators and/or insulated ductwork must be installed where necessary to minimise the transmission of fan noise.

Balancing dampers shall be provided at all flexible duct take offs to ensure only final trimming of air flows is required at the air outlet thus preventing regenerated air noise.

Consideration should be given to additional acoustic treatment such as attenuated spigots or acoustic enclosures etc. where plant (e.g. fan coil units) is located within ceiling space or in close proximity to occupied spaces. FCU noise break-out and ceiling construction should also be considered.

Care must be taken to minimise transmission of vibration to the structure from mechanical equipment. Reciprocating or rotating equipment must be isolated from the structure by vibration isolators. Reciprocating or rotating equipment must be mounted on suitable inertia bases where excessive vibratory forces exist in relation to the supporting structure or to limit excessive movement due to start up of the equipment.

Refer also to Clause 3.7.2 - Ambient Sound Levels and Subsection 3.8 - Vibration Controls.

13.5 Piping, Valves and Fittings

The piping, valves and fittings should include the following design and performance features:

- Chilled water and condenser water lines within buildings should generally be of Type B Copper. All chilled water pipework within occupied spaces in the building must be run in service ducts, risers or ceiling spaces and must be adequately insulated.
- Main distribution pipework must be capable of handling an increase of 20% in water quantity, and pumps and motors should be selected with this in mind. To this end, pipe velocities shall initially be limited to the following:

  Main risers: 1.0 – 1.8m/sec
  Main distribution: 1.0 - 1.8m/sec
  Headers: 0.9 – 1.5m/sec
- All valves and fittings laid in-ground must be in drained pits and must have stainless steel bolts and washers. Transition from one material to another should be made adjacent to the buildings in a pit which is always readily accessible.
- All designs shall in incorporate an appropriate level of balancing valves to ensure systems can be effectively balanced without the need to use isolating valves such as gate valves or butterfly valves as throttling valves. Where throttling is required, valves similar to STA-T or equal shall be specified. Selection of pumps must be rated to the appropriate duty and impellers correctly sized for the duty with requiring unnecessary throttling.
- STAT Valves must be installed on the return mains, sub mains and risers.

- No automatic three way valves are to be used in chilled water distribution systems as by passes for air handling units or fan coil units.
- All motorised control valves must be spring-return and must be rated to resist the system pressure when shut.
- All valves in insulated pipework must have extended shafts to accommodate complete insulation.
- All valves must be labelled for their service and function.
- Incoming mains and main distribution pipes must be of a size adequate to permit future air conditioning of the whole building where this is not done initially. The extent of pipework master planning should be verified with the UTS Project Manager at the design development stage.
- All headers are to be provided with at least one spare flanged and valved connection for future use.
- Where pipes pass through floors or walls, sleeves must be specified and filled with appropriate insulation or fire-rated material to suit the application.
- All equipment, valves and fittings which are located in ceiling spaces and are subject to sweating must be insulated and fitted with a stainless steel safety tray.
- All pipe risers must be provided with dirt legs and drains at the bottom. Dirt legs and drain valves shall be minimum 65mm diameter. Drains are to be fitted with a hose cock. Each level of pipework must be isolated and provided with drains at the lowest point of each branch and at the riser. Automatic air bleeds must be provided at the highest point of any piping system. Typical locations should be indicated on the design drawings.
- All screwed valves and fittings must have unions for easy removal without the cutting of pipework.
- Test plugs similar to 'Binder' must be fitted in all chilled water and condenser water headers and to flow and return lines at all air-handling units, fan coil units and pumps, and must extend a minimum of 15mm beyond the outside surface of the insulation. ‘Binder’ plugs must be located next to a pressure/temperature DDC point.
- Suitably sized sensor wells must be installed in the supply and return chilled water lines to each building to allow for insertion of temperature sensors for energy monitoring via the BMS.
- On completion, all pipework must be tested, chemically cleaned, flushed and drained. Chemicals for dosing of water systems must be identical to those currently in use by the University.

Refer also Section 12 - Piped Services and Storage Tanks.

13.6 Ductwork and Registers

The following requirements should be addressed in the preparation of the design and specifications:

- Low velocity systems are preferred. Ductwork must be designed to limit air velocities to a maximum of 6 m/s unless approved otherwise. Main riser ducts must be capable of handling an increase of 15% in air quantity, and fans and motors should be selected with this in mind. In general office areas, ductwork systems should enable subdivision of 40% of the net useable space into single offices of not less than $10m^2$, i.e. numerous smaller air outlets should be provided, as opposed to fewer larger outlets.
- Ductwork must be constructed and installed in accordance with AS4254 Ductwork for Air Handling in Buildings and supplemented where appropriate with the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) HVAC Duct Construction Standard, Metal and Flexible, unless otherwise specified.
- Lockable quadrant single or multi-blade dampers must be provided for volume control at each flexible duct take off. Provide dampers also at supply air diffusers for trimming purposes only.
- Push / pull (splitter dampers) must not be used.
- Unlined rigid fibreglass board ductwork and fibreglass insulation must not be used. Ductwork insulation must be external wherever possible except for acoustics and where exposed to view. Where ductwork and equipment has internal insulation, it must be lined with perforated reflective foil or perforated metal so as not to expose the insulation directly to the air stream.
- To allow duct cleaning, provide duct access panels in the risers at each floor and in each branch or sub-branch. Duct access panels must be not more than 10 metres apart of minimum size 300 x 200mm. Where access panels are located above ceilings, they must be coordinated with the ceiling grid, light fittings and equipment layout.
- Ceiling registers must have retained removable cores. The interior of ductwork behind registers must be painted black.
- Wall registers must be of the adjustable blade type with the front set of blades horizontal.
- Linear slot air diffusers are not permitted to be used in offices, meeting rooms, classrooms and other such spaces where comfort conditions are required due to down drafts created by these installations.

Linear slot diffusers are only permitted in corridors and other areas where occupant comfort is not a major consideration.

- Exhaust grilles must be removable aluminium egg-crate.
- Plenum ceilings for supply air must not be used.
- Ductwork penetrations to walls and floors must be packed with appropriate insulation or fire-rated material to suit the application and must be flanged on both sides of the penetration. No ductwork is to be concreted into wall openings.
- Where considered necessary because of dirty atmosphere or length of intake duct, outside air intakes must be provided with easily removable dry media filters to pre-filter the air before it enters the unit(s). All grilles are to be provided with vermin proof screens, removable for cleaning purposes.

13.7 Insulation to Chilled Water Pipework

The following requirements should be addressed in the preparation of the design and specifications:

- All chilled water pipework must be insulated with sectional, preformed, polystyrene and/or 'Foamglas' cellular glass insulation in accordance with AS1366, complete with vapour seals. Mineral wool or fibreglass insulation must not be used.
- All hot piping carrying heating, warm and hot water and piping hazardous to personnel, including blow down piping, must be insulated with mineral wool or glasswool, resin-bonded to form tubular sections.
- Insulation for valves, flanges and fittings must be arranged for easy removal for maintenance purposes and must have hinged and clipped (not screw fixed) casings. Snap-on insulation as marketed by Tour and Anderson is acceptable for valve insulation.
- At hangers, provide hardwood insulation blocks except for pipes up to 25mm diameter where zinc annealed saddles may be used.
- All insulated pipework exposed outdoors and insulated pipework in plant rooms and walk-in risers and ducts up to a minimum height of 2700mm, and where exposed to view including in plant rooms, must be metal sheathed.
- Condensate drains must be continuously insulated with approved elastomeric closed cell insulation equivalent to ‘Armaflex’.
- All chilled water pipes buried in the ground must be ‘Insapipe’ or approved equivalent.

13.8 Plant and Equipment

13.8.1 Centrifugal Pumps

Close coupled pumps must not be used. 50mm and over suction must be ‘end-suction, back pull-out’ type, from a reputable supplier. Pump materials must be selected for the particular service. The default selection is cast iron casings, bronze impellers and stainless steel shafts. All seals must be mechanical type. Select pump impellers so that their size is not greater than 90% of the size of the largest impeller the casing can accommodate. .

13.8.2 Motors and Drives

Motors must be totally enclosed fan cooled high efficiency and normally be limited to 1450 rpm maximum. Motors to packaged air handling units must be mounted external to the conditioner casing. Motors rated at more than 10kW must be provided with a lifting eye.

13.8.3 Heater Banks

Heater banks may be electric where hot water is not available. Hot water heating coils are preferred if life cycle cost demonstrates value and the impact of the potential for undetected heating hot water leakage occurring at hot water valves with cooling coils are in series, has been considered. Heater banks in ductwork should preferably be located in plant rooms and must be clearly identified on the ductwork.

Heater banks in fan coil units must be of the low surface temperature type to the full extent of the air outlet.

The electric heater must have a minimum air flow switch and two high – temperature limit sensors, one with manual reset to interrupt all current to the heater in case other control devices fail and one with automatic reset to turn off the control circuit on high limit.

13.8.4 Air Filters

The following requirements should be addressed in the preparation of the design and specifications:

- The following is a guide to the type of filters to be specified:

Built-up air-handling units	-	Extended surface deep bed type
Unitary fan coil units	-	Panel filter type
Grease filters	-	Aluminium honeycomb type.

- Dry media filters must be of the disposable type. In areas where high efficiency filtration is warranted, such as in Libraries, electrostatic filters should be considered.
- All large filter banks must be provided with manometers to measure the differential pressure across the filters. The manometers must be mounted in an easily accessible, visible location and must be either Dwyer Mk II Model M700Pa or Magnehelic Gauge Cat. No. 2000-250Pa. The reading when filters are new and expired must be clearly marked.

13.8.5 Chiller Installations

Additional chiller installations should be compatible with existing if paralleled together.

13.8.6 Cooling Towers

For small installations UTS has a preference for air cooled condensers. Where cooling towers are approved by UTS, they must be stainless steel or fibreglass. Cooling towers shall be sited to avoid any cross contamination between cooling tower discharges and air intakes and/or occupied areas.

Towers must comply with all relevant codes, standards, Acts and regulations. Provision must be made for cleaning internal wet areas. Fixed access ladders and guarded platforms must be provided on all cooling towers to provide safe maintenance access to all areas of the tower, i.e. fan motors etc. Care is to be taken in the design to eliminate the possibility of introducing Legionnaire's Disease as far as possible.

13.8.7 Air Cooled Condensers

Air cooled condensers should preferably be of the vertical air flow type. Where multiple compressors are installed, each compressor must be capable of being individually isolated for maintenance.

13.8.8 Belts and Pulleys

All belt-driven equipment must have a minimum of two vee belts. All equipment pulleys must be equivalent to SPZ Taper lock

Belts and pulleys must be protected by the use of easily removable and replaceable guards.

13.8.9 Air Handling Units (Packaged Type)

Air handling units must be double skinned insulated sandwich panel construction (preferably modular type) designed for easy, safe access to all equipment.

13.8.10 Air Coils

Maximum Face Velocity:

Cooling coils:	2.25m/s
Heating coils:	3.5m/s

Provide individual stainless steel drip trays at each cooling coil section, connected to a main drain.

For coils in ceiling or concealed spaces, provide access panels for inspection and maintenance, suitably labelled.

13.8.11 Equipment Location

All equipment such as air handling plant, fans, outside air fans, pumps, switchboards, etc. must be located in easily accessible adequately sized plant rooms. All equipment is to be located so that fan shafts can be removed/replaced without moving fans or demolishing buildings. Clearances around the mechanical switchboards shall comply with AS3000.

13.8.12 Air Conditioning Electrical System

The following requirements should be addressed in the preparation of the design and specifications:

- Switchboards and Motor Control Centres must normally be of type tested construction with IP rating approved by FMU prior to tendering.
- Permanent, clearly legible traffolyte labels must be screw fixed to all internal and external controls. All labels in switchboards must be mounted on stand-off brackets and must not be surface-fixed to the back plate of the board.
- Provision for fire mode operation must be provided in accordance with the requirements of AS/NZS 1668 and AS1670 AMDT as applicable.

- Buildings designed as not being fully air conditioned must be provided with a minimum of 30% spare space and capacity in all switchboards, sub-boards and control panels to allow for future expansion of the air conditioning system. This spare capacity also applies to the switchboard feeder cables. Fully air conditioned buildings must have 20% spare capacity.
- Trays must be clearly labelled as to their contents.
- Hours-run meters must be provided on all items of equipment which are duplicated or run in parallel, and where else considered necessary.
- Polyphase kilowatt-hour meters must be provided to the air conditioning switchboard to meter the power consumption. This meter may be located on the main electrical switchboard and grouped with all other meters, suitably labelled. Make provision for linking the meters to an Energy Management System..
- All cables must be run on cable ladders and terminated in terminal strips. Cables must be identified by numbered ferrules at each termination, including field terminations. All cables entering switchboards, control panels etc which are part of a multi-core cable, and any other cable which is unused, must enter the switchboard through a gland nut and be terminated on a terminal block, labelled as to its origin and numbered. All neutral and control wiring must also be number ferruled both in the switchboard and at field terminations. Wrap around tape numbering systems are not acceptable to FMU.
- Indicate cable tray runs on design drawings where co-ordination of building services is critical.
- Heater banks must be controlled by BMS via an Auto/Off/Manual switch irrespective of air conditioning controls. Facility for energy load shedding via the BMS must also be provided. Heater banks must be provided with fault indication to BMS.
  SCR controls to heater banks will be favourably considered as an alternative to contactor controls.
- Electrical drawings must be prepared with Circuit Reference Numbers to indicate the number of contacts and their location to IS Standard on an approved drawing.
- A GPO and single 20W fluorescent lamp must be provided in each switchboard or control cupboard.
- The Auto/Off/Manual control to fan coil units (FCUs) must isolate all components including all controls to heaters and chilled water when in the ‘Off’ position, and must enable all controls when in the ‘Auto’ or ‘Manual’ positions. Air handling units must be controlled from the switchboard via an Auto/Off/Manual switch which when in the ‘Auto’ position, enables the operation of the unit by the BMS. Pumps must be similarly controlled. Fan coil units located in Faculty offices must be controlled by a proprietary room controller.
- The earth and neutral bar must be sized to accommodate separately all earth and neutral cables. Multi-joining of cables prior to termination on bars is not acceptable.
- On all projects with a connected air conditioning electrical load in excess of 50kW, all air conditioning switchboards must be checked by the contractor prior to the expiration of the defects liability period using a Thermoscan unit or similar. Any defects found must be rectified and a complete report including thermal photographs must be supplied prior to the Certificate of Practical Completion being granted.
- All mechanical switchboards must have a lamp test facility incorporated into the control system.
- All mechanical boards with DDC control must have the low voltage and DDC controls mounted on the right-hand side of the board while the 240V/415V equipment must be mounted on the left-hand side. Separate DDC boards will be accepted.
- All DDC cables must be screened and not run adjacent to any 240V electrical cables.
- Separate ducting must be provided within the switchboard to separate Direct Digital Control (DDC) and power cables.
- All mechanical switchboards, Air Handling Units (AHUs) and Fan Coil Units (FCUs) are to be numbered consecutively from the lowest level upwards.

13.9 Identification of Equipment

All items of equipment, both in plant rooms and in the field, must be suitably identified with traffolyte labels of an approved size and type. Thermometer bulbs, pressure gauge tapings and remote sensing points must be similarly labelled to indicate their function.

Labelling of all plant and equipment shall comply with UTS plant labelling requirement.

13.10 Identification of Pipework

All pipes must be identified in accordance with AS1345 - Identification of the Contents of Piping, Conduits and Ducts, and AS1318 - SAA Industrial Accident Prevention Signage. ‘Safetyman’ adhesive labels are an acceptable method for identification of pipework. Flow direction arrows must be provided to all pipework, together with labels stating pipework contents and flow direction (e.g. 'Chilled Water Flow'). All exposed pipework in plant rooms and risers and walk-in ducts must be colour banded in accordance with the UTS Colour Schedule (refer Section 19 - Colour Schedule for Plant and Equipment). Colour standards must be in accordance with AS2700.

13.11 Future Air Conditioning

All buildings are to be designed to have the capacity to allow for extension of air conditioning throughout the building. All chilled water pipe systems must be designed to have 20% spare capacity throughout.

13.12 Air Conditioning Control Systems & Building Management System (BMS)

The University's buildings on all campuses are controlled and monitored through a BMS system. A number of BMS systems currently exist on site. Consultants should integrate any refurbishment proposed with the existing systems

The following Systems are currently in use:

Building 1: Reliable Controls

Building 2: Reliable Controls

Building 3: Reliable Controls

Building 4: Johnson Controls

Building 5: Reliable Controls & some Johnson Controls

Building 6: Reliable Controls

Building 7: Honeywell Controls

Building 8: Control Works

Building 10: Johnson Controls

Building 11: Alerton Controls

For full details of the requirements for BMS and air conditioning refer to Section 27 of these Design Guidelines.

14 FUME EXHAUST AND FUME CUPBOARDS

14.1 General

The fume cupboard installation and associated services must conform to the requirements of AS/NZS 2243.8 - Safety in Laboratories, Fume Cupboards, AS/NZS 2243.8S - Laboratory Construction, AS2982 - Classification of Hazardous Areas, Specific Occupancies, and the current Workplace Health and Safety Regulations.

The fume cupboard design & specification is to be coordinated with the overall mechanical systems for the room [or lab/floor] in the building which contains the fume cupboard. This to minimise problems in commissioning the air balancing within the overall room, achieving/maintaining negative room pressures.

The requirements of this section relate to fume cupboards intended for general chemical use. It is essential that all fume exhausts and cupboards be designed to suit the specific need of the Users. It is the Consultant's responsibility to clarify the exact performance criteria applicable and to specify the systems in accordance with the requirements of the end User.

14.2 Fume Cupboard Design

Fume cupboards must be single-entry, of proprietary manufacture, and supported by NATA certified laboratory performance test results. Cupboards must have characteristics set out in a Data Schedule in the specification (refer Subsection 14.8).

Ensure that the gap above the fume cupboard is fully enclosed to conceal ductwork and other services and provided with an access panel as required for servicing of concealed equipment. Include the enclosure either in the mechanical services, scope of cupboard supply, or ensure it is specified by other trades as appropriate.

The design of the fume cupboard shall ensure that condensation inside the cupboard or in the ductwork drains to waste.

The design of the fume cupboard shall incorporate baffles in accordance with AS2243.8.

Ensure that the fume cupboard is specified with the following features. Access to the fume cupboard shall be via a single door with the following requirements:

- of 6mm thick armour plate glass stamped by the manufacturer and with the SAA approval stamp.
- slide vertically and be carefully balanced by a lead counterweight using stainless steel cables and low friction pulleys to ensure even and easy operation.
- closure cushions installed at the bottom of the track to ensure a 50mm minimum opening.
- a sash height limiting device to limit the operator opening to 500mm.
- limiting device to be cushioned and able to be over-ridden by the operator to enable access for large apparatus within the cupboard.
- a curved lower edge section to ensure smooth airflow into the cupboard, and doubling as a handle for raising and lowering.

The floor of the fume cupboard must be covered with hard-wearing acid and heat resistant unglazed ceramic tiles. The tiles must be returned at least 300mm up on the sides where possible. All corners must have rounded tiles to ensure easy cleaning. (Default requirement: Specify actual requirements in Data Schedule).

The fume cupboard must include a sump with a minimum depth of 10mm. The sill must include a wide sloping 'lip' at the front to drain back to the sump and to inhibit the loss of spilt fluid out of the door opening, while avoiding disruption of the airflow. The sump must hold a minimum of five (5) litres of spilt fluid. Where a removable flat working surface is incorporated, it must be mounted on moulded mounting pads to position the working surface so that a space exists all around to allow runoff of any spill into the sump.

The fume cupboard must have as a minimum one gas, one compressed air, one vacuum, and two water service outlets and a single pot sink. Services outlets must generally be located on the inner surface of the fume cupboard with the pot sink located under the water outlets. Controls to services must be mounted on the fascia panel below the door. All outlets must be clearly identified both inside and outside the cupboard at outlets and controls with engraved plastic labels. (Default requirement: Specify actual requirements in Data Schedule).

The following signs relating to the safety in use of fume cupboards must be located on the control and alarm panel:

> WARNING
>
> THE MAXIMUM QUANTITY OF FLAMMABLE LIQUID INTRODUCED INTO THE FUME CUPBOARD AT ANY ONE TIME IS 2.0 LITRES. IN THE EVENT OF A SPILL OR FIRE, ACTIVATE THE EMERGENCY ISOLATOR. THE PLACEMENT OF ANY IGNITION SOURCE WITHIN THE SUMP IS PROHIBITED.

14.3 Exhaust System

14.3.1 Permissible Airflows

The design of the system must satisfy the following requirements with respect to velocity through the fume cupboard face, in accordance with AS2243.8

- Average face velocity must not be less than 0.5 m/s.
- Velocity at any point must not be less than 0.4 m/s.
- Velocity at any point must be no greater than 1.0 m/s.
- Airflow across the leading edges into the fume cupboard must not be turbulent.
- Airflow across the face must be laminar, i.e. the velocity over the cross section of flow must be substantially uniform, with a variation of not more than 20%.

A reserve capability of at least 20% must be designed into the extraction system to cover any loss of performance in service.

14.3.2 Noise and Vibration

The consultant must ensure that the sound pressure level within the laboratory measured at a point 1.5 metres from the fume cupboard opening, with the air-conditioning in operation, must not exceed:

NR 45 - Fume cupboard without scrubber
NR 50 - Fume cupboard with scrubber.

All equipment must be installed so as to prevent vibration.

14.3.3 Siting of Equipment

The consultant should be pro-active in the design process with regard to siting of exhaust fans and ductwork external to the building, to ensure that ducts under positive pressure are located outdoors and ensuring that equipment is accessible for maintenances purposes, Refer also to AS2243.8 Clauses 3.2.6 and 3.2.7.

14.3.4 Exhaust Fans

Note: The following is the minimum default construction for fans. The consultant is responsible for obtaining full details and quantities of chemicals to be used in fume cupboards and selecting appropriate materials for the fans.

The exhaust fan to each fume cupboard must be a single speed centrifugal type mounted on vibration isolators ideally located external to the occupied areas of the building.

The exhaust fans must be of the forward curved centrifugal type with overhung wheel, constructed of PVC and being of approved design and manufacture capable of being adjusted to run at 110% of the specified rating.

The fan casing must be fabricated entirely from heavy gauge unplasticised rigid PVC plate reinforced with welded PVC bars and angles. Fibreglass or stainless steel (316) fabrication may be submitted for consideration as an alternative.

The impeller must be of all PVC welded construction except for a stainless steel centre. Shafts are to be stainless steel.

All metal parts which may be exposed to corrosive fumes must be completely covered with PVC. The impeller centre must be extended outside the fan casing and must be fitted with a high quality plastic seal which is resistant to chemical corrosion, wear and tear.

The complete fan assembly must be of rigid 3mm thick welded PVC construction and must be dynamically balanced.

The motor/fan base must be constructed of galvanised hot dipped mild steel, spring mounted to a concrete plinth. Stainless steel nuts and bolts must be used.

Fan bearings must be of the ball or roller type with readily accessible grease points.

Fans must be belt driven with drives designed for the motor starting torque and not less than 150% of the motor rated kW. Belts must be matched sets, and a minimum of two belts must be used on each fan. Motors must be of totally enclosed fan cooled, running at not more than 24rev/s and suitable for operation on 3-phase, 415 volt, 50Hz supply. Provide belt guards on all fan drives with DZUS fasteners. Pulleys must be ‘Taperlock’.

A drain connection must be provided in the bottom of the fan casing. PVC drains must run from each fan directly into the laboratory waste system.

Exhaust air fans must be selected for an outlet velocity to comply with AS2243.8 however where optimum static efficiency can be achieved by exceeding this velocity, an alternative fan selection may be submitted for approval.

14.3.5 Ductwork

Note: The following is the minimum default construction for ductwork. The consultant is responsible for obtaining full details and quantities of chemicals to be used in fume cupboards and selecting appropriate materials for ducts.

Ductwork must be constructed from grey, pressed unplasticised PVC sheeting, heat formed to the required section. Extruded PVC pipe may also be used for circular ducting. PVC ductwork construction shall be in accordance with SMACNA.

Horizontal ductwork must be installed with a minimum fall of 1:100 back to the fume cupboard, and must be adequately supported to prevent flexing, 'drumming' or sagging.

Where welding at bends, tees, transitions etc is required, welds must be V-type, using hot air welding equipment. Welding must be in accordance with AS1477 Part 5.

Sampling points must be provided in each exhaust duct on the discharge side of the fan to enable air flows to be measured. Provision should also be made for isolation dampers below the exhaust fan with interlocked micro switches to facilitate fan maintenance. Access openings must be provided in the ductwork at each change in direction and in straight lengths at not more than 5m spacings. Access openings must not be installed in the invert of horizontal ducting.

Discharge ducts external to the building must be of 316 stainless steel adequately braced and must comply with AS2243.8 for height above roof and discharge velocity. Fire protection must be provided to all slab penetrations. (Default requirement: Consultant should be pro-active in the design process with regard to locating ducts in fire rated shafts).

14.3.6 Exhaust Fume Scrubbing

Fume cupboard discharges need to be assessed to determine the filtration and scrubbing requirements to meet the EPA and User requirements, considering both gaseous and particulate discharges. The proposed method must be acceptable to and approved by applicable Authorities and UTS.

14.4 Air Conditioned Make-up Air Supply

Unless otherwise advised, the method of ensuring air balance in laboratories with fume cupboards shall be:

- additional make-up air is required to the laboratory during the operation of the fume cupboards.
- the quantity of air conditioned air make-up must be proportioned to the number of cupboards operating and to the requirements of AS2243.8.
- one approach for achieving variation in the make-up air is by measuring the face velocity at each cupboard opening, and via an electronic control system, increase/decrease the speed of the supply air fan, together with an adjustment to the blade position of the outside air damper, to vary air flow.

14.5 Electrical

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

Note: Electrical supplies can be from electrical distribution boards. Consultant should liaise with UTS to determine the preferred arrangement for power supplies to fume cupboards and associated fans.

Provide a minimum of two double general purpose outlets (GPOs) mounted as low as possible on the front fascia above the fume cupboard opening. Each GPO must be red in colour and be complete with neon indicator lamps.

Power to the GPOs on each fume cupboard must be supplied from the local electrical sub-board associated with that laboratory.

Provide an industrial type fluorescent light fitting in the cupboard above the working space to provide a lighting level in accordance with AS2243.8. The light fitting must be suitably clip fastened to the cupboard for easy tube replacement and maintenance.

14.6 Controls

Each fume cupboard system must have a flush mounted control panel mounted on the front fascia above the fume cupboard opening. This panel must consist of a white traffolyte panel engraved with black lettering containing the following:

- Emergency isolators in accordance with AS2243.8.
- ON/OFF switch controlling the exhaust fan
- One run indication light (green)
- One fault indication light (red)
- One maintenance indication light (amber)
- ON/OFF switch for fluorescent light inside fume cupboard.

- ON/OFF switches must be 10 amp rated and the indicating lights must have 23mm minimum diameter green lenses and be fitted with a 6 watt 240v Neon lamp. Incandescent SBC type indicating lamps are not acceptable.

The fluorescent lamp illuminating each fume cupboard must be interlocked with the fan so that it may only operate when the fan runs.

Each control panel must be fitted with a label which states the switchboard cubicle, control fuse number of motor control circuit.

Provide an interlock between gas supply and air flow such that gas is automatically shut off to fume cupboard(s) in the event of air flow failure.

The mode of operation must be as follows:

- operation of any one ON/OFF switch must bring on all fume cupboard fans in the room.
- run light must be energised via an alarm manometer switch located in the duct to indicate that the fume cupboard is operational.
- fault light must be interconnected with run light alarm manometer switch and fan motor contactor to indicate if a fault exists on each fume cupboard.
- to indicate malfunction of any fume cupboard system, provide audible alarm to each system, located in each fume cupboard. Isolation of the alarm must be from the switchboard isolation switches.
- a maintenance light (amber) should be provided on each fume cupboard indicating the system is down for maintenance.
- to clear fault alarm and activate the maintenance light, the fume cupboard is isolated at the fan and a maintenance switch is closed. To restart the fume cupboard after maintenance, the maintenance switch is opened.

14.7 Testing and Commissioning

The minimum requirements for testing and commissioning must be as detailed in AS2243.8 and AS2243.9 Safety in Laboratories - Part 8 - Fume Cupboards and part 9 recirculation fume cabinets.

In addition, the following must be specified:

- verification of specified discharge velocity
- verification of specified fume cupboard face velocity
- smoke tests to determine correct air flow patterns around fume cupboards
- motor running current tests
- control and safety equipment tests.

All tests are to be carried out by a technician licensed to carry out NATA testing. Tests must be carried out in the presence of the Project Manager or his representative.

14.8 Fume Cupboard Data Schedule

Suggested minimum format for consultants to specify requirements for each cupboard.

Cupb'd No.	Room Location	Nom. Size cupb'd (W x D)	Nom. Size opening (W x D)	Services*	Dischge scrub. or filters	Cupbd floor material	Notes

* For example: Acid resistant sink and drainer
Pot sink
Vacuum, natural gas, water, compressed air, helium, nitrogen
(All as required by User).

15 ELECTRICAL SERVICES

15.1 General

This section outlines the University's minimum requirements for electrical services.
The section should be read in conjunction with Subsection 2.6 - Energy Management, Section 10 - Doors, Hardware and Locks, Section 22 - Special Requirements and the remainder of the Guidelines where they are applicable. Particular attention is drawn to Section 23 - Audio Visual Services for all audiovisual installations in Lecture Theatres, Lecture Rooms, Laboratories, Conference Rooms and Meeting Rooms. Any electrical equipment installed, which is covered by minimum energy performance standards (MEPS) should exceed the minimum performance standard by at least 10%.
Note that all electrical services design must comply as a minimum standard with BCA Section J requirements.

15.2 Flexibility of Design

The layout of light fittings and power outlets should allow flexibility such that spaces can be subdivided into separate areas. Easy Access for replacement of globes etc must be provided to all light fittings.

15.3 Lighting

15.3.1 Performance Standards

Lighting in accordance with the requirements of AS/NZS 1680. The minimum level of illumination in working areas must be 320 lux maintained unless otherwise specified in the Project Brief. Where different illumination levels are proposed by Consultants (to accommodate User requirements), these must be approved by the Project Manager before the design is finalised.

15.3.2 Light Fittings

The Building Contract must provide for the supply and installation of sample light fittings prior to final installation.

It is acknowledged that LED lighting technology is now becoming mature and viable for wholesale utilisation. Accordingly it is now the preferred technology and the use of fluorescent luminaires will only be accepted where a suitable LED luminaire is not available or viable.

Note also that the general performance criteria that are quoted here for fluorescent technology applies equally for LED technology.

The specification of light fittings must be undertaken with reference to the following requirements:

- Light fittings should be manufactured from Australian-made components and be approved by the Electricity Authority.
- Note that where luminaires have or might have imported components or components that are manufactured overseas under Australian licence / agreement, full electrical test data must be provided that confirms full compliance with AS61000 series standards. If this data is not provided or if the data is inadequate to establish compliance with all applicable parts of the standard and the luminaire is subsequently found to be functionally non-compliant the contractor shall be liable for the wholesale replacement of the lighting installation, with a compliant luminaire as specified by UTS, entirely at the contractors cost.
- Fluorescent fittings must incorporate power factor correction and be of the switch start type complete with fuse terminal blocks and low loss ballasts. Spring loaded tombstone lamp holders must not be used.
- All fittings must be adequately ventilated.
- Diffusers must be easily removable and all components must be easily accessible. Fittings that have to be dismantled in order to replace lamps must not be used. Refer to Section 23 - Audio Visual Services Subclause 23.5.2.11 for diffusers for lights in teaching spaces with projection systems.
- Light fitting design and layout should satisfy the intensity requirements for open offices but should have sufficient flexibility to enable partitioning of individual perimeter or island offices.
- Light fittings should be easily accessible for maintenance and should not be placed over stairs (landings only and where possible wall mounted). Light positions in teaching and learning spaces, particularly tiered rooms, need special consideration.
- Where false ceilings are provided, fluorescent fittings must be connected to the wiring loom by means of a three-pin plug and 1800mm of flexible lead. Lighting loom sockets in ceiling spaces must be circuit numbered using IPA studs or traffolyte labels or equivalent.
- Starters must be of the electronic type equivalent to WOTAN DOES ST171.
- Dimmable electronic ballasts must be provided in conjunction with fluorescent lighting to provide dimmable lighting for video projection requirements in all lecture and seminar rooms.
- Lighting diffusers shall be selected for appropriate glare control, particularly in teaching spaces.

- Electronic dimmers must be provided whenever dimming is required.
  Note: Dimmable electronic ballasts in fluorescent fittings shall be compatible for use with the selected dimmer units. For low voltage downlights, ensure compatibility with the dimmer type selected, i.e. leading edge type transformers, or trailing edge type transformers.
- High efficiency type luminaries must be used and low energy lamps specified.
- Downlights must not be used for general illumination. Where adopted, compact fluorescent lamps must be used.
- Incandescent lamps must not be used.
- Movement sensitive light switching to be used where appropriate and / or required. All classrooms shall be provided with motion detectors. Switches shall also be provided to allow lighting to be switched off for video projection etc.
- Fluorescent fittings are to be provided along corridors.

Refer also to Section 24 – Accessible Environments Policy.

15.3.3 Lighting Control Philosophy

Standards - NCC Section J, Australian Standards
Guidelines - Green Star Design & As Built v1.

- The University promotes the ability of users to manage the comfort conditions and lighting in their own environment. To achieve this end, user friendly switching facilities, zoned and grouped appropriately, must be provided for switching and for after-hours switching for occupants use and for the night cleaning staff use.
- The University encourages the community participation in emissions and energy reduction in their own environment, and promotes the use of light switches for switching on/ off in support staff areas. The use of PIRs and/or central lighting control when applied should remain a back-up control.
- The installation of approved user friendly controls that are inherently non-complex are appropriate. They should be programmed to the agreed needs of UTS for the identified space.
- The University is committed to providing a low greenhouse gas emission and low energy use in its institutional operations. It is estimated about 35% of electricity used on campus is used as lighting energy. The switching off or lowering of light levels when spaces are not in use is essential.
- In teaching spaces lighting shut downs for energy conservation should not impact on any teaching/ research related work. All lighting shut down should be done in multiple stages (minimum 3) giving adequate warning to the space users.

The Lighting Strategies

- PIR detectors with PE cells should to be installed where day lighting is available such as in car parks, glassed stairwells, fire-stairs and similar transit spaces and where continuous occupancy is not needed.
- Dimmers are not to be used, unless specified for overhead projector or presentations, perimeter daylight harvesting or other similar use.
- All light switching and control must be provided in accordance with BCA Section J6 as a minimum functional standard.
- All light switches when operated, should be programmed to reflect an immediate change of state, fully or partially to the desired state, and without a time delay.
  (The UTS environment is different to a domestic, or to other regular user environment. Switches are operated by hundreds of different users at UTS. If light switches have inbuilt time delays and do not show a change of state they will be considered as faulty, and staff/ students will stop using them)
- For the purpose of lighting time scheduling, the following are considered as non- working days
  - Saturdays, Sundays and Public Holidays,
  - December 25 to January 1 (inclusive).

After hour switching facilities must be available in all centrally controlled lighting areas.

- All installed lights should be LED, low energy fluorescent or cathode less induction – except for special lighting which needs to be low energy.
- Standard lightning colour temperature used is 4000k or Cool White
- All daylight sensors (PE cells) to be high quality, adjustable for the light levels needed and of ‘fail-safe’ type.
- All installed equipment that may require maintenance access must have provision for safe access. Lights in fire stairs need to be safely accessible.
- All lighting control programming details must be documented and approved by the project manager prior to the programming of lights – time scheduling, PIR delays
- All lighting control panels and circuits must be adequately labelled, and a copy of the programming logic must be mounted on location at the control switch board.

- All user interface light switches to be user friendly with clear labelling for the use of occupants, subject to approval by UTS.
- Light switches at entrances to unlit areas should be visible at the ambient lighting level, if not a pilot LED light should be installed for the purpose
- 'Presentation Modes' to be programmed in consultation with UTS Audio Visual Service (AVS) – refer to Section 23 of the Designs Guidelines

PART A - TEACHING SPACES

Lecture Theatres with UTS AVS supervisory control

Provide the UTS standard four button switch at main entrances programmed as follows:

1 Scene 1 minimum lighting for access to Lecturer's podium, and the activation of all PIRs
2 Scene 2 where the projector and screen will be used
3 Scene 3 where selected AVS equipment will be used in a different lighting scenario
4 Scene 4 all lights off, and PIRs activated for detection of entry for access lights, and PIR to be deactivated if no motion is detected for a further 5 mins.

The Lecturer's AVS console will be programmed by UTS's Audio Visual Section, and AVS will call in the four lighting scenarios to the AVS Crestron, or other teaching space control system as programmed in by the controls installers. Refer to Section 23 of the Designs Guidelines.
The controls installer should seek written approval from the Project Manager/ UTS's AVS Section for each installation as the AVS requirements may vary from space to space.
The lights should be activated initially by the switch at the door. Provide PIR detectors with adequate coverage. The PIR should not activate the entire lighting in a large space on entry. The PIR should only maintain the lights where motion is detected, and shut down lights when no motion is detected as described below.
Allow a three stage lighting sequential shut down after 20 min PIR delay in sequence with 2 min delay interval in between the following in sequence –

a) first stage - initial warning dimming and return to selected scenario if motion is detected
b) second stage – dimming of lecturers podium and return to selected scenario if motion is detected
c) third stage – dimming of all remaining all lights and return to selected scenario if motion is detected

If dimming is not available shut down such non-essential or periphery lights, screen light or selected warning lights in sequence at each stage.
Detection of movement by any of the installed PIRs after 5 minutes of final shut down should bring back the last selected scenario.

Seminar Rooms/ Meeting Rooms/ Board Rooms using AVS supervisory control

Provide the UTS standard four button switch at main entrances programmed as follows:

1 Scene 1 All lights on
2 Scene 2 where the projector and screen will be used
3 Scene 3 where selected AVS equipment will be used in a different lighting scenario
4 Scene 4 all lights off

The Lecturer's AVS console will be programmed by UTS's Audio Visual Section, and AVS will call in the four lighting scenarios to the AVS Crestron, or other teaching space control system as programmed in by the controls installers. Refer to Section 23 of the Designs Guidelines.
The controls installer should seek written approval from the Project Manager/ UTS's AVS Section for each installation as the AVS requirements may vary from space to space.
The lights should be activated initially by the switch at the door. Provide PIR detectors with adequate coverage. The PIR should not activate the entire lighting in a large space on entry. The PIR should only maintain the lights where motion is detected, and shut down lights when no motion is detected as described below.
Allow a three stage lighting sequential shut down after 20 min PIR delay in sequence with 2 min delay interval in between the following in sequence –

a) first stage - initial warning dimming and return to selected scenario if motion is detected
b) second stage – dimming of lecturers podium and return to selected scenario if motion is detected
c) third stage – shut down of all remaining all lights and return to selected scenario if motion is detected

If dimming is not available shut down such non-essential or periphery lights, screen light or selected warning lights in sequence at each stage.

Seminar Rooms/ Meeting Rooms without AVS supervisory control

These rooms may have independent controls for lights and AVS equipment.
Provide two button switch mounted near entrance and with PIR detector with 20 min delay. The manual switch to provide on/off and the PIR detector to switch off with a 2 minute dim down/ part shut down warning. Central lighting controls are not recommended.
Allow a three stage lighting down after 20 min PIR delay in sequence with 2 min delay interval in between the following in sequence –

a) first stage - initial warning dimming and return to selected scenario if motion is detected

b) second stage – dimming of lecturers podium and return to selected scenario if motion is detected
c) third stage – shut down of all remaining all lights and return to selected scenario if motion is detected

If dimming is not available shut down such non-essential or periphery lights, screen light or selected warning lights in sequence at each stage.

Research Laboratories

Where AVS supervisory controls are to be installed, consult UTS's AVS.

At all times – Lights switch off by PIR detectors on 1 hour delay reducing lights in 3 stages by switching off banks or by dimming. The final stage lights to be left on at 5% lux level for manual switch off or by PIR after 20 mins.

Where AVS supervisory controls are not installed – zoned manual on/ off switching with PIRs to switch off

At all times – Lights switch off by PIR detectors on 1 hour delay reducing lights in 3 stages by switching off banks or by dimming. The final stage lights to be left on at 5% lux level for manual switch off or by PIR after 20 mins.

Teaching Laboratories

Where AVS supervisory controls will be installed, consult UTS's AVS.

Allow a three stage lighting sequential shut down after 20 min PIR delay in sequence with 2 min delay interval in between the following in sequence –

a) first stage - initial warning dimming and return to selected scenario if motion is detected
b) second stage – dimming of lecturers podium and return to selected scenario if motion is detected
c) third stage – dimming of all remaining all lights to 5% lux level, and return to selected scenario if motion is detected

If dimming is not available shut down such non-essential or periphery lights, screen light or selected warning lights in sequence at each stage.

On work days - In all cases, PIR detectors on 1 hour delay reducing lights in 3 stages by switching off banks or by dimming.

On non-working days and after 10 pm all days - In all cases, PIR detectors on 20 min delay reducing lights in 3 stages by switching off banks or by dimming. The final stage lights to be left on at 5% lux level for manual switch off or by PIR after 20 mins.

Where AVS supervisory controls are not installed – zoned manual on/ off switching.

Allow a three stage lighting sequential shut down after 20 min PIR delay in sequence with 2 min delay interval in between the following in sequence –

a) first stage - initial warning dimming and return to selected scenario if motion is detected
b) second stage – dimming of lecturers podium and return to selected scenario if motion is detected
c) third stage – dimming of all remaining all lights to 5% lux level, and return to selected scenario if motion is detected

If dimming is not available shut down such non-essential or periphery lights, screen light or selected warning lights in sequence at each stage.

On work days till 10 pm- In all cases, PIR detectors on 20 mins delay reducing lights in 3 stages by switching off banks or by dimming.

On non-working days and after 10 pm all days - In all cases, PIR detectors on 20 min delay reducing lights in 3 stages by switching off banks or by dimming. The final stage lights to be left on at 5% lux level for manual switch off or by PIR after 20 mins.

Computer Laboratories

Where AVS supervisory controls will be installed, consult UTS's AVS

Allow a three stage lighting sequential shut down after 20 min PIR delay in sequence with 2 min delay interval in between the following in sequence –

a) first stage - initial warning dimming and return to selected scenario if motion is detected
b) second stage – dimming of lecturers podium and return to selected scenario if motion is detected
c) third stage – dimming of all remaining all lights to 5% lux, and return to selected scenario if motion is detected

If dimming is not available shut down such non-essential or periphery lights, screen light or selected warning lights in sequence at each stage.

On work days - In all cases, PIR detectors on 20 min delay reducing lights in 3 stages by switching off banks or by dimming.

On non-working days and after 10 pm all days - In all cases, PIR detectors on 20 min delay reducing lights in 3 stages by switching off banks or by dimming. The final stage lights to be left on at 5% lux level for manual switch off, or by PIR after 20 mins.

Where AVS supervisory controls are not installed – zoned manual on/off switching,

Allow a three stage lighting sequential shut down after 20 min PIR delay in sequence with 2 min delay interval in between the following in sequence –

a) first stage - initial warning dimming and return to selected scenario if motion is detected
b) second stage – dimming of lecturers podium and return to selected scenario if motion is detected
c) third stage – dimming of all remaining all lights and return to selected scenario if motion is detected

If dimming is not available shut down such non-essential or periphery lights, screen light or selected warning lights in sequence at each stage.

On work days till 10 pm - lights off by PIR detectors on 20 min hour delay reducing lights in 3 stages by switching off banks or by dimming. Final stage lights to be left at 5% lux level for manual switch off.

On non-working days and after 10 pm on all days - lights off by PIR detectors on 20 min delay reducing lights in 3 stages by switching off banks or by dimming. The final stage lights to be left on at 5% lux level for manual switch off, or by PIR after 20 mins.

Open Student Areas

Allow a three stage lighting sequential shut down after 20 min PIR delay in sequence with 2 min delay interval in between the following in sequence –

a) first stage - initial warning dimming and return to selected scenario if motion is detected
b) second stage – dimming of lecturers podium and return to selected scenario if motion is detected
c) third stage – dimming of all remaining all lights and return to selected scenario if motion is detected

If dimming is not available shut down such non-essential or periphery lights, screen light or selected warning lights in sequence at each stage.

On work days till 10 pm - lights off by PIR detectors on 20 mins delay reducing lights in 3 stages by switching off banks or by dimming. Final stage lights to be left at 5% lux level for manual switch off.

On non-working days and after 10 pm on all days - lights off by PIR detectors on 20 min delay reducing lights in 3 stages by switching off banks or by dimming. The final stage lights to be left on at 5% lux level for manual switch off or by PIR after 20 mins.

Library – open areas

Zoned manual switching on/ off of all spaces to be provided. These may be grouped for master switching.

On all days – Zoned PIR detectors on 1 hour delay reducing lights in 3 stages by switching off banks or by dimming.

The final stage lights to be left on at 5% lux level for manual switch off or by PIR after 20 mins.

PART B - NON TEACHING SPACES

Single Office Rooms

Two button switch with PIR detector with 20 min delay. Central lighting controls are not recommended. A manual two button switches in enclosed offices to be mounted on or near door frame.

Open Plan Office Spaces

Zoned two button switches for each zone on PIR detector with 20 min delay

If automatic lighting control or equivalent is available in corridor or nearby then overriding automatic switching off at end of day at 6 pm – after hour switches to be provided

On all days after 10 pm and PIRs to shut down lights with a 5 min delay.

Seminar Rooms/ Meeting Rooms/ Board Rooms using AVS supervisory control

These rooms may have independent controls for lights and AVS equipment. Provide two button switch mounted near entrance and with PIR detector with 20 min delay. Central lighting controls are not recommended. The manual switch to provide on/off, and the PIR detector to switch off with a sequence of 2 minute dim down/ part shut down warning.

Provide the UTS standard four button switch at main entrances programmed as follows:

1 Scene 1 All lights on
2 Scene 2 where the projector and screen will be used
3 Scene 3 where selected AVS equipment will be used in a different lighting scenario
4 Scene 4 all lights off

The AVS console will be programmed by UTS's Audio Visual Section, and AVS will call in the four lighting scenarios to the AVS Crestron, or other teaching space control system as programmed in by the controls installers. Refer to Section 23 of the Designs Guidelines.

The controls installer should seek written approval from the Project Manager/ UTS's AVS Section for each installation as the AVS requirements may vary from space to space.

The lights should be activated initially by the switch at the door. Provide PIR detectors with adequate coverage. The PIR should not activate the entire lighting in a large space on entry. The PIR should only maintain the lights where motion is detected, and shut down lights when no motion is detected as described below.
Allow a three stage lighting sequential shut down after 20 min PIR delay in sequence with 2 min delay interval in between the following in sequence –

a) first stage - initial warning dimming and return to selected scenario if motion is detected
b) second stage – dimming of lecturers podium and return to selected scenario if motion is detected
c) third stage – dimming of all remaining all lights and return to selected scenario if motion is detected

If dimming is not available shut down such non-essential or periphery lights, screen light or selected warning lights in sequence at each stage.
Detection of movement by any of the installed PIRs after 5 minutes of final shut down should bring back the last selected scenario.

Where AVS supervisory controls are not installed – zoned manual on/ off switching,
Allow a three stage lighting sequential shut down after 20 min PIR delay in sequence with 2 min delay interval in between the following in sequence –

a) first stage - initial warning dimming and return to selected scenario if motion is detected
b) second stage – dimming of lecturers podium and return to selected scenario if motion is detected
c) third stage – dimming of all remaining all lights and return to selected scenario if motion is detected

If dimming is not available shut down such non-essential or periphery lights, screen light or selected warning lights in sequence at each stage.
On work days till 10 pm - lights off by PIR detectors on 20 min hour delay reducing lights in 3 stages by switching off banks or by dimming. Final stage lights to be left at 5% lux level for manual switch off.
On non-working days and after 10 pm on all days - lights off by PIR detectors on 20 min delay reducing lights in 3 stages by switching off banks or by dimming. The final stage lights to be left on at 5% lux level for manual switch off, or by PIR after 20 mins.

PART C - BACK OF THE HOUSE & TRANSIT SPACES

Store Rooms

On motion sensor on 5 min delay. Provide Manual switch at door for rooms larger than a single office space.
For large store rooms provide zoned PIR sensors – LED, CFL or Linear T5 luminaires
For large store rooms provide a 24 hour LED equivalent 2 W 230 v.

Plant Rooms

24 hour LED equivalent 2W 230 v lighting at all entry doors and strategic locations. Provide manual switches for switching on/ off at the entrances/ Local zone switches + multi way switches at entrances and exists.
Plant rooms should not be connected lighting control systems such as CBus, Dynalite KNX, Plugwise etc.
Each plant room be assessed for safety and suitability of PIRs based on rotating machinery, hazards etc.
Install sufficient cautioning signs to users at entry/ exit doors indicating the allowed PIR time delays of minimum 20 minutes.

Lift Lobbies & High Use/ Common Use Corridors/ Communal Spaces

One 2W, 230v LED equivalent permanent light spaced 10 m & switched on 24 hours. All other lights on motion and light sensors with 20 min switch off delay on work days, and 2 min time delay between 10 pm to 8 am working days, and at all hours on non-working days. Where daylight is available daylight sensor PE cells to be fitted in series or be incorporated in the PIR detector

Corridors in Secured Areas

One 2W, 230 v LED equivalent permanent light spaced 10 m & switched on 24 hours. All other lights on motion and light sensors with 20 min switch off delay during work days, and 2 min time delay between 10 pm to 8 am working days, and on all hours on non-working days
Where daylight is available daylight sensors to be fitted in series

Toilets

a) 24 hr lights – 1 or more 2w 230 v LED switched 24 hrs to take out the gloom
b) All other lights in the toilets to be LED, CFL or Linear Fluorescent T5 Luminaires on motion and light sensor with 20 min delay switch off

Adequate number of PIR sensors to be positioned to detect movement at the main entrance, and at the entry door to toilet cubicles.

Open Space External Lights

On daylight sensor fitted at accessible height for ease of testing, and for daytime maintenance work on lights

Seek options for solar photo voltaic panel operated system with storage batteries.

External lights on buildings

On daylight sensor fitted at accessible height for ease of testing, and for daytime maintenance work on lights. External lighting shall be solar where practicable.

Building Floodlights

On daylight sensor fitted at accessible height for ease of testing, and for daytime maintenance work on lights. Two lux level lighting to be considered for operation past midnight.

Stairwells – Firestairs

Two stage lux level lights with PIR sensor. LED, CFL or linear T5 luminaries to be used. The fittings must be stand alone with a withdrawable battery pack when used for the emergency lights. Enlighten Chameleon or approved equivalent. Where daylight is available daylight sensor incorporated fitting must be used.

Car Parks (Internal)

Two stage lux level lights with PIR sensor LED luminaries to be used. The fittings must be stand alone with a withdrawable battery pack when used for the emergency lights. Enlighten Chameleon or approved equivalent. Where daylight is available daylight sensor incorporated fitting must be used.

Car Parks (External)

LEDs or Low energy metal halide flood or cathode less induction lights on daylight sensor.

Notes:

All deviations to this Guideline are to be reported to UTS in the Designs Guidelines Deviations Schedule by the Consultant

All areas not listed above are to be designed to meet the philosophy, standards, guidelines, strategies outlined in the document, and prior design approval be obtained.

15.3.4 Exit, Emergency and Fire Stair Lighting

Emergency lighting and exit signs must be designed and installed to the requirements of AS2293, the relevant Building Codes and all Statutory requirements.

Exit lights must be the maintained type, i.e. .designed to be 'ON' at all times.

Emergency lighting in fire stairs and other areas as appropriate shall be LED type with two energisation levels (full and stand-by) activated by an inbuilt motion detector within the fitting with adjustable time out. The fittings shall be equal to Chamaeleon^{tm} III as distributed by Enlighten Refer also to Section 23 - Audio Visual Services, Subclause 23.5.2.1 - Exit Lights.

Stand alone computer controlled Exit and Emergency Light maintenance systems shall not be installed, unless the system forms part of a building wide lighting control system. Where a lighting control system is installed, local 2 hour test switches, in accordance with the requirements of AS 2293, must also be provided at each sub-board to enable testing of the operation of the exit and emergency lighting system independently from the lighting control system.

15.3.5 Special Applications

Consultants are required to clarify UTS requirements for the lighting of specialised areas. Refer also to Section 9 - Furniture and Fittings, Subsection 9.16 - Works of Art for specific requirements.

15.4 Power

15.4.1 Power Points

Unless specific requirements are detailed, allow as a minimum two double general purpose outlets (GPOs) per 10m^2 of net useable space. Double GPOs must be provided in all locations which call for general purpose outlets. All outlets must be identified by means of circuit identification IPA studs. Special purpose outlets must be Clipsal "56 Series" or similar. Three-phase outlets must be Clipsal or similar and must have five (5) round pins.

Allow a GPO at each 20m along all corridors, laboratories, general offices, lecture theatres and at main stair landings for cleaners' use. These GPOs must be on a separate circuit and must have neon indication and a green rocker.

GPOs at the front of teaching spaces shall be fully co-ordinated at the design stage with proposed motorised screen locations, overhead projector locations etc., to minimise extension lead runs.

To all common room kitchens allow separate circuits (15A) for two (2) percolators and a microwave (3 total). Provide also a separate supply for a Dishwasher and a Zip Hydroboil Series 2000 boiling water unit complete with timer control for energy efficiency, to turn off units outside working hours.

Distribution of wiring for power may be by means of two (2) channel perimeter black aluminium duct equal to ESCO or Moduline complete with factory manufactured corners and fittings and marviplate duct covers. Sheet metal cable ducts are not acceptable. Where conduits cannot be cast in floor slabs or wiring provided from below, Service Poles similar to Esco Space Pole may be used. Where island rooms exist, these must be conduited to allow for the installation of power from the relevant sub-board where these are not installed in the first instance. Floor outlets for power must be of 'Clipsal' manufacture or equal. All ducts must have a minimum of 2 x 32mm conduit feeds from the sub-board to each section of the duct.

In computer laboratories, run 2-channel ducts at 100mm below underside of benches and at normal skirting level. An alternative option is to run ducts above the benches and at normal skirting level, with an additional 'basket' tray running under the bench at the rear. For office workstation refer subsection 22.5.7 Power Cable Management.

In other areas, ducting must be run at normal skirting level to service desks and benches.

Provide dedicated circuits where possible for computers.

Refer also Section 9 - Furniture and Fittings and Section 22 - Special Requirements.

15.4.2 Switchboards and Sub-boards

The switchboards and sub-boards must be designed to comply with the following criteria:

- Note all switchboards and distribution infrastructure must incorporate energy monitoring and sub metering in accordance with BCA Section J8. This represents a minimum functional standard.
- The main switchboard must be of type tested (Form 3b) NB: achieving the form of segregation shall be by enclosure structures (partitions and barriers) reliance on insulation and local housing i.e. 'h' and 'i' is not acceptable. Note also that MSBs that are supporting mission critical services such as major data facilities shall be Form 4b floor mounted, free standing compartmented cubicle type construction. Provision must be made to extend the main busbar systems in either direction. At least 25% spare space complete with busbars must be provided. No equipment is to be mounted less than 300mm above the floor.
- The IP rating for all boards must be agreed with FMU prior to finalisation of the design.
- Sub-boards and load centres must be arranged for wall mounting unless circumstances dictate otherwise. 100% spare space must be provided on all sub-boards in science type buildings. Provide 50% spare space on all sub-boards in non-science-type academic buildings. Non-academic buildings must be provided with 25% spare capacity. Load centres must be provided within areas of heavy load concentration. All light and power circuits to be loaded to only 75% of their rated capacity.
- Busbars must be extended into the spare space and circuit breakers must be fitted to 50% of the spare space. Sub-mains must be sized for the appropriate spare capacity, and cables must be labelled indicating size and source of supply.
- Sub-boards and load centres must be clearly labelled to indicate source of incoming supply.
- All switchboards and sub-boards must be designed to be vermin proof with lockable doors.
- All fuses must be HRC cartridge type conforming to AS60947 AS61818 and AS3135. A minimum of three (3) spare cartridges for each rating must be specified at each switchboard position mounted on a suitable rack. At the main switchboard position, fuses must be located in a wall-mounted enclosure in the switch room. At distribution boards, the fuses must be mounted in a convenient location in the respective cupboards. In special circumstances DIN fuses may be acceptable after consultation with FMU.
- Polyphase kilowatt-hours meters must be provided on each main switchboard to register building consumption and consumption for each of the main building services emanating from the board, including but not limited to Air Conditioning and Mechanical Services, Hydraulics and Hot Water. The main kWh meter for the building must be a Cutler Hammer IQ DQ II digital unit or approved equivalent with a kWh output to the BMS. Other kWh meters must be standard polyphase meters complete with the multiplication factor clearly displayed.
- All meters must be selected such that the normal deflection is 80% of the full scale range. A voltmeter with selector switch and three (3) ammeters must be provided on each main switchboard.
- Every control and switch on main switchboards and sub-boards must be clearly labelled. All labels must be engraved white/black/white traffolyte (or white/red/white traffolyte for emergency lights). Glueing or the use of self-tapping screws to fix labels is not permissible.
- Circuit schedules must be typed and must be provided at all switchboard positions. Circuit numbering must be continuous without segregation between light and power to achieve maximum efficiency. Schedules must be secured in purpose made clear PVC covered holders. Circuit schedules must indicate the room number or area served by each circuit.

- It is essential that all circuit labelling is upgraded on any refurbishment projects.
- All switchboards must be colour electric orange X15 (AS2700) externally and white internally, unless required otherwise by the Brief.
- Circuit breakers to final sub-circuits must be Cutler Hammer Quicklag or approved equal miniature circuit breakers. Where earth leakage protection is required, and where required by Workcover and the Work Health and Safety Act and associated Regulations, use Cutler Hammer ELQ 116C.3 30 mA breakers to provide single point protection. Where power points are not EL protected, they must be clearly identified.
- kW transducers must be fitted to the main switchboard and connected to the BMS, or if an IQ DP II kWh meter is used then the output from this device can be used by the BMS in lieu of the kW transducer.
- All neutrals, earths and active cables must have ferrules with numbers to correspond to the circuit breaker number. All circuit breakers must be numbered consecutively on the fascia from top to bottom on the left hand side then top to bottom on the right hand side, and also on the circuit breaker mounting bracket for ease of identification once the fascia has been removed.
- All active cables entering circuit breakers must be via cable lugs. All control wiring must have ferrules with numbers as indicated on as-built drawings.
- Neutral and earth bars must have the same number of terminations as there are circuit breaker positions. Multi-joining of earths and neutrals into one joint prior to termination is not acceptable. Blue Point connectors must not be permitted within switchboards and sub-boards. Neutral and earth cables must be looped from light fitting to light fitting, switch to switch or power point to power point.
- Standard equipment for all switchboards and sub-boards for light, power, air conditioning or other building services must be as follows or approved equal:

Alarm Relays	Releco MR-C 11 pin base.
Time Relays	Releco MR-C 11 pin base.
Auto/Off/Manual Switches	Kraus and Naimer CG4.
Active Links	Blue Point or Busbar System.

- Where electrical tee-off boxes are used, they must be accessible, painted orange X 15 (unless directed otherwise) and labelled on the front to indicate the switchboard served by the box. If a fused tee-off box is used, the fuses must be labelled and the front panel must be complete with a legend stating which switchboard is serviced by the fuses.
- Submetering is to be provided for light and power for each floor and/or subtenancy. Electricity sub-metering should be provided for significant end users that will consume more than 10,000 kmp/a

15.5 Wiring

Wiring must be specified and installed in accordance with the following criteria:

- Power and lighting cables must not be less than 2.5mm^2, stranded copper conductors. Colour coding must be in accordance with AS/NZS 3000 Part 3.2. Control wiring must be white, or brown. Field control wiring for extra low voltage (less than 32 v ac/110 v dc) must be not less than 1.5mm^2 stranded copper.
- Cable entries to switchboards or equipment via gland plates or through panels must 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 must be used when the cable rating exceeds 100 amps. An effective cable management system must be specified by the Consultant after approval by UTS. All cable tray routes shall be clearly indicated on the design drawings. Particular attention is drawn to the need for consultants to identify and clarify cable support routes in existing buildings.
- Cable Ladders, Conduits and Conduit Saddles must have the following colour coding throughout the entire installation:

Power, lighting and 240V controls	-	Orange
Extra low voltage or low voltage controls	-	Grey

- Conduit saddles must be of the stand-off type in exposed areas or on painted walls.
- Cable ladders and ducts must be fully galvanised where fixed in ceiling spaces or service ducts or exposed to the weather and colour banded every three (3) metres when in plant rooms.
- All cable ladders and ducts must have 50% spare carrying capacity.
- Main sub-board feeders and sub circuit wiring must generally be run on cable tray/ladder in risers and major routes in ceiling voids. Cables must be supported clear of ceiling structure by approved cable supports system such as ‘Unicon’, and cable tied to catenary wires or suspended hangers such as flat steel hoop iron complete with ‘Unicon’. Care must be taken to have enough slack in the cable runs to eliminate stretching of the cable and strain on the ‘Unicon’.
- All submain and wiring systems shall be either single or 3 phase. Two phase distributions is not not be used.
- All multiphase submain circuits wired on single core cable shall be configured in trefoil arrangement. ‘spaced / laid flat’ is not acceptable under any circumstances.

- Refer also to Subsection 10.6 - PIN Access System and Subsection 10.11 - Electro Magnetic Hold-Open Devices.
- The consultant shall identify all redundant circuits associated with refurbishment works. All redundant circuits shall be disconnected in an approved manner i.e. cable disconnected, coiled and tagged.

All tagging and lock off of equipment shall be undertaken in accordance with UTS procedures.

15.6 Underground Electrical Services

All underground electrical services must be installed in accordance with the requirements of AS3000 and must be laid in sand with 75 mm below and 150mm above and to sides and must be identified by laying continuous PVC marker tape 150mm minimum above the conduits. The marker tape must be colour coded and printed with the identification of the contents of the conduits.

Only selected backfill must be used and must be compacted in layers not exceeding 200mm to a density of 90%. The minimum cover must be in accordance with AS3000 and in any case, not less than 500mm to top of conduit. Concrete cover to conduits to a lesser depth will be allowed only after written approval.

Minimum size of underground conduit must be 25mm dia. All underground cable must be TPS cable, not less than 2.5mm^2. Underground cable joints are not acceptable, unless approved by the project manager

Maximum acceptable distance between pits on underground cable is to be 60m.

All underground pits must have their lids marked with a brass plate indicating the service installed and the route from the pit, and must be adequately drained.

Brass marker plates with lettering not less than 10mm high must be installed at kerbs and road crossings and any changes in direction. In unpaved areas, the marker must be set in a concrete pad not less than 300square x 200mm deep.

Separation distances to other services as required by relevant Acts and Regulations must be observed.

15.7 Lightning Protection

Lightning protection must be provided to all buildings where required by AS1768. Copper or stainless steel conductors must be used. A risk matrix must be produced and submitted for review.

15.8 Electric Fans and Fan Heaters

In all non-air-conditioned spaces, provide a 900mm ceiling fan. Larger and multiple fans may be used in larger spaces.

In non-air-conditioned spaces, appropriate heating solutions shall be provided. Exposed element bar type heaters shall not be used.

15.9 Testing

The entire installation must be thoroughly tested by an independent testing authority prior to being energised. Testing must be fully in accordance with AS3000 and supply authority requirements.

A signed test report for all circuits shall be provided to the Project Manager. This shall be provided for all works including refurbishment or major works.

Acceptance testing of the entire system shall be undertaken whenever additional fittings are added to an existing system.

15.10 As-Built Drawings

Copies of all shop drawings and as-built drawings are to be provided to UTS at Practical Completion by the Contractor. The as-built drawings are to be provided in accordance with the UTS Facilities Management Unit CAD Drawing Standards and to be a format fully compatible with the UTS CAD Record Keeping System. An electronic copy on CD is also required.

16 FIRE SERVICES

16.1 General

Each building must be provided with a system of fire protection in accordance with the relevant codes and standards. It is the policy of UTS that the priority in the design of any system is the protection of life followed by the protection of property.

It is the University's preference that where work is undertaken on a fire system, that the work is undertaken by the University's Long Term Maintenance (LTM) Contractor. It shall be specified that where contractors elect not to use the UTS LTM Contractor and use alternative sub-contractors, they shall engage the services of the exiting LTM Contractor to perform acceptance testing of the system. Acceptance testing of all systems shall be specified to ensure that full integration with the existing system has occurred for all services, i.e. fire detection, EWIS etc... The Consultant shall ensure that signed Installation and Inspection Certificates are provided for the building's essential services are provided. Subcontractors shall provide signed Certificates. Sign off shall also be obtained from the LTM Contractor.

Existing buildings shall be assessed for compliance with current code requirements. All works necessary to bring the area being refurbished up to current standards shall be undertaken. Where it is not possible to make an area code compliant due to base building system deficiencies, the consultant shall discuss upgrade options with the FMU Project Manager, in conjunction with UTS Building Services.

When work is undertaken in existing buildings with active fire detection systems, any isolation of systems shall be undertaken strictly in accordance with Building Services fire system isolation procedures.

Consultants are advised that BCA/Fire Compliance reports based on Engineered fire solutions have been prepared for several UTS buildings, e.g. CB02, CB05, CB06. Consultants must clarify with the Project Manager at an early stage whether the building under consideration is the subject of an Engineered solution or upgrade program. Where work on a building with an Engineered Fire Solution is undertaken the design of the works must be integrated into and address issues raised in the existing Fire Safety Assessment Strategy. A copy of the Fire Safety Assessment Report must be provided to Building Services for future records.

Building Services Branch hold data on the extent of the essential services in each of UTS's buildings. This information includes a description of the type of essential services within the buildings and a summary of the design standards to which the facilities were built, where this information is available. These documents are updated on an ongoing basis, as new information on existing systems comes to light or when "code compliance" upgrade projects improve the base building systems to comply with today's standards.

On all refurbishment or major projects, this document should be consulted and the assistance of Building Services Branch obtained to ensure that any design proposals match the current or proposed standards for the building.

For works in older buildings where fire systems do not comply with current codes, the consultant must identify non-compliance of the systems and consult with FMU Projects and Building Services concerning the extent of upgrade works to be incorporated into the project.

This section of the Guidelines outlines the University's minimum requirements for the following types of Fire Protection Systems:

- Automatic fire alarms;
- Hydrants and hose reels;
- Hand extinguishers;
- Passive Fire Systems
- Sprinklers;
- Special systems.

An important consideration in the design of fire services must be the elimination of potential false alarms. Care must be taken in the placement of sensors in heat and/or smoke generating areas such as kitchens and plant rooms.

The placement of break glass alarms connected to the Early Warning and Intercommunication System (EWIS) must be approved by the UTS Project Manager early in the design stage. The placement of red & white break glass alarms in public spaces should be avoided as far as possible i.e. when required by the Standard they should be placed in hose reel cupboards with WIP phones adjacent to the exits.

16.2 Automatic Fire Alarms

In general, all buildings must be equipped with automatic fire alarms connected to the buildings' Fire Indicator Panel (FIP), the Site FIP or equivalent, and to the local Fire Service.

Alarms

In general, the buildings must be protected with detection and alarm systems designed and installed in compliance with AS1670 and AS1603 ..

Smoke detectors (ionisation type) should be used where early warning is required in areas such as sub-stations, switch rooms, PABX and MDF rooms.

Smoke detectors (obscuration type) should be used for general areas and in air conditioning systems in supply and return air systems to comply with the requirements of AS1668:2002 - The Use of Mechanical Ventilation and Air Conditioning in Buildings.

All thermal and smoke detectors must have a plug-in base mounting.

Consideration should be given to an intermixing of smoke detectors of both types in areas such as computer rooms or rooms containing sophisticated electronic equipment particularly where air movement is considerably high or the use of air aspirating systems such as VESDA™. When a VESDA is installed, it must be monitored from an area which is manned 24 x 7, such as the Security Supervisors Office. Allow for all necessary interfacing.

All thermal and smoke detectors must be provided with integral neon or led indicating lamps. Concealed space detectors must be equipped with remote neon indicators labelled with the type and location of the detector. Alarm zones must be arranged to suit the attending Fire Service.

All alarms must be identified by means of an approved label fixed to the alarm base, identifying the circuit and detector number corresponding to the numbering plan on the as-built drawings and the location programmed into the FIP program so that the location may be displayed on the FIP screen, where fitted.

New detectors are to be analogue addressable smoke detectors.

Fire Indicator Panel (FIP)

Each building must be equipped with its own Fire Indicator Panel (FIP) showing all alarm circuits. Allow on each FIP a minimum of 20% spare space. The maximum number of thermal alarms or smoke detectors that must be provided on any circuit must be no greater than 90% as permitted by the code.

FIPs must be placed in a position easily accessible to the Fire Service from vehicular access and the position of the FIP should be checked at documentation stage with the relevant parties including Building Services.

The building must be connected to the campus FIP from which an alarm will be transmitted to the Fire Service. Telephone cables/network may be underground where they comply with AS1670. Provision must be made for all connections and modifications necessary to the campus site plan forming part of the campus FIP (where appropriate). A general fire trip signal shall be transmitted to Security office. Final details shall be discussed with Security.

FIPs must be capable of running a test to identify dirty detectors.

Lightning protection must be installed to the FIP.

The FIP must incorporate the following:

- To allow simple isolation/de-isolation of groups of detectors, provide an appropriate grouping of detectors to allow the whole or part of a zone to be isolated with a single pushbutton toggle switch which is clearly labelled. The grouping shall be based on a common sense approach, given the size, nature of activities and operational boundaries in the buildings. The system is to have an enunciator which indicates when the board is in isolate and/or alarm. The grouping is to be identified on the detector block plan, which is to be posted on the wall of the fire control room. A soft copy of this block plan shall also be provided. The block plan is to display building grouping identification in line with room numbering/ identification.
- A mechanical services reset button to reset the fire services following a trip.
- A single pushbutton on/off switch to allow isolation from tripping of the mechanical systems which are required to operate in fire mode. This is to have LED's to indicate when the board is in isolate and also to indicate if an alarm output has been generated.
- A single pushbutton on/off switch to allow lift detector isolation and to have LED's to indicate when the board is in isolate and also to indicate that an alarm output has been generated.
- A Fire Door release override switch fitted to manually release or lock all required fire exit doors which are wired to open on fire trip. This is to be operated by 003 key. LED lights are to be fitted to indicate when the doors are in locked (will not release in alarm state), normal (ready for operation-auto) and alarm (tripped).
- A single pushbutton on/off switch to allow Special equipment (e.g. VESDA or Gas trip etc) isolation and to have LED's to indicate when the board is in isolate and also to indicate if an alarm output has been generated.
- The support of analogue addressable smoke detectors.

Fire Service Ducts

All fire alarm wiring must be run in a separate, accessible, riser duct or a separate dedicated cable tray.

16.3 Hydrants and Hose Reels

Hydrants are to be provided where required by the BCA. In general, each level of a building must have sufficient landing valves such that no portion of that level is more than 30m from a hydrant plus water jet.

Hose reels must be 'Wormald' brand (or equal approved) and should be a minimum of 36m x 20mm ID hose. Hydrant systems must be designed and tested to provide water within the range of pressures specified by the relevant Australian Standard and BCA requirements. Booster connections must be provided if required to meet design pressure. System duties and locations are to comply with the BCA, AS2419:2007 and AS2441:2005.

16.4 Hand Fire Extinguishers

Hand fire extinguishers must be provided to all areas in accordance with the BCA. All extinguishers should be specified to ensure compliance with AS2444:2001 - Portable Fire Extinguishers and Fire Blankets - Selection and Location.

Additional extinguishers should be used where the risk so demands. All extinguishers must be provided with coded location signs and usage signs in accordance with the requirements of AS1851. Only extinguishers approved by the SAA will be acceptable.

16.5 Sprinklers

Sprinklers should be considered in areas where automatic extinguishing is justified as well as where required to comply with the Building Code of Australia and other statutory requirements or fire upgrade program. All sprinkler installations must also comply with AS2118.1 - 2006 - Automatic Fire Sprinkler Systems. The provision of an 'Early Suppression Fast Response' system should be considered if appropriate. Quick response needs should also be considered to ensure code compliance in certain circumstances for alternative solution upgrade programmes.

Flow switches are to be used for each different level/fire compartment and fitted with a solenoid valve for remote testing.

16.6 Special Systems

In certain applications, consideration should also be given to special systems. These include:

- very early smoke detection alarm system
- gas extinguishment systems.
- high velocity water spray systems.
- high expansion foam systems.
- air aspirating systems.
- water mist.

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

16.7 Door Hold-Open Devices

Refer to Subsection 10.11 for requirements for hold-open devices activated by fire alarm systems, namely:
Electro-magnetic hold-open devices and sequence closers must be provided to all fire or smoke barrier doors in high traffic areas which must automatically release the door, allowing closure, in the event of any smoke or fire alarm activated at the Fire Indicator Panel.

Zoning of door closers shall be undertaken where buildings are fire zoned, eg. Haymarket.

16.8 Evacuation System

All fire alarm panels must incorporate an Emergency Warning System designed in accordance with AS1670 and AS4428.4:2004 - Emergency Warning and Intercommunication Systems in Buildings for emergency purposes All speakers must be of the fully recessed type where ceilings are available. The requirements of AS1905.1:2005 (SAA Fire Door Code) must also be observed whenever applicable.

An Emergency Warning and Intercommunication System shall be per AS4428.4:2004 where required and shall be next to but a separate panel from the FIP.

All systems shall have a minimum of 10% spare zones and 20% minimum on each amplifier circuit.

To facilitate Warden Communication Intercom Point (WIP) phones should be installed adjacent to appropriate fire stair doors.

16.9 Control of Doors and Services

Any doors secured by electric locks must be interlocked with and controlled by the fire alarm system (refer Section 10 for lock types). These doors must be wired through manual release switches adjacent to the FIP so that manual release of all security controlled doors can be effected from the FIP location. Flammable gas services must be automatically isolated during a fire alarm. Provision must be made for the automatic fire mode operation of the air-conditioning and mechanical ventilation systems in the event of any activated fire alarm. A suitable relay should be provided in or adjacent to the main fire alarm panel for this purpose.

16.10 Smoke Exhaust Systems

Smoke exhaust systems must be incorporated into the design in accordance with the BCA and Australian Standards.

16.11 As-Built Drawings

Copies of all shop drawings and as-built drawings are to be provided to UTS at Practical Completion by the Contractor. The as-built drawings are to be provided in accordance with the UTS Facilities Management Unit CAD Drawing Standards and to be a format fully compatible with the UTS CAD Record Keeping System. An electronic copy on CD is also required.

16.12 Essential Services Manual

All Major Projects shall be provided an Essential Services Manual in addition to a standard Operating and Maintenance Manual. Refer to UTS Contract Preliminaries for further information

16.13 Passive Fire Protection

All penetrations in fire walls must be constructed by approved methods in compliance with the requirements of the BCA & Australian Standards.

To Facilitate easy identification of required Fire walls they are to be painted red on both sides above the ceiling and in other locations which are not visible to the public, so as not to detract from the building colour scheme but to clearly identify the fire wall and minimise inadvertent penetrations in subsequent works.

17 SECURITY

The Security requirements for each project will need to be clarified with the Project Manager and UTS Manager, Security Services. It is the general policy of the University to have the cabling infrastructure for the security system provided under UTS Building Contracts. The installation and commissioning of the security system, (including cameras) are co-ordinated separately by UTS Security Services. Provision for the Supply and Installation of the project must be made for this item in the project budget.

All Door Furniture Assigned to work in conjunction with electronic locking equipment can be identified in Section 10.

17.1 Security System Design

ALL NEW INSTALATIONS ARE TO BE HONEYWELL IDENTIPOINT READERS LINKED TO HONEYWELL EBI CONTROL SYSTEM

- When a proposed security system is designed it must be checked and signed off by the UTS Security Systems Manager.
- Upon approval of security system design UTS Security will identify exact CCTV Camera types best suited for CCTV intention
- A special provision needs to be made for all CCTV and electronic locking locations. Should extra strength be needed to be accounted for in the project. This will be outlined by a UTS Security Representative.

17.2 Access Control Cable Installation

- All cabling must be installed to AS3000.
- Cables must be run for their entire route length without any terminations.
- Cables must be concealed in public places but may be run open in ceiling spaces. Where internal surface wiring is approved, cable trays must be used
- This requirement also extends to open areas of basement ceilings. Where external surface wiring is approved, cables must be enclosed in screwed conduits. All wiring is to be installed in such a manner as to be inaccessible to intruders and vandals and provide appropriate protection against mechanical damage. All cable ties used must be the colour green.
- All wiring must be installed in a neat manner and be loomed within enclosures. Cables must be indelibly numbered and these numbers be referred to in ‘as-installed’ schedule. The ‘as installed’ schedule is to be handed to the UTS Security Systems Manager.

17.2.1 Door Access Control Cabling

Cable	Notes
CAT6A (Siemon certified) (Terminated with green lugs)	Z MAX shielded Cat6A outlet (GREEN) – Z6A-S07
2 x Figure 8	Card reader power and door strike
1 x 2 pair shielded	Encrypted RS485 communications between card reader and IOM
1 x 3 pair shielded	Door reed switch, push to exit button, break glass monitoring (if installed)

- Location to be advised from UTS Project Manager.

17.2.2 Double Door Access Control Cabling

Provide the following:

- As above.
- As per Honeywell specification

17.2.3 Reed Switches Cabling

Provide the following:

- As per Honeywell specification

17.2.4 Space Detection Cabling

- As per Honeywell specification

17.3 CCTV Cable Installation

17.3.1 CCTV Camera Cabling

- Security CCTV Cameras are to be cabled in accordance with ITD specification as described in section 28. CAT6A SIEMON certified.
- CAT6A cable is to be Power over Ethernet and installed and terminated with GREEN Jacks and fittings as per the ITD specification.

17.4 Security Location Specification

17.4.1 TSG Rooms

- Access control will be installed on all new TSG rooms entry doors.
- Space is to be provided for Honeywell Access Control panels on walls.
- All Access Control Panels are required to have a double GPO installed within .3mt of Access Control panels.
- GPO assigned to of Access Control Panel must be connected to UPS power supply.
- Fire Trip Relays are to be run and tested by designated fire contractors. Cable is to be terminated inside box within .3mt of Access Control Panels.
- Locks are to be Mortise locks Lockwood 3570 or equivalent and are to be Fail Secure

17.4.2 Computer Laboratories

- Access control will be installed on all new Computer Laboratories entry and exit doors.
- CCTV cameras are to cover 100% of rooms whilst giving full identification of persons entering room.
- Where hazardous materials are used a provision is to be made for Duress Remotes. Duress Remotes are to interface into existing UTS infrastructure in CB01.4 Security office.

17.4.3 Car Parks

- Access control will be installed on all new car park entry and exit doors.
- Intercoms are to be installed at all entry and exit roller shutters.
- CCTV cameras covering all driveways and loading docks. A dedicated high resolution CCTV camera is to be installed to recognize all numberplates of cars entering and exiting in all lighting conditions

17.4.4 Office & Reception Areas

- Access control will be installed on all new entries to office areas.
- CCTV cameras are to cover all entries and corridors.
- If reception desk is behind an Access Control door, a request exit device is to be installed behind desk.
- If reception desk is public, Access Duress Remotes are to be installed and interfaced into existing UTS infrastructure in CB01.4 Security Office.

17.4.5 Workshops

- Access control will be installed on all new workshops entry and exit doors.
- CCTV cameras are to cover 100% of rooms whilst giving full identification of persons entering room.
- Where hazardous materials are used a provision is to be made for Duress Remotes. Duress Remotes are to interface into existing UTS infrastructure in CB01.4 Security Office.

17.4.6 Laboratories

- Access control will be installed on all new laboratories entry and exit doors.
- CCTV cameras are to cover 100% of rooms whilst giving full identification of persons entering room.
- Where hazardous materials are used a provision is to be made for Duress Remotes. Duress Remotes are to interface into existing UTS infrastructure in CB01.4 Security Office.

17.4.7 Main Entries to Buildings

- Access control will be installed on all new entries and exit doors.
- CCTV cameras are to give full identification of persons entering and exiting main entry doors to buildings.

17.4.8 Fire Stair Access

- Access control should be installed on all new fire stair access doors. Doors need to be interfaced to buildings fire system and are to release on alarm.

- CCTV cameras are to give full identification of persons entering and exiting street level exit door.
- All fire doors to have the facility to be key operated from the occupied side of the landings and street level

17.4.9 Lecture Theatres

- Access control will be installed on all new Lecture Theatre doors, entries and exits.
- CCTV cameras are to cover 100% of rooms whilst giving full identification of persons entering room.

17.5 Security Equipment Hardware Specifications

17.5.1 Access Control Hardware Outline

- Access Control Doors need to be compiled of UTS Security Approved locking hardware. When UTS approved lock will not accommodate, the suggested solution must be approved by a UTS Security Representative.
- All space and strength to accommodate locking hardware is to be accounted in the design stage of the projects.
- All Electronically Controlled Doors are to be automatically closed after a valid entry (see section 10 for hardware types)
- All Electronic Striker Doors will be installed with an existing Restricted BiLock Key override.
- Access Control Doors need to monitor door forced, tamper, door open too long and request exit.
- Access Control Doors must be compatible with the Honeywell Identipoint readers and EBI.
- Any Duress Remotes need to be compatible with all existing UTS Security infrastructure.

17.5.2 List of UTS Security Approved Electronic Access Control Hardware

- Padde ES9000 Electric Strike.
- FSH Magnetic Locking Range or equivalent.
- Mushroom type exit button or equivalent that also complies with Accessible requirements .
- Double Pole Glass Break Switches.
- Honeywell Identipoint Card Readers and Honeywell EBI system.
- Allen Bradley Smart Logix Controllers.

17.5.3 CCTV System Hardware Outline

- All CCTV hardware needs to be compiled of UTS Security Approved CCTV Hardware. When a UTS approved CCTV camera will not accommodate, the suggested solution must be approved by a UTS Security representative and must be fully compatible with the UTS Avigilon Video Management Software.
- All cameras are to be ONVIF compliant.
- Cameras assigned for identification are to be of a minimum resolution of 5 megapixels with day night capability.
- Cameras assigned for a general overview can be made up of single colour lenses or single black and white.
- Recording Servers are to be compiled of a minimum of 21TB, Avigilon HD NVR 2U Rack Mount.
- CCTV cameras are to be compatible with Avigilon CCTV infrastructure.

17.5.4 List of Approved CCTV System Hardware

- CCTV cameras are to be of the IP CCTV, compatible with Avigilon CCTV systems and approved by the Security Systems Manager.

17.6 Security System Testing and Commissioning

Upon completion of the proposed security system the assigned contractor will co-ordinate with UTS Security the following:

- As built drawings.
- Cross reference of cable schedule and door ports installed.
- Testing of each installed Access Control Door with door open too long, door forced, door break, glass tamper, key override tamper, access granted, request exit granted, lockdown, cold start and fire trips.
- Create electronic maps showing all CCTV camera locations with Focus windows, Alarm windows and Live windows.
- A copy of each camera configuration is to be downloaded to disk and given to the UTS Security Systems Manager.

17.7 Mechanical Doors, Hardware and Locks.

Refer Section 10

18 DESIGN OF VERTICAL TRANSPORTATION SERVICES

18.1 General

The University has approximately 70 lifts installed in the City Campus. These existing lifts are of various design, age and manufacture.

The University wishes to standardise, as much as possible, any new lift system to meet, but not be limited to, the following minimum basic requirements:

- The lifts and escalators must be safe and comply with all relevant codes and standards.
- The lifts and escalators must be easily maintained, with minimal problems, by multiple (other than the original manufacturer) lift maintenance contactors.
- The lifts are to be as flexible and versatile in operation as possible.
- All controls and car finishes must be robust and vandal resistant.
- The lifts and escalators must have a proven, local history of reliability.
- The lifts and escalators must meet minimum requirements of handling capacity and waiting time for passenger lifts (refer subsections 18.7-18.9) and materials for goods lifts.
- All goods / passenger lifts shall be designed to transport a scissor with a minimum weight of 1,000 kg without the need for special operation or the lift by the lift contractor the use of special devices.
- The lifts must meet the minimum requirements for use of persons with disabilities as defined by AS 1735.12 and the Building Code of Australia..

18.2 Requirements

Any new installation shall only be installed by a competent, well-established, lift contractor with at least 10 years local lift installation experience.

The lifts and escalators must comply fully with all local rules, regulations, codes and practices as well as gain approval and certification from the local lift inspectorate prior to the lift being placed into service.

All lifts shall be, as a minimum, user friendly to people with disabilities and in compliance with the Building Code of Australia. Full compliance to the lift code AS1735.12 will be applied as detailed in clause 5.

Consideration should be given to lift power systems that are energy efficient and environmentally friendly. Any lift power system that can be proven to be more efficient or less power consuming and/or environmentally friendly shall have preference over a less efficient system.

As numerous high passenger two-way traffic peaks will be placed on the vertical transportation system throughout each day, the system must be able to provide a very high level of service at all times particularly during these peaks.

Vertical transportation services for classrooms, laboratories, lecture theatres etc. shall provide a level of service to ensure that at no time (even under the most intensive demand) a passenger shall wait more than 5 minutes for a lift .Well-established escalator and lift systems that have a proven track record of reliability and ease of maintenance should only be considered

18.3 Standards

All new lift / escalator installations must comply with the following standards and requirements:

AS1735	-	Lift, Escalator and moving walks code.
AS3000	-	Wiring Rules
Building Code of Australia	-	In total plus any NSW requirements
WorkCover NSW	-	Local Inspectorate

18.4 Minimum Vertical Transportation Services

For 2 and 3 storey buildings, there is a minimum requirement to provide a lift for the vertical movement of furniture, goods and persons with disabilities.

Where the height of a building exceeds 10.5 metres or there are more than 3 floors served, consideration should be given to more than one lift being installed.

Where class rooms, lecture theatres, laboratories etc. are involved, the use of escalators, at least in part, should be seriously considered.

18.5 Requirements for Persons with Disabilities

All lifts installed at any of the University campuses or buildings shall comply with at least the Building Code of Australia requirement for Facilities for People with Disabilities Clause E3.6 plus all lift car control buttons shall comply with clause 8.3.4 Tactual Labelling of AS1735.12.

Only lifts complying with AS1735 Parts 2 or 3 shall be used for providing access for people with disabilities.

Unless prior approval from the University is given the following lifts **shall not be used** for the access of people with disabilities.

AS1735.13	Lifts for persons with limited mobility	- manually powered
AS1735.14	Lifts for persons with limited mobility	- restricted use - low rise platforms
AS1735.15	Lifts for persons with limited mobility - restricted use	- non-automatically controlled lifts
AS1735.16	Lifts for persons with limited mobility - restricted use	- automatically controlled

Where the need is clearly identified for the specific use for access of people with disabilities then Part 12 of AS1735 shall be applied to the lift or at least one lift if more than one lift is being installed in a group.

Where AS1735 Part 12 is applied, clause 8.1 - Automatic Audible Information shall be applied as follows for the lift car position indicator and operation of all lift car buttons.

Automatic audio information shall be by oral announcement only.

18.6 Provision of Stretchers and Emergency Lifts

Provision shall be made for the use of stretchers and emergency lifts as detailed in the latest version of the Building Code of Australia.

18.7 Performance Requirements (Administrative and Office Buildings Only)

If a normal passenger lift service, as distinct from class rooms, lecture theatres, laboratories, goods service or Facilities for Disabled Persons lift, is to be installed it shall be designed to meet the following design criteria:

Waiting Interval - the maximum up peak average departure interval from the main lowest floor landing for administrative and office buildings:

1 to 4 floors served - 45 seconds
5 to 8 floors served - 35 seconds
8 and higher floors served - 30 seconds

Handling Capacity – Minimum 5 minute handling capacity expressed as a percentage of building population above the main lowest floor landing for administrative and office buildings:

1 to 4 floors served - 10.0 %
5 to 8 floors served - 12.5 %
8 and higher floors served - 15.0 %

18.8 Performance Requirements (Class Rooms, Lecture Theatres, etc.)

The basic requirement for class rooms, lecture theatres, etc. shall be a5 minute handling capacity of 25% (twenty five percent) . For any lift installation in a building of this type, careful and thorough theoretical traffic analysis is required. A detailed study is to be carried out and a full written report is to be provided by an appropriate independent consultant or at least 3 separate studies supplied by 3 potential tendering lift companies.

The use of escalators at least in part should be seriously considered.

18.9 Performance Requirements (Special Circumstances and Mixture of Class Rooms and Offices)

Where a building has a mix of classrooms and offices, it will be evaluated on an individual basis. Overall the requirements of clause 2,4,7 and 8 must be observed.

18.10 Type of Lift Drive and Escalators

The type of lift drive shall be based on the following:

Machine Room Less — To be used for all applications from 2 floors and higher, and for speeds of 1 metre per second up to 1.6 metres per second.
Overhead Gearless — To be used for lift requiring a speed of 2.5 metres per second and higher.

Alternating Current machines are to be used for the main driving machine. Variable Voltage Variable Frequency Alternating Current machines are preferred for both geared and gearless lifts. Variable Voltage Direct Current machines being a secondary option for Gearless lifts only.

Escalators shall comply with the following:

- Step chains shall have a service life of at least 100,000 hours
- All step chain rollers are to have roller or ball bearings not bushes
- The use of nylon or other "soft" materials shall not be used for major items such as drive and handrail sprockets
- Automatic lubricators shall have sufficient capacity to provide lubrication at appropriate levels for periods of at least one (1) month without topping up
- All handrail returns (newels) are to have roller guides not sliders
- Balustrades are to be made of substantial materials other than glass unless otherwise approved by UTS
- There shall be at least three (3) level steps at the entry and exit of each escalator
- The speed of any escalator shall be limited to 0.5mps.

18.11 Lift Details and Escalator Size

The minimum size of lift cars shall be 9 persons for all passenger lifts.

Lift doors and frames must be finished satin stainless steel to approval for both car and landings. Internal car finish must be textured stainless steel or similar approved finish to minimise the possibility of damage.

Goods lifts are to have provision for protective blankets in the lift car to protect their finishes.

Goods lifts are to be sized and have features as required for their particular application and usage. All lifts that specifically carry goods shall have durable and appropriate finishes. Handrails shall be kept to a minimum and only as required by the lift code AS1735.12 i.e. no longer than 600mm. The use of hard wood timber bump rails shall be used on both sides and rear wall. The hard wood timber is to be through bolted into the lift car walls. The timber is to be a minimum of 200mm wide by 50mm thick. The timber is to have a clear lacquered finish.

All controls are to have vandal resistant controls and communication systems.

Any lift car emergency phone system is to be auto dialling, hands free and shall be directly connected to the University's Security Office for 24 hour monitoring.

Escalator step width shall be not less than 600mm.

18.12 Maintenance

The University has many lifts and several escalators under maintenance and requires all new lifts and escalators to be as compatible and easily integrated with the existing lifts, escalators and maintenance contractors as possible. To that end consideration must be given, and documentation must be provided, before accepting any new lift system, or escalator, that clearly identifies it as being easily and effectively maintained by the existing maintenance contractor.

18.13 Integration with Existing Maintenance Procedures

The following procedures are to be implemented into any new lift/escalator construction specification so as to assist the integration of any new lifts into the existing lift maintenance program.

1. The University's Building Services Branch is to be involved in all new vertical transportation tender assessments. All documentation must be made available to the Section with at least 1 week prior notice of the assessment date.
2. The University's Building Services Branch is to be involved in the commissioning of all new lift and escalator installations. At least 2 weeks prior notice is to be given to the Section of any commissioning of new lifts or escalator.
3. Prior to commissioning of any new lifts (at least one week) the University's Works and Property Section are to be given at least one (1) copy of the Operational and Maintenance Manuals for the particular lift or escalator. The manual must contain the NSW Workcover lift registration number and design number.
4. Any lifts or escalator placed into a Defects Liability Period must comply with the procedures for recording and reporting of the existing lifts that are in place for the University at the time of tender.

18.14 Passenger Lift Interiors

Lift carpet to be Ontera "wombat" blackbat 880 carpet tiles or equal set at ¼ turn.

In no case is stone to be used on lift interiors. Bumpers around 3 sides to be stainless steel round sections. All stainless steel linings on the side and rear walls to have textured finish to limit damage.

A full width mirror to be provided at rear of car above height of bumper, refer item 18.12 above.

The use of hand rails shall be kept to a minimum in lift cars. The hand rails shall be no more than 600mm in length and fully compliant with AS1735.12 Section 5.

19 COLOUR SCHEDULE FOR PLANT AND EQUIPMENT

All plant and equipment in plant-rooms, service risers and wherever exposed to view must be painted to the colour scheme detailed below. Where colours are not specified for particular items of plant, the University must be consulted before colours are nominated. All pipework, valves and fittings in plant-rooms, ducts and wherever exposed to view must be colour banded. Pipework identification must be achieved throughout by use of Safetyman pipe markers and labels to indicate contents and flow.

Colours should comply with the following Australian Standards:
AS2700 Colours for General Purposes
AS1345 The Identification of Piping Conduits and Ducts.

19.1 Pumps

		AS 2700 Colour
Domestic Cold Water Pumps		
Motor	Orange	X15
Pump	Canary	Y11
Coupling Guard	Golden Yellow	Y14 with black stripes
Base	Black	
Domestic Hot Water Pumps		
Motor	Orange	X15
Pump	Pumpkin	X12
Coupling Guard	Golden Yellow	Y14 with black stripes
Base	Black	
Fire Service Pumps		
Motor	Orange	X15
Pump	Signal Red	R13
Coupling Guard	Golden Yellow	Y14 with black stripes
Base	Black	
Chilled Water Pumps		
Motor	Orange	X15
Pump	Canary	Y11
Coupling Guard	Golden Yellow	Y14 with black stripes
Base	Black	
Condenser Water Pumps		
Motor	Orange	X15
Pumps	Pumpkin	X112
Coupling Guard	Golden Yellow	Y14 with black stripes
Base	Black	

19.2 Air-Handling Plants

Fan Coil Units and Conditioners	Deep Cream	Y25
External Motors	Orange	X15
Belt Guards	Golden Yellow	Y14 with black stripes
Toilet Exhaust Systems		
Fans	Pumpkin	X12
Motors	Orange	X15
Coupling Guards	Golden Yellow	Y14 with black stripes
Base	Black	
Ductwork	Pumpkin	X12
Supply Air Systems		
Fans	Straw	Y224
Motors	Orange	X15
Coupling Guards	Golden Yellow	Y14 with black stripes
Base	Black	
Ductwork	Canary Yellow	Y11

Fume Exhaust Systems		
Supply Air Fans	Pumpkin	X12
Exhaust Fans	Pumpkin	X12
Motors	Orange	X15
Belt Guards	Golden Yellow	Y14 with black stripes
Ductwork	Pumpkin	X12
Miscellaneous Exhaust (other than those listed above)		
Fans	Pumpkin	X12
Motors	Orange	X15
Guards	Golden Yellow	Y14 with black stripes
Base	Black	
Ductwork	Pumpkin	X12

19.3 Air Compressors and Vacuum Pumps

Air Compressors		
Motors	Sapphire	B14
Compressor	Aqua	B25
After Cooler	Sapphire	B14
Air Receiver	Sapphire	B14
Guards	Grey Blue	B43
Belt Guards	Golden Yellow	Y14 with black stripes
Base	Black	
Vacuum Pumps		
Motors	Sapphire	B14
Vacuum Pump	Aqua	B25
Silence	Sapphire	B14
Vacuum Tank	Sapphire	B14
Guards	Grey Blue	B43
Belt Guards	Golden Yellow	Y14 with black stripes
Base	Black	

19.4 Refrigeration Systems

Centrifugal Chillers		
Compressor/Motor	Orange	X15
Condenser Vessel	Pumpkin	X12
Chiller Vessel	Canary	Y11
Oil Pump Vessel	Orange	X15
Frame	Black	
Pipework Tubing	Raffia	X31
Condensing Units		
(DX System)	Lettuce	G33

19.5 Electrical

Main Electrical Switchboard	Orange	X15
Electrical Distribution Board	Orange	X15
Mechanical Service Switchboard	Orange	X15
Power Load Centres	Orange	X15
Cable Trays, Ladders, Ducts & Conduits	Orange	X15
Fire Alarm Cable Ladders, Ducts & Conduits	Signal Red	R13

19.6 Pipework, Valves and Fittings (not Outlets)

Service	***Pipe***		***Valves***		***Valve Tops***
Domestic Cold Water	Mid Blue	B15	Signal Red	R13	Black
Domestic Hot Water	Jade	G21	Signal Red	R13	Black
Chilled Water	Jade	G21	Signal Red	R13	Black
Fire Services Water	Signal Red	R13	Signal Red	R13	Black
Mains					
Condenser Water	Jade	G21	Signal Red	R13	Black
Drains	Black				
Gas L. Petroleum	Raffia	X31	Pumpkin	X12	Black
Compressed Air	Aqua	B25	Ultramarine	B21	Black
Vacuum	Aqua	B25	Ultramarine	B21	Black
Oxygen	Raffia	X31	Pumpkin	X12	Black
Acetylene	Raffia	X31	Pumpkin	X12	Black
Other Gases	To approval				
Demineralised Water	Palm Green	G44	Signal Red	R13	Black
Internal Downpipes and Stormwater	Mid Grey	N52			

19.7 Brackets, Supports and Rods

All mounting brackets, MS angle supports and hanger rods to be painted ‘Black’ where exposed.

19.8 Underground Marker Tape

Underground marker tape must be installed 300mm above the top of all underground services.

The colour code must be as follows:

Service	***Colour***
Sewer	Buff
Water (including Chilled and Demineralised)	Green
Fire Service	Red
Stormwater	Blue
Electrical	Orange
Communications (including telephone, data and special services)	White

20 PAINTING

20.1 Paint System Selection

The painting of any UTS buildings must be executed in accordance with the latest edition of the following Australian Standards:

AS/NZS 2310:2002	Glossary of Paint and Painting Terms
AS/NZS 2311:2000	Guide to the Painting of Buildings.
HB 73.1:2005	Handbook of Australian Paint Standards

Suppliers of all paints specified are required to provide a written warranty stating that the finishes supplied must, subject to the use of the manufacturers recommended application procedures, show no deterioration and remain in good condition for the period noted in Table 1 from the date of application. The paint system and finishes for each application shall be in accordance with Table 20.1. For any application not noted in Table 20.1, refer to the FMO/PMO Project Manager for directions.

The Painting Specification must include a clause notifying the Builder that the Dulux Quality Assurance (QA) System will be adopted for each project and that a Dulux Quality Assurance Project Activity Card (QAPAC) will also be issued for each project. This QA System verifies that the paint systems specified are executed in the works.

Table 20.1: Paint Systems for Each Application

Substrate	System	Duspec No:	Warrranty Period Years
INTERNAL			
New plasterboard walls	DULUX Wash & Wear 101 Advanced Low Sheen	SD0002	10
New plasterboard walls – Low VOC*	DULUX Professional Enviro2 Interior Low Sheen	SD2185	10
Previously painted plasterboard walls	DULUX Wash & Wear 101 Advanced Low Sheen	SD0007	10
Previously painted plasterboard walls – Low VOC*	DULUX Professional Enviro2 Interior Low Sheen	SD2316	10
New water resistant plasterboard walls	DULUX Wash & Wear 101 Advanced Low Sheen	SD1964	10
New water resistant plasterboard walls – Low VOC*	DULUX Professional Enviro2 Interior Low Sheen	SD2289	10
Previously painted water resistant plasterboard walls	DULUX Wash & Wear 101 Advanced Low Sheen	SD3308	10
Previously painted water resistant plasterboard walls – Low VOC*	DULUX Professional Enviro2 Interior Low Sheen	SD2316	10
New plasterboard ceilings	DULUX Wash & Wear 101 Advanced Flat	SD1029	10
New plasterboard ceilings – Low VOC*	Dulux Professional Enviro2 Interior Flat Acrylic	SD2187	10
Previously painted plasterboard ceilings	DULUX Wash & Wear 101 Advanced Flat	SD0005	10
Previously painted plasterboard ceilings – Low VOC*	Dulux Professional Enviro2 Interior Flat Acrylic	SD2315	10
New FC walls	DULUX Wash & Wear 101 Advanced Low Sheen	SD2935	10
New FC walls – Low VOC*	DULUX Professional Enviro2 Interior Low Sheen	SD2288	10
Previously painted FC walls	DULUX Wash & Wear 101 Advanced Low Sheen	SD1515	10
Previously painted FC walls – Low VOC*	DULUX Professional Enviro2 Interior Low Sheen	SD2319	10

Substrate	System	Duspec No:	Warrranty Period Years
New FC ceilings	DULUX Wash & Wear 101 Advanced Flat	SD3174	10
New FC ceilings – Low VOC*	Dulux Professional Enviro2 Interior Flat Acrylic	SD2342	10
Previously painted FC ceilings	DULUX Wash & Wear 101 Advanced Flat	SD3174	10
Previously painted FC walls – Low VOC*	Dulux Professional Enviro2 Interior Flat Acrylic	SD2342	10
New cement render walls	DULUX Wash & Wear 101 Advanced Low Sheen	SD1128	10
New cement render walls – Low VOC*	DULUX Professional Enviro2 Interior Low Sheen	SD2287	10
Previously painted cement render	DULUX Wash & Wear 101 Advanced Low Sheen	SD1023	10
Previously painted cement render – Low VOC*	DULUX Professional Enviro2 Interior Low Sheen	SD2326	10
New hardset plaster ceilings > 8 weeks old	DULUX Wash & Wear 101 Advanced Flat	SD2533	10
New hardset plaster ceilings > 8 weeks old – Low VOC*	Dulux Professional Enviro2 Interior Flat Acrylic	SD2276	10
Previously painted hardset plaster ceilings > 8 weeks old	DULUX Wash & Wear 101 Advanced Flat	SD0824	10
Previously painted hardset plaster ceilings > 8 weeks old – Low VOC*	Dulux Professional Enviro2 Interior Flat Acrylic	SD2728	10
New steel balustrades	DULUX Super Enamel High Gloss	SD1930	5
New steel balustrades – Low VOC*	DULUX Aquanamel Gloss	SD2987	5
Previously painted steel balustrades	DULUX Super Enamel High Gloss	SD1983	5
Previously painted steel balustrades – Low VOC	DULUX Aquanamel Gloss	SD2921	5
New galvanised steel balustrades	DULUX Super Enamel High Gloss	SD0381	5
New galvanised steel balustrades – Low VOC*	DULUX Aquanamel Gloss	SD2282	5
Previously painted galvanised steel balustrades	DULUX Super Enamel High Gloss	SD0387	5
Previously painted galvanised steel balustrades – Low VOC*	DULUX Aquanamel Gloss	SD2282	5
New Steel Doors	DULUX Super Enamel High Gloss	SD1783	5
New Steel Doors – Low VOC*	DULUX Aquanamel Gloss	SD2987	5
Previously painted steel doors	DULUX Super Enamel High Gloss	SD1983	5
Previously painted steel doors – Low VOC*	DULUX Aquanamel Gloss	SD2921	5
New galvanised steel door frames	DULUX Super Enamel High Gloss	SD0381	5
New galvanised steel door frames – Low VOC*	DULUX Aquanamel Gloss	SD2282	5
Previously painted galvanised steel door frames	DULUX Super Enamel High Gloss	SD0387	5
Previously painted galvanised steel door frames – Low VOC*	DULUX Aquanamel Gloss	SD2282	5
New Pre-primed timber doors	DULUX Super Enamel High Gloss	SD1002	5
New Pre-primed timber doors	DULUX Aquanamel Gloss	SD0458	5

Substrate	System	Duspec No:	Warrranty Period Years
– Low VOC*			
Previously painted timber doors	DULUX Super Enamel High Gloss	SD0040	5
Previously painted timber doors – Low VOC*	DULUX Aquanamel Gloss	SD1554	5
New timber trim	DULUX Super Enamel High Gloss	SD1002	5
New pre-primed timber trim – Low VOC*	DULUX Aquanamel Gloss	SD0458	5
Previously painted timber trim	DULUX Super Enamel High Gloss	SD0040	5
Previously painted timber trim – Low VOC*	DULUX Aquanamel Gloss	SD1554	5
New MDF timber	DULUX Super Enamel High Gloss	SD1168	5
New MDF timber Low VOC*	DULUX Aquanamel Gloss	SD3298	5
Previously painted MDF timber	DULUX Super Enamel High Gloss	SD1002	5
Previously painted MDF timber – Low VOC*	DULUX Aquanamel Gloss	SD3299	5
EXTERNAL			
New cement render	DULUX Weathershield X10™ Low Sheen Acrylic	SD0854	10
Previously painted cement render	DULUX Weathershield X10™ Low Sheen Acrylic	SD0879	10
New cement render	DULUX AcraTex 955 AcraShield	SA0909	10
Previously painted cement render	DULUX AcraTex 955 AcraShield	SA3032	10
Previously painted cement render – Graffiti resistant	DULUX Weathermax® HBR	SI1084	5
New brickwork	DULUX Weathershield X10™ Low Sheen Acrylic	SD0312	10
Previously painted brickwork	DULUX Weathershield X10™ Low Sheen Acrylic	SD1972	10
New brickwork	DULUX AcraTex 955 AcraShield	SA0915	10
Previously painted brickwork	DULUX AcraTex 955 AcraShield	SA3003	10
New concrete	DULUX Weathershield X10™ Low Sheen Acrylic	SD1062	10
Previously painted concrete	DULUX Weathershield X10™ Low Sheen Acrylic	SD1498	10
New concrete	DULUX AcraTex 955 AcraShield	SI2994	
Previously painted concrete	DULUX AcraTex 955 AcraShield	SA3172	10
New structural steel	DULUX Weathermax® HBR	SI3107	
New misc. steelwork	DULUX Super Enamel High Gloss	SD1930	2
Previously painted misc. steelwork	DULUX Super Enamel High Gloss	SD1983	2
New timber doors	DULUX Super Enamel High Gloss	SD1002	2
Previously painted timber doors	DULUX Super Enamel High Gloss	SD1002	2
New timber fascia & trim	DULUX Weathershield X10™ Low Sheen Acrylic	SD0035	
Previously painted timber fascia & trim	DULUX Weathershield X10™ Low Sheen Acrylic	SD2414	
New zincalume gutters & downpipes	DULUX Weathershield X10™ Low Sheen Acrylic	SD3689	

Substrate	System	Duspec No:	Warrranty Period Years
Previously painted gutters and down pipes	DULUX Weathershield X10™ Low Sheen Acrylic	SD3663	

*** Low VOC =Areas/substrates requiring paint systems with low levels of Volatile Organic Compounds**

Colours of all priming, body and undercoats are to be in different shades and lighter than the finish coat specified. All proposed colour schemes to be approved by FMO/PMO.

Factors such as the need and inconvenience of maintenance arising from exposure to wear, the elements, or possible vandalism must be carefully considered in determining the appropriate paint system. In confined areas occupied by staff only, 100% acrylic paints should be used to reduce the problems of VOC fumes associated with solvent based paints. Enamels should be used on all hardwearing surfaces such as doorframes and skirtings providing unnecessary inconvenience in their application will not be caused to existing occupants.

All paint specifications must clearly describe the surface preparation, type of paint system and method of application.

20.2 White Board Paint

In lieu of white boards white board paint – 'Idea Paint' distributed by Baresque Australia Pty Limited is a two pack polyurethane paint applied by a rough roller, installed by a professional contractor. It should be applied to entire walls finishing to an internal corner or a mullion. Once installed it should be cured for 7 days before use.

20.3 Colour Schemes

Proposed colour schemes must be approved by FMO/PMO at an early stage. This approval should take the form of a sample board presentation together with the other finishes for the affected areas. A schedule should be provided at the time of presentation, listing the type of paint system proposed for each space and the relevant finish (e.g. low sheen acrylic).

Colours should compliment the original palette of the respective buildings and take colour generation clues from existing durable finishes eg tiles in entry foyer. As rule of thumb 60% of the room should be the dominant colour 30% intermediate colour and 10% accent colour. High chroma colours (which are high in VOCs) should be limited to 10-30% of wall area colour. Pale colours should be used in small rooms to create the illusion of spaciousness.

Colour schemes to comply with AEP Section 24 as applicable – with minimum 30% luminance contrast between adjacent surfaces.

The University has adopted a number of standard colours. For the Kuring-gai Campus refer to Section 27 - Kuring-gai Campus Interior Design Guidelines. For the other campuses, the standard colours include the following:

Area	Manufacturer	Colour	Shade Reference
Walls	Dulux	Aran white	PW 2.D7
	Dulux	Spanish Cream	P11.61
	Dulux	Facemark	P12H4
Doors & Frames	Taubmans	Arnham Tan	1203R
	Dulux	Kimberly Sea	P33C6
	Dulux	Wizard	P41F7
	Taubmans	Coalcliff Black	9084N
Aluminium Powdercoat	Taubmans	Arnhem Tan	1203R
	Dulux	Kimberly Sea	P33C6
	Dulux	Wizard	P41F7
	Dulux	APO Grey	32786
	Dulux	Vivid White	PW1. H9
Steel	Taubmans	Coalcliff Black	9084N
	Taubmans	Arnhem Tan	1203R
	Dulux	Kimberly Sea	P33C6
	Dulux	Wizard	P41F7

21 SIGNAGE

21.1 UTS Sign Standards

All signage must be designed and installed in accordance with the UTS Sign Standards. For the Sign Standards refer to http://www.fmu.uts.edu.au/for/consultants/docs/UTSSignStandards.pdf

Signage to comply with AEP Section 24 as applicable – with minimum 30% luminance contrast between signage lettering and background surfaces.

21.2 Emergency Evacuation Diagrams

21.2.1 Introduction

- In order to comply with the Australian Standard 3745 *Planning for Emergencies in Facilities*, the University requires all new buildings and renovated spaces to:
- Display correct, compliant and adequate emergency signage in the building or space;
- Update related signage as required; and,
- Provide soft copies of the 'as built' nature of the building or space, identifying the features discussed within this section.

This signage is to be compliant with the both section 3.5 *Evacuation Diagrams* of the AS 3745, and to the UTS management strategy for Emergency Planning. As such, aspects of this signage will incorporate additional elements designed to satisfy prescriptions elsewhere in the standard, including – but not limited to – strategies to ensure visitors are aware of our Emergency Response Procedures and Evacuation Procedures.
It is the responsibility of the Project Manager to ensure that this signage is installed in a complete and finished state prior to occupancy.
Templates for signage are available from Security Services Branch through
http://www.uts.edu.au/about/maps-and-facilities/safety-and-security/emergencies

21.2.2 Signage Types

The University applies three types of AS 3745 compliant Evacuation Diagrams and Emergency Procedure Diagrams. These are:

- Evacuation Diagrams
  - A4
  - A3
- Emergency Procedures Signage
  - A4

21.2.3 Format Specifications

Emergency Evacuation Diagrams (A4) – DA4	
Size	Standard Landscape A4 (Width: 297mm, Height: 210mm)
Margins	Less than 7mm all sides.
Colour Scale	CMYK
Digital Format	AutoCAD compatible .DWG or Adobe Illustrator .AI
Emergency Evacuation Diagrams (A3) – DA3	
Size	Standard Portrait A4 (Width: 297mm, Height: 420mm)
Margins	Less than 7mm all sides.
Colour Scale	CMYK
Digital Format	AutoCAD compatible .DWG or Adobe Illustrator .AI
Emergency Procedures Sign - EPS	
Size	Standard Portrait A4 (Width: 210mm, Height: 297mm)
Margins	Less than 7mm all sides.
Colour Scale	CMYK
Digital Format	AutoCAD compatible .DWG or Adobe Illustrator .AI

21.2.4 Position

The AS 3745 prescribes that compliant signage shall be placed within the following parameters:

Height	Lowest edge shall be not less than 1300mm and not more than 1500mm above the plane of the finished floor.
Spacing	Not less than 10mm from cornering or wall curvature.

21.2.5 Placement (Quantity and Location)

In order to achieve holistic compliance with AS3745, the UTS Emergency Planning Committee has determined the following specifications for the placement of Evacuation Diagrams posters.

Space Type	Requirement
Open Floor Plan Office	• No less than 1 x Emergency Evacuation Diagram (A3), • Visible from all points within the space, or; • Adjacent to Entry/Fire Exit route from space (at discretion of EPC); and • Additional Evacuation Diagrams (A4) signage such that no point on the office floor is more than 20m from an Emergency Evacuation Diagram
Public Space	• No less than 1 x Emergency Evacuation Diagrams (A3) [1, 2]
Lift Lobby	• No less than 1 x Emergency Evacuation Diagrams (A3) [1]
Fire System Cupboard (WIP/BGA/Fire Hose Reel)	• No less than 1 x Emergency Evacuation Diagrams (A3)
Hallway	• No less than 1 x Emergency Evacuation Diagrams (A3) [1, 2]
Classroom	• No less than 1 x Emergency Procedures Sign
Classroom (Partitioned)	• No less than 1 x Emergency Procedures Sign, and; • No less than 1 x Emergency Procedures Sign per partition, excluding any partitions containing any other type.
Lecture Theatre (Capacity greater than 50 persons)	• No less than 1 x Emergency Evacuation Diagrams (A3) adjacent to each exit.
Lecture Theatre (Capacity less than 50 persons)	• No less than 1 x Emergency Evacuation Diagrams (A3) adjacent to main entryway, and; • No less than 1 x Emergency Procedures Sign adjacent to each other exit.
Bathrooms	• No less than 1 x Emergency Procedures Sign
Fire Stair Entry	• No less than 1 x Emergency Evacuation Diagrams (A3)
Staffrooms and Kitchenettes	• No less than 1 x Emergency Evacuation Diagrams (A3) [2]
Photocopy Rooms	• No less than 1 x Emergency Evacuation Diagrams (A3) [2]
Plant Rooms	• No less than 1 x Emergency Procedures Sign

[1] May be incorporated into way finding or other public signage, as per *Incorporations.*
[2] Not required within a 10M radius of another Emergency Evacuation Diagrams (A3).

21.2.6 Mounting

It is recommended that signs be produced on white paper (80GSM or higher) for ease of replacement and maintenance.
Mounting frames used must comply with the following specifications:

- Be immovable and fixed to the wall (Double Sided Foam Tape is considered acceptable);
- Be labeled or printed with a matching serial number (SID) to the corresponding poster.

21.2.7 Signage Identification Markings

Signage ID (SID) codes are to be printed on all types of Emergency Evacuation Diagrams, and on their corresponding mountings. These codes shall also be the file name for digital copies provided to UTS at the completion of the project.
SID codes are aligned with the UTS CAD Standards, using:

Discipline Code	R - Fire
Drawing Type Code	D - Details

21.2.8 Content

All signs must comply with the Australian Standard 3745.

Minimum contents and prescriptions specified by both the standard, and the UTS Emergency Planning Committee include:

Evacuation Diagrams (A4) – DA4	
Diagram	A pictorial representation of the floor or area, which shall be at least 200mm x 150mm. *See 'Floor Plans' Section*
Title	The title 'EVACUATION DIAGRAM' above the diagram
You Are Here	The 'YOU ARE HERE' location in blue
Location Name	Room Number, Floor, Building, Address, Nearest Cross Road.
Exits	The designated exits in the facility, which shall be green.
Warden Intercommunication Points (WIPs)	WIPs, which shall be red.
Manual Call Points (MCPs)	MCPs (Red Break Glass Alarms), which shall be red.
Emergency Call Points (ECPs)	EPCs (White 'Emergency' Break Glass Alarms), which shall be white - or have a black border.
Controls	Main controls/panels for the Occupant Warning Equipment
Hose Reels	Hose Reels, which shall be red.
Hydrants	Hydrants, which shall be red.
Extinguishers	Extinguishers, which shall be red with an additional appropriate colour as specified in AS/NZS 1841.1
Fire Blankets	Fire Blankets, which shall be red.
Fire Indicator Panel/Fire Control Rooms	As applicable.
Refuges (N/A)	As applicable. (N/A)

Assembly Area Diagrams	The location and route to assembly area(s), pictorially represented.
Legend	Which shall reflect symbols used.
North	North (Arrow or using an appropriate symbol)
Hazardous Chemical Stores	Hazardous Chemical Stores
Spill Response Kits	Spill Response Kits
Emergency Information	See *Emergency Information* section.
Paths of Travel	Recommended paths of travel, coloured Green.
Date of printing	Date of Printing (No less than 4pt Arial Font) (Validity Date)
Emergency Contact Numbers	000, TTY106, Dial 6, 1800 249 559, Security Enquiries 02 9514 1192. NOTE: 'DIAL 6' and 'DIAL 1800 249 559' shall be the most identifiable of the contact numbers on the poster.
SID Code	See *Signage Identification Markings.*

Emergency Evacuation Diagrams (A3) - DA3	
Diagram	A pictorial representation of the floor or area, which shall be at least 210mm x 297mm. *See 'Floor Plans' Section*
Title	The title 'EVACUATION DIAGRAM' above the diagram
You Are Here	The 'YOU ARE HERE' location in blue
Location Name	Room Number, Floor, Building, Address, Nearest Cross Road.
Exits	The designated exits in the facility, which shall be green.
Warden Intercommunication Points (WIPs)	WIPs, which shall be red.
Manual Call Points (MCPs)	MCPs (Red Break Glass Alarms), which shall be red.
Emergency Call Points (ECPs)	EPCs (White 'Emergency' Break Glass Alarms), which shall be white - or have a black border.
Controls	Main controls/panels for the Occupant Warning Equipment
Hose Reels	Hose Reels, which shall be red.
Hydrants	Hydrants, which shall be red.
Extinguishers	Extinguishers, which shall be red with an additional appropriate colour as specified in AS/NZS 1841.1
Fire Blankets	Fire Blankets, which shall be red.

Fire Indicator Panel, Fire Control Rooms, MIMIC Panels	As applicable.
Refuges	As applicable
Assembly Area Diagrams	The location and route to assembly area(s), pictorially represented.
Legend	Which shall reflect symbols used.
North	North (Arrow or using an appropriate symbol)
Hazardous Chemical Stores	Hazardous Chemical Stores
Spill Response Kits	Spill Response Kits
Emergency Information	See *Emergency Information* section.
Paths of Travel	Recommended paths of travel, coloured Green.
Date of printing	Date of Printing (No less than 4pt Arial Font) (Validity Date)
Emergency Contact Numbers	000, TTY106, Dial 6, 1800 249 559, Security Enquiries 02 9514 1192. NOTE: 'DIAL 6' and 'DIAL 1800 249 559' shall be the most identifiable of the contact numbers on the poster.
UTS Help Points	Emergency Help Points, which shall be in Orange.
Smoke Prevention	Smoke Doors and Curtins
Fire Doors	As applicable
SID Code	See *Emergency Information* section.

Emergency Procedures Signs	
Title	The title 'EMERGENCY PROCEDURES'
Location Name	Building, Address, Nearest Cross Road.
Exits	The designated exits from the facility, which shall be green.
Assembly Areas	The location and route to assembly area(s), pictorially represented. This diagram shall include a 3D view of the immediate precinct, with the building shaded in blue.
You Are Here	The building shaded in blue labelled YOU ARE HERE, within the Assembly Areas diagram.
Legend	Which shall reflect symbols used.
North	North (Arrow or using an appropriate symbol)
Emergency Information	See *Emergency Information* section.
Paths of Travel	Recommended paths of travel, coloured Green.
Date of printing	Date of Printing (No less than 4pt Arial Font)

	(Validity Date)
Emergency Contact Numbers	000, TTY106, Dial 6, 1800 249 559, Security Enquiries 02 9514 1192. NOTE: 'DIAL 6' and 'DIAL 1800 249 559' shall be the most identifiable of the contact numbers on the poster.

21.2.9 Pictograms

All pictograms shall comply with the examples provided in AS3745, and/or other relevant Australian Standards.

21.2.10 Floor Plans and Assembly Area Diagrams

In line with AS3745, pictorial diagrams of floor plans included in Evacuation Diagrams (A4) and Emergency Evacuation Diagrams (A3) signage shall comply with the following stipulation:

"Individual evacuation diagrams shall have the correct orientation with regard to the direction of egress and its location to the 'YOU ARE HERE' point. Where an assembly area diagram is included, the assembly diagram area shall have the same orientation to the rest of the diagram"

21.2.11 Records

Upon occupancy, Security Services Branch must be provided with the following documents in electronic format:

- Floor Plans – Marked to AS3745 standards (explained below)
- Inventory of Signage Designs
- Inventory of Signage Placement

Floor Plans – Marked

Floor plans for each level, marked to AS3745 standards, in unlocked .DWG format, including the following layers:

Layer Number	Layer Name/Title	Layer Description
Layer 1	EM-FP	Floor Plan
Layer 2	EM-FCP	Fire Control Points
Layer 3	EM-MIMIC	MIMIC Panels
Layer 4	EM-FCR	Fire Control Rooms
Layer 5	EM-EX	Fire Exits
Layer 6	EM-FE	Fire Extinguishers
Layer 7	EM-FD	Fire Doors
Layer 8	EM-SM	Smoke Doors and Curtins
Layer 9	EM-MCP	Manual Call Points
Layer 10	EM-ECP	Emergency Call Points
Layer 11	EM-EDR	Emergency Door Releases
Layer 12	EM-HR	Hose Reels
Layer 13	EM-FIP	Fire Indicator Panels
Layer 14	EM-FB	Fire Blankets

Layer 15	FM-HYD	Hydrants
Layer 16	EM-WIP	Warden Intercommunication Points
Layer 17	EM-PRO	Placements of Emergency Procedures Signage (Including SID codes)
Layer 18	EM-ED4	Placements of Evacuation Diagrams (A4) (Including SID codes)
Layer 19	EM-ED3	Placements of Evacuation Diagrams (A3) (Including SID codes)

Pictograms used shall align with those used within the Evacuation Diagrams

Inventory of Signage Designs

An Electronic Copy of each sign posted, in unlocked and layered .DWG or .AI format shall be provided.

Inventory of Signage Placement

A spreadsheet containing the following information regarding every sign shall be provided in Microsoft Excel '.xlsx' format.

Column 1	Building Number
Column 2	Floor / **L**evel
Column 3	Room Number
Column 4	Signage Type (i.e. Diagram or Procedure)
Column 5	Signage Size (i.e. A4 or A3)
Column 6	Signage ID Number
Column 7	Complete Signage ID Code (e.g. 01.01.01.PA4_SID_001)
Column 8	Date of Last Edit
Column 9	Date of Print

21.2.12 Emergency Information

Where required by the *Content* section of this document, the following Emergency Information shall be included on signage:

Section 1	**Required: ALL**
Title	On Hearing the Alert Signal
Content	BEEP… BEEP… BEEP…[3]
	Shut down or secure machinery and computers
	Prepare to evacuate
	Check whether others may require assistance
	If danger is present, evacuate immediately

Section 2	**Required: ALL**
Title	On Hearing the Evacuation Signal
Content	WHOOP… WHOOP... WHOOP…[3]

	Evacuate

	A public announcement may tell you to:
	'EVACUATE AS DIRECTED'[3]
	Leave the building via the nearest fire exit
	Do not use lifts
	Follow the directions of Emergency Services, Wardens and Security Staff
	Provide assistance to others where required
	Proceed to the assembly area
	Do not return to the building until told to do so by UTS Security staff

Section 2	Required: Emergency Procedures Signage - EPS
Title	On Instruction to Shelter in Place
Content	Listen for instructions
	Secure your immediate environment by locking doors if safe to do so
	Keep others away from public areas such as foyers and hallways
	Silence Mobile Phones, and turn off Machinery and Audio-Visual equipment if possible.
	Close all windows, blinds and curtains
	Move away from the doors and windows, remain quiet and stay there until told otherwise by Police or UTS security
	Provide assistance to others where required
	Follow the directions of Emergency Services, Wardens and Security Staff

[3] This must align with instructions provided by the Automated Fire System installed.

21.2.13 Incorporations

In some circumstances, it may be acceptable to incorporate the content required by AS3745 into Way Finding and other Information signage.

This *may* negate the need to place other signage in the immediate vicinity.

Each instance of incorporated signage must be approved in writing by the UTS Emergency Planning Committee, through application to http://www.uts.edu.au/about/maps-and-facilities/safety-and-security/emergencies

21.2.14 Template and Design Variations

Any requests for variations from the provided template must be submitted in writing to the Emergency Planning Committee via emergency@uts.edu.au. Applications shall include an example of the preferred template, and must be made available for use by future projects and Facility Management Operations.
Any variations submitted should attempt to align with the intentions of the UTS Signage Manual where possible, including – but not limited to – Typography and UTS Brand: Evacuation Diagrams Example

21.3 Numbering Methodology

21.3.1 Introduction

Historically, the University had wide ranging methodologies for numbering or 'labelling' its buildings and rooms. It is the responsibility of the Facilities Management Unit to ensure that, upon appropriate approvals; all street address, building code, level, room and workstation signage is installed in accordance with UTS Sign Standards.

21.3.2 Building Identification and Signage

The primary building identification on signage and in directories shall be by way of **building numbers**. These numbers shall be shown on all external building signage and wayfinding signage. Secondary to building numbers shall be a system of building codes as described in the following. The codes will enable easy electronic coordination of entries in computer-based databases such as asset management, telephone directories and timetables.

21.3.3 Campus & Site Location

UTS has one campus in the southern part of Sydney's CBD
In addition to the campus, there is also a sports facility at Haberfield, a field research station at Alderley Glen near Stroud, and a conference centre at Yarramundi called Yarrawood.

Campus/Site Name	**Site**
CITY	**CB**
Accommodation Properties	**CA**
NON-CAMPUS SPECIFIC	
Haberfield Rowing Club	**HA**
Stroud Alderley Glen Field Station	**ST**
YarraWood Conference Centre	**YW**

21.3.4 Building Numbers

	Identification Codes	**name**	Previous Codes #
CITY CAMPUS			
Building 1	**CB01**	Tower	
Building 2	**CB02**		
Building 3	**CB03**	Bon Marché	
Building 4	**CB04**		
	CB4B	Ross Milbourne Sports Hall	
Building 5		Haymarket, Building 5	
	CB05A	Block A	CM05A
	CB05B	Block B	CM05B
	CB05C	Block C	CM05C
	CB05D	Block D	CM05D
Building 6	**CB06**	Peter Johnson Building	
Building 7	**CB07**	(including Library Retrieval System)	
Building 8	**CB08**	Dr Chau Chak Wing Building	
Building 9	**CB09**	The Loft	
Building 10	**CB10**		
Building 11	**CB11**		
Building 13	**CB13**	Convenience Store	
Building 15	**CB15**	TAFE Building U	
Building 18	**CB18**	The Terraces	CB08
Building 21	**CB21**	Blackfriars, Shop Front	CC21;CC01
Building 22	**CB22**	Blackfriars Former Girls & Infants School	CC22;CC02
Building 23	**CB23**	Blackfriars Child Care Centre	CC23;CC03
Building 24	**CB24**	Blackfriars (former Temporary Building 10)	CC24;CC04
Building 25	**CB25**	Blackfriars, Former Boys School	CC25;CC05
Building 26	**CB26**	Blackfriars, Toilet Block	CC26;CC06
Building 27	**CB27**	Blackfriars, The Residence	CC27;CC07

	CB61	187 Thomas Street (Insearch)	CT61;CT01
	CB71	10 Quay Street	CT71;CQ01
	CB72	Prince Centre, 8 Quay Street	CQ72;CQ02
	CB81	Magic Pudding Child Care Centre	CK81;CK01
	CB91	Mary Ann House, 645 Harris Street	CB91;CH01
Accommodation			
	CA01	Geegal 82 Ivy Street	
	CA02	Bulga Ngurra 23 Mountain Street	
	CA03	Gumal Ngurang 161 Broadway	
	CA06	Yura Mudang 702 Harris Street	
NON-CAMPUS SPECIFIC			
	HA01	Haberfield Rowing Club (Activate UTS)	
		Stroud Field Station	
	ST01	Alderley Cottage	
	ST02	Toilet Block	
		Yarrawood	
	YW01	Conference Building	
	YW02	Caretaker's House	
	YW03, 04 etc	Cabins 3, 4 etc.	

 # Previously a unique identifier representing multiple locations at City were used (CB:Broadway, CM:Markets, CC:Chippendale, CH:Harris Street, CK:McKee Street, CQ:Quay Street, CT:Thomas Street). With this campus and site naming system adopted circa 2000 each identified site commenced numbering from 01: CB01, CM01, CC01, CH01, CK01, CQ01, CT01, i.e. in shorthand several Building Number Ones. Coupled with this there has been a drive to promote the City Campus as one entity. To overcome potential confusion with wayfinding on City Campus duplicate building numbers are being phased out however the codes will remain on some databases and component labelling. This affects Blackfriars Precinct and leased premises and, in respect of codes, Haymarket. The building number for The Terraces was changed from 08 to 18 in 2013.

21.3.5 Street Addresses

Many of the University's buildings are accessed from a public street (particularly the City Campus). Therefore, Council derived street addresses are used to identify street entrances to UTS buildings.

"1 Broadway" is the official address of the University, however for essential city services and wayfinding, actual street addresses of the access points to the particular facility shall be used.

Signage indicating a street address of a building entrance should be placed at every prominent street entry. Current street addresses of UTS buildings & access points can be found at the Building and Room Identification Standard at http://maps.uts.edu.au/overview.cfm

21.3.6 Room & Level Numbers

The level number is the first number or numbers that appear in a room number. Room "two twenty-six", for example, is on level two of a building. The first two spaces are reserved for floor identification, with a dummy zero for floor 1 to 9. The dummy zero in the floor number is intended to make the sorting results more comprehensible. Examples follow:

Building One Level 23	Room 26 =	CB01.23.26
Level 7 of Building One	Room 26 =	CB01.07.26
Level 2, B Block, Building Five	Room 26 =	CB05B.02.26
Level 4A of Building One	Room 26 =	CB01.04A.26

A stop delineates the floor characters of the room number from the rest of the room number.

Five (5) characters may be required after the delineation. For floors with less than 100 rooms, only 2 characters are required for rooms off a main corridor. For floors with more than 100 rooms, 3 characters will be required. In all cases, a dummy zero is required to standardise the length of this part of the room numbers. The remaining 2 or 3 characters are for subsidiary rooms off the main room and subdivisions of the main room, if any.

All subsidiary rooms off a main room, eg. Room 02.20, are suffix-lettered clockwise from the primary entrance to the room or suite as 02.20A, 02.20B, 02.20C and so forth. This is for small groupings of rooms with a clear single entry point.

In large open plan office situations with complex plan or multiple entrances, rooms and workstations are to be numbered as a whole number without letter suffixes and in clockwise sequence from the most prominent entrance. If this methodology is used, signage indicating the

entire range of numbers used within the suite must be provided outside the prominent entry point.

Gaps in numbering sequences are inevitable and it is recommended that they be provided in creating any new numbering scheme. Renovations on a floor occur regularly and the number of doors on a corridor change frequently. Gaps are useful when new numbers are assigned to new spaces so that new numbers can fit logically within an existing sequence.

Lifts, Stairs, Service rooms, and Fire Hose Reels are to be numbered in a way that clearly delineates them from core purpose rooms. Incorporating two alpha characters after the separation mark allows identification of the room. Examples follow:

CR Corridor
FH Fire hose reel
LT Lift
SR Service riser or area (Ducts, electrical cupboards, etc.)
ST Stair

Corridor 4 on level 9 of Building One	=	CB01.09.CR04
Fire Hose Reel number 2 on level 5 of Building Two	=	CB02.05.FH02
Lift 1 on level 5 of Building Three:	=	CB03.05.LT01
Electrical Cupboard number 1 on level 4 of Building Six	=	CB06.04.SR01
Stair 3 on level 7 of Building One	=	CB01.07.ST03

21.3.7 Room Numbers on Signage

For the signage format for the door of a room, it is acceptable to drop the dummy zero in level although in recent numbering schemes it still appears. Either is acceptable based on the method used in the building. Examples follow: Level 5, room 22 in Building 1 would be signed as:**1.5.22**Level 4, room 39 in Building 10 would be signed as:**10.04.39**It is assumed that in the majority of instances the individual seeking a room will know what building he or she is in. However, in instances where large buildings are divided into blocks or sections, the most essential portion of the building number should be displayed. For example:

Level 2, room 24 in Building 1 would be signed as:	**5.2.24**
Level 4, room 13 in Haymarket Block C would be signed as:	**C4.13**

21.3.8 Room Numbers in Databases & Directories

Information systems within the University, such as Archibus (Space & Inventory) and Syllabus Plus (Timetable) store Building, Level and Room information in separate fields. Other systems such as CADS (Telephone Directory and Billing), Existing Timetable, Salaries, and Human Resources databases have restrictions on the number of characters and fields available for use. Therefore, for display purposes, the following format is used, with a stop as a separator.

BuildingNumber.LevelNumber.RoomNumber

Where: Building number comprises of 4 (typical) or 5 alphanumeric characters to first describe the campus or site then building number. Level Number is two (2) characters, and Room Number is up to five (5) characters.

For example:

Room 16.18A in Building 1 at City is coded as:	**CB01.16.18A**
Room 7.117A in Building 2 at City is coded as:	**CB02.07.117A**
Room 1.01A in Block D of Building 5 at City is coded as:	**CB05D.01.01A**

This room numbering system provides a basis for information to be shared between the different databases within UTS. When displaying the address of a room for other purposes such as in timetables generated by Syllabus Plus, the site number may be shown in a more 'user-friendly' manner, such as Broadway, Blackfriars, etc.

21.3.9 Workstation Numbers

For a workstation in room number 25 of level 05 the workstation numbering would be **WS05.2501**, where WS is the code for Workstations, 05 is the level for the building, 25 is the room number and 01 is the assigned workstation number. For additional workstations in the same room the workstation numbers would be **WS05.2502**, **WS05.2503** and so forth. For an office or room (eg Room Number – 06.03) containing only one workstation the workstation number would be the room number with the addition of the prefix "WS" i.e.**WS06.03.**

As workstation numbering was introduced at UTS in 2002 under a different system there will be instances where the numberer will need to use the existing system in the building. In instances where suites of workstations are given numbers under an earlier system that does not include a room number the workstation numbers must be displayed at the entrance door to the suite of workstation.

21.3.10 Hearing Loop Identification

Rooms with Hearing Loop provided to have the Hearing Loop Sign displayed adjacent to the entry door. Indication of rooms with hearing loops should also be given on Databases and directories

22 SPECIAL REQUIREMENTS

This section should be read in conjunction with the remainder of the Guidelines. Where the Special Requirements make reference to items described elsewhere in the Guidelines, this section shall take preference in determining UTS requirements unless otherwise indicated by the Project Manager.

22.1 Services Equipment Rooms

Services Equipment Rooms are to be provided to cater for data, voice communication, security and Building Monitoring Systems.

The number and location of these rooms must be confirmed with FMU.

Refer to Section 28 - UTS Information Technology Division Communications Infrastructure Design Guidelines. Refer also to Section 17 - Security and to Section 23 – Audio Visual Services. Refer to Section 24 – Accessible Environments Policy.

22.2 Laboratories

22.2.1 General

All laboratories must be designed to meet the requirements of the AS/NZ 2982.1 – Laboratory design and construction, AS 2243 parts 1-10 - Safety in Laboratories and AS2243 – Safety in Laboratories and EN 14056 – Laboratory furniture recommended for Design and Installation.

Laboratories must be designed in accordance with Classification 8 of the Building Code of Australia. The most stringent conditions must apply in the event of conflict.

22.2.2 Air Conditioning

Each laboratory must be served by its own individual air-conditioning system to minimise the possibility of contamination of adjacent areas. Where necessary, consideration should be given to all outside air systems. Refrigeration should normally be supplied as chilled water from the Central Chiller Plant. In special circumstances, individual DX systems are required for purposes of achieving special room conditions.

22.2.3 Lighting and Power

Artificial lighting in Undergraduate and Research Institute Laboratories must be provided to give a minimum average intensity of 600 (lux). A load centre must be provided in each laboratory to serve the power requirements of the area. All laboratory general purpose power outlets including **fume cupboards must be provided with single point earth leakage circuit breakers using Eaton Electric systems ELQ 116 – C3 TW 30 m amp sensitivity breakers. The requirements for load** centres are equivalent to those for electrical sub-boards.

In all Science Laboratories Emergency Power-off (EPO) switches are required to be mounted adjacent to each exit at 1200 above finished floor level. Activation of these switches shall de-energise all power sub-circuits leaving general lighting and fume cupboards still energised. The EPO should be mounted so as to avoid nuisance tripping and in any case be shrouded to prevent accidental usage.

Some circuits within laboratories may be non-earth leakage for equipment such as refrigerators, incubators. Such circuits should be labelled ‘No Earth Leakage Protection’ using white/red/white traffolyte or by the use of a standard switchplate factory supplied with similar wording similar to those manufactured by HPM.

Where laboratories share an immediately adjacent common preparation area they may share a common distribution switchboard. These switchboards should have a hinged door but should not normally be locked.

22.2.4 Laboratory Benching

Unless other requested, bench frames must be welded RHS with powdercoat finish, black in colour. All bench legs must have a stainless steel adjustable foot.

In wet laboratories, the central services spine must be the only fixed bench component, with the bench tops each side being loose and of varying height if required.

Bench surfaces in all laboratories must be moisture resistant MDF with 1.2mm thick Laminex RBC chemical resistant post form grade laminate or equal, conforming with AS/NZS 2924.1

Where an epoxy finish is required no less than five coats of ‘Dulux’ EPIGLOSS to a colour approved by UTS is to be applied.

Laboratory services are to be reticulated through a central services spine. The services spine is to be accessible by removable access panels.

Under-bench units must be provided as noted.

Refer also to Subsection 9.11 - Built-in Furniture.

22.2.5 Fume Exhaust Systems

See Section 14 - Fume Exhaust and Fume Cupboards.

22.2.6 Sinks

Generally all laboratory sinks must be 316 grade stainless steel with acid resistant stainless steel outlets and washers equal to Enware .Detailed requirements must be verified in the project brief and with the UTS Project Manager.

22.2.7 Floor Finish

Refer Section 6 – Floors and Floor Finishes

22.2.8 Safety Isolators

Provide the relevant safety isolators for power, gas and other services as required by the relevant standards and regulations.

22.2.9 Services

All laboratory service outlets for plumbing, LP gas, vacuum and compressed air must be black epoxy coated and colour coded as per the International Standard except for hot water. Refer to the specific requirements for individual services described elsewhere in these Guidelines including Sections 11, 12, 13, 14, 15 and 16.

22.2.10 Access to Laboratories for People with Disabilities

Refer to Section 24 – Accessible Environments Policy.

22.2.11 Glass Washer

Provision must be made for the installation of a three phase commercial quality dishwasher (supplied by the University) where required. The following services must also be provided:

- a three phase five pin Wilco outlet sized to suit the load of the dishwasher.
- hot water, cold water and demineralised water from the laboratory services terminating in an appropriate type and size of tap.
- Glass washer should be within 1.5 stars of the most energy efficient available.

22.2.12 Emergency Showers

Emergency showers and eye washes must be provided in accordance with AS2982.1. Laboratory design and construction and be equal to Enware. Detailed requirements must be verified in the project brief and with the UTS Project Manager.

22.3 Trade Waste

Trade waste must be treated to ensure full compliance with all local by-laws and statutory requirements. This requirement includes the treatment of photographic trade wastes. Typical requirements which must be considered include the following:

- solvents, both chlorinated and hydrocarbon are not to be put into the drainage system - these are to be recycled.
- silver recovery units must be installed for all photographic waste discharges, or alternatively, the chemicals used should be disposed of by other means than to Sydney Water's sewer.
- liquids only are to be discharged into the sewer. A basket arrestor must be provided (to be emptied daily) or sink strainer installed.
- laboratories are to have a silt arrestor connected to all trade waste discharges where floor wastes are provided.

22.4 Computer Facilities

22.4.1 General

General access computer facilities are an important resource in the UTS study program. Labs are open 24 hours, 7 days a week and students typically spend large blocks of time working in these venues. The quality and reliability of resources, coupled with ergonomics of workstations and the aesthetics of general environment are important aspects of the students study experience at UTS. Computer facilities can be either formal teaching spaces or non-teaching labs which will not be booked for formal classes but are for personal or group study. There are some minor variations in the guidelines between the two categories of facility.

Variations from the Computer Facilities Guidelines contained in the document require the approval of the Manager , IT Client Services.

22.4.2 Environment

The location and design of Computer labs will facilitate easy access by large groups of students while labs vary in size; typically a practical size for a computer lab varies between 20 and 50 students. All computer labs will cater for students with special mobility needs. Laboratory spaces will have an open feel and high level of visual connectivity with public areas and access corridors. Glass partitioning should be used to provide acoustic isolation from surrounding noise sources. Computer laboratories should be grouped or clustered in precincts and located as close as possible to IT Support Facilities. A print release station, comprising computer/s, printer/s and debit-card terminal shall be provided either in the computer lab or in an adjoining space. A lockable storage cupboard is required in the same location as the printer. Larger labs will also provide a group study annex and lounge area to cater for student discussion and rest breaks, while minimising the impact on the private study of others working in the lab.

22.4.3 Room Colour Scheme

The Manager, IT Client Services is to be included in consultations regarding the selection of colour schemes.

22.4.4 Workstations

The work area of each student workstation shall be a minimum of 950 wide by 800 mm deep (850mm deep if space permits). Work areas are defined by the position of computers secured to a long purpose-designed table. The table shall comprise a laminate covered MDF top with a rolled front edge mounted on a purposed designed, powder coated, steel frame base securely fastened to the floor. The MDF finish should be of a non-reflective (i.e. matt) finish suitable for use of an optical mouse. The base frame shall be fitted with horizontal ducting for power and data cables.(refer to Section 22.5.6 below for cable management requirements)

22.4.5 Special Mobility Needs

Adjustable tables of same dimensions and finish are to be provided in a ratio of one adjustable workstation for every 20 fixed workstations within a general access computer facility. Separate adjustable tables are required for each workstation. The adjustable workstation shall allow for a height extension between 730mm and 850mm. The adjustable workstations shall be located in the most accessible area, preferably close to the entrance, to provide ease of access for special mobility needs.

22.4.6 Workstation Cable Management

Workstations will be fitted with horizontal ducting affixed to the underside of the tables for power and data cables. The ducting is to have two separate channels, one for power and the other for data. Power is to be located in the top channel and data below. Penetrations in the rear of table top will allow both the terminated data cable to be run directly from the service channels to the computer and the power leads from the computer to be run to the power points located under the table. This penetration is to have a cover/grommet to prevent any accidental dislodgement or tampering to the cables.

The power channel is to be fully sealed to prevent any access to the cables. The data cable channel is to have one access point per workstation to allow storage of excess cabling. The access point is to be of a size that allows hand access.

22.4.7 Power Outlets

A double power outlet must be provided for each workstation located under the table. A further double power outlet is required at the presenter's position above the table to support laptop computers or other ancillary equipment. Additionally one double power outlet per two workstations for ancillary use shall be located above the table.

22.4.8 Seating

All seating supplied in Computer Laboratories is to be a minimum of Australasian Furnishing Research and Development Institute (AFRDI) and AS/NZS 4438 level 6 Bluetick. Additionally all seating design should be similar to the Herman Miller Caper multitask chair and should come with a minimum ten year warranty.

22.4.9 Notice Boards & Signage

All Computer Labs are to be fitted with a glass fronted lockable notice board 1200 x 1200mm. All Computer Labs to be fitted with 'Conditions of Lab Usage' Signs (approx size 1800 x 1200mm) signs to be supplied by ITD. In Teaching Labs 2 x 2400 x 1200 mm ceramic whiteboards with pen tray to be installed at the presenter's end of the room.

22.4.10 Network Data Cabling

All cabling will comply with UTS network infrastructure standards (see Communications Infrastructure Design Guidelines ITD 1001). Data cables, between workstations and the local

network switch, will be a continuous, unbroken, cable run; **patch cables are not to be used** for connecting student workstations. Both ends of the cable will be labeled to facilitate patching and servicing.

Cables will be run through furniture as set out under 22.5.6. Cable entry points will be protected from physical damage by a gland or approved grommet. Rooms utilising a locally housed network switch will require optical fibre to be installed between the TSG room and switch (refer Section 3, Communications Infrastructure Design Guidelines)

Connectors

Data cables will be terminated in a RJ45 connector fitted with a strain relief boot. Termination of RJ45 connectors will be AS3080 T568 and CSA specification. Computer labs fitted with a locally housed network switch will require both ends of the student workstation data cables to be terminated in RJ45 connectors. Where student workstation data cables terminate in a TSG room, then the termination equipment and standards applicable to horizontal cabling in TSG rooms will apply (see Section 28 – ITD Communications Infrastructure Design Guidelines).

Equipment Enclosures

Computer labs may require a local network switch to efficiently support the large number of workstations in a particular lab. An equipment enclosure or rack is required to accommodate the active network equipment used in the lab. The location and design of the enclosure will resolve related fan noise, access for service, cable management, equipment security, tampering and thermal ventilation. The preferred location of this enclosure is in an adjoining room or integrated into a wall recess. Wall mounted enclosures require the approval of the Manager IT Client Services.

Where multiple computer labs are in close proximity then central TSG room will be create as the hub of all lab cabling in that location (see Section 28-ITD Communications Infrastructure Design

22.4.11 Lighting

The design of lighting within computer labs shall provide a low glare, high brightness environment. The choice of light fittings and position will ensure minimal reflection of lighting hotspots from the workstation screen into eyes of users. Light levels at the workstation surface must be minimum of 320 lux. Lamp colour temperature shall be balanced to provide reliable assessment of workstation screen colours. External light sources must be controlled using blinds, curtains, tinted glass or a combination of control mechanisms to ensure the workstation image is not compromised by external light sources. Complying with AS 1680.2.2. Interior lighting office and screen based tasks.

22.4.12 Air-conditioning

- Base air conditioning to be connected to BASF building Air Conditioning System.
- Additional booster unit to be installed in each Computer Lab to offset equipment heat load.
- Noise rating for a teaching lab is NR35 and for a non-teaching lab NR40.
- Minimum outside air requirement and air changes per hour to comply with AS/NZS 1688.2.

22.4.13 Presentation Position

Every teaching lab requires a presentation position suitable for display of local computer and laptop images. Refer to Section 23-Audiovisual Services.

22.4.14 Screens

Refer to Section 23-Audiovisual Services.

22.4.15 Flooring

Industrial grade, polymer backed, carpet tiles are to be installed as the standard floor covering in computer laboratories. The tile shall be equal to Ontera Modula Carpets P/L.to be approved by FMU.

22.4.16 Security

CCTV cameras shall be installed to provide a full coverage of the laboratory area and access corridor. Number and location of cameras to be confirmed by the Manager UTS Security Services). Entry door pin access shall be provided.

22.4.17 Phones

Wall mounted contact phone shall be installed in each computer laboratory.

23 AUDIOVISUAL SERVICES

23.1 Introduction

23.1.1 Preamble

The purpose of this document is to provide guidelines for the design of Lecture Theatres, Learning Spaces and other UTS presentation spaces including; Conference rooms, Meeting rooms, Event Venues and Public Spaces.

In Major Projects, AVS acts in a consultative and project management role, providing AV specialist services, design and specification detail to PMO/FMO and the University community. As AVS provides the front line support of teaching and learning, it is ideally positioned to provide up to date information on the needs and usage patterns of the eventual users of developed teaching spaces.

AVS have specific details regarding the quality of audiovisual infrastructure that must be adhered to. This will be provided on request.

23.1.2 Contact

Mr Russ Langford
Manager, Audio Visual Services.
University of Technology Sydney.
CB02.04.25B
Telephone: 9514 1932
Facsimile: 9514 2049

23.1.3 Objectives

The objective of this document is to facilitate the flow of information to both internal and external entities involved in the development of teaching infrastructure at UTS. This will be achieved by providing guidelines that pertain to procedures and specifications required for achieving consistent and efficient outcomes for UTS.

Design of lecture theatres, classrooms and learning spaces requires a balanced relationship between intended learning activities. architectural/construction skills, established audiovisual design principles and available technology.

The objective of the design team should be to optimise the 'function' of space, by clearly identifying all performance requirements and allowing for these needs in the design phase. The design team should aim to achieve the best possible arrangement of architectural elements and teaching facilities so that both teaching and learning is maximised. In addition the support requirements may influence final AV design.

Given the great variety of room shapes and sizes and the possible current and future uses, AVS must be consulted at the design phase of a project, in order to provide a tailored specification on a room-by-room basis consistent with the University's standards.

Each project AVS undertakes will be supported by analysis of client requirements, interviews with users and consideration of applicable standards.

23.1.4 Scope

As the title ***design guidelines*** suggests, this document should not be viewed as the definitive reference for all things audiovisual at UTS. The intention is that this document will give those involved in the development of learning infrastructure at UTS an insight into the scope and basic procedural and technical requirements of audio visual and related systems within the University.

23.1.5 Definitions

AV	[*Audio Visual*] A generic term which, as the name suggests encompasses integration and control of lighting, audio and visual technologies.
Bio Box	A room at the rear of lecture theatre or performance venue, usually with a window into the adjoining room. From the bio box an operator can discretely control presentation equipment and /or various aspects of the room environment. Applies only to major venues or specialised learning facilities.
Boardroom	A purpose designed, well appointed, meeting room for 10-25 people with inbuilt AV presentation facilities designed to

	efficiently service high profile meetings. Often boardrooms will be fitted with video conference facilities.
Conference Room	Similar design to a boardroom but generally with a more basic AV presentation system and lower level of general finish. The term conference room may also apply to purposed design videoconference rooms which require specialist lighting, acoustic and AV design solutions...
Control System	A purpose designed, microprocessor based system that allows for programmed control of presentation equipment and room systems (eg Crestron, AMX). Often employs a touch panel or PC based user interface.
Data network	The University Local Area Network and Wide Area Network. (refer: UTS Telecommunications Infrastructure Design Guidelines – document No. ITD1001 version 4.1)
Floor boxes	A metal enclosure embedded in the room floor, usually with a lift up flap that allows convenient and discrete access to AV, data & power connectors mounted on a recessed sub-panel. N.B. Not suitable for use in flexible spaces.
Intercom	VOIP phones, programmed for internal use and single button dial to AVS and Security, installed in nominated teaching spaces.
Laboratories	A teaching room that houses equipment or materials relating to a specific discipline or task, such as computing, chemical, biological, physical or human movement.
Lecture Theatre	A tiered teaching space using either fixed or movable seating to support collaborative engagement activities.
Luminaires	Lighting fixtures.
MATV	[Master Antenna Television] A distributed RF television system. Off air or other modulated video sources are made available over a coaxial cable network.
Meeting Room	A room specifically designed for meeting usage. Often features a purpose designed table/s fitted with power and data outlets. Meeting rooms are generally equipped with electronic whiteboards and display screens.
Presentation	Describes the delivery of information to a group or individuals.
Presenter position	A notional position in a room where a presenter has convenient access to presentation resources.
Projection	Describes the function of various devices that use a focused light source to create an image on a distant surface.
Rear projection	Images on a translucent screen surface produced by the projection of a reversed image from the rear.
Teaching room	A Flat floor room with fixed or flexible seating to support a variety of group learning activities and modes of engagement.
Wall boxes	A metal or PVC enclosure either surface mounted or embedded in the wall, usually fitted with a removable cover or a hinged flap that allows convenient and discrete access to internal connectors mounted on a sub-panel. The sub-panel can be populated with various connectors (power, video, audio & control) depending on the services required. In certain applications connectors will be mounted on the cover plate, instead of an internal sub-panel.
Zoned lighting	Describes the grouping for switching or control purposes of luminaires into logical zones. These logical zones usually relate to functionally different areas within a room.

23.1.6 Glossary

EH&S	Environmental Health & Safety
BMS	Building Management system
GUI	Graphical User Interface

ITD	Information Technology Division (UTS-IT)
AVS	Audio Visual Services (ITD)
LAN	Local Area Network
PIR	Passive Infra Red
FMU	Facilities Management Unit
UTS	University of Technology Sydney
OHP	Overhead Projector
WAN	Wide Area Network
Cbus	Lighting control network
KNX	Lighting control network
DMX	Lighting control network – generally used for theatrical lighting

23.2 The UTS Environment

23.2.1 Presentation Environments

23.2.1.1 Equity

UTS is committed to the principles and practices of equity. This relates to Audiovisual services in terms of both physical access and service provision.

- The design of new teaching/presentation/performance spaces where audio-visual presentation systems are required must include the capacity to provide assistance to the hearing impaired. UTS standard provides for both *Audio Frequency Induction Loop* system conforming to AS 60118.4-2007 for public venues and infrared (IR) hearing augmentation for most new teaching venues. AVS will provide advice on the most suitable hearing augmentation technology to use for each room. (see detail in Specifications 23.5.4 – Audio Systems)
- Access to bio boxes, rear projection rooms, studios and control rooms or any area where technical staff operate will use the same criteria as other spaces designed for human occupancy. (see 23.4.1.4 Bio Boxes.)
- Projection screen size must relate to the room's further most viewing position to allow for clear viewing. The furthest most viewer should be no greater than a distance equal to 6 times the projected image height. The ceiling height of a room is usually the limiting factor in relation to screen size. The closest viewer should be a distance equal to or greater than twice (x2) the height of the projected image (see detail in Subclause 23.5.3.1 – Projection Screens) Ceilings may be required to be stepped in vicinity of the screen to achieve an effective viewing height. Projected image must have clear sightlines to furthest viewer and bottom of the image should be no lower than 1100mm AFFL.
- Lecture theatres should have reserved space for the wheelchairs in a position with appropriate access. Consideration must also be given to access for wheelchairs to the presenter position and related AV facilities.

23.2.1.2 Teaching & Learning Spaces

Lecture Theatres (>120 students)	All UTS lecture theatres must be fitted to the AD1 level. (see detail in Subclause 23.4.1.4 (b))
Teaching Rooms & Lecture Theatres (60-120 students)	All UTS teaching spaces with seating capacity of 60 to 120 must be fitted to CT1 level. (See detail in Subclause 23.4.1.4 (a))
Teaching rooms (>30-40 students)	All UTS teaching spaces with a seating capacity of >30 to40 must be fitted to the CL2/3 level. (See detail in Subclause 23.4.1.3 (b) & (c))
Teaching rooms (<30 students)	All UTS teaching spaces with a seating capacity 30 or below must be fitted to a minimum of CL1 level. (See detail in Subclause 23.4.1.3 (a)
Computer labs	A high proportion of UTS general access computer labs are used for teaching. Labs identified for teaching use must be

	fitted to the LB1 level (see detail in Subclause 23.4.1.3 (d)).
Collaborative Learning Spaces	UTS provides a variety of spaces for students to work informally in groups. Many such spaces are equipped with large screen display systems with local computers, set-top boxes and connections for students to plug-in laptop computers. UTS may require Interactive Whiteboards and Ultra Short Throw (UST) Projectors as an alternative to LCD screens in some student work areas. Collaborative learning spaces requiring AV must be fitted to SP1/CP1/CT1 level. (see detail in Subclause 23.4.1.1 (a) & (b), 23.4.1.4 (a))

23.2.1.3 Special Purpose Spaces

Boardrooms	Boardrooms are designed to achieve a high standard of functional and aesthetic balance appropriate to corporate presentation and meeting requirements of the University. Generally AV facilities will concealed while providing a high level of functionality for displaying documents, computer presentations and video content from a range of sources (e.g. videoconference, TV). Boardrooms must be fitted out to a MR 3 Level.
Conference Rooms	The term conference room is essentially generic. It is used to describe functionally specific conference rooms such as videoconference facilities, which are AV intensive, and those that may only have an electronic whiteboard and projection screen/surface. AVS must be consulted in the design phase of the project to determine the most appropriate solution for the specific purpose. Conference rooms are typically MR 2 fit-out level.
Meeting Rooms	Meetings typically accommodate 6-12 participants. Increased use of electronic display of documents require a basic level of AV presentation capability, either using a wall mounted LCD monitor or interactive whiteboard with UST projector. Conference Room are typically an MR 1 fit out level.
Deans Offices	Offices of Deans, Heads of Schools, Directors of Centres or Institutes often have specific AV requirements. AVS must be consulted in the design phase of the project. Generally the fit-out standard will be MR 1 with MATV feed.
Performance venues	Performance venues require special consideration in terms of their AV technology requirements. As a space that is functionally specific, the AV component is integral to achieving that functionality. AVS must be consulted in the design/concept development phase of these types of spaces.
Exhibition spaces	Exhibition spaces require special consideration in relation to the accessibility of various services. These include data, 240V and or 3 phase power supplies, audio, video and lighting control systems. AVS must be consulted in the design/concept development phase of these types of spaces.
Public spaces	Public spaces in UTS buildings that are exposed to high volumes of pedestrian traffic should be considered for both visual and audio presentation systems. UTS utilises electronic signage systems operating over the data network to facilitate information flow to students and staff moving through pedestrian nodes. Public display systems are particularly important during major UTS (Orientation, Graduations) and external events (conferences & seminars).

23.2.1.4 Off-Campus spaces

Rooms on campus are supported by a quality AV & IT services provided by ITD

Client Services. AVS is not currently funded to provide equivalent services to off-campus locations. This must be taken into consideration in the design of rooms remote from the main campuses should they require AV or IT infrastructure. To ensure a self-sufficient operation the design and installation of audio-visual systems in these areas will need to be approached differently to those on campus and will have AV infrastructure to allow remote monitoring, operation and basic diagnosis of issues. ITD must be consulted on a project-by-project basis.

23.2.1.5 Presentation area

Presenter position

This is a **notional** position in a room where a presenter can have convenient access to and operation of presentation resources. The physical and functional aspects of the individual room such as size, windows, projection systems and access determine the presenter position. The presenter position has a direct influence on the positioning of other essential services such as power, data, floor boxes, lighting and projection systems.

Floor boxes

Floor boxes provide convenient access for presenters to 240v power, AV and data services. Floor boxes also provide safety benefits by reducing cross - floor cabling provided they are not located under movable furniture. The requirement for floor boxes and their specific configuration is dependent on the functional requirements of the room. Floor boxes, both in floor and above floor, are essential for new lecture theatres and highly desirable when upgrading existing facilities to current AV types. These also provide input/output of various signals for external AV operators/equipment such as Radio and Television Crews.

Presentation Desk/Lectern

A UTS designed presentation desk shall be used as the presentation platform in all teaching spaces. The lectern houses all presentation equipment required for a functional AV system, other than projectors and speakers. Presentation Desk must be bolted to the floor next to the floor box Connection of the presentation desk to projectors, speakers, data network and lighting network is made through connectors housed in the floor box. Some locations, where a floor box is not a practical solution, will require the lectern to be connected to a wall box.

Presentation Interface

Computer laboratories have a nominated workstation as the presenter position. The presenter's table is generally attached to the centre row of workstations and orientated to face the students. Connection of the presenter's laptop computer, local workstation or portable AV equipment is through connectors and interface housed in a Crestron Flip-top box, mounted on the top surface of the presenter's table.

Entry/Exit

The presentation area should be positioned to be clear of through traffic and be operable/for mobility impaired teaching staff eg. wheelchair accessible.

Orientation

The orientation of installed AV equipment is largely determined by the physical and functional aspects of the room. Lecture theatres in the traditional sense (multiple rows of tiered fixed seating) have very little flexibility in orientation. The proliferation of lower cost projection systems has allowed smaller rooms to enjoy an increased presentation capability. These smaller rooms are inherently flexible as they usually do not feature fixed seating. UTS Teaching & Learning consultants, AVS and the appropriate faculties must be consulted on a project-by-project basis to clarify presentation options and room orientation.

Collaboration Pods

The UTS learning Model seeks to create a broad range of engagement options for student while on campus, both in timetabled activities within the classroom and while working in communal precincts. This learning model changes the functional requirements of classroom layout and technology from supporting a didactic delivery model to one of enhancing electronic group work and focused engagement.

The new learning model requires a range of classrooms to be equipped with both a lecture based presentation system as well as a number of technology enabled group work pods. Each pod provides groups of 6 or 6 students work with a common viewing screen to collaborate on tasked projects and then electronically review their findings with the full class.

23.2.2 Relationships

23.2.2.1 Clients

AVS provides a complete AV project management service to support University projects. Communication in the first instance should be to the AVS Manager, to help develop:

- Desired outcomes
- Critical dates and milestones
- Project stakeholders
- Budget estimates
- List of approved AV Contractors

23.2.2.2 FMU

In Major projects, AVS acts in a consultative and project management role, providing AV specialist services and specification detail to PMO/FMO.

23.2.2.3 Contractors

Supply of equipment	AVS is able to assist in the supply of audio-visual equipment, particularly custom items. This can be of benefit to help circumvent component supply difficulties before the AV sub contractor commences installation work, avoiding possible low quality substitutes.
Special Systems	In cases where system components need to be manufactured or fabricated, specific components may be supplied by third parties. This detail will be included in the AV specification provided by AVS.

23.2.3 Flexible Learning

The impact of new learning strategies on instructional technology should be considered as a tangible design parameter. System design and integration must take into account the rapid rate of technology change and uptake in teaching and learning. If the rate of technology change since the UTS amalgamation in 1990 is used as a benchmark, change must be seen as a key element in the university environment. Design and development strategies should reflect this reality.

The impact of this on the system design process is the importance of both broad and focused consultation. This is a continuous process. The approach to flexible learning will not be homogenous across the university community and therefore instructional technology solutions are more likely to be user specific and less generic. These design guidelines have been constructed with this in mind, the focus being basic principles and procedures. *IML and T&L will be consulted about AV designs, especially for flexible/collaborative learning spaces*

23.2.4 Evolving Strategies

Effective outcomes for UTS in the development of teaching infrastructure rely on a coherent approach to the planning process. Early consultation with clients , stakeholders and AVS is a vital component in the development of strategic initiatives and key action plans.

23.3 Procedures

23.3.1 Project Initiation

Where there is a clear intent that the proposed functionality of the space requires presentation technology, AVS should be involved in the concept development phase. PMO/FMO will advise the AVS project management team in writing at the commencement of the project to develop:

- Critica
- \l dates and milestones
- Project stakeholders
- Budget estimates based on number/types of spaces
- Consultants

In preparation of budgets, the audio-visual infrastructure and the support from AVS need to be taken into consideration.

For any project proposing modification of any audiovisual facilities or where building works will affect existing systems, PMO/FMO will advise the AVS project management team in writing prior to commencement of the project.

23.3.2 Consultation

Consultation with AVS is essential for any project where the proposed functionality of the space requires presentation or AV integrated technology. A crucial issue is the notification of deadlines for Tenders. The Project Manager (AVS) must be given adequate notification of proposed tender issue dates to allow for the preparation and inclusion of AV specifications. The time required to prepare AV specifications relates to the budget and complexity of the proposed systems. **One calendar month should be regarded as the minimum notification to AVS of the posting of Tender documentation**.

23.3.3 Communication

The Project Manager (AVS) must be informed of all project related site meeting schedules and consultants meetings where appropriate. Specific documentation for each project to be forwarded to the AVS Project Manager, this includes:

- Reflected ceiling drawings
- Electrical drawings
- Elevations
- Consultant's reports: Lighting & Acoustic
- Existing CAD files in electronic form for mark up
- Site meeting schedule
- Works schedule
- List of relevant sub contractors

23.3.4 Approvals

23.3.4.1 Supply of samples for approval

Components detailed in AV specifications supplied either by AVS or as part of tender documentation provided by PMO/FMO cannot be substituted without the express written consent of AVS. For verification of specified components, sub-contractors must produce samples for inspection by a representative of AVS. This particularly applies to those components that form the infrastructure of the installation, including cables, connectors, conduit, cable trays, ducting and mounting brackets.

SAMPLES - CONTRACTOR'S SUBMISSIONS IDENTIFICATION:
Identify each item giving:

- Manufacturer's name
- Product
- Trade name and number
- Project name
- Contractor's name
- Subcontractor's or Supplier's name
- Date of submission
- Any operating instructions, guarantees warranties etc

23.3.4.2 Final positioning

Drawings contained in AV specifications prepared by AVS that detail installed positions, are indicative only. **Final positions for installed components must be approved on site by the appropriate AVS project manager or approved UTS representative and a written record of approval details maintained.**

23.3.4.3 Acceptance Testing

AVS will inspect the audiovisual installation to confirm it complies with the tender specification and raise defect notice where it does not.

23.3.5 Documentation

23.3.5.1 Brief development

AVS is available to assist with brief development. Communication should be directed to the AVS Design & Development Manager,

23.3.5.2 As-Built drawings

Copies of all shop drawings and as-built drawings are to be provided to UTS at practical completion. A suitably protected set of documentation should be provided on site for all projects, preferably located in the equipment rack. All drawings are to comply with the UTS CAD Drawing Standards. A full list of AV deliverables for Practical Completion is written in the AV tender specification

23.4 Teaching Spaces

23.4.1 Categories

SP1	Student Pod
CP1	Classroom Pod
MR1	Basic Meeting Room
MR2	Standard Meeting Room / Boardroom
MR3	Advanced Meeting Room / Boardroom
CL1	Small Classroom
CL2	Medium Classroom
CL3	Medium / Collaborative Classroom
LB1	Computer Labs
CT1	Collaborative Theatre
AD1	Auditorium

Relationship of category to space type and room size/use is:
Student Pod - SP1 Joinery allows for 4 - 8 student seats
Classroom Pod - CP1 Joinery allows for 4 - 8 student seats
Basic Meeting Room - MR1 Meeting Room allows for 4 to 10 seats
Standard Meeting Room / Boardroom - MR2 Meeting Room allows for 6 to 20 seats
Advanced Meeting Room / Boardroom - MR3 Meeting Room allows for 10 to 30 seats
Small Classroom - CL1 Classroom allows for <30 seats
Medium Classroom - CL2 Classroom allows for 30 – 40 seats
Medium / Collaborative Classroom - CL3 Classroom allows for 30 – 40 seats
Computer Labs - LB1 Classroom allows for 30 – 40 seats
Collaborative Theatre - CT1 Theatre allows for 60 to 120 seats
Auditorium - AD1 Auditorium allows for >120 seats

Note: Consult the AVS Project Manager for clarification of which standard to be used.

Standard equipment list of each av category are available in latest version of "UTS AV Category v1.2 " document. See (Appendix 1)"

23.4.1.1 Mandatory requirements across UTS Audio Visual spaces:

The following applies to all categories Audio Visual space requirements under UTS Audio Visual Spaces Section 23.4:

- Each system shall comply with the UTS Hearing Augmentation Strategy (v2.2) requirements.
- System components and cabling shall be HDCP compliant where applicable.
- Both Video Displays and Speaker types are dependent on room usage, viewing distances, sightlines and other architectural constraints, with the exception of SP1 - Student Pod & CP1 - Classroom Pod spaces.
- Display types include but are not limited to; LCD Monitors, Interactive LCD Monitors, Interactive Projectors with whiteboard, a Lamp-less HD Projector with Motorised Screen and Screen Box or Lamp-less HD Projector on a Fixed Frame Projection Screen.
- All systems shall allow for a 'quick switch' between AV sources via an AV presentation switcher and carry lossless audio, lossless video and various control signals using the standard HDBaseT, with the exception of SP1 – Student Pod & MR1 (*Basic*) – Meeting Room systems.
- Network connectivity to a remote monitoring server and software system managed by UTS, is required for each system.
- All systems provide a Web / Software based Control Panel; as part of the control system programming development, a detailed Control Panel for Tier 3 support and a secondary Control Panel representative of the Touch Panel User Interface, that allows for Tier 1 support by UTS.
- All AV Touch Panel User Interface shall be of UTS AVS standard design and layout.
- In Meeting Room spaces; the preferred presentation position is at the Meeting Room Table with coordinated services of power, data & AV.

23.4.1.1(a) SP1 – Student Pod

SP1 - Student Pod; typically applies to student collaboration spaces in general areas requiring AV capability.

The AV design of this category of spaces provides for small groups to share presentations from an optional installed PC or BYOD. Portable devices can share AV wirelessly via a Network Presentation Gateway or via physical AV connections.
The installation shall comprise of the following:

- A joinery / wall mounted LCD Monitor (typically 46" or 117 cm)
- Control of the AV System is via a Button Panel mounted on the joinery.
- An HDMI and Audio 'Fly-lead' (3.5mm) for BYOD AV connectivity.
- A Network Presentation Gateway allows for BYOD AV connectivity via a wireless UTS Network connection.
- A minimum of four General Purpose Outlets to power / recharge BYOD's.
- External LCD speakers and a four-way headphone amplifier facilitate Program Audio.
- A wall mounted Room Booking Panel adjacent to the Student Pod, displays current bookings of the space.

Optional requirements:

- A permanently installed PC with Keyboard & Mouse.

23.4.1.1(b) CP1 – Classroom Pod

CP1 - Classroom Pod; typically applies to student collaboration spaces in a classroom requiring AV capability.
The AV design for this category of spaces provides for small groups to share presentations from an installed PC, a BYOD via a Network Presentation Gateway, physical AV connections or shared content to & from other Classroom Pods, the Presentation Position and primary Video Display in a CL3 (Medium Collaborative) Classroom. Refer to section 23.4.1.3 (c).
The installation shall comprise of the following:

- A joinery / wall mounted LCD Monitor (typically 46" or 117 cm)
- Control of the AV System is via a Touch Panel mounted on the joinery.
- An HDMI and an Audio 'Fly-lead' (3.5mm) for BYOD AV connectivity.
- A Network Presentation Gateway allows for BYOD AV connectivity via a wireless UTS Network connection.
- A permanently installed PC with Keyboard & Mouse.
- A minimum of four General Purpose Outlets to power / recharge BYOD's.
- External LCD speakers and a four-way headphone amplifier.

Optional requirements:

- Collaboration Software nominated by UTS allows content sharing between installed PC's.

23.4.1.2 (a) MR1 (Basic) – Meeting Room

MR1 - Meeting Room; typically applies to a meeting room requiring 'basic' AV capability. Implemented in smaller rooms, an MR1 requires BYOD to facilitate any AV presentations.
The AV design for this category of spaces provides for meeting room presentations on a single Video Display from a BYOD via physical AV connections or via an optional Network Presentation Gateway. Note well; this AV category may also be considered by UTS for implementation in Specialist Faculty Teaching Spaces for small group presentations or research specific applications.
The installation shall comprise of the following:

- A Video Display.
- Control of the AV System is via a wall mounted Button Panel.
- An HDMI 'Fly-lead' for BYOD AV connectivity.
- If specified, an Interactive Video Display requires USB connectivity at the Presentation Position.
- A minimum of one General Purpose Outlets to power / recharge BYOD's at the presentation position.
- Program Audio is facilitated via LCD Speakers, Ceiling Speakers or preferably Wall Speakers.
- An Audio Output Socket (3.5mm headphone) for connection of a portable infrared hearing assistance system.
- A wall mounted Room Booking Panel at the entrance displays bookings of the space.

Optional requirements:
- A Network 'fly-lead' for UTS Network connectivity.
- A Network Presentation Gateway allows for BYOD AV connectivity via a wireless or wired UTS Network connection.

23.4.1.2 (b) MR2 (Standard) – Meeting Room / Boardroom:

MR2 - Meeting Room / Boardroom; typically applies to a meeting room requiring 'standard' AV capability.
The AV design for this category of spaces provides for meeting room groups to view presentations on a single Video Display from an installed PC, a BYOD via physical AV connections or via a Network Presentation Gateway. Optional AV input sources may include a Document Camera and a Software Based Video Conferencing System via the installed PC and a VC Camera.
The installation shall comprise of the following:
- A Video Display.
- Control of the AV System is via a Touch Panel at the presentation position.
- An HDMI 'Fly-lead' for BYOD AV connectivity.
- A UTS Network 'Fly-lead' for UTS Network connectivity.
- If specified, an Interactive Video Display requires USB connectivity at the Presentation Position.
- A Network Presentation Gateway allows for BYOD AV connectivity via a wireless or wired UTS Network connection.
- A permanently installed PC with Keyboard & Mouse.
- USB connectivity to the installed PC from the Presentation Position.
- Typically a General Purpose Outlet per every two meeting table seats or more.
- Program Audio is facilitated via LCD Speakers, Ceiling Speakers or preferably Wall Speakers.
- Lighting control shall be integrated with the AV control system.
- An Audio Output Socket (3.5mm headphone) for connection of a portable infrared hearing assistance system.
- A wall mounted Room Booking Panel at the entrance displays bookings of the space.

Optional requirements:
- Ceiling mounted Document Camera.
- Video Conferencing Software on the installed PC
- VC Camera for Software Based Video Conferencing.
- Wired Microphone(s) are preferred for Software Based Video Conferencing.
- Wireless Microphones may be required in difficult spaces for Software Based Video Conferencing.
- A certified ultra-low spill array induction loop, shall be implemented if an integrated Software Based Video Conferencing system is required, replacing the Audio Output Socket.

23.4.1.2 (c) MR3 (Advanced) – Meeting Room / Boardroom:

MR3 - Meeting Room / Boardroom; typically applies to a meeting room requiring additional 'advanced' options above those of an MR2 Meeting Room / Boardroom with 'standard' UTS AV capability. This is generally to cater for large capacity spaces and or additional presentation requirements.
The AV design for this category of spaces provides for meeting room groups to view presentations on one or multiple displays, from an installed PC, BYOD via a Network Presentation Gateway or physical AV connections. Other optional input sources for display can include: a Document Camera, Video Conferencing via optional PC Software / VC Camera, Blu-ray Player and Terrestrial TV (*Future IPTV*).
The installation shall consist of the following:
- Typically 1-3 Video Display(s).
- Control of the AV System is via a Touch Panel at the presentation position.
- An HDMI and an Audio 'Fly-lead' (3.5mm) for BYOD AV connectivity.
- A Network 'Fly-lead' for UTS Network connectivity.
- If specified, an Interactive Video Display requires USB connectivity at the Presentation Position.
- A Network Presentation Gateway allows for BYOD AV connectivity via a wireless or wired UTS Network connection.
- A permanently installed PC with Keyboard & Mouse.
- USB connectivity to the installed PC from the Presentation Position.

- Typically a General Purpose Outlet per every two meeting table seats or more.
- Program Audio is facilitated via LCD Speakers, Ceiling Speakers or preferably Wall Speakers.
- Lighting control shall be integrated with the AV control system.
- An Audio Output Socket (3.5mm headphone) for connection of a portable infrared hearing assistance system. (Unless optional VC integration.)
- A wall mounted Room Booking Panel at the entrance displays bookings of the space.

Optional requirements:

- Ceiling mounted Document Camera.
- Video Conferencing Software on the installed PC.
- VC Camera for Software Based Video Conferencing.
- Wired Microphone(s) are preferred for Software Based Video Conferencing.
- Wireless Microphones may be required in difficult spaces for Software Based Video Conferencing.
- A certified ultra-low spill array induction loop shall be implemented if an integrated Software Based Video Conferencing system is required, replacing the Audio Output Socket.
- A Blu-ray Player to play optical media sources.
- Terrestrial TV to view local free-to-air television stations (Future IPTV).

23.4.1.3 Mandatory AV Requirements in all Teaching Spaces

The following applies to all Audio Visual Teaching space requirements under UTS Audio Visual Spaces Section 23.4 including CL1, CL2, CL3, LB1, CT1 and AD1 spaces:

- A wall mounted Room Timetable Panel at the entrance displays a timetable with bookings of the space.
- Zoned & dimmable room lighting control shall be integrated with the control system.
- USB connectivity for installed PC & BYOD to Interactive Displays at the Presentation Position.
- A height adjustable UTS Presentation Table is the preferred AV source location, to provide a presentation position that reflects the classroom furniture utilised by students. In restrictive or alternative spaces, other presentation positions may be considered by UTS.
- A ceiling mounted Remote Monitoring Camera allows for Tier 1 support via UTS remote monitoring software.

When a ‘height adjustable UTS Presentation Table’ is mentioned in Teaching Space requirements, the following AV capabilities and services are assumed unless noted otherwise:

- Control of the AV System is via a Touch Panel at the presentation position.
- An HDMI and an Audio ‘Fly-lead’ (3.5mm) for BYOD AV connectivity.
- A Network ‘Fly-lead’ for UTS Network connectivity.
- A Network Presentation Gateway for BYOD, AV connectivity via a wireless or wired UTS Network connection.
- A permanently installed PC with Keyboard & Mouse.
- Video Conferencing Software on the installed PC (Not integrated with AV system unless with optional VC integration).
- A table mounted Document Camera.
- A Blu-ray Player to play optical media.
- A minimum of one General Purpose Outlet to power / recharge BYOD’s at the presentation position.
- A Gooseneck Microphone for speech reinforcement.
- A Wireless Microphone system with recharging facility, for speech reinforcement.

23.4.1.3 (a) CL1 – (Small) Classroom:

CL1 – Small Classroom; typically applies to a classroom of ‘small’ physical size and capacity, that requires AV capabilities to support tutorials.
The AV design for this category of spaces provides for tutorial groups to view presentations on a Video Display from an installed PC, Network Presentation Gateway, BYOD, Blu-ray Player, Document Camera and separate Audio Connection. Microphone(s) and Speakers provide sound reinforcement and an Infrared System provides Hearing Assistance.

The installation shall consist of the following:

- A Video Display.
- A height adjustable UTS Presentation Table. (Not including Wireless Microphone system.)
- Program Audio is facilitated via Wall Speakers.
- An infrared hearing assistance system.

Optional requirements:

- A Wireless Microphone system with recharging facility, for speech reinforcement.
- An AV Recording System to record the permanently installed PC AV and system Microphone(s).

23.4.1.3 (b) CL2 – (Medium) Classroom:

CL2 – Medium Classroom; typically applies to a classroom of 'medium' physical size and capacity, that requires AV capabilities to support tutorials.

The AV design for this category of spaces provides for tutorial groups to view presentations on two independent Video Displays from an installed PC, Network Presentation Gateway, BYOD, Blu-ray Player, Document Camera and separate Audio Connection. Microphones and Speakers provide sound reinforcement and an Infrared System provides Hearing Assistance.

The installation shall consist of the following:

- Two Video Displays.
- A height adjustable UTS Presentation Table
- Program Audio is facilitated via Wall Speakers and or Ceiling Speakers.
- A Presenters Spot Light shall be positioned above the Presentation Position and also controlled via the AV system.
- An Infrared Hearing Assistance System.

Optional requirements:

- An AV Recording System to record the permanently installed PC AV and system Microphone(s).

23.4.1.3 (c) CL3 – (Medium Collaboration) Classroom:

CL3 – Medium Collaboration Classroom; typically applies to a classroom of 'medium' physical size and capacity, that requires AV capabilities to support tutorials with additional AV technology for student group 'collaboration' and or Software Based Video Conferencing.

The AV design for this category of spaces provides for tutorial groups to view presentations on multiple displays from an installed Desktop PC, Network Presentation Gateway, BYOD, Blu-ray Player, Document Camera and separate Audio Connection. Microphones and speakers provide sound reinforcement and an Infrared System provides Hearing Assistance. Optional CP1 - Classroom Pods can display shared AV content between other Classroom Pods, the Presentation Position and Video Display. Refer to previous section 23.4.1.1 (b). The addition optional of VC Camera(s) and microphones integrate the Classroom AV system with Software Based Video Conferencing.

The installation shall consist of the following:

- Typically (2) or more Video Display(s).
- Program Audio is facilitated via Wall Speakers and or Ceiling Speakers.
- A Presenters Spot Light should be above the Presentation Position and controlled via the AV system.
- An Infrared Hearing Assistance system. (Unless optional VC integration.)

Optional requirements:

- Multiple CP1 – Classroom Pods; refer to previous section 23.4.1.1 (b).
- Collaboration Software nominated by UTS allows content sharing between installed PC's.
- Video Conferencing Camera(s) and Ceiling Microphones for Software Based Video Conferencing.

- A certified ultra-low spill array induction loop shall be implemented if an integrated Software Based Video Conferencing system is required, replacing the Infrared system.
- Terrestrial TV to view local free-to-air television stations. (Future IPTV).
- An AV Recording System to record the permanently installed PC AV and system Microphone(s) or additionally video via the optional VC Camera.

23.4.1.3 (d) LB1 – Computer Lab:

LB1 – Computer Lab; typically applies to a 'Computer Lab', that requires AV capabilities to support tutorials. In addition, each student position has a desktop PC specified by UTS ITD.

The AV design of this category of spaces provides for tutorial groups to view presentations on multiple displays from an installed PC, Network Presentation Gateway, BYOD, Document Camera and separate Audio Connection. Microphones and speakers provide sound reinforcement and an Infrared System provides Hearing Assistance. Optional Collaboration Software allows content sharing between installed PC's.
The installation shall consist of the following:

- Typically (1) to (4) Video Display(s).
- A height adjustable UTS Presentation Table. (Not including a Blu-ray Player.)
- Program Audio is facilitated via Wall Speakers and or Ceiling Speakers.
- A Presenters Spot Light should be above the Presentation Position and also controlled via the AV system.
- An infrared hearing assistance system.

Optional requirements:

- Collaboration Software nominated by UTS allows content sharing between installed PC's.

23.4.1.4 (a) CT1 – Collaborative Theatre:

CT1 – Collaborative Theatre; typically applies to a theatre of 60-120 seat capacity, that requires AV capabilities to support tutor student group 'collaboration' and or Software Based Video Conferencing. The space can be flat floored or tiered with group focused furniture to support student collaboration.

The AV design of this category of spaces provides for tutorial groups to view presentations on one or multiple displays from an installed Desktop PC, Network Presentation Gateway, BYOD, Blu-ray Player, Document Camera and separate Audio Connection. Auxiliary AV connections allow for additional AV content input for AV sources, portable audio equipment, optional LCD Foldback Video Monitor(s) and or AV Event Support capabilities. In addition optional VC Camera(s) and microphones can integrate the Theatre AV system with Software Based Video Conferencing. Video Annotation overlay of the UTS Presentation Table AV sources is also an option if required.
The installation shall consist of the following:

- Typically (2) or more Video Display(s).
- A height adjustable UTS Presentation Table
- Program Audio is facilitated via Wall Speakers and or Ceiling Speakers.
- A Presenters Spot Light should be above the Presentation Position and also controlled via the AV system.
- A certified ultra-low spill array induction loop shall be implemented for hearing assistance.
- Auxiliary AV connections at a Floor Box, Wall Box, Bio Box or additional connections at the UTS Presentation Table.

Optional requirements:

- A Fixed Frame Projection Screen due to limitations of Motorised Screen sizes and weights.
- An additional Wireless Microphone system for Team Teaching.
- Collaboration Software nominated by UTS allows content sharing between installed PC's.
- Video Conferencing Camera(s) and Ceiling Microphones for Software Based Video Conferencing.
- Terrestrial TV to view local free-to-air television stations. (Future IPTV).

- An AV Recording System to record the permanently installed PC AV and system Microphone(s) or additionally video via the optional VC Camera.
- Annotation System capable of video annotation over UTS Presentation Table Sources.
- AV Operator Touch Panel for Event Support at a location other than the UTS Presentation Table.
- Additional Event Support AV Auxiliary Inputs & Outputs.
- A Bio Box or other area to house additional AV equipment in a rack required to support increased functionality.
- An installed LCD Video Foldback Monitor(s) for use with General Teaching and Events.

23.4.1.4 (b) AD1 – Auditorium:

AD1 – Auditorium; typically applies to an Auditorium of >120 seat capacity, that supports video and audio reinforcement for large lectures / audiences.

The AV design of this category of spaces provides for lecture groups to view presentations on 2 or more displays from an installed Desktop PC, Network Presentation Gateway, Laptop or other portable AV capable device, Blu-ray Player, Document Camera and 3.5mm Audio connection. Auxiliary AV connections allow for additional AV content input for AV sources, portable audio equipment and or optional LCD Video Foldback Monitor(s). In addition, optional VC Camera(s) and microphones can integrate the Auditorium AV system with Software Based Video Conferencing. Video Annotation overlay of AV sources is also an option if required.

Event Support is a requirement of the space via an Operator Touch Panel and an AV support location or Bio Box. System Integration with Stage Lighting may be required to support videography and staged lecture requirements outside of general teaching. Multi-channel audio reinforcement may be required, for play back of 5.1 & or 7.1 audio sources.

The installation shall consist of the following:

- Typically 2 or more Video Display(s).
- A height adjustable UTS Presentation Table
- Multiple Wireless Microphone Systems for Team Teaching and Event Support.
- Program Audio is facilitated via Wall Speakers and or Ceiling Speakers.
- A Presenters Spot Light should be above the Presentation Position and also controlled via the AV system.
- A certified ultra-low spill array induction loop shall be implemented for hearing assistance.
- Auxiliary AV connections at a Floor Box, Wall Box, Bio Box or additional connections at the UTS Presentation Table.
- AV Operator Touch Panel for Event Support at the Bio Box or other Event Support location.
- Additional Event Support AV Auxiliary Inputs & Outputs.
- A Bio Box or other suitable area to house additional AV equipment in a rack, required to support increased functionality.

Optional requirements:

- A Fixed Frame Projection Screen due to limitations of Motorised Screen sizes and weights.
- Collaboration Software nominated by UTS allows content sharing between installed PC's.
- Video Conferencing Camera(s) and Auto Echo Cancellation system for Software Based Video Conferencing.
- Terrestrial TV to view local free-to-air television stations. (Future IPTV).
- An AV Recording System to record the permanently installed PC AV and system Microphone(s) or additionally video via the optional VC Camera.
- Annotation System capable of video annotation over AV Sources.
- An installed LCD Video Foldback Monitor(s) for use with General Teaching and Events.
- Multi-Channel Audio sound reinforcement. (Typically does not require surround audio certification.)
- System Integration with Stage Lighting to support videography and staged lecture requirements.

23.4.1.5 Other - Special Purpose

Rear projection rooms The ventilation of rear projection rooms must be light sealed to prevent ambient light from entering the

projection area. All surfaces to be painted in matt black acrylic paint. All joints to be sufficiently sealed to prevent intrusion of external light and dust.

Bio boxes

Lecture theatres typically do not have a Bio box at the rear of the room. The level of AV fit out for a Bio Box is related to the functional aspects of the adjoining space. The following are points for consideration:

Air conditioning
As bio boxes house equipment that generate heat and the space must be adequate for extended periods of occupancy by operators, air conditioning is a primary consideration. The system may be required to be discrete from general building air plant, preferably a split system with the compressor in a remote location to minimise noise in the bio box.

Floor
As a bio box is often the hub of control for the adjoining room, there is the need to adequately manage the cable infrastructure. This can be optimised by the use of false floors as currently employed in TSG rooms across UTS.

Dust control
Bio boxes must be adequately sealed to prevent the intrusion of dust, light and external noise.

Lighting
A bio box should have dimmable room lighting discrete from the main room lighting control system. This should be a combination of incandescent and fluorescent. There should also be independent, dimmable work lights discrete from the main room lighting control system.

Monitoring
As most bio boxes are acoustically sealed from the adjoining lecture theatre, a quality audio monitoring system is required to effectively control the presentation audio levels. This should include stereo speakers with local amplification and volume control. The system should also provide signal processing to allow the monitored sound speaker output to match the frequency contour of the lecture theatre.

Security
To facilitate efficient access to the bio box for AVS and/or academic staff, the room should be fitted with the standard UTS access keypad.

Power
Bio boxes should be fitted with adequate power outlets to provide the operational flexibility required. This also relates to the position and type of outlet. The outlets should be on a filtered/protected “AV system only” circuit. Consideration should be given to earth leakage protection for circuits powering user accessible equipment.

Telephone/Data
Communications in bio boxes is a crucial aspect for consideration. There should be at least one (1) internal telephone point and two (2) data points near the operator position in bioboxes.

Conference Rooms/ Meeting Rooms

All conference/meeting rooms must use the AV1 (see under Subclause 23.4.1.1 Teaching Spaces) specification as the minimum benchmark for AV. Where the room has a specific presentation or communication functionality, AVS must be consulted in the design development stage to determine specific AV fitout requirements.

In conference rooms larger than 16 sq m, where there is not an initial requirement for providing AV facilities, cables

or appropriately sized conduits shall be installed to enable retro-fitting of AV equipment without removing carpets or wall surfaces.

Walls likely to be used for mounting of heavy display devices shall be strengthened for the attachment of brackets, supporting up to 60 kg static load.

Detailed design is required to ensure the safe and aesthetic management of power, data & AV cables from wall areas to the table top interface, without the risk of interference or damage from chairs or occupants. A floor box shall be installed where meeting room tables are required to be moved/removed to enable the disconnection of table's services.

23.4.2 Portable Equipment

A secure room, for storing mobile audio-visual equipment, shall be provided in close proximity to any new teaching facilities where the teaching rooms are not within reasonable distance of an AVS Client Service support office,.

23.4.3 Acoustics

Special consideration must be given to the design of teaching spaces with regards to acoustic performance to achieve high speech intelligibility and isolation from noises sources. Rear wall reflections should be minimised by appropriate acoustic treatment. The overall acoustic treatment should ensure short reverberation times. Refer to Section 3 - Architectural Controls, Subsection 3.7 - Acoustic Control.

23.4.4 Lighting

Teaching spaces have the additional requirement for zoned lighting. The specifications that relate to light intensities, colour temperature, position and luminaire type are determined by the zone function. In spaces that include video, data or film projection, special consideration should be given to minimise or control lighting "spill" onto the projection surface. See Clause 23.5.2 – Lighting Systems in Subsection 23.5 - Specifications in the following.

Dimming is the preferred method of light control in teaching spaces.

For general lighting requirements refer to Section 15 - Electrical Services, Subsection – 15.3 Lighting.

23.4.5 Air Conditioning

Special consideration must be given to acoustic treatment to minimise noise levels from all mechanical services installations. Refer to Section 3 - Architectural Controls, Subsection 3.5 - Acoustic Control. The position of AC outlets close to projection screens may produce significant movement and/or distortion of projection surface. The design of AC system must ensure airflow does not impact on the stability of projection surfaces.

23.4.6 Furniture

The placement of fixed furniture in teaching spaces should not impede or interfere with the presenter position, sight lines, and access for portable equipment or service personnel. The type and covering of furniture can have dramatic effect on the acoustic environment of a space.

Floor carpet should be low static, chosen from ranges approved by FMU.

23.4.7 Windows

Windows and exterior light control systems should be carefully considered in relation to the impact on the effectiveness of presentation systems used in teaching spaces. Lecture theatres in particular must not have windows. Where windows exist, appropriate means of light filtering and control must be provided. This can be curtains, blinds or shutters.

Motorised blinds systems when installed must be integrated and controlled by AV control system via low voltage dry contact relay. See Clause 23.5.6 – Control Systems in Specifications.

23.5 Specifications

AVS has specific details regarding infrastructure quality that must be adhered to. AVS will make these available on request.

23.5.1 Standards of Work / Diligence

Unless a higher standard is laid down in project specifications, all processes are to comply with the relevant specifications and codes of Standards Australia and `Best Practice' as defined by the International Communication Industry Association (ICIA)

23.5.1.1 Safety

(refer to Contractor Safety and Working Conditions)

23.5.1.2 Cleanliness

(refer to Contractor Safety and Working Conditions)

23.5.1.3 Audio Visual installation

All cable and equipment installation must comply with installation 'Best Practice' as defined by current ICIA Guidelines and equipment / cable manufacturers. Installations requiring connection to the UTS LAN or patching racks will comply with standards, practices and certifications as required by the ITD Communication Standards.

23.5.1.4 Documentation

All cable labelling must conform to the standards set out in the project specification. All documentation must conform to the UTS CAD Drawing Standards, unless otherwise specified in project documentation.

23.5.2 Lighting Systems

23.5.2.1 Exit lights

Special consideration should be given to the type and location of exit lights in lecture theatres and performance venues. Exit lights can have a detrimental effect on projection quality by producing an unacceptable level of ambient light. Legends for exit signs shall be green lettering on black background. Refer also to Section 15 - Electrical Services, Clause 15.3.5 Exit, Emergency and Stair Lighting.

23.5.2.2 Dimming

Any space where the basic functionality involves presentation technology should have lighting dimmers installed. Dimming provides a finer control of the presentation environment and can optimise the performance of other components. In large spaces, dimming can also result in more efficient use of energy. The space should have functionally different areas allocated to discrete circuits on the dimming system.

The following zone description is a guide only:

- Whiteboards left*
- Whiteboards right*
- Whiteboards centre
- Front row/s of ceiling fixtures*
- Remainder of ceiling fixtures*
- Wall wash left
- Wall wash right
- Spotlight left*
- Spotlight right
- Spotlight centre

** Typical zoning requirements in AV2 Level rooms*

23.5.2.3 Zoning

Zoning of lights according to functional areas improves the flexibility and utility of a teaching space. Dimmers must employ a network buss control to allow for remote wall panels and control via third party control systems, as described in Clause 23.5.6 of this document.

23.5.2.4 Dimmer programming

The generic scenario for lighting programming provides for four (4) basic scenes. These have been developed in consultation with clients and support the basic teaching and presentation formats.

As a guide, the programming of dimmer scenes should be as follows:

Scene 1	=	All fixtures	100%
Scene 2	=	Whiteboards	0%
		Spotlight	100%
		Front row	25%

		Remainder	75%
Scene 3 (Video preset)	=	Whiteboards	0%
		Spotlight	50%
		Front row	0%
		Remainder	50%
Scene 4	=	All fixtures	0%

23.5.2.5 Dimmer location

Dimmers should be located in positions that facilitate easy access. They should not be located in ceiling cavities or in false floors. Within the cupboard dimmers must be mounted at a height which allows ready access for a standing technician, without using a ladder or having to crouch or kneel down. The operation of the dimmers must not cause electronic magnetic or any other kind of interference with other systems within the room or in the vicinity.

23.5.2.6 Control interfaces

Dimmers must have a control interface for control via third party control systems. See Clause 23.5.6 – Control Systems in Specifications.

Control parameters must include:

- Scene recall
- Scene status
- Scene programming
- Channel levels
- Channel status
- Fade times

A direct connection to the dimmer's network buss via RS232 , RS485 or a centralised IP gateway is the required interface to the lecture theatre control system.

23.5.2.7 Location of control plates

Dimmer control plates should be positioned at the room entries and at the presenter position. The control plate(s) should be located in proximity to other services such as screen controls, voice and data outlets.

23.5.2.8 Disability considerations

Positioning of control plates shall be in accordance with the requirements for switches and general purpose outlets in AS1428.1. Refer also to Section 24 – Accessible Environments Policy.

23.5.2.9 Custom control plates

In some applications, various services can be combined on custom control plates. This can improve efficiencies of operation, enhance the appearance and reduce costs.

23.5.2.10 PIR

In all teaching spaces where there is an existing or proposed control system, Passive Infra Red (PIR) detectors maybe installed as part of the project lighing specifications. The output of the PIR should be available to the control system and in many cases will also provide input to the Lighting control system/ Cbus. This may allow for energy management of AV equipment in the space. Energy management of lighting systems in not part of AV control system but part of current UTS energy management strategy as programmed in the Lighting control system.

23.5.2.11 Diffuser types

In teaching spaces with projection systems, special consideration should be given to control reflected light that can have an adverse effect on projection performance. The diffusion of overhead or wall wash lighting must be controlled to provide suitable conditions for viewing projected images while taking notes. For general lighting located on ceilings low brightness diffusers are preferred and lighting intensity modelling should be used to predict the impact of the lighting design on projection performance in teaching spaces.

23.5.2.12 Control of external/ambient light

In teaching spaces with projection systems, special consideration should be given to control ambient light that can have an adverse effect on projection performance. This

can be achieved by limiting the use of windows in dedicated teaching spaces, and the use of curtains or blinds. (See Clause 23.4.7 - Windows)

23.5.2.13 Lectern or Presenter's lights

As presentations are often performed under low light conditions to optimise projected images, the presenter's work plane requires additional illumination. The light source must provide sufficient light (see Clause 23.4.4 - Lighting) for reading of notes while providing minimal diffusion.

23.5.2.14 Whiteboard lights

Whiteboard lights are essential for the visibility of the whiteboard. There is a range of specific fixtures for this purpose. Contact FMU for details.

23.5.3 Projection Systems

23.5.3.1 Projection Screens

The size and position of projection screens in a teaching space is determined by the physical properties of the room, particularly the ceiling height, thus determining the effective useable room length. The following should apply to new facilities and should be taken into account when upgrading existing facilities:

Furthest Student	No student should be positioned further than six screen height multiples from the projection screen.
Closest Student	No student should be positioned closer than two screen height multiples to the projection screen.
Horizontal Viewing Angle	Students should be positioned within an arc of 45 degrees off the centre line of projection.
Screen Position	The base of the screen should generally be at least 1100mm clear of the floor at the front of the room.
Vertical Viewing Angle	Students should be limited to 15 degrees maximum head tilt excursion above horizontal, to reference the centre of the projection screen.

The recommended screen size (NPA) for a teaching space(CL1/2/3, LB1,CT1) (CL) is 1615mm (height) x 2880mm (width) Finished. ceiling heights in the vicinity of the projection screen should be at minimum 2700. Ceiling height of 2900 mm AFFL is preferred.

Motorised screens have specific construction requirements for installation in suspended ceilings particularly where the ceiling space acts as the air return for the air conditioner system. A purpose designed, flush finished, MDF ceiling box is the preferred method of enclosing screens within ceiling cavities A `non AV' GPO is required adjacent to the left-hand side of the screen box to provide power for the screen motor..Low voltage switching is utilised for motorised screen control. Contact AVS for details.

Note: The preferred location for ceiling mounted video data projectors and motorised projection screens can be compromised by the location of air conditioner ducting, cable trays etc within the ceiling space. Hence the need for AVS to be involved at the design phase.

23.5.3.2 LCD Monitors

LCD monitors, with their lower cost, reduced weight, high resolution and brightness, offer a viable alternative to projection systems for many small room applications. UTS standard requires the use of industrial grade monitors with RS232 connectivity for control. General requirements:

- Size options 23/24", 40", 46" & 57"
- LED backlighting (preferred)
- HDMI, DP, and VGA
- RS232 / Network IP control
- 10 Watt inbuilt amplifier

25.5.3.4 Interactive Whiteboard

Interactive whiteboards for use in UTS teaching spaces should comply with the following criteria:

- 87" diagonal
- Wall mounted

- Touch sensitive with specialist pens
- Ultra Short Throw Projector on stable cantilever or ceiling bracket
- Cleanable surface without special solvents

IWB bottom image should between 850 to 950 mm AFFLAudio Systems

23.5.4.1 Sound reinforcement

The specification of sound reinforcement systems relates to the logical room type (see Clause 23.4.1 - Categories). All components and their positions must be approved by AVS prior to installation on a project by project basis.

- Speakers attached to the LCD monitor will generally be used for small rooms and collaborative work booths. Conference rooms will normally require a distributed ceiling speaker array to provide uniform coverage of the working area.
- Stereo presentation speakers at the front of the room should be provided for program materials. Bandwidth should satisfy hi fidelity reproduction (30Hz-20KHz) and provide arelatively uniform coverage with a minimum SPL of 80dbA at the centre of the classroom without audible noise, hum and distortion.
- Hearing assistance system: Where a sound system is provided, a listening system to aid hearing impaired people shall be installed and shall cover at least 10 per cent of the enclosed space. New installations at UTS must be of the Audio Frequency Induction Loop system unless otherwise specified. For further information refer to Section 24 – Accessible Environments Policy and Appendix 2: UTS Hearing Augmentation Strategy document v2.2
- Voice reinforcement system to provide clear and even intelligible speech reproduction in all areas of the enclosed space without undesirable audio artefacts.

23.5.4 Video Systems

The minimum specification of video projection systems relates to the logical room type and function. All components and their relative positions must be approved by AVS prior to installation on a project-by-project basis. See Clause 23.4.1 - Categories. All AV categories must support the following requirements

- Multiple input viewing
- Support for High Definition Video with resolution no lower than 1080P resolution
- or support for standard computer resolution with resolution no lower than WUXGA
- Capacity to switch multiple sources of each format to one or more projectors
- HDCP compliant video systems

23.5.5 Control Systems

Control systems for use in AV systems must comply with the following criteria:

- Design based on a modular or open architecture concept
- Support multiple interfaces concurrently including push button panels, touch panels and PC
- Programming applications to run on PC compatible platform
- Employ a networked communication/data buss system to support remotely located devices
- User defined and editable device drivers
- Remote monitoring and intervention
- TCP/IP connectivity
- Locally supported (Australia)

23.5.6 Whiteboards

All teaching, tutorial, meeting and conference rooms at UTS must have installed whiteboards. White boards should be regarded as a basic room fixture as you would with carpet, furniture and light fittings.

All whiteboard surfaces must be of the porcelain coated metal type

The following is a guide only:

Teaching Room	2 off 1200mm x 2400mm with pen tray
Meeting/Conference:	1 off 900mm x 1400mm plain paper – Electronic Whiteboard with pen tray

23.5.7 Racks

The points below provide guidelines for racks in teaching spaces. These are separate to the audiovisual rack within the Equipment Services (TSG) Rooms.

- Comply with standard 19" rack mount equipment.
- Lockable, removable side panels
- Lockable, acrylic front door
- Lockable, steel rear door
- Plinth with cable access
- Raised top or fan forced ventilation to allow av equipment ambient operating temperature of about 25deg Celcius
- 1 shelf per 5 standard rack units
- Velcro cable tie rails for proper cable management
- 1 power outlet per 2 standard rack units
- Service illumination
- Colour to suit room decor

23.5.8 Cables

All cabling shall be consistent with types set out in project specifications.. Copy of the latest AVS Cable Type list available on request. Cabling that is run in ceiling spaces or on cable tray shall be cable tied at 600mm intervals and be clearly labeled as A/V CABLING at every second tie. Audio Visual cables shall be separated from electrical services by a minimum of 600mm for parallel runs greater than 1m. Run cables in false ceiling spaces, wall cavities, conduits and ducts, keeping clear of other services. Cables are not to be embedded in plaster, mortar, cement, or run in cracks or joints in walls, ceilings, floor slabs and the like. Cables must run continuously from the point of origin to the terminating point without intermediate joints or connections.

Labelling must conform to the project specification and follow the three (3) field schemes:

TYPE	DESCRIPTION
V	VIDEO
A	AUDIO
C	CONTROL
	LOW VOLTAGE
H	HIGH VOLTAGE
S	SPEAKER

NUMBER	DESCRIPTION
0-899	STANDARD
900-999	TIE-LINE

Example (i)

V	120
<Video cable>	<cable number 120>

Example (ii)

A	55
<Audio cable>	<cable number 55>

23.5.9 MATV

MATV systems for installation at UTS must comply with Australian Standards as described in AS1367 Multiple outlet distribution systems. Trunk route extensions shall comprise three runs of RG11 and distribution nodes shall comprise an Ikusi one way multi-tap (MT-5W15DC) and 16 way Multi-switch.

23.5.10 LCD/TV Monitors

Monitors used in public space signage or student collaborative work booths must comply with the following:

- Minimum screen size of 63cm diagonal
- Infra red remote control
- Discrete video, audio inputs on rear panel
- RF modulated tuner input on rear panel
- TV cabinet to be black in colour

23.5.11 Lecterns

The type and design of lectern is related to the functional and physical aspects of a room. UTS have two standard versions for use in lecture theatres. Check with AVS for the recommended type. Points for consideration are:

- Functional requirements of room
- range of users
- equity and EEO
- housing of specific equipment
- workspace required
- aesthetics (refer to the FMU Project Manager)

23.5.12 Computers

Due to the rapid rate of technology change, there is no generic specification for computers in teaching spaces. The specification will depend on the individual project and application requirements. All computers installed in teaching spaces must have continuous connection to the UTS LAN. Computers and monitors not housed in secure enclosures must be fitted with a UTS approved security cable.

UTS AV Category - v1.2	Student Pod	Classroom Pod	Meeting Room / Boardroom			Classrooms			Computer Labs	Collaborative Theatre	Auditorium
AV Type code	SP 1	CP 1	MR 1	MR 2	MR 3	CL 1	CL 2	CL 3	LB 1	CT 1	AD 1
Display											
Display (Number, Type)	1, L	1, L	1, #	1, #	n, #	1, #	2, P, IP	n, #	n, #	n, #	n, #
Foldback Video Monitor										*	✓
AV Source											
Resident PC	*	✓		✓	✓	✓	✓	✓	✓	✓	✓
Document Camera				*	*	✓	✓	✓	*	✓	✓
Network Presentation Gateway	✓	✓	*	✓	✓	✓	✓	✓	✓	✓	✓
HDMI Flylead	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Blu-Ray					✓	✓	✓	✓		✓	✓
Software Codec Video Conference				*	*	*	*	*	*	*	*
Collaboration Software		*						✓	*	✓	*
MATV/IPTV					*			*		*	*
LAN Flylead			*	✓	✓	✓	✓	✓	✓	✓	✓
Video Conferencing Camera				*	*			*		*	*
3.5mm Audio Input Flylead	✓	✓		*	*	✓	✓	✓	✓	✓	✓
Lecture Recording System						*	*	*		*	*
Annotation System										*	*
Audio											
Program Audio	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lectern Mic						✓	✓	✓	✓	✓	✓
Wireless Mic				*	*	*	✓	✓	✓	✓	✓
Table/Ceiling Mic				*	✓			*		*	*
Front of House Speakers				✓	✓	✓	✓	✓	✓	✓	✓
Ceiling Speaker					*		*	*	*	✓	✓
Hearing Augmentation **			✓	✓	✓	✓	✓	✓	✓	✓	✓
Headphone Amp	✓	✓									
Control											
AV Touch Panel Control		✓		✓	✓	✓	✓	✓	✓	✓	✓
Button Panel Control	✓		✓								
Remote Control											
AV Operator Touch Panel										*	✓
Lighting											
Zoned and Dimmable ***				✓	✓	✓	✓	✓	✓	✓	✓
Presenter Spot						✓	✓	✓	✓	✓	✓
Presentation											
Lectern Height Adjustable ****						✓	✓	✓	✓	✓	✓
Group Study Pods								*			
Aux Floorbox										✓	✓
Biobox										*	✓
Event Capabilities (AV aux in / outs)										*	*
Services											
Fusion Remote Monitoring	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Remote Monitoring Camera						✓	✓	✓	✓	✓	✓
Room Booking Panel	✓		✓	✓	✓						
Timetable Panel						✓	✓	✓	✓	✓	✓
Room Phone						✓	✓	✓	✓	✓	✓
Whiteboards						✓					
Voice Point Teleconference				*	✓						

Key:
* - Optional
** - refer UTS Hearing Augmentation Strategy
*** - refer to AV Lighting Specification
**** - Lectern may not be used due to space constraints
n - Multiple Independent Displays to suite space

Display Type (#)
L - LCD Panel with Inbuilt Speaker
IL-Interactive LCD
P - Projector
IP - Interactive Projector

UTS Hearing Augmentation Strategy (v2.2)		**Hearing Loop**	**Infra red (IR) flooder/s**	**Entry signage showing augmentation type and area of coverage**
Coverage	*Audio Facilities*	*80% coverage of floor areas*	*95% coverage of floor area*	*Comments /Use*
Public lecture venues / auditoriums	Speech Reinforcement and Program Audio	✓		Venue used frequently for public events. Designed for 'T' position hearing aid pickup and meets Australian Standard for level uniformity for an inductive loop.
UTS General Teaching Spaces with speech reinforcement	Speech Reinforcement and Program Audio		✓	Primary room use: Students undertaking UG or PG courses. UTS Special Needs Unit currently provides IR receivers with personal loop and headphones to student on a semester loan basis. Current demand is 6-10 portable systems per semester. Proposed to maintain a University wide pool of 25 receivers to cover all IR equipped rooms for semester bookings and incidental use. Additional receivers for incidential use available from UTS Security.
Laboratories	Speech Reinforcement and Program Audio		✓	as above
UTS General or Faculty Teaching Spaces without speech reinforcement	Program Audio only or no Audio replay facility	No requirement	No requirement	.
Laboratories	Program Audio only	No requirement	No requirement	Audio replay for media only,
Boardrooms (Speech Reinforcement Installed)	Speech Reinforcement and Program Audio	✓		Boardrooms equipped with microphones for audio/video conferencing or speech reinforcement.
Meeting rooms	Program Audio only	No requirement	Portable System with wall/table connection point	Meeting rooms for groups of up to 25 participants , no speech reinforcement; may include audio replay of videos or other media content. Closed captioning for encoded media sources
Collaborative work pods (6 students/pod)	Program Audio only; available through speakers or headphones	No requirement	No requirement	Small group work area with LCD screen, loud speakers / headphone listening station with indivdual volume controls for 4 students. No speech reinforcement for pods.

24 ACCESSIBLE ENVIRONMENTS POLICY

The University has developed an Accessible Environments Policy (AEP) to ensure access and equal opportunity for all persons regardless of disability. The AEP provides a strategic overview of the principles that inform the UTS Access Guidelines. The AEP ensures that access for everyone, including persons with disability, older people, and other campus participants is provided to and within all UTS facilities and student accommodation.

The purpose of the AEP and UTS Access Guidelines is to promote and implement equitable, inclusive and accessible environments in response to the Disability Discrimination Act 1992 (DDA), relevant legislation, codes and requirements. DDA complaints can be lodged in relation to existing and / or proposed buildings and services.

The ABCB (Australian Building Codes Board) Access to Premises Standard (APS) was adopted by the Federal government in March 2010 and provides compliance dates and application requirements.

The Building Code of Australia (BCA) is a uniform set of technical requirements for the design and construction of buildings and other structures throughout Australia.

The APS is applied to new buildings and parts of buildings through BCA 2011. The intent of the APS and BCA 2011 is to harmonise BCA access provisions with the complaints based DDA. BCA 2011 came into force nationally on 1 May 2011.

Applicable BCA 2011 Access Standards are AS1428.1 – 2009, AS1428.4.1 – 2009 and AS2890.6 – 2009.

The University is committed to consulting with disability stakeholders and users to enhance access to the built environment at UTS. The main mechanisms for this are by direct consultation with stakeholders and through the Accessible Environments Advisory Group (AEAG). The role of the AEAG is to assist the University to develop a co-ordinated and strategic approach to identifying, prioritising and resolving disability access issues, and scheduling implementation in a phased manner based on feedback from stakeholders about priority areas.

The University is committed to engaging specialist access consultants when necessary to ensure that the requirements of the Disability Discrimination Act 1992 are met. Consultants may be required to make presentations to stakeholders and users and to the Accessible Environments Advisory Group as necessary.

The AEP considers the design, construction and maintenance of all the physical facilities of the University. This includes:

- access, egress and circulation for continuous accessible pathways of travel within and between premises and satisfactory linkages with transport;
- amenities, such as seating, toilets, furniture and equipment, that are suitable for everyone including people with a disability;
- communications, including hearing augmentation, lighting and signage to adequately meet the needs of people with a disability.

The implementation of the Access Guidelines is the responsibility of the UTS Facilities Management Unit (FMU) Planning and Design Review Branch.

24.1 Addressing Access Issues

The procedures and responsibilities to ensure equitable access for everyone including persons with disability are as follows:

- The Access Guidelines are to be issued to all Project Teams by FMU Project Managers and Architects at the briefing stage of the project.
- Project Control Groups (PCGs), if established, should assess and make recommendations regarding sign off for the project.

24.2 Performance Criteria

The Access Guidelines are the performance criteria for the following:

- External areas and public domains
- All building work and external works
- Assessment of access barriers in existing facilities.

24.3 Access Guidelines

These guidelines and AEP link Project Type to Access Criteria for the provision of access by everyone, including persons with disability, to all UTS facilities.

- All projects are subject to compliance with the BCA, local Council and other statutory requirements.
- For refurbishments, alterations and extensions to parts of existing buildings and external spaces the following UTS policy applies*:*
  Where application of the Access Guidelines and AEP could impose an unjustifiable hardship in accordance with the DDA, the specific building or item will be referred to the Project Control Group (PCG).

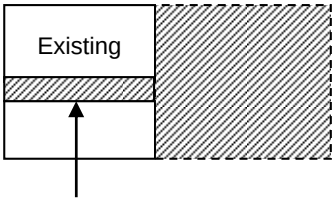
The APS applies to all new Class 1b, 2, 3, 5, 6, 7, 8, 9, or Class 10 buildings and to a new part, and any affected part, of a building, approved on or after 1 May 2011 for construction. The APS does not apply to the internal parts of a sole-occupancy unit.

An affected part is (a) the principal pedestrian entrance of an existing building that contains a new part; and (b) any part of an existing building, that contains a new part, where it is necessary to provide a continuous accessible path of travel from the entrance to the new part.

APS Part 4 (4.3, 4.4 & 4.5) provides concessions for lessees, existing accessible lifts and toilets.

24.4 Project Type

The Access Guidelines shall be applied as follows:

Project Type	Extent of Application	Application of Criteria
1. OUTDOOR ACCESS/ TRANSPORT LINKS A transport link is defined as a bus stop shelter, railway station or bus/rail interchange or ferry terminal.	OUTDOOR ACCESS: All outdoor accessible paths of travel.	Components 1 to 6, 8, 9, 10, 13, 15, 17 to 23.
	TRANSPORT LINKS: Extent of facility	Components 1 to 23.
2. NEW BUILDING 	Extent of building including the principal pedestrian entrance and not less than 50% of all pedestrian entrances.	Components 1 to 29.
3. EXTENSION TO EXISTING BUILDING 	Any affected part of the building or facility.	Components 1 to 29.
	Path Of Entry.	Components 1 to 10. Components 13 to 23.
4. NEW STUDENT ACCOMMODATION	Extent of building including the principal pedestrian entrance and not less than 50% of all pedestrian entrances. Accessible external and internal common areas. Visitable and accessible housing.	Components 1 to 11. Components 13 to 23. Components 30 to 33
5. EXTENSION AND / OR REFURBISHMENT TO EXISTING STUDENT ACCOMMODATION	Any affected part of the building or facility. Accessible external and internal common areas. Visitable and accessible housing.	Components 1 to 11. Components 13 to 23. Components 29 to 33.

24.5 Access Criteria

Access criteria for each built component (interior and exterior) are as follows:

24.5.1 General Criteria

New UTS buildings are to comply with components 1 to 23. Existing UTS buildings are to comply with components 1 to 23 as required by Subsection 24.4 and 24.5.

	COMPONENT	ACCESS CRITERIA
1.	Dimensions	Requirements of AS1428.1. Dimensions are clear of projecting skirtings, kerbs, handrails or other fixtures.
2.	Circulation Spaces	Requirements of AS1428.1. Wheelchair footprint 800 x 1300. Area required for wheelchair to turn 180 degrees is 2070mm in direction of travel and 1540mm wide. Circulation widths and categories: Arterial 1800mm Main 1500mm Secondary 1200mm
3.	Continuous accessible path of travel	Requirements of AS1428.1. Provide an equitable range of seating with back and arm rests in all major public areas.
4.	Walkways, ramps	Requirements of AS1428.1. Dimensions and circulation widths for ramps and walkways to comply with components 1 & 2.
5.	Ground and floor surfaces	Requirements of AS1428.1. Carpet to be fixed, with a firm surface and pile not exceeding 6mm. Floor and wall surfaces are to have low reflectivity and minimum 30% luminance contrast with adjacent finishes.
6.	Handrails and grab-rails	Requirements of AS1428.1. Handrails to return through 180 degrees at each end or return fully to end post or side wall. Minimum 30% luminance contrast with background. For two or more steps provide handrails to both sides.
7.	Doorways doors and circulation space at doorways	Requirements of AS1428.1. Doors to main entrances to allow independent operation. Door and frames to provide minimum 30% luminance contrast. Student accommodation: Main entrance doors: 850mm clear opening. Unit entry doors: 820mm clear opening.
8.	Lifts	Requirements of the BCA – with internal 1400 x 1600 minimum lift car size. Note: APS existing accessible lifts concession.
9.	Stairways	Requirements of AS1428.1. Risers to be closed. Contrasting strip 25-50mm wide to be applied to riser at nosing.
10.	Car parking	Requirements of AS2890.6. Minimum of one accessible space in every car park. Student accommodation: provide one accessible visitors car space.

	COMPONENT	ACCESS CRITERIA
11.	Sanitary facilities	Requirements of AS1428.1. Provide not less than one accessible unisex toilet at every floor where toilets are provided, and adjacent to not less that 50% of each bank of toilets on a floor. Install automatic doors to all accessible toilets with preference for sliding doors. Install duress buttons to all accessible toilets with auto doors. Note: APS existing accessible toilets concession.
	Cubicles for people with ambulant disability	Requirements of AS1428.1. Provide one PAD cubicle in each new male and female group of toilets, with appropriate identifying signage.
	Combined shower and toilet facilities	Requirements for AS1428.1.
12.	Parents Room	Requirements of AS1428.1. Requirements of AS1428.2 for sink and bench. Generally provide one Parents Room per building (assess if need for). Locate adjacent to accessible toilet. Provide baby change table, sink in bench, comfortable chair, sanitary bin complying with AS1428.2
13.	Symbols & signs	Requirements for AS1428.1. Signage in tactile and Braille formats at key orientation locations. Refer AS1428.2. Table for height of letters for varying viewing distances.
14.	Warnings	Requirements of BCA. Incorporate independent travel guidance systems in new buildings to assist people with vision impairment.
15.	Lighting	Uniform lighting levels with graduated illumination at new building entries and exits.
16.	Hearing systems	Requirements of AS1428.1. Floor, wall and ceiling finishes to be selected to minimise reverberation. **NOTE: Refer UTS Hearing Augmentation Strategy.**
17.	Drinking Fountains	Requirements of AS1428.2. Provide at least one accessible drinking fountain where drinking fountains are provided.
18.	Viewing Ranges	Requirements of AS1428.2.
19.	Vending Machines, ATMs	Requirements of AS1428.2
20.	Telephones	Requirements of AS1428.2 A minimum of one accessible telephone in each bank of telephones. At least one telephone typewriter (TTY) in each major public area, with appropriate signage.
21.	Street Furniture	Requirements of AS1428.2
22.	Controls	Requirements of AS1428.1.

24.5.2 Specialist Facilities Criteria

New specialist facilities are to comply with components 1 to 23 and as follows. Existing specialist facilities are to comply with Components 1 to 23 as required by Subsection 24.4 and 24.5 and as follows.

	COMPONENT	ACCESS CRITERIA
23.	Auditorium and Assembly Areas	Requirements of AS1428.2 clause 26. Provide access to all podiums and stage areas. All controls for sound, lighting, microphones and audio-visual equipment should be operable from the podium. Provide wheelchair accessible seating complying with the BCA and including a minimum of 3 wheelchair space and companion seat for each 150 auditorium seats, or part thereof, equitably located and with comparable sight lines. Provide hearing augmentation complying with AS1428.1
24.	Lecture Theatres	Writing tablets to comply with AS1428.2 clauses 22, 23, 24.1 and 24.2. Provide a minimum of 3 seats in each lecture theatre without writing tables. Where writing tablets are provided, provide adjacent wheelchair spaces. Provide wheelchair accessible seating complying with the BCA and including a minimum of 3 wheelchair space and companion seat for each 150 auditorium seats, or part thereof, equitably located and comparable sight lines. Provide hearing augmentation complying with AS1428.1. Provide access to all podiums and stage areas. All controls for sound, lighting, microphones and audio-visual equipment should be accessible and operable from the podium.
25.	Computer Laboratories	Requirements of AS1428.2 clauses 22, 23, 24.1 and 24.2. Provide at least one adjustable work position to allow use by a person with a disability in each computer laboratory.
26.	Science, Engineering or similar Laboratories	Requirements of AS1428.2 clauses 22, 23, 24.1 and 24.2. Minimum of one adjustable work position to allow use by a person with a disability and one adjustable wet bench to allow use by a person in a wheelchair. Provide access between benches as for Components 2 and 3. Reach distances for work positions for people with a disability to be accessible. Services and controls at work positions to be accessible for people with a disability. Any identified difficulties due to Work

	COMPONENT	ACCESS CRITERIA
		Health and Safety Legislation or industrial practices shall be referred to the PCG.
27.	Customer Service Counters and Serveries, Shops for sale of goods (including cafes and services eg copying)	Requirements of AS1428.2 clauses 22, 23, 24.1 and 24.2. Customer service counters and serveries for food and beverage to have at least one accessible position with a minimum length of 1,000 mm.

24.5.3 Student Accommodation Criteria

Site selection for new student Accommodation is to consider topography linkages to key locations including public transport, local shop, and recreation areas as referenced in the UTS Student Accommodation Design Guidelines.

AS4299 clauses that are referenced apply to “post adaptation” mode only.

All new and existing designated accessible student accommodation units are to meet Access Criteria Components 1 to 23, as required by Subsection 24.4 and 24.5, and the following:

	COMPONENT	ACCESS CRITERIA
28.	External Common Areas	Requirements of BCA and AS4299 clauses 4.5, 4.7, 4.8, 4.9 and 4.11. Provide an accessible path of travel linking adjacent accessible entrance to accessible car space, adjacent streets and public transport. Common use areas and facilities including letterboxes, garbage and recycling bins, leisure areas and clothes drying areas to be linked to student accommodation by an accessible path of travel. Clothes drying areas to be located on level, hard stand area.
29.	Internal Common Areas	Requirements of BCA and AS4299 clauses 4.5, 4.7, 4.8, 4.9 and 4.11. All common areas of Class 2 and Class 3 buildings should be accessible. Laundry areas require 1300mm minimum clearance in front of appliances.
30.	Visitable Housing	Requirements of BCA and AS4299 clauses 1.4, 2.2, 3.2, 3.3 and 3.4. All new housing units to be visitable in accordance with AS4299, comply with BCA requirements for Class 3 buildings, and provide equitable mix of right and left handed layouts.
31.	Accessible Housing	Requirements of BCA and AS4299 Adaptable housing Class C essential features. A minimum of 10% of all student accommodation units is to be accessible. .All new housing units to be visitable in accordance with AS4299, comply with BCA requirements for Class 3 buildings, and provide equitable mix of right and left handed layouts.

25 ENVIRONMENTAL SUSTAINABILITY

The UTS Environmental Sustainability Policy includes the University's commitment to ensure that in its institutional practices "emphasize "that UTS demonstrates and promotes the achievement of sustainable futures embracing ecological, economic and social aspects of human existence".

The UTS Sustainability Policy can be viewed at http://www.gsu.uts.edu.au/policies/sustainability-policy.html

The Environmental Sustainability Guidelines have been developed to implement this policy in regards to the University's built environment.

All stages of building projects inclusive of master planning, urban design, external works, new buildings and refurbishment works including furniture and equipment selections shall be based on environmentally sustainable principles.

25.1 Process

The following procedures shall be used to ensure environmental sustainability is addressed in each project type:

- Environmental Sustainability Guidelines as part of the UTS Design Guidelines will be issued to all project teams by FMU Project Managers and Architects.
- For all projects over $1 million value or 1,000 sqm floor area an Environmental Sustainability Design (ESD) Consultant is to be engaged.
- For all projects over $10,000 and under $1 million an ESD statement must be prepared, refer to Subsection 25.19 ESD Statement and Objective/Achievement Schedule.
- FMU Architects, Consultant Architects and Engineers are responsible for addressing sustainability issues in each project and for determining the extent of the application of the Sustainability Guidelines.
- The Project Architect or ESD consultant if engaged is responsible to prepare an ESD Statement for each project and complete the Objective/Achievement Schedule.
- FMU Project Managers and Architects are responsible to monitor Contractor's compliance on site with Recycling and Waste Management Plans and Environmental Management Plans.

25.2 Performance Objectives

The Sustainability Guidelines are the performance objectives for the following:

- All new building work (internal and external), furniture, fittings, finishes and equipment;
- Assessing existing buildings and external areas, furniture, fittings, finishes and equipment.

25.3 Amendments to Environmental Sustainability Guidelines

The Environmental Sustainability Guidelines shall be reviewed and amended to adopt new practices as they are developed incorporating amendments made to statutory regulations. These guidelines list sustainability objectives for the future development of UTS Campuses.

25.4 Heritage

Assess the heritage significance of proposed sites and implement preservation or risk education programs where appropriate. Ensure that there is no loss of significant heritage items. Restore and reuse such items wherever possible. Where demolition of buildings is required, individual items of heritage significance are to be saved and made available for public view. Anything of archaeological significance should at once be reported to FMU, if uncovered in the course of excavation and demolition.

25.5 Environment Management

Consideration shall be given to the appropriate alternatives to development of such as the 'no development' option and non structural alternatives.

Where appropriate, evaluate site and local ecosystems using structured Environmental Impact Assessment Processes.

For projects over **$1m**, or over 1,000 sqm the Contractor is responsible for the preparation and adoption of Environmental Management Plans through all phases of the project and an ESD statement is required demonstrating minimum 4 Star rating under Green Star Office existing building tools.

For projects over **$.5m**, the Contractor is responsible for the preparation and adoption of a Waste Management Plan for the construction process. Local councils also have criteria establishing when Waste Management Plans are required and an ESD statement is required demonstrating minimum 4 star rating. Refer to monitoring and feedback Section 25.20.

25.6 Recycle Buildings, Use Existing Infrastructure

Assess thoroughly as a first option, both the opportunities to reuse existing facilities and the long-term viability of new facility proposals. Select and use appropriate assessment procedures such as economic appraisals, value management and master planning.

25.7 Protect and Enhance the Site's Natural Ecosystems

Site the building for minimum impact on ecosystems – minimise cut and fill.

Preserve and protect the physical viability of natural ecosystems by ensuring systems are retained intact, uninterrupted and unified. Seek to provide wildlife corridors between fragmented ecosystems in cooperation with neighbouring properties. Re-establish the widest possible range of indigenous plant and animal communities, in appropriate habitats, to restore the site to its potential diversity of species.

Support the maintenance of biodiversity with site remediation activities such as regeneration and revegetation.

Conserve viable site populations of all native species and maintain their habitats. Protect natural habitats from the adverse effects of settlement such as stormwater runoff, erosion and invasion by exotic species.

Preserve appropriate existing landscape features where possible as a first option. Landscape design of built areas should reflect the inherent natural patterns of a site (the result of natural processes that have shaped it), as well as the human modifications of these patterns.

Minimise the use of chemicals (pesticides, herbicides and fertilisers) by designing for diversity, careful species selection and using thoroughly researched planting details and specifications.

Protect the water quality of adjacent environments during construction by effective erosion and run-off controls.

25.8 Design and Build Energy Efficient Buildings

- Adopt Passive Design Solutions
  Minimise energy demand by adopting passive design solutions (e.g. exploiting local climate and intrinsic properties of the design and materials) as a first priority, before resorting to active design solutions (e.g. energy-consuming engineering services or systems). Apply this approach in conjunction with optimising user amenity and comfort. Good passive building performance results in the active systems, even if required, using less energy and often being of a smaller capacity, thereby also saving capital costs.
- Optimise energy outcomes by considering and selecting design options on the basis of lowest life cycle costs. Where life cycle costs are within 10% of each other, select the option with the lowest greenhouse gas emissions.
- Minimise energy demand by taking maximum advantage of site selection and planning, by means such as:
  - Give preference, if possible, to a site with suitable shape, orientation and topography that allows building design and placement to optimise passive attributes.
  - Site the building with due consideration to orientation, solar gains, daylight access, overshadowing within and outside the site, while also meeting the functional needs. Minimise energy requirements by optimising the building design, while also meeting the functional needs by means such as:
  - Building form: Select the building form (shape, shallow or deep plan, single or multi-storey) that best provides for daylight access and control of heat gain and loss. Avoid causing undesirable overshadowing within and outside the site.
  - Building orientation: Orientate the building to optimise solar control. Generally, the preferred orientation is an east-west long axis for ease of controlling solar gains through north and south facing windows, to maximise daylight opportunities and to minimise solar loads on east and west elevations.
  - Building planning: Plan the layout of internal spaces to maximise opportunities for and to fully exploit passive design measures such as daylighting strategies and passive heating from controlled solar access. Minimise the effects of undesirable heat gains by arranging 'buffer zones' between the source and the occupied zone; for example, locating service cores, stores, plant rooms or toilets on the western side of building.
  - Building envelope and structure: Optimise the thermal resistance of the building envelope to optimise heat gain or loss, and to minimise consequential thermal discomfort and cooling/heating energy use. Use insulation.
  - Fenestration: Control solar access and optimise the use of daylight to minimise the need to energy consuming mechanical cooling/heating and artificial lighting. Optimise solar control to minimise summer heat gains, and if appropriate, benefit from the passive heating of winter sun (note that winter solar gains may be undesirable in some cases), use external sun shades, taking into consideration that the façade has to be safely maintained and cleaned.
  - Building materials: Maximise the use of local resources, where possible, to reduce transportation energy.
  - Choose products with less embodied energy. Keep this in mind when choosing building construction methods and products. Concrete and aluminium are both high in embodied energy for their production. Imported products embody energy used in their transportation to site.

25.9 Engineering Services

Minimise energy consumption by optimising the engineering services design. As a priority, integrate the engineering services to gain maximum benefit from the passive attributes of the building (e.g. Artificial lighting and daylight). Engineering services design should include:

- Zoning: Divide the building into zones according to function and operational needs, cooling and heating load profiles, occupancy patterns and densities, out-of-hours use, and local emissions. Identify zones for special uses that require special or more stringent environmental conditions, and treat them separately rather than raise the servicing and energy consumption levels of the building as a whole.
- System types: Select the system types (e.g. central plant or distributed discrete plant, combination ambient-task lighting or general lighting) most appropriate for the zones and the building as a whole, to ensure optimum operating efficiency and minimum energy wastage from unnecessary operation.
- Controls: Select the control systems most appropriate for the zones, engineering services or systems, and the building as a whole, ranging from simple local controls (e.g. local switches, time switches, occupancy sensors) to fully integrated building management and control systems (BMCS), to ensure optimum operating efficiency and minimum wastage from unnecessary operation.
- Monitoring: Provide metering and monitoring systems to a level commensurate with the complexity of the building, as energy management tools to ensure efficient building operation. Such systems can be set up to track systems or sub-systems for heating, cooling, ventilation, lighting, general power and water heating.
- Lighting: Design the lighting systems to ensure optimum efficiency under all conditions of the buildings expected usage. Maximise efficiency and minimise unnecessary energy use by means such as:
  - Choose the most efficient lighting system design and minimum lighting level appropriate for the required application, with energy efficiency in relation between natural and artificial lighting.
  - Use the most efficient luminaires appropriate for the required application. High efficiency luminaires reduce energy use and heat generated, which also means a lower air conditioning load or a lower impact on comfort in a naturally ventilated building.
  - Adopt effective lighting controls to ensure optimum operating efficiency and minimum wastage from unnecessary operation (e.g. localised switches to encourage occupants' use, occupancy sensors, timers, central programmable time switches or control systems).
  - Maximise the contribution of daylight to reduce the use of artificial lighting (e.g. switch lighting rows parallel to daylight sources to enable luminaries to be separately switched off or dimmed).
  - Minimise unnecessary operation of external lighting by using photoelectric switches, and solar powered light.
- Heating ventilation and air conditioning (HVAC): Design the HVAC systems to ensure optimum efficiency under all expected building operating conditions, from part load to full load conditions. Maximise efficiency and minimise unnecessary energy use by means such as:
  - Zones with different cooling/heating demands, operating hours or more stringent temperature/humidity requirements should have separate HVAC systems.
  - Minimise conflicting cooling and heating demands, and avoid reheat systems, which waste energy in simultaneous cooling and heating.
  - Limit outside air quantities to meet relevant code and dilution requirements, to minimise unnecessary heating and cooling of unconditioned air.
  - Comfort air conditioning should not have humidity control.
  - Include automatic start/stop controls (e.g. time switches, after-hours switches for limited out-of-hours use) to limit unnecessary HVAC operation.
  - Use the building's thermal mass to delay and reduce peak loads, thereby achieving reduced plant size and energy consumption.
  - Adopt energy-saving devices and systems such as variable speed drives for fans and pumps, waste heat recovery to pre-heat incoming air or water, insulation.
- Consider using energy cogeneration or trigeneration principles.
- Domestic hot water: Select the most appropriate hot water units (e.g. electric, gas, solar with electric/gas boost, heat pump) for the building. Minimise heat and energy loss by locating units close to areas of greatest demand. Centralised systems with recirculating closed loop reticulation are generally less efficient then decentralised discrete units at points of use with minimum dead legs of pipework. Recirculating pumps should be thermostatically controlled to limit unnecessary operation.
- Greywater. Water from uses such as basins and shower can be captured for reuse in areas such as landscaping Refer www. Sydneywater.com.au and www.health.nsw.gov.au.
- Lifts: Energy-efficient lifts should include intelligent controls to optimise operational efficiency against occupant movement patterns, and to minimise unnecessary travel. Lift linings should be light.
- Equipment and appliances: Select energy efficient equipment and appliances based on their rated minimum energy performance standard or recognised star rating scheme. Refer www.energy.gov.au.
- On completion of installation, ensure the engineering services and energy efficiency measures are properly commissioned and are operating as the design intended.
- During the building's operating life, carry out programmed preventive maintenance on all systems to ensure they continue to operate efficiently.
- As part of managing the building operation, provide the ability to locally monitor its energy use to ensure it is within acceptable limits (such as the forecast energy consumption from the Energy Efficiency Statement, a benchmark for this type of building or a pre-determined target). Account for any overruns and take corrective actions. Implement further opportunities to improve operational efficiency as the building usage changes over time.

25.10 Air Quality

Internal Air

All new and refurbished buildings must comply with AS1668.2-1991 Mechanical Ventilation and Air Conditioning.

- Maximise effectiveness of ventilation through careful consideration of the integrity of the fresh air intake, provide filtration of fresh air, and due regard to internal building divisions and configuration.
- Use local exhaust ventilation for specific indoor sources such as wet areas, photocopier and printer locations etc .Refer: Section on Photocopiers.
- Consider adoption of a building flush-out immediately prior to occupancy. Sustaining a period of full ventilation using 100% outdoor air for a period of at least one week will reduce levels of residual volatiles. This can be a useful strategy to improve indoor air quality (IAQ) in high-risk situations.
- Control humidity in mechanically ventilated buildings to 40-70% RH by steam (not water spray) humidification.
- Protect against release of microbial hazards such as Legionella bacteria into ambient air by proper design and maintenance of air conditioning and ventilation systems.
- Avoid the use of air polluting materials. Refer to Low Impact Construction Materials.
- Ensure reduction of construction contaminants in buildings prior to occupancy such as dust, water infiltration related contaminants, volatile organic compounds (VOCs) etc. Specify appropriate protocols.
- Do not use unflued gas heaters.
- Use building materials such as insulation and carpet backing free of CFC and HCFC.
- Maintain high level of indoor air quality (IAQ). Design to avoid in new buildings or monitor for presence in refurbished buildings potential air quality hazards such as:
  - Formaldehyde from building boards and insulation
  - Radon from some soils or fill especially Granite base.
  - Carbon monoxide from motor fuel in parking areas.
  - Volatile organic compounds from some building products
  - Cyanides from concrete sealing compounds
- Specify fitout and management procedures to minimise toxic fume emission and VOCs, from adhesives, sealants, paints, coatings, carpets, and pest control practices etc. Emissions from materials can be quite high at fitout time but then decline rapidly. The use of vapour barriers and lack of ventilation tends to permit the build-up of chemical vapour in a space. Materials of high sink capacity (carpets, fabrics, upholstery, etc.) absorb and then slowly emit chemical concentrations. Avoid these installations while major emissions are still fresh.
- Avoid use of hazardous materials such as asbestos and lead-containing products. For all glass and mineral fibres, a policy of care needs to be adopted. Masks should always be used and batts should be isolated in bags until installation.
- Select building materials to avoid pollutant release and smoke generation during fire.

The following table gives some alternative products that may be chosen when building or renovating to provide a healthier environment. Refer to the FMU Project Manager for approval for the use of the "safer product".

Potentially hazardous product	**Safer Product**
Chemical termite treatment	Barrier methods made from granite or stainless steel
Carpets	Hardwood timber
Synthetic carpet underlay	Jute or wool/jute mix underlay
Petrochemical paints and varnishes	Plant chemistry-based paints and varnishes
Pressed wood cupboards and furniture	Hoop pine plywood
Pressed wood sub-flooring	Solid timber
Glues and adhesives	Use physical methods e.g. nailing, cementing of floor tiles. Use rubber latex, casein or PVA glues sparingly.
Unflued gas heating and cooking	Electric heating and cooking. Flued gas heating and install range hood above stove vented to outside.

(Source: Klymenko, P., 1996,l Indoor Air Quality: Selecting products for cleaner air. Green Games Watch)

External Air

- Minimise air pollution and emissions from buildings.
- Specify refrigerants and processes that minimise Ozone Depleting Potential and Greenhouse Warming Potential. The use of chlorination of water on sites should be discontinued and ozone or UV used instead.

25.11 Save Water

- As per water efficiency laboratory 0-6 star scale (WELS)
- Use AAA rated water efficient equipment, e.g. toilets, taps, showers, appliances, and should be at the highest available Wels rating.
- Note preference for waterless urinals in Section 11..

- Develop systems to reuse waste water where possible before discharge to waste or natural systems.
- Landscape to minimise water use i.e. select plants that require minimal watering.
- Design landscape to maximise rainwater infiltration and slow peak stormwater velocities which may cause erosion. Measures may include: minimise paved areas and increase permeability to increase absorption; convey stormwater via grassed swales rather than gutters or drains.
- Use external surfaces where possible for the collection of storm water
- Collect rainwater from roofed areas and reuse in toilet flushing, cooling towers and landscape irrigation
- Control stormwater runoff from parking areas to prevent oil and grease runoff entering nearby waterways. Prevent any discharge of stormwater into the sewerage system. Consider measures to reduce pollutant loads entering the stormwater and /or sewer systems.
- Direct fire pump test water back to fire storage or rainwater tank.

25.12 Make the Building Healthy

- Avoid the use of polluting substances. Refer to Subsection 25.16 – Select Low Impact Construction Materials. Provide high quality indoor air quality.
- Consider holistically, the common denominators of Sick Building Syndrome such as: temperature and air velocity; fresh air ventilation rates; relative humidity; lighting; noise; micro-organisms; respirable particulates; volatile organic compounds; gaseous pollutants; ; control by occupants; and negative ions.
- Provide appropriate lighting levels for various uses. Refer to Section 15 – Electrical Services, Subsection 15.3 Lighting.
- Maximise use of daylight.
- Minimise unacceptable noise. Refer to Subsection 3.7 – Acoustic Control.

25.13 Noise

- Protect sites from noise pollution from local features such as traffic, industry and entertainment venues. Provide screening or appropriate earth mounding to control noise.
- Design site layout to separate noise generating activities from quiet activities.
- Minimise noise emitted from external equipment such as fans, air-conditioners, compressors, and from other noise generating sources.
- Minimise noise transmission from space to space within multiple-occupancy buildings.
- Minimise noise transmission from roofs

25.14 Light

- Do not install glass on facades exposed directly to the sun without the provision of sunshading.
- Avoid overshadowing and visual intrusion of adjoining site and open spaces.
- Design and site buildings to avoid hazardous or undesirable glare to pedestrians, motorists, people using open spaces and those in other buildings and landscaping.
- Design to minimise the impact of night lighting on adjacent areas.
- Install solar powered external lighting.

25.15 Select Low Impact Construction Materials

- Consideration is to be given to the ‘cradle to grave’ implications of material choices, the implications of the materials’ extraction, manufacture, use, disposal and transportation.
- Subject building material selections to systematic consideration of whole of life environmental impacts Life Cycle Assessment (LCA) methodology. The “precautionary principle” should be adopted by avoiding the use of hazardous or suspected materials or only using them with adequate safety devices and precautions. Impacts that should be considered are: impact on natural ecosystems from which the material was extracted/grown; amount of energy required in production/transportation; environmental impacts generated by construction activities, amount of toxin waste generated in production; potential of the material to be recycled; amount of recycled material used in production; life space and durability of product; effectiveness of product; any threat to human health from deterioration of the product; nature of waste generated by disposal of the product.
- Adopt life cycle costing (LCC) principles for materials and systems selection that includes capital, recurrent and disposal costs. Coordinate criteria used for calculations with methodology used for LCA.
- Use recycled and recyclable building materials, where fit-for-purpose, in walls, roofs and floors and demolition materials in fill and hardcore. This may include the re-use of materials or components from existing site facilities that are to be demolished. Investigate local facilities for receiving recyclable materials and establish a policy for the construction phase to be written into specifications. There will be a cost and potential environmental penalty if the specification makes unrealistic demands through additional transport for recycling. Also, landscape design should include provision for the recycling of green and organic waste during establishment and facility operation.
- Do not use rainforest timber and timber from Australian high conservation forests. Balance consideration of environmental impacts of use of treated plantation timbers against use of untreated timbers from natural growth forests. Use untreated plantation timber wherever appropriate.
- Design for use of timber substitutes or engineered wood products in preference to solid wood. Consider appropriate design detailing for engineered products to avoid any off-gassing potential.
- Avoid using petrochemical based products like plastic and vinyls.
- Give preference to the use of locally made products and materials as opposed to those with need to be transported long distances.

Preferred Products:-

- Hoop pine ply
- Woollen upholstery fabrics and carpets
- Leather upholstery in lieu of vinyl
- Plantation timber products and cane products.
- Demountable systems.
- Natural rubber or cork flooring where practical instead of vinyl.
- Low VOC paints.
- Locally produced materials and products.
- Lift finishes should be selected to reduce lift weight loads

25.16 Life Cycle Initiatives and Adaptability of Building

- Design for ease of future adaptability taking into account design and planning principles for durability, versatility, access, redundancy, simplicity, upgradability, independence. Ensure retention of full as-built-documentation to assist effective decision making and prevention of costly probing exercises.
- Maximise the potential life cycle length of facilities to reduce energy costs in demolition and reconstruction. The durability of materials and so the maintenance required to extend its life can also significantly affect both the resources and energy use of a building.
- A purpose built facility will not be as adaptable to future change of usage as a “generic” facility.

25.17 Waste

Construction and Demolition Waste

Design for minimum wastage.

- Formally apply dimensional coordination where it will practically assist the efficiency of material use, particularly for modular components and materials supplied in set sizes or dimensions or where high levels of wastage may occur.
- Give design consideration to the future ability and ease of recycling construction materials and components at the time of refurbishment or completion of a facility’s life.
- Prepare and implement waste management project plans during project in the construction phase for construction and demolition wastes. Plans should identify the alternatives to landfilling and describe procedures and management practices.
- Make provision in project programming for the project plans during project in the construction phase for construction and demolition wastes. Plans should identify the alternatives to landfilling and describe procedures and management practices.
- Make provision in project programming for the recovery, storage and transfer of re-useable materials from demolition works including their transport from site to recycling and re-use stations; specify accordingly and supervise during construction. Consider the use of separable or early works packages where this is of advantage to the project.
- Adopt special procedures for disposal or recycling of hazardous materials in refurbishing existing buildings according to legislative requirements.
- Reduce dust and run-off from building works to a minimum.

25.18 ESD Statement and Objective/Achievement Schedule

ESD Statement

An environmental rating tool developed by the Green Building Council of Australia for rating the design and construction of new office buildings, rated buildings on a scale of 6 stars is equivalent to best practice, 5 stars Australian Excellence 6 stars world leader refer https://www.gbca.org.au/green-star/. At the Sketch Design Stage of each project for projects above $10 thousand the Project Architect (or ESD consultant if engaged) must prepare an ESD Statement outlining the opportunities and issues to be addressed, to achieve the proposed green star rating this will form part of an undertaking to achieve this level of performance to Sydney City Council and UTS.

Objective/Achievement Schedule

At the completion of each stage of a project (sketch design, design development, and documentation) the relevant section of the following checklist must be completed to show how the detailed components of the Environmental Sustainability Guidelines have been addressed.

Only sections of the Checklist relevant to a particular project type should be completed.

25.19 Monitoring and Feedback

- For Greenstar Ratings to be awarded a full accounting system must be set up for products used and proof of purchase, including original invoices. Refer Greenstar Building Council of Australia. This may require Greenstar Accredited ESD project management. UTS will require completed Greenstar Educational Tool and Greenstar Office Existing Building tool for fitout input worksheets for works over $1 million.
- For new areas, tenancies and buildings metering should be set up to monitor energy and water usage.

ENVIRONMENTAL DESIGN GUIDE
OBJECTIVE/ACHIEVEMENT SCHEDULE

Goal is to establish an Environmental Score and Aim to achieve or better it.

ITEM	OPPORTUNITY 0 = None 5= Maximum						TOTAL	OBJECTIVE N/A Not Applicable	TASK	RSPBLTY	SCORE	%ACH'VD	SIGN OFF
	0	1	2	3	4	5							
SITE PLANNING													
• Maximise site views													
• Minimise effect on adjoining site views													
• Maximise site's solar access													
• Consider adjacent site's solar access													
• Reuse existing structures if any													
• Demolish existing structures													
• Reuse demolished materials													
• Limit & restrict cleared areas													
• Minimise effect of Biodiversity													
• Minimise excavation													
• Accept/use slope constraints													
• Retain/stockpile materials													
• Maximise porous paving surface													
• Consider on-site water use													
TOTAL													

WASTE & RECYCLING PROVISIONS													
Construction Wastes													
Occupation Wastes													
TOTAL													

ENVIRONMENTAL DESIGN GUIDE
OBJECTIVE/ACHIEVEMENT SCHEDULE

Goal is to establish an Environmental Score and Aim to achieve or better it.

ITEM	OPPORTUNITY 0 = None 5= Maximum						TOTAL	OBJECTIVE N/A Not Applicable	TASK	RSPBLTY	SCORE	%ACH'VD	SIGN OFF
	0	1	2	3	4	5							
BUILT FORM													
• Minimise footprint													
• Orientation													
• Building's depth													
• Building's massing													
• Maximise controllable daylight													
• Maximise passive solar capabilities													
• Maximise natural ventilation													
• External shading													
• Structural system													
• Prefabrication off site													
• Choice of materials													
TOTAL													

CONSTRUCTION PROCESS MGT													
Waste													
Pollution													
Compaction													
Parking													
Contamination													
Indiscrimate damage													
TOTAL													

ENVIRONMENTAL DESIGN GUIDE
OBJECTIVE/ACHIEVEMENT SCHEDULE

Goal is to establish an Environmental Score and Aim to achieve or better it.

ITEM	OPPORTUNITY 0 = None 5= Maximum						TOTAL	OBJECTIVE N/A Not Applicable	TASK	RSPBLTY	SCORE	% ACH' VD	SIGN OFF
	0	1	2	3	4	5							
INTERNAL PLANNING													
• Reduce internal circulation space													
• Group areas of similar need:													
- Heating													
- Cooling													
- Lighting													
• Integrate indoor/outdoor spaces													
• Maximise passive opportunities for:													
- Heating													
- Ventilation													
- Daylighting													
TOTAL													

ENERGY													
• Use of renewable resources													
• Passive Solar Design													
• Solar Control													
• Natural Ventilation													
• Daylighting													
• Low Energy Lighting													
• Insulation													
• Energy Efficient Appliances													
• Energy Management Systems													
TOTAL													

ENVIRONMENTAL DESIGN GUIDE
OBJECTIVE/ACHIEVEMENT SCHEDULE

Goal is to establish an Environmental Score and Aim to achieve or better it.

ITEM	OPPORTUNITY 0 = None 5= Maximum						TOTAL	OBJECTIVE N/A Not Applicable	TASK	RSPBLTY	SCORE	%ACH'VD	SIGN OFF
	0	1	2	3	4	5							
MATERIALS/FINISHES													
• Environmental Impact (whole life)													
• ESD fit for particular use													
• Rare & non-embodied energy													
• Carbondioxide emissions													
• End of use recycling													
• Recycled materials													
• Human health (toxins & reactive organic compounds)													
• Eco systems (toxic waste)													
• Thermal comfort													
• Transport													
• Maintenance													
• Durability													
• Cost													
TOTAL													

WATER USE													
• Retention of stormwater													
• Treatment of Effluent for reuse													
• Reduction of Use of Potable Water													
• Use of Water Efficient Appliances													
TOTAL													

26 HERITAGE ASSETS

26.1 Introduction

Heritage assets are an integral part of UTS's campuses. In the context of this policy and the following guidelines heritage assets are specifically defined as:
'a landscape, place, work, building or relic of architectural, archaeological, aesthetic, social, cultural, technical, scientific or natural heritage significance.'

More specifically this policy aims to:

- conserve significant heritage assets for the benefit of present and future generations
- systematically identify, assess and develop appropriate management strategies for heritage assets
- maintain viable and living uses for heritage assets
- maintain required management standards and conditions for heritage assets

Management of Heritage Assets shall be in accordance with Section 24 AEP as applicable – to ensure that access provisions do not compromise heritage significance.

26.2 Heritage Asset Management Process

Heritage issues shall be viewed as an essential part of the management of the asset.

The management of heritage assets shall be integrated into UTS Total Asset Management Plans, and Capital Development Plans and Asset Maintenance Plans

The Heritage Asset Management Guidelines are the process for UTS to identify, prepare and implement strategic plans for heritage assets.

26.3 Processes to Address Heritage Issues at Project Level

The procedures and responsibilities to ensure heritage issues are addressed at project level are as follows:

- FMU to prepare and regularly update a heritage asset register
- Heritage Asset Management Guidelines to be issued to all project teams by FMU Project Managers, Architects, Property and Faculty Managers as part of the UTS Design Guidelines
- FMU Project Managers, and Architects, to determine if a proposed project affects any heritage assets
- Users, stakeholders and lesees of all UTS heritage assets to be notified of the requirement to gain permission from FMU for all proposed maintenance works modifications and changes.

26.4 Heritage Asset Management Process

The process for managing Heritage Assets is summarised in Table 26.4

Identify	Strategic Planning	Detailed Planning	Implement	Monitor
Identify assets	Determine heritage management policy	Produce work plan	Allocate resources	Review & evaluate
Assess assets	Review corporate objectives and service strategy	Identify and rank tasks	Implement plan	
Record assets	Produce a Conservation Plan	Secure resources		
Register assets	Determine future use	Incorporate into Total Asset Management Plan		
		Incorporate into UTS Asset Maintenance Plan		

(Source: NSW Department of Public Works and Services Heritage Asset Management Guideline)

26.5 Identification

UTS shall periodically survey its property and asset portfolio to identify any assets which have heritage significance. Standard heritage categories shall be used to organise the survey and begin the process of heritage assessment. The NSW Heritage Council's assessment guidelines and criteria shall be used as the basis of assessment and classification.

The survey shall reveal dominant heritage features, define the location of specific items, and place them within their historical context.

UTS shall maintain an accurate Heritage and Conservation Register of all assets which have heritage significance in accordance with the Heritage Act of NSW 1977. Refer to the UTS Heritage and Conservation Asset register to follow:

UTS Heritage and Conservation Asset Register

Item	Listing	Legal Status of Listing and Notes
Blackfriars Precinct 4-12 Buckland Street Chippendale	Listed as heritage items by South Sydney Council in LEP 1998 (includes Site and 2 former main school buildings and former Headmaster's Residence) Listed within South Sydney Council Chippendale Conservation Area Classified by the National Trust of Australia (NSW) as part of the St. Benedict's Precinct	Statutory Authorative (Non statutory) No statutory planning or heritage implications however the views of the National Trust are respected and often sought by Local Government
Brick Sewer Pipe Line of ovoid cross section on Dairy Farmers site, 37 Ultimo Road Ultimo	Nil	Item protected by the Heritage Act of NSW 1977. Section 139 of the Act disallows disturbance unless in accordance with an 'examination permit' from the Heritage Council. Section 146 of the Act requires the relic to be reported to the Heritage Council.
Bon Marche Building 1-7 Broadway, Broadway	Listed as heritage item by Department of Planning in REP 26 - City West Listed within National Trust Conservation Area	Statutory
The Loft Rear 9-13 Broadway, Broadway	Listed as heritage item by Department of Planning in SREP 26 - City West	Statutory
The Terraces 9-13 Broadway, Broadway	Listed as heritage item by Department of Planning in SREP 26 - City West	Statutory
Building 15 (TAFE BUILDING U) 622 Harris Street, ULTIMO	Listed as heritage item by Department of Planning in SREP 26 - City West	Statutory
Kuring-gai campus [leased] Eton Road Linfield	Nominated by Ku-ring-gai Council to be listed as a heritage item	Pending Statutory

26.6 Strategic Planning

UTS shall determine management strategies for each heritage asset. Where appropriate a Conservation Management Plan (CMP) shall be prepared in establishing the significance of the heritage asset, provide a conservation policy, advise appropriate uses, development constraints and opportunities. The CMP should be reviewed regularly and updated as required.

Strategic Planning shall also include consideration of the following:

- the performance required from the asset in relation to the ability of the asset to provide this performance
- the Statutory Regulations that apply to the asset and the constraints that may affect future development
- the preferred option for use:
  - continue with the current issue
  - adapt to a new use
  - transfer of ownership

In general UTS shall endeavour to maintain a living and viable use for heritage assets.

UTS to ensure that building users are aware of heritage significance and conservation constraints. Where appropriate this may extend to users having contractual obligations (particularly lesees).

26.7 Detailed Planning at Asset Level

The detailed planning shall incorporate whatever is necessary to protect and conserve, and where appropriate reveal and explain the heritage significance of the asset.

The recommendations of the CMP (where available) shall be followed for all assets.

Detail Planning decisions should not result in the integrity of a heritage asset to be diminished by the following:

- physically damaging or altering all or part of the asset
- isolating an asset from its setting or altering the character of the setting that contributes to the asset's integrity
- introducing visual, audible or atmospheric elements that are out of character with the asset or that alter its setting
- leaving an asset vulnerable to theft, vandalism, trespass, deterioration or destruction

26.7.1 If continuing with current use:

Follow the recommendations of the CMP. Integrate conservation strategies with the UTS Total Asset Management Plan and the Capital Management Plan.

26.7.2 If adapting the asset to a new use:

Ensure reuse and design/development options are compatible with heritage requirements. Justify preferred options through a 'Statement of Heritage Impact' where appropriate. Obtain all required approvals. Notify relevant authorities of change of use.

26.7.3 If transferring the asset:

Ensure heritage values are fully understood and are not compromised during the transfer process. Avoid abandoning or destroying heritage assets. Demolition of heritage assets requires the consent of the Heritage Council.

Ensure that the asset is not left unprotected or unoccupied and prone to vandalism.

Arrange for all statutory approvals and notify relevant authorities where required.

26.8 Maintenance

The appropriate maintenance strategy shall be determined for each asset e.g. preventative maintenance and cyclic maintenance.

Follow the recommendations of the CMP where available for each asset.

When assets are initially registered on the Heritage and Conservation Register their condition should be assessed and maintenance work prioritised and included in the UTS Asset Maintenance Plan.

26.9 Implementation

Implementation includes for example, upgrading and maintaining the UTS asset register, undertaking maintenance programs, undertaking adaptive reuse or development of heritage assets.

The UTS asset register and CMP's shall be regularly reviewed and upgraded as required.

Reference should be made to the CMP and work plans where available.

Obtain approvals from statutory authorities where required.

Where in-house resources are unavailable specialist input should be sought for all aspects of heritage work.

26.10 Monitoring, Review and Feedback

UTS shall annually monitor the following for heritage assets included in the UTS Heritage and Conservation Asset Register:

- the condition of assets
- the progress of achieving the objectives of Management Plans for assets
- the progress of works identified in Asset Maintenance Plans
- the performance of the asset in meeting Business Plans

UTS shall ensure that actions by other government agencies or the private sector do not erode heritage qualities and result in the integrity of the heritage asset being diminished as noted in Detailed Planning.

27 BUILDING MANAGEMENT SYSTEMS (BMS)

27.1 Purpose

The purpose of this Guideline Requirements and Specifications is to provide a design guide for Project Managers and Designers developing specifications for Building Monitoring and Control Systems at the University of Technology.

27.2 Scope

This document scopes the type of technology and systems that are compatible with the current UTS BMS system architecture, based on a BACnet IP network and with the intent to connect each system to a future Enterprise Headend supplied by UTS.

Overview functionality of DDC controls is included in this document. It is expected that designers will specify the controls required within their documentation package, however this specification includes minimum requirements for typical air-conditioning systems.

This 

symbol means that design input is required.

Controllers and other system equipment is specified to the extent that compliance with BACnet and some basic architecture and functionality requirements are met. It is not intended to completely specify requirements that consultants may need, but is aimed at providing a minimum and also encouraging vendors to offer innovative solutions. Vendors may offer equipment that exceeds these specifications, however in general the University intends to maintain standards that are practical (for example avoiding elaborate programmable wall thermostats).

27.3 References and Standards

1. National Institute of Standards and Technology (NIST). GSA Guide to Specifying Interoperable Building Automation and Control Systems Using ANSI/ASHRAE Standard 135-1995, BACnet
2. American Society of Heating Refrigeration and Air-conditioning Engineers. BACnet PICs (protocol Implementation Conformance Statement)
3. American National Standards Institute (ANSI). EIA-485 Communications Standard
4. AS/NZS 3000:2007 Standards Australia. Electrical Installations
5. Australian Communications and Media Authority: Radio-communications (Electromagnetic Compatibility) Standard 2008

27.4 Definitions and Abbreviations

AI, Analog Input a value that can be read from a controller

AO, Analog Output, value that be read from a controller and written to by software

AV, Analog Value, a holding variable such as a setpoint,

BACnet, Interoperability protocol ASHRAE Standard 135p.

BACnet Advanced Application Controller (BACnet AAC), application controller

BACnet Application Specific Controller (BACnet ASC), application controller for VAV, FCU etc

BACnet Building Controller (B-BC), controller device profile for high level network based controllers.

BACnet Operator Workstation (B-OWS), network level workstation

BCS, Building Control Station, a high level BMS controller typically connected directly to the UTS WAN . Commonly used to control chillers, large Airhandling systems and other complex equipment. Must conform to BACnet B-BC device profile.

BI, Binary Input, a digital value read from a controller

BO, Binary Output, a digital value that can be written to by software

BV, Binary Value, a digital holding variable

EMS, UTS Energy Monitoring System – Optergy 2

UTS System Integrator, specialist integrator of University of Technology UTS, tasked to integrate BMCS systems to the UTS Server

BMS Contractor, company employed to deliver an individual UTS BMS into a building

BMS System Software, Software deployed in a building that provides the configuration, graphics, trendlogs, alarming and other functions that form the key user components of the system.

DSC, Distributed Control System

LDAP, Lightweight Directory Access Protocol

Lonworks, Echelon Corporation Lonworks network standard

Modbus/RTU, Modbus over serial link (RS-485)

Modbus/TCP, Modbus over IP (Transmission Control Protocol)

Native BACnet system, a system that can be proven to be designed around the BACnet standard. Excludes systems that provide BACnet gateways or BACnet integration at only the LAN level. Native BACnet should support a majority of BACnet objects including but not limited to Points, Services, Alarms, Time Schedules, Trendlogs and Programs.

NMS, Network Management System, a software system for monitoring network devices.

NTP, Network Time Protocol

SNMP, Simple Network Management Protocol

SMTP, Simple Mail Transfer Protocol

RDC, Remote Distributed Controller, BACnet application oriented controllers, typically linked to a BCS or a BACnet router for supervisory functionality, may reside on a lower speed (78Kbs) peer to peer LAN. Commonly provide VAV, FCU, small AHU, and Packaged Equipment local control. Required to support B-AAC or B-ASC profile.

RDP, Remote Desktop Protocol (multi-channel allowing remote clients to connect to Microsoft Terminal Services).

SDD, System Design Document, includes all design information for approval prior to installation

VAV, Variable Air Volume (referencing the controller/actuator)

AHU, Air Handling Unit

FCU, Fan Coil Unit

ACU, Air Conditioning Unit

UTS, Facilities Managemen Operations

UTS, Programme Management Office

UTS MAINTENANCE DELEGATE,

VPN, Virtual Private Network

KVM Switch, Keyboard/Video/Mouse switching device

SRT, System Restoration Time

UTC, Coordinated Universal Time (*Temps Universel Coordonné)*

27.5 General

27.5.1 Overview Requirements

27.5.1.1 This guideline has been developed to assist engineers developing specifications for Building Management Systems to be installed for the University of Technology Sydney.

27.5.1.2 The University of Technology has adopted BACnet as the integration standard for all Building Management Systems. Each Building within the Broadway Precinct shall be controlled and monitored through a Native BACnet BMS system.

27.5.1.3 The purpose of this guideline is to promulgate a consistent quality of installation in each new installation.

27.5.1.4 . Each building is to have BMS System Software supplied and supported from a single manufacturer. Controllers connected to the BMS shall be configurable by the BMS System Software. This is intended to prevent a proliferation of software and controllers within a single building that cause increased maintenance complexity.

27.5.1.6 Workstations (or servers) and controllers, including unitary controllers, shall support native BACnet devices. No gateways shall be used for communication between controllers however BACnet routers may be used to provide network connectivity design. Non-BACnet-compliant or proprietary equipment or systems (including gateways) shall not be acceptable.

27.5.1.7 The University of Technology may in future develop an enterprise wide architecture that incorporates an enterprise BACnet BMS server. Each BMS shall be designed and delivered with the capability to integrate graphics, alarms, data logging, and time scheduling with a BACnet Server supporting BACnet AWS (Advanced Operator Workstation) profile. This capability must be demonstrated during witness testing with UTS representatives.

27.5.1.8 Each BMS shall separately control all mechanical equipment, including all unitary equipment such as VAV boxes, heat pumps, fan-coils, AC units, etc., and all air handlers, boilers, chillers, etc using native BACnet-compliant components.

27.5.1.9 Building Management Systems will allow for the use of industry standard protocols for the connection of various field equipment. This equipment must terminate on a BACnet BCS, RDC or protocol gateway to make the data available as BACnet data:

For example:
- Modbus for devices (chillers, water meters, electricity meters etc)
- Lonworks or C-Bus (lighting and other device networks)
- KNX (for metering devices and other device networks)
- M-bus (heat meters)
- Fieldbus, DNP, CIP (PLCs and other industrial controls for power generation etc)

27.5.1.10 The architecture of the BMS shall support a single user interface for configuration and user operations (configuration and graphics). Systems that require two separate non-integrated applications to configure controllers and view graphics will not be acceptable.

27.5.1.11 The systems shall be web oriented, so that configuration and user operations can be completed using a web browser, with a server that shall be located in the Building 1 Level 9 data centre.

27.5.1.12 Preference will be given to systems that provide a fully integrated HTML based user interface.

27.5.2 Requirements of the BMS for future integration

27.5.2.1 In each new building there will be a specialist BMS contractor, tasked with delivering the control and monitoring functionality required in the building.

27.5.2.2 The BMS contractor will be required to include the coordination of UTS WAN addressing of each components connected to the UTS WAN, graphics, data-point

name conventions, network design, alarm setup, history log setup and other integration requirements.

27.5.2.3 The BMS server supplied shall be compatible with future integration to a protected high performance BACnet server managed by the University of Technology.

27.5.2.4 The BMS System Software shall support integration of the following functions:

- Web-user access (for viewing and control of room temperature set points or other parameters required by UTS)
- Clock Synchronisation and scheduling functions
- Alarm Management, event archiving and email notification
- History Logging and trend archiving
- Supervisory Controls and Monitoring
- Building energy and utility performance profiling

27.6 BMS Specifications

27.6.1 General

27.6.1.1 Each Building Management System provides a standalone function, independent of any other System, unless it is specifically designed to integrate with other UTS buildings or plant.

27.6.1.2 Each Building Management System provides all local automatic control for mechanical plant and includes all hardware, software and programming necessary to achieve a complete Building Management System.

27.6.2 Scope by BMS Contractor

27.6.2.1 The BMS contractor is required to provide a complete system with all Software, Building Control Stations, Remote Distributed Controllers, field points, field instrumentation, actuators, controls programming, alarm programming, email, sms triggers, time schedules, histories (trend logs), graphics (with room numbers accurately matching current space planning floor plans), and all other requirements sufficient to meet the specification and hand over a fully operational system to UTS.

27.6.2.2 Interfacing with other systems as set out in the specification.

27.6.2.3 System documentation, with details of system engineering and system design drawings provided in advance of installation works for approval.

27.6.2.4 Supervisory specialists and technicians at the job site to assist in all phases of system installation, start-up, and commissioning.

27.6.2.5 Complete set of O&M manuals. Full schematic drawings (electrical and DDC) must be supplied as part of the maintenance manuals, as well as logic flow diagrams of the DDC control programming, workstation software, diagrams, and all other associated project operational documentation (such as technical manuals) on approved media, the sum total of which accurately represents the final system.

27.6.2.6 Copies of all shop drawings and as-built drawings are to be provided to UTS at Practical Completion by the Contractor. The as-built drawings are to be provided in accordance with the UTS Facilities Management Unit CAD Drawing Standards and to be a format fully compatible with the UTS CAD Record Keeping System. An electronic copy on DVD is also required.

27.6.2.7 Comprehensive formal training for the clients maintenance representatives of at least 5 days for up to 5 people, and others to attend as observers. The specialist contractor to provide not less than eight hours of operational and programming instruction on the DDC system to staff nominated by the Director, FMO

27.6.2.8 The Contractor must provide high quality, well documented detailed designs for all functions, equipment, points, time schedules, system databases, graphic displays,

controls and energy management programs, logs, reports and any other engineering artefact required by the tender documents.

27.6.2.9 The Contractor should prepare documentation for approval prior to the commencement of installation including hardware layouts, interconnection drawings, and software configuration from project design data. This documentation shall include the following elements as a minimum:

- System Description
- Functional Specification
- System Interfaces
- Network topology diagram
- Equipment location diagrams
- Equipment installation drawings
- Detailed Equipment Bill of Materials (including spares)
- Maintenance Schedules
- Valve and Actuator selection and design data
- Test Plans

27.6.3 System Engineering

The Contractor should prepare detailed System Engineering services and documentation, including:

27.6.3.1 Astrategy to ensure that the system is designed for reliable operation and ease of maintenance during its life. The supplier is to advise the design life of the system. Design life will not be less than 15 years.

27.6.3.2 Individual hardware layouts, interconnection drawings, and software configuration from project design data.

27.6.3.3 Equipment schedules for installation compliant with all relevant standards.

27.6.3.4 Detailed design for all analogue and binary objects, system databases, graphic displays, logs, and management reports based on control descriptions, logic drawings, and configuration data.

27.6.3.5 Inter-connection diagrams between all Building Control Stations (BCS) systems via an approved structured LAN cabling system. Where applicable Building Control Stations will be connected directly to the Campus Area Network and will show IP addresses and BACnet addresses assigned by UTS IT.

27.6.3.6 Complete manufacturer's specifications for all items that are supplied. Include vendor name of every item supplied.

27.6.3.7 All graphics templates for new systems are to be constructed on a common format such that they can be ported directly to a future BACnet enterprise BMS server. The BMS Contractor is to ensure that Graphics are built in accordance with University of Technology Style-sheets (q.v. APPENDIX B).

27.6.3.8 Power reticulation schematics to the DDC control panels and field devices. All controls emanating from the DDC to external devices must be 24VDC or 24VAC originating from a 240V/24V transformer mounted within the DDC cabinet or in external switchboards and switched by the internal relays within the DDC control panel. No DDC controller is to switch 240VAC. All 240 VAC switching must be done in a mechanical Motor Control Centre (MCC) with relay isolation between DDC controllers and the mechanical electrical control circuit.

27.6.3.9 Provide supervisory specialists and technicians at the job site to assist in all phases of system installation, start-up, and commissioning.

27.6.3.10 The specialist contractor to provide not less than eight hours of operational and programming instruction on the DDC system to staff nominated by UTS.

27.6.4 Scope by others

Where the system is required to interface with other building systems including but not limited to Air-conditioning, fire, security, laboratory ventilation, chilled water manager, lifts, and UTS Campus Area Network, the design is required to clearly set out the requirements of each

interface. The documentation is also required to clearly engineer the interfaces such that any functional, reliability, maintainability or availability issues can be identified before the system installation commences.

27.6.5 Network Architecture

27.6.5.1 Systems shall be based on ANSI/ASHRAE Standard 135-2008, BACnet. The operator's workstation, all Building Control Stations (BCS) and Remote Distributed Controllers (RDC), shall communicate using the protocols and network standards as defined by ANSI/ASHRAE Standard 135–2008, BACnet.

27.6.5.2 BACnet/MSTP (where used to link sub-controllers) must use approved EIA-485 cable with properly grounded and screened twisted pair. Distances must not exceed the EIA-485 specification.

27.6.5.3 The BMS must be able to reside on a VLAN on a routed network wherein master controllers are to be assigned private IP addresses by the UTS IT Services.

27.6.5.4 Each system will consist of a networked communication structure (with TCP/IP on gigabit or fast Ethernet at its highest level).

27.6.5.5 Inter-connection between Direct Digital Control (DDC) systems connected to UTS TSG Room patching panels must be via an approved structured LAN cabling system. BACnet/IP must use structured cabling in accordance with UTS Design Guidelines.

27.6.5.6 Systems that support an internal System Manager (such as Chilled Water Manager or Lighting Manager) are to be monitored through BACnet directly. The BMS should not independently measure data that is measured more accurately or at higher resolution by the System Manager.

27.6.5.7 BACnet Routing will be used to link from IP network segments to RS-485 network segments. Each floor is to contain routers to provide separation between IP backbone and floor networks of controllers connected to an RS-485 network. A BCS connected to the BACnet/IP network may act as a router to lower speed RS-485 BACnet MS/TP networks.

27.6.5.8 Local Workstations are to comply with BACnet Operator Workstation profile (B-OWS) and must be connected directly to the UTS WAN using BACnet IP.

27.6.5.9 All proposed BACnet controllers are to be furnished with a BACnet protocol Implementation Conformance Statement (PICS see APPENDIX C) and should be BACNET TESTING LABORATORIES (BTL) listed for conformity to the BACnet standard.

27.6.5.10 All BACnet devices are to conform to a BACnet Standardized Device Profile (Annex L) and be provided with a list of all BACnet Interoperability Building Blocks supported (BIBBs, Annex K).

27.6.5.11 All top level controllers connected to the UTS IP Network must support BACnet/IP. At least one BACnet B-BC connected to the UTS VLAN will be able to communicate as if resident on a LAN, however any BACnet/IP device must support Annex J "Multicasting" or BACnet/IP Broadcast Management Device (BBMD). In general each subnet shall include one BBMD. The BMS Contractor shall seek approval for more than one BBMD in any IP subnet.

27.6.5.12 Building Control Stations (BCS) must comply with BACnet B-BC and be connected directly to the UTS WAN.

27.6.5.13 BACnet controllers used in VAV, FCU, AHU and other application specific applications can use either Ethernet/IP (BACnetIP), or RS485 (BACnet MS/TP).

27.6.5.14 For all BACnet controllers the master BACnet addressing scheme is included in APPENDIX A. BACnet network addresses and controller devices ID's will be allocated by FMO.

27.6.5.15 BMS servers must be located in the Building 1 Level 9 Data Centre. The BMS Contractor must allow for coordination with UTS IT personnel to manage the

installation of server equipment or server software into the Data Centre. Any requirement to install a server outside the UTS data centre must be expressly approved by UTS.

27.6.6 Field Controllers

27.6.6.1 All software required to program application specific controllers and all field level devices and controllers will be left with UTS. All software passwords required to program and make future changes to the system will also become the property of UTS.

27.6.6.2 Building controllers shall include complete energy management software, including scheduling building control strategies with optimum start and logging routines. All energy management software and firmware shall be resident in field hardware and shall not be dependent on the operator's terminal. Operator's terminal software is to be used for access to field-based energy management functions only. Provide zone-by-zone direct digital logic control of space temperature, scheduling, runtime accumulation, equipment alarm reporting, and override timers for after-hours usage.

27.6.6.3 Direct Digital Controls (DDC) will be distributed to the Building Control Stations (BCS) and Remote Distributed Controllers (RDC) in accordance with best practice distributed processing.

27.6.6.4 Building Control Stations (BCS) will support B-BC profile and incorporate sophisticated high level capability. Each BCS must support a field point population of no more than 350 points (not including soft points). The BCS timeclock must be able to synchronise with a Time Server (Network Time Protocol), feature flexible block DDC programming, memory for standalone trend logging of all field points at 30 second intervals for 12 hours, and local alarm buffering for up 500 alarms offline from the server.

27.6.6.5 The BCS must support a variety of subsystem drivers to allow connection to a variety of device networks based on other protocols including MODBUS, C-BUS, EIB-KNX, MBUS and LONWORKS.

27.6.6.6 Remote Distributed Controllers (RDC) typically support B-AAC or B-ASC profiles for lower level packaged or compact flexible air-conditioning controls are to be based on BACnet/IP or BACnet/MSTP as the field network. Controllers in MS/TP networks must be capable of operation at data rates up to 76kbs. No more than 48 field points to be connected to any individual RDC.

27.6.6.7 Each BCS and RDC shall be equipped with non-volatile memory for the protection of user programs, data, graphics and logs.

27.6.6.8 All BCS and RDC must have Web based console port (RJ45 socket) to allow standalone interrogation from any location on the network using only a browser. RDC that require special programming software tools for viewing of field data and basic configuration (clock, BACnet addressing, local BACnet field variables) are not acceptable.

27.6.6.9 Lonworks tunnelling on the UTS network (or VLAN) is not permitted. Any Lonworks device is to wire in FTT10A cabling direct to a BCS or BACnet to Lonworks gateway that will connect to the UTS network using BACnet protocols.

27.6.6.10 Programming must utilize block DDC logic techniques allowing UTS staff to easily read and understand the operational logic. B-BC, B-AAC and B-ASC must support the same set of block programming objects for commonality of purpose. Block libraries must contain all point types. It must include analog and digital inputs and outputs, analogue and Boolean Variables, and support enumerated and string variables. A full suite of logic functions, arithmetic functions, control loops, time schedules, alarm handling, point type conversion, unit conversion, energy management library must be available in the controller. In addition to block programming library, controllers may offer scripting language for complex programming but this must only supplement the block programming capability.

27.6.6.11 RDC using BACnet MS/TP must support tunnelling such that all field points, DDC programs, DDC logic functions, alarms, trend logs, control loops, schedules and all

other functionality can be access via the IP network without requiring the use of a laptop directly plugged in to pre-program the controller.

27.6.6.12 Analogue to Digital resolution must be at least 12bits for analogy Inputs and 8bits for Analogue Outputs. All inputs and outputs shall be protected against noise and transient voltages.

27.6.6.13 RDC with profile B-BC must have flexible IO capacity. Inputs should be capable of configuration as either Binary Input (BI) or Analogue Input (AI).

27.6.7 Minimum Field Data Requirements

27.6.7.1 Mechanical Services

27.6.7.1.1 VAV controllers

Must support BACnet ASC or AAC profile and must support as a minimum the following variables:

Input
Required

Point Name	AI	BI	AO	BO	AV	BV
Occupied Mode						R/W
Start/Stop				R/W		
Space Temp	R					
CO2 (IAQ)	R					
Damper (2)				R/W		
Air Flow	R					
Air Flow Setpoint					R/W	
Min. Heating Airflow					R/W	
Cooling/heating					R/W	
Cooling/Heating mode						R
EDH				R/W		

27.6.7.1.2 FCU controllers

Must support BACnet ASC or AAC profile and must support as a minimum the following variables:

Input
Required

Point Name	AI	BI	AO	BO	AV	BV
Occupied Mode						R/W
Start/Stop				R/W		
Status (Pressure Sw)		R				
Space Temp	R					
Space Setpoint					R/W	
Supply Temp	R					
Filter Condition		R			R	
Heating Valve			R/W			
Cooling Valve			R/W			
EDH				R/W		

27.6.7.1.3 AHU (Variable Volume) controllers

Must support BACnet B-BC or B-ASC profile and must support as a minimum the following variables:

Input
Required

Point Name	AI	BI	AO	BO	AV	BV
Occupied Mode						R/W
Start/Stop				R/W		
Status (Pressure Sw)		R				
Supply Pres SP					R/W	
Supply Air Pressure	R					
Supply Fan Speed			R/W			
Supply Temp Setpoint					R/W	
Supply Temp	R					
Return Air Temp						
Return Air Humidity						
Damper Cycle (OA/RA)			R/W			
Min OA Damper				R/W		
Filter Condition		R			R	
Heating Valve			R/W			
Cooling Valve			R/W			

27.6.7.1.4 AHU (Constant Volume) controllers

Must support BACnet B-BC or B-ASC profile and must support as a minimum the following variables:

Input
Required

Point Name	AI	BI	AO	BO	AV	BV
Occupied Mode						R/W
Start/Stop				R/W		
Status (Pressure Sw)		R				
Supply Temp Setpoint					R/W	
Space Temp	R					
Return Air Temp						
Return Air Humidity						
Damper Cycle (OA/RA)			R/W			
Min OA Damper				R/W		
Filter Condition		R			R	
Heating Valve			R/W			
Cooling Valve			R/W			

27.6.7.1.5 Chiller Manager

Must support BACnet B-BC or B-ASC profile and must support as a minimum the following variables. Chiller data must be delivered directly from the Chiller controller via BACnet such that data is synchronized between BMS and Chiller Manager. The meter must be located in a plant room, a readily accessible service duct, or the valve room, and must be easily readable without the use of a ladder.

Input
Require

27.6.7.1.6 Boiler Controller

Must support BACnet B-BC or B-ASC profile and must support as a minimum the following variables.

Point Name	AI	BI	AO	BO	AV	BV
Cooling Call						R/W
ChW Entering Temp	R					
ChW Leaving Temp	R					
CW Leaving Temp	R					
CW Entering Temp	R					
Amps	R					
COP	R					
Load			R/W			
ChW Setpoint			R/W			
Evap refrig Pres	R					
Evap refrig temp	R					
Cond refrig Pres	R					
Cond refrig temp	R					
Comp Disch refrig temp	R					
Oil Temp	R					
Oil pres	R					
CW Water Flow Status		R				
ChW Flow Status		R				
Chiller Operating Status		R				
Chiller Alarm		R				
Chiller Start/Stop				R/W		
ChW Pump Start				R/W		
ChW Pump Status		R				
ChW Supply Temp	R					
ChW Return Temp	R					
CW Pump Start				R/W		
CW Pump Status		R				
CW Supply Temp	R					
CW Return Temp	R					
CT Fan Start				R/W		
CT Fan speed			R/W			

Input Required

Point Name	AI	BI	AO	BO	AV	BV
Heating Call						R/W
HW Entering Temp	R					
HW Leaving Temp	R					
HW Water Flow Status		R				
Boiler Start				R/W		
Boiler Status		R				
Boiler Fault		R				

27.6.7.1.7 Weather Station

The system will receive global variables from the local weather station.

Input Required

Point Name	AI	BI	AO	BO	AV	BV
Ambient Temperature	R					
Ambient Humidity	R					
Wind Speed	R					
Wind Direction	R					
Cloud Cover	R					
Dew Point	R					
Rain Condition	R					
Temp prediction Day+1	R					
Temp prediction Day+2	R					
Temp prediction Day+3	R					
Temp prediction Day+4	R					
Temp prediction Day+5	R					
Barometric Pressure	R					

27.6.7.1.8 Variable Speed Drive

Must be operated via BACnet or Modbus. The following tables indicates the minimum points required.

Input Required

Point Name	AI	BI	AO	BO	AV	BV
VSD Status		R				
VSD Fault status		R				
Speed (%)			R/W			
Output Power	R					
VSD Start/Stop				R/W		
VSD setpoint						R/W
Controlled Input	R					

27.6.7.1.9 Hydraulic and Lift Services

Input Required

Point Name	AI	BI	AO	BO	AV	BV
Booster Pump Fail		R				
Booster Pump low pres		R				
Hot Water Pump Start				R/W		
Hot Water Pump Status		R				
LMR Hi Temp		R				
Sump Pump Status		R				
Sump Pump Fault		R				
Tank Low Level		R				
Tank Extra Low Level		R				
Tank High Level		R				
Supply Pressure	R					
Compressed Air Fault		R				

27.6.8 Electrical and IT

Input
Require

27.6.8.1 Switchboards

27.6.8.1.1 Provide for monitoring of all major Circuit Breakers status, trip and Phase fail relays.

27.6.8.1.2 Provide an electrical meter in all mechanical switchboards and provide inputs to the university's energy monitoring systems.

27.6.8.1.3 Chillers should be metered independently.

27.6.8.1.4 Electricity meters must not be connected using simple industrial signaling (0-10vdc or 4-20mA), but must be the type having serial data connectivity using Modbus.

27.6.8.1.5 Modbus/RTU (serial RS-485) may be used for daisy chaining meters within a single building.

27.6.8.1.6 Modbus/TCP can be used where data is to be routed from building to building across the UTS network.

27.6.8.1.7 Meters must conform to Standard Class 0.5s for Power (IEC62053-22) and Class 1 (IEC62053-21) for Reactive Power.

27.6.8.1.8 Volts, Current and other variables should be measured at an accuracy of at least 0.5%. Current Transformers should be specified in accordance with AS 60044.1 (2007).

27.6.8.1.9 Match CT classes with metering, however where it is impractical to do so, recommend alternatives using existing CTs.

27.6.8.1.10 Meters must provide Total Harmonic Distortion as a percentage.

27.6.8.1.11 Meters must be the type able to be fitted to a standard 90mm square cutout with illuminated display and buttons for configuration and interrogation.

27.6.8.2 Server Room, Technical Services Group Room and Equipment rooms

27.6.8.2.1 Server Room, TSG Rooms and Equipment temperature is to be monitored.

27.6.8.2.2 Provide selected monitoring for Server Rooms, TSG and Equipment rooms.

27.6.8.2.3 Monitor Computer Room AC (CRAC) units (these will have local failover controls). CRAC units and Emergency power systems are to be monitored via BACnet or MODBUS. Fault monitoring of CRAC units is to include hardwire fault input.

27.6.8.2.4 Monitor Emergency power systems including generators, batteries, chargers and fuel supplies (where required, unless monitored by Dataroom NMS).

Electrical Points	AI	BI	AO	BO	AV	BV
Circuit Breaker Status		R				
Circuit Breaker Trip		R				
Phase Fail		R				
Room Temp	R					
Mains Fail		R				
CRAC Status		R				
CRAC Temp	R					
CRAC Fault		R				

CRAC Force Start				R/W		
Generator Status		R				
Generator Run		R				
Generator Start				R/W		
Generator Fault		R				
Generator Fuel Low		R				
Battery Charger Fault		R				
3ph Volts	R					
Current – A phase	R					
Current – B phase	R					
Current – C phase	R					
3ph kW	R					
3ph kWhr	R					
3ph kVA	R					
Power Factor	R					
Frequency	R					

27.6.8.3 Lighting

27.6.8.3.1 Lighting system integration with the BMS must be considered within the design to allow flexible programming of lighting functions with overrides and status's available to the BMS. Where a lighting management system (based on Dynalite, C-Bus, KNX, or other type) is specified, the interface to the BMS must include the following points.

27.6.8.3.2 Where a contactor based hardwired interface is specified, this must be configured to provide group control as necessary.

27.6.8.3.3 Each BMS controlled lighting circuit is to be equipped with status monitoring to confirm operation of the lighting circuit to the BMS.

27.6.8.3.4 Each floor is to be provided with separate lighting controls and a labelled BMS override switch to permit afterhours users access to lighting.

Input
Require

Point Name	AI	BI	AO	BO	AV	BV
External Lighting		R		R/W		
Foyer Lighting		R		R/W		
Corridor Lighting		R		R/W		
BMS Override		R				
Stairwells		R		R/W		
Toilets		R		R/W		
Security		R		R/W		

27.6.8.4 Fire Services

27.6.8.4.1 Fire alarm monitoring is to provided to the BMS such the BMS is capable of operation in "fire" mode. Where hardwired fire signals control plant, the BMS is required to place automatic controls in a mode consistent with the presence of a fire alarm.

27.6.8.4.2 VESDA and Gas systems are required to be monitored by the BMS.

Input
Require

Point Name	AI	BI	AO	BO	AV	BV
General Fire Alarm		R				
FIP Fault		R				
VESDA Fault		R				

VESDA Level 1		R				
VESDA Level 2		R				
VESDA Level 3		R				
Gas Discharge		R				
Gas Fault		R				
Gas Isolate		R				

27.6.8.5 Security Services

27.6.8.5.1 The BMS will report critical alarms to the security system by either hardwired contact supplied to the building security system

Input Required

Point Name	AI	BI	AO	BO	AV	BV
Toilet Exhaust Alarm				R/W		
LMR Hi Temp Alarm				R/W		
Laboratory Alarm				R/W		
TSG Room Alarm				R/W		
Equipment Room Alarm						

27.6.9 Field Sensors and Actuators

Input Required

27.6.9.1 Dampers, actuators (other than VAV actuators), valves, transducers, relays and field instrumentation are to be based on standard industrial signaling techniques (4-20mA or 0-10VDC).

27.6.9.2 Temperature sensors

27.6.9.2.1 Thermocouple (type K or type T) may be specified for critical or wide range temperature measurement and provided with suitable industrial grade transmitter providing 0-10vdc or 4-20mA signalling.

27.6.9.2.2 RTD may be used for general temperature measurement. May be used to measure to ±0.03°C.

27.6.9.2.3 Thermistor (NTC 10K, 30K) may be used for space temperature measurement to approximately ±0.3°C with appropriate linearisation. Where applications call for greater long term stability and low drift thermistors should not be used without suitable calibration at recommended intervals.

27.6.9.3 Temperature - Fluid Measurement

27.6.9.3.1 Indirect Immersion sensors are required that penetrate the pipe to no deeper than half the pipe diameter. Immersion sensors are to be located so that fluid is mixed sufficiently to measure a true indication of the temperature. Lagging is to be patched properly such that the immersion well is not exposed to the ambient. Thermo-conducting paste is to be used to provide an efficient coupling between the well and the sensor element. Stainless stain wells are required for corrosive liquids such as seawater or brine.

27.6.9.3.2 Strap on type sensors are not acceptable for control applications, other than for general monitoring.

27.6.9.3.3 For chilled water systems the following accuracy is mandatory, inclusive of transmitter error, with maximum non-cumulative drift of ±0.1 °C/year (annual field calibration is required for sensors specified at higher accuracy):

- Outside air Temperature ±1.0 °C
- Relative Humidity ±5.0 %
- Chilled and Condensor Water

Temp mains	±0.1 °C
• Chilled and Condensor Water Temp other	±0.3 °C
• Water Temp Delta-T (where used for load measure)	±0.05 °C
• Water Flow	±1 % FSD
• Water Pressure	±2 % FSD
• Electrical Power	±1% of reading, 3kHz for VSD

27.6.9.3.4 Mechanical trade is to be directed to fit a Binder type fitting into the pipework adjacent to every liquid sensor for the purposed of calibration.

27.6.9.3.5 Critical temperature sensors are required to be “field calibrated” to a NATA traceable master instrument and the certificate is to be furnished with the commissioning records. This is mandatory for any liquid sensor participating in BUILDING OR CHILLER LOAD CALCULATIONS, or CHILLER STAGING DECISIONS.

27.6.9.4 Temperature – Air measurement

27.6.9.4.1 Space temperature sensors are to be installed 1500mm above the finished floor level.

27.6.9.4.2 Sensor housings are to be the aspirating type sealed from wall cavities.

27.6.9.4.3 Accuracy of space temperature measurement is to be at least ±0.5 °C, with non-cumulative drift of no more than 0.1 °C/year.

27.6.9.4.4 Space temperature sensors generally should not be co-located with occupancy override buttons where design required these features. Sensors shall be mounted in a location (generally 1500AFFL) consistent with accurate space measurement. Buttons shall be mounted on a standalone standard sized wall plate conveniently close to the entrance door and shall have a momentary press mechanism labelled “Air conditioning” and a GREEN lamp to denote that air conditioning is active, a RED lamp to denote that air conditioning is off.

27.6.9.4.5 Duct temperature sensors shall be designed to provide average indication across a section of the duct, not a point measurement.

27.6.9.4.6 Accuracy of Duct temperature measurements is to be at least ±0.3 °C, with non-cumulative drift of no more than 0.1 °C/year.

27.6.9.4.7 Active sensors are to be 24VAC powered and provide 0-10vdc or 4-20mA output.

27.6.9.4.7 Wall mounted temperature sensors are never to be mounted where other fittings (such as coat hooks) can cause the sensor to be covered.

27.6.9.5 Humidity Measurement

27.6.9.5.1 For non-demanding environments such as occupied spaces, humidity is to be measured at ±5.0 % in spaces or ducts, non-condensing environment from 0% to 95% RH and temperature of 23°C.

27.6.9.5.2 For demanding environments (such as environmental controlled laboratories) humidity is to be measured at better than ±3.0 % in spaces or ducts, non-condensing environment from 0% to 100% RH and temperature of 23°C.

27.6.9.5.3 Active sensors are to be 24VAC powered and provide 0-10vdc or 4-20mA output.

27.6.9.6 Flow Measurement - liquids

27.6.9.6.1 For chilled water and condenser water applications line size magnetic flow meters are required. Accuracy required is ±1% of reading.

27.6.9.6.2 Active sensors are to be 24VAC powered and provide 0-10vdc or 4-20mA output.

27.6.9.7 Absolute Pressure or Differential pressure - liquids

27.6.9.7.1 For chilled water and condenser water applications measuring accuracy shall be at least ±0.5% FSD with a maximum pressure of 25bar. Measuring range shall be selected for equal or better than ±2% of the measuring range.

27.6.9.7.2 Pressure devices shall be fitted with valves for isolation, equalization, and draining. Connections shall be properly plumbed with 6mm copper tube coiled for vibration isolation.

27.6.9.7.3 Active sensors are to be 24VAC powered and provide 0-10vdc or 4-20mA output.

27.6.9.7.4 Mechanical trade is to be directed to fit a binder type fitting into the pipework adjacent to every liquid sensor for the purposed of calibration.

27.6.9.8 Differential pressure – air

27.6.9.8.1 For air sensing applications (such as VAV AHU pressure control) accuracy must be at least ±3% FSD and time constant of no greater than 1 second.

27.6.9.8.2 Active sensors are to be 24VAC powered and provide 0-10vdc or 4-20mA output.

27.6.9.9 Pressure Switch – air

27.6.9.9.1 For air monitoring applications (such as fan proving and filter condition monitoring) switching must be capable of calibration at less than 2.5Pa in 300Pa range and less than 5Pa in 1000Pa range.

27.6.9.9.2 Output shall be voltage free contact (rated at 24VAC/VDC, 250VAC 1A resistive) and capable of at least 1,000,000 operations.

27.6.9.10 Other instrumentation

27.6.9.10.1 Other instrumentation shall be selected and sized to meet the consulting engineers' design.

27.6.9.11 Valves and actuators

27.6.9.11.1 Valves for AHU/FCU shall be selected according to design requirements.
For smaller valves characterized ball valves are acceptable.

27.6.9.11.2 Butterfly valves are not to be used for critical control applications. Control Valves are to be specified.

27.6.9.12 Damper actuators

27.6.9.12.1 Damper actuators shall be selected according to requirement. The designer shall specify the power, torque rating, action, coupling, spring return, limit switches, manual functions and all other as necessary to provide clear and consistent specification.

27.6.10 Specification of the local Headend computer

Input Required

27.6.10.1 The local BMS head end computer/server will provide a small footprint tower format HP, DELL or Lenovo PC, (minimum 3 Ghz Intel i7 CPU, 1333FSB, 8GB 800Mhz RAM, 2TB HD, DVD writer, Windows).

27.6.10.2 Where a fixed PC is provided as a HMI, it shall be 24inch HD widescreen (1920x1080 pixel)

27.6.11 Specification of enclosures, colour, cabling and labeling

27.6.11.1 All BMS equipment is to be enclosed appropriately to provide environmental, electrical, RFI and mechanical protection, security against unauthorised access and indication of function. Where controllers and field equipment are fitted externally (without housings – such as VAV controllers), the equipment must be endorsed by the manufacturer for such use.

27.6.11.2 All equipment enclosures are to be labelled using a robust, long life and permanent labelling system. Each enclosure must be fitted with a document pocket allowing local storage of key information and indication of the drawing numbers where the equipment details will be found.

27.6.11.3 Cables are to be selected and affixed in accordance with Australian standards and manufacturers recommendations.

27.6.11.4 All cables within electrical switchboards are to be clearly labelled. BMS cables must be clearly identifiable on drawings and schedules to ensure easy traceability.

27.6.11.5 Enclosures are to have RAL7035 powercoat with white gear plate.

27.7 Software

27.7.1 General

27.7.1.1 These guidelines relate to the detailed software functionality of each BMS.The following guidelines are to be used by the BMS contractor to interface and integrate with the UTS BMS network.

27.7.1.2 At handover the BMS Contractor shall provide to UTS FMO, without further charge:

(a) All software required to make any program changes anywhere in the system, along with scheduling and trending applications,

(b) All software passwords required to program and make future changes to schedules, trends and related program changes,

(c) All software required for all field engineering tools including graphical programming and applications, and

(d) All software passwords required to program and make future changes to field engineering tools, including graphical programming and applications.

27.7.2 Security

27.7.2.1 The BMS will only be accessible offsite via secure VPN.

27.7.2.2 UTS server user authentication will be encrypted.

27.7.2.3 Any BMS computer will be defaulted to deny Remote Desktop, Telnet and other remote access functions unless advised by UTS. The programming and configuration requirements will be carried out using built in configuration tools direct to the BMS. These will be protected from unauthorised access by passwords.

27.7.2.4 All BMS computers will be equipped with Anti-malware protection as prescribed by UTS.

27.7.2.5 Building to Building Communication will be restricted by firewalls to permit only the necessary BACnet application ports to be opened for data to pass between each building or the UTS Server.

27.7.2.6 Workstations will be provided with Patch and Hotfix management by UTS. Auto-update on Windows systems is to be turned off unless advised by UTS.

27.7.2.7 All email services will be re-directed via the University SMTP mail service from the UTS BMS server. These mail accounts will be protected by antivirus and anti-spamming software.

27.7.2.8 Access to the local BMS will be controlled. Most general access by University Administrators and Mechanical Services Contractors will take place directly via the UTS Server.

27.7.2.9 This will permit University users, and most service providers sufficient access to BMS data. It will also provide for universally controlled access via the web (initially through a Virtual private Network).

27.7.2.10 The local BMS will be accessible only by the system maintainer and the UTS System Integrator. Profiles will be required on the system to permit a Supervisor (full access), Engineer (Read/Write/Initiate) and User (Read Only).

27.7.2.11 Access to the system has been set as a key goal of the new architecture. The university requires that access be ultimately achieved by users with these profiles:

- Administrator and engineering
- Building Service companies
- Academics and students
- Public

To achieve this, the system will need to be a centralized web based system allowing mobility of users and controlled use of the Universities' IT Services networks.

27.7.2.12 The system will be accessible both on-site and offsite.

27.7.2.13 Administrator access to the data centre will be required on an “as needs” basis, by pre-arrangement for entry permission.

27.7.3 Interoperability

27.7.3.1 UTS has a variety of systems, open interoperability is required at the BMS system level by employing the BACnet protocol. This means the system must be designed to accept transmit data from other buildings directly via BACnet/IP.

27.7.3.2 To achieve user HMI interoperability, each BMS may in futurebe integrated with a dedicated BACnet server (the UTS enterprise Server). The UTS Server will be managed separately by FMO. The UTS enterprise Server will remainfree for supervisory tasks and is not intrinsically required for data passing between buildings.

27.7.4 Commonised Network and Addressing scheme

27.7.4.1 A master device addressing scheme is required for each building that has a BACnet BMS.

27.7.4.2 The BACnet network number will be coded to UTS requirement (Bacnet networks have a unique address from 1 to 64,000)

27.7.4.3 BACnet Device IDs (BACnet Devices must have a unique ID in the range 0 to 4,000,000)

27.7.4.4 The BACnet network and device map is available in APPENDIX A.

27.7.4.5 All network numbers and device IDs will be allocated by UTS.

27.7.5 *Point Naming Convention*

Naming for individual points are to match the universities’ Facility Management requirements. The naming of IO points is to be kept uniform, AND IS A MAXIMUM of 40 CHARACTERS.

In general:

- Each Building or Facility has up to a 5 character name (CM05, CB10 etc).
- Within each Facility, the Facilities Management Unit requires clear identification of the ROOM, examples are: floor 23, room 26. The maximum is 5 characters.
- There is no space between the Building Name and the Room or Area Name:
  (For example Building One, Level 23, Room 26 will be CB01.23.26)
- After the Building and area locator fields, there will be a space then an Equipment Field. The equipment field may be up to 9 Characters. No space between the Equipment designator and the number.
  (For example:
  AHU2.2 = Airhandling Unit 2.2
  VAV11.23 = VAV Box level 11 number 23
  MSB1.1 = Main Switch Board 1.1
  CH1 = Chiller 1
  BLR2 = Boiler 2
  BCS1.1 = Building Control Station 1.1
  RDC2.2 = Remote Distributed Controller 2.2
- After the Equipment Field there will a space a then a 21 character Point descriptor.

  (Examples are:
  Heating setpoint
  Supply Air Velocity
  Average Temp
  Damper Position
  Fan Status
  Chiller Start/Stop
  Return Air Enthalpy
  Supply Air Diff Pres
  ChW pump Start/stop

Return Water Temp
Supply Water Temp

27.7.5.1 Each point thereby named:

<Facility> <Area><Plant><Function>

27.7.5.2 The fields will be based on a 40 character schema.

<up to 5char - Building> <No Space> <up to 5char – Level.Room> <space> <9char- Plant> <Space> <21char- Function>

For example: "CB01.23.26 VAV1.24 Room Temperature" (Building 1 Level 23, Room 26, VAV Box number 26.24 Room Temperature)

27.7.6 *Graphics*

Input
Require

27.7.6.1 The specification is indicative only. Designers should ensure that any special needs of the project are covered in the specification.

27.7.6.2 The graphics will be able to start/stop, monitor and adjust BMS control parameters within the system. All BMS systems will be required to provide a simple to use "web based (that is browser based)" user interface.

27.7.6.3 All programming functionality (INCLUSIVE OF CONTROLLER CONFIGURATION AND USER GRAPHICS) is to be provided via the local Web Based Used interface (for ultimate fallback in the case of failure of the Server or networks).

27.7.6.4 In addition to the above requirement, all key graphics for new buildings is to be created in "web" pages. These pages will be hosted on the UTS Server.

27.7.6.5 All control and monitoring will provided via the UTS Server. The only access to the local web pages will be for the use of the system (BMS Contractor) maintainer.

27.7.6.6 The BMS contractor will be provided with graphic style sheet templates by UTS that allow to build graphics within the frame required by University of Technology, consistent with the master web-site style sheets. The graphics template and sample graphics are located in APPENDIX B of this document.

27.7.6.7 Local graphics are to be built using this format such that UTS can transfer selected graphics layouts to a future UTS enterprise BMS Server. Content is to be built within the "useable viewing area". The UTS System integrator will create the titles and navigation panes required for display and navigation on the Server.

27.7.6.8 Navigation is be provided on a fixed pane at the left side. It shall always be possible to navigate forward and back, to the master page and other relevant pages with one click. A maximum of three clicks will be required to any page.

27.7.6.9 All graphics dimensions are to be based on a 15.6 INCH WIDESCREEN LAPTOP, 1600 x 900 pixel screen resolution, or for larger graphics, on a 23 INCH WIDESCREEN USXGA format, 1920x1080 pixels resolution.

27.7.6.10 Graphics are to be prepared and sized in accordance with the style sheets such that the title, navigation pane, body and footer do not overlap the specified areas, measured in mm. System Graphics are to be made available in the specified format such that the graphic templates will be copied in future to a UTS BMS enterprise server.

27.7.6.11 The Common Interchange format for various elements will be as follows:

- backgrounds and photographic images are to be supplied in JPEG format
- Logos and Moving images are to be supplied in GIF or PNG format
- Line diagrams and schematics are to be supplied in TIF format

27.7.7 *Schematic Graphics*

27.7.7.1 Schematic Graphics will be provided for all items of plant (AHU, FCU, FAN, CHILLER, BOILER etc) giving a clear system overview for trouble shooting purposes.

27.7.7.2 Present an accurate drawing representation of the plant, i.e. if the unit is a multi-zone unit the graphics shall clearly show this.

27.7.7.3 Include all significant aspects or items associated with plant, i.e. economy cycles, dampers, return air fans, filters, chilled water and heating water coils, ductwork etc.

27.7.7.4 Indicate control variables and set points, zone temperatures, on/off/fault status etc to provide clear present indication of the status and condition of the plant.

27.7.7.5 Include fan status indication via pressure switch input for AHUs and current sensing devices for FCUs.

27.7.7.6 Include time schedules and trending

27.7.7.7 Include links with appropriate descriptors to floor plans and other elements or connections of the system

27.7.7.8 Include links to tabulated summary information.

27.7.8 Tabular graphics

27.7.8.1 For a system containing multiple FCUs, the tabulated information would contain, FCU number, rooms served, fan enable, fan status, chilled or hot water valve position, supply air temperature, room set point, room temperature, duct heater status etc.

27.7.8.2 The amount of information provided per page shall, per table shall be such as to summarise as much information as possible on one page, yet remain legible. As an example, for a floor containing 10 FCUs it would be expected that this could be contained on one page.

27.7.9 Floor Plans

27.7.9.1 Floors plans must use colour legibly to ensure that adequate contrast is present, however zones are not to be coloured individually. If zone colours are used, these must either form colour floods on a change in temperature or be used as a “mouse over” to depict an area. Background colours shall be in accordance with the Style Sheets.

27.7.9.2 Include the latest version of the UTS floor plans for each new installation or update

27.7.9.3 Include the correct room numbers on each room. Where new work or refurbishments are carried, IT WILL THE RESPONSIBILITY OF THE CONTRACTOR TO CHECK THAT THE ROOM NUMBERS ON FLOORS PLANS CORRESPOND TO CURRENT ARCHITECTURAL AND SPACE PLANNING LAYOUTS AND THAT ROOM NUMBERS MATCH CURRENT RECORDS.

27.7.9.4 Indicate all FCU and AHU locations and also indicate in a single line format, the ductwork layout(excluding flexible ductwork) with any terminal reheats, VAV boxes or other items of significance shall be shown on the single line ductwork run. Hyperlink from each AHU or FCU directly to the relevant schematic.

27.7.9.5 Allow an operator who is skilled in operating a BMS graphical interface and who has a degree of familiarity with air conditioning systems to be able to quickly and effectively navigate the system without reference to external mechanical or architectural drawings for clarification.

27.7.9.6 A link shall be provided on each building home page to the chiller graphics. Each building shall also contain a box containing the building chilled water supply temperature.

27.7.10 Alarms

27.7.10.1 The local BMS provides alarm monitoring of all building services within the building.

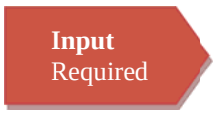
27.7.10.2 Alarms from each BCS will be gathered for local display, and link to the UTS Server for global alarm management. The Server maintains an active alarm queue for each building system, updated in real time by the local BMS system.

27.7.10.3 Critical alarm messaging will be handled by the UTS Server, which links directly to the UTS SMTP (Simple Mail Transfer Protocol) Server. For this reason, the system must be capable of integration with the UTS Server. BACnet will be used to uplink alarms or create each field point in the Server for the application of alarm logic.

27.7.10.4 All alarm handling will be distributed, based on alarm messages time stamped at the source.

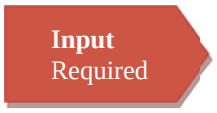
27.7.10.5 In principle, this system will include those alarms that are considered by UTS to be significant plant related alarms. The type of alarms required are listed here (this is a non-exhaustive list and may be expanded in due course):

27.7.10.6 Equipment Class HVAC.



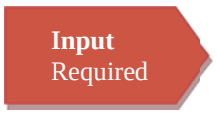
Alarm	Function	Priority colour
Chiller Fail to start	Chiller failed to start after start delay	Red
Chiller Fault	Chiller status OK but fault	Yellow
Pump Fail to Start	Pump failed to start after start delay	Red
VSD Fault	VSD Fault with VSD status running	Yellow
AHU/FCU Fan Fail to Start	Fan status (pressure) fail to follow start/stop	Red
AHU/FCU General Fault	AHU Fault while status indicating running	Yellow
Process Cooler Fault	Process cooler fault active and not running	Red
Critical Temperature outside limits	Lo, lo lo, hi, hi hi on critical temp – nominally chilled or CW only	Yellow
Condensor Water failed	No flow in condenser water circuit	Red

27.7.10.7 Equipment Class Electrical



Alarm	Function	Priority colour
Mains Fail	Incoming mains has failed	Red
Phase Fail	A phase fail relay has tripped	Yellow

27.7.10.8 Equipment Class Hydraulic



Alarm	Function	Priority colour
Domestic water pump fail	Domestic water pump failed to start	Red
Subsoil drainage pump fail	Subsoil drainage pump failed to start	Red

27.7.10.9 Equipment Class Fire

Alarm	Function	Priority colour
Building Fire alarm	General building fire alarm	Red
VESDA fault	Subsoil drainage pump failed to start	Red
VESDA Level 1 alarm	Smoke level trips VESDA level 1	Yellow
VESDA level 2 or 3 alarm	Smoke level trips VESDA level 2 or 3	Red
Gas system discharge	Gas system has operated	Red
Gas system fault	Gas system has indicated a fault	Yellow

27.7.10.10 Each building will have its own separate alarm queuing and handling queue, allowing for display of alarms on each building "web page".

27.7.10.11 Each alarm point is to be based on the Point Naming Convention. Alarm points are assigned a name that includes Location, Equipment and Condition as per the following table.

Field groups	Point Descriptor Fields	Meanings
Location	Building	Building Location e.g. CM05, CB04, CB10
	Room	UTS Room coding e.g. "234"

Equipment	**Equipment**	**Specific equipment or device(s) that make up a service e.g. Chiller1**
	Device	**Component of Equipment e.g Compressor**
Condition	**Condition Descriptor**	**Alarm description – e.g. Fail, Fault, Overtemp**
	Criticality colour	**Major Minor (Red or Yellow)**

Example:

Major alarm **CB01.L0.PR.01 Chiller1 Global Alarm**

Minor Alarm **CB01.L0.PR.01 Chiller1 Comp1 Fail**

Major – Red

Minor – Yellow

Cleared – Green

All alarms will be archived for future reference, sort, search.

For information the meanings of the colours in the present system are as per table:

Alarm Colour	Alarm Description
RED -Fail	This indicates a **failure** of a piece of equipment on a facility which is in need of attention and also means that the equipment may not be available. An example would be a Chiller Failure. This type of alarm requires immediate attention. The alarm screen in the security desk will flash and beep simultaneously until acknowledged.
YELLOW – Fault	There is either a fault on a particular part of an equipment, the primary piece of equipment has failed and the secondary is in use. E.g. “UPS on battery”.
GREY -log only	Event record only
GREEN – Clear	An alarm that has gone from either , Red or Yellow to Green means that the equipment has returned to its full operational status.

27.7.10.12 Alarm Processing at the Security Desk

Major alarms should be able to be routed to the Security Desk. It is assumed that the Security Desk may monitor the alarm system 24x7.

Alarms will only require “acknowledgement” for the “alarm”, not the “return to normal” condition.

Each alarm is programmed with an “instruction page”. The instruction page provides details of UTS staff and contractor required to be called in the event of each alarm.

27.7.11 Time Scheduling

27.7.11.1 The BMS is to provide local time scheduling for all appropriate building services within the building. Time Schedules must be BACnet compliance and be readily accessible from each plant graphic.

27.7.11.2 Global time synchronization is required where energy management functions require plant starts to occur at predictable times. To ensure this occurs, the server will be required to synchronise all systems to a centralised clock (set to provide GMT+10 hours). The mechanism will source from the Universities Network Time

Protocol (NTP) server and will be distributed to the building by synchronisation of the BMS with this clock.

27.7.11.3 The server clock will also provide synchronisation to the change of Australian Eastern Standard Daylight Saving Time. Each system will be expected to accept and support automatic change of AEST at the appointed dates.

27.7.11.4 The UTS server will provide a global scheduling system, distributed from the Server to the building systems and then linked down through BACnet to the individual building system.

27.7.11.5 The calendars time schedules within the BMS are to be exposed via BACnet to enable this information to be sourced from the UTS Server.

27.7.12 History and trend logging

27.7.12.1 Each BCS or RDC device shall be capable of local trending into non-volatile memory

27.7.12.2 The BCS must be sized to ensure that field points are sampled at a rate sufficient to permit effective and efficient control and history logging functions.

27.7.12.3 The BMS will store on its harddisk all operational data history logs for at least one month. All current history data shall be uploadable to the UTS Server.

27.7.12.4 There shall be an automatic archiving function prompting and facilitating the archiving of data at selected intervals.

27.7.12.5 Change of Value (COV) reporting is to be implemented where controllers support it. Changes in measured value or state shall be updated at the Local User Interface generally within 20 seconds.

27.7.12.6 History archiving will be a function of the UTS server such that trendlogs in the BACnet system controllers can learned and up-linked at interval to the UTS server for archiving and display purposes.

27.7.12.7 Trendlogs will be provided in both graphical and in tabular form. Graphs shall be multi-trace and provided with legends and tables shall be provided with descriptive headings identifying the points.

27.7.12.8 Trendlogs will display either individual points or groups of points related to a particular system in multi-trace format.

27.7.12.9 Trendlog requirements will be refined in design however the BMS contractor is to allow delivery trendlogging initially for:

27.7.12.9.1 each point actioned or monitored , i.e. room temperatures, chilled and hot water valves,

27.7.12.9.2 damper positions, supply air temperature, fan status, fan enable, etc

27.7.12.9.3 Chiller and Condensor water temperatures and pressures

27.7.12.10 Trendlogs will be programmed for each point for two periods over a minimum period of 7 previous days in a rolling format in 15 minute intervals and the previous 12 hours in rolling format in 30 second intervals.

27.8 Plant Control Functions

Input Required

Designers to select plant control functions according to project requirement.

27.8.1.1 Global energy management may be implemented by data point passing from a Building Control Station (programmed for global energy functions) direct to the local BMS, or ultimately from the UTS Server. Energy management functions are to be coordinated with UTS.

27.8.1.2 The intent of all control system strategies should be to provide appropriate comfort control strategies while minimising energy consumption. The University is committed to reducing its Greenhouse Gas emissions. This will be achieved by a number of methods, which includes, but is not limited to;

27.8.1.3 The use of energy efficient technology (not directly a control issue)

27.8.1.4 Minimising plant operating hours.

27.8.1.5 Providing local on/off control in lieu of automatic time clock operation where appropriate and engaging staff and students to turn plant on and off as necessary. i.e. staff should be encouraged to turn systems on and off, however an over-riding off function should be provided.

27.8.1.6 Providing for Air quality monitoring where approved by UTS to modulate ventilation within acceptance/safe limits while minimizing excess heating and cooling operations.

27.8.1.7 Where VAV systems or zoned systems are installed, allowing control separation of systems to allow zones to be shut down when not in use and only the occupied zones to have air supply provided. This would be achieved by providing multiple local start/stop stations and appropriate control.

27.8.1.8 Providing the widest practicable dead bands on temperature control loops to avoid unnecessary energisation of zone heating or cooling.

27.8.1.9 All control systems must be furnished with fully programmable setpoints for heating and cooling. That is, an authorised operator must be able to independently adjust heating and cooling setpoints, while ensuring that software does not permit overlapping heating and cooling operations (other than specifically required – such as for dehumidification operations).

27.8.1.10 Not operating special purpose rooms during un-occupied times. For example, a local FCU serving a training room that is not continuously occupied would be locally started and stopped (or on demand by a space booking system), while providing over-riding off functionality via a timer or special purpose schedule.

27.8.1.11 A wall mounted switch should be the primary preferred means of energizing zone FCUs. Where motion sensing is specified, it must be clearly designed to operate effectively, be walk tested properly, and be suitable to the function required. When a user enters the room they should energise the a/c via the wall switch, provided a master schedule permits continuous occupancy. Once energised the FCU should run, say, for one or two hours with a time delay off. Alternatively the button may be “push to start” and “push to stop” during normal occupied hours. The time delay should be programmable via a simple adjustment on the user graphic interface. A green indicating light must be illuminated when the plant is running. When the unit switches off the green light must de-energise and a red indicating light should illuminate.

27.8.1.12 As noted above, run and stop indication of the FCU should be provided via green and red indicating lights on the wall switch.

27.8.1.13 If an event of known duration is to be held in the room, i.e. for 5 continuous days, 9 am – 5 pm , then the control strategy shall allow either the time clock to be programmed by Building Services to provide continuous running during this period, or the run on timer could be changed to operate for say 4 hours, for morning or afternoon sessions - the FCU would need to be energised once in the morning and once in the afternoon. If the time clock has been energised and the room is vacated earlier than expected, then the users should be able to turn off the FCU when the room is vacated, whether the FCU is operating under time clock mode or run on timer mode. Pressing the wall button should turn off the FCU and bring on the red indicating light. The currently activated time schedule should be over ridden but the next scheduled FCU start should take control again to start the unit. If the FCU is turned on before the time schedule has commenced and the delay off has not reached the end of its time period before the time schedule commences then the FCU should then run under the time schedule control until the schedule de-energises the FCU or the occupant turns the FCU off on leaving the room by pressing the toggle button to stop the unit. The air conditioning room switches to be located near the entrance to the room and grouped close to the lighting switches.

27.8.1.14 The above outline describes the intent of the operation of the control system. A similar control strategy is envisaged for office spaces and classrooms. Where VAV systems are used a similar control philosophy should be adopted and modified to suit the circumstances. The number of local stop/start points would need to appropriate to the use of the facility. Ideally the control system for all VAV systems should provide the capability for each VAV box to be energized locally with a local start/stop push button. i.e. the main AHU should ramp up to meet only the demand of those VAV boxes that have been locally activated. VAV boxes should default to the closed position when not energised. A time clock function as described above should also be included. The consultant shall attempt to optimise the balance between the complexities of having too many start/stop zones and the energy efficiencies gained by zoning the system. i.e. if multiple classrooms are on a system they would be zoned individually, but an open plan office area may be provide with say only one stop/start station that might control a number of VAVs.

27.8.2 Miscellaneous Comments

27.8.2.1 Local exhaust fans (other than toilet exhaust) must all be provided with local manual controls

27.8.2.2 Economy cycles should be used where ever possible on air handling units.

27.8.2.3 All lecture theatres capable of seating 100 or more persons must incorporate the use of enthalpy control or heat transfer systems on outside air.

27.8.2.4 All chilled water pumps and large air-handling units incorporating VAV boxes must have variable speed, variable frequency drives must be capable of being controlled by the BMS.

27.9 APPENDIX A. Standardised Methodology for BACnet addressing

27.9.1 Commonised Network and Addressing scheme

27.9.1.1 A master device addressing scheme is required for each building that has a BMS. This is important because the UTS BMS Server will need to have a unique address for each building and for each device.

ALL CONTRACTOR REQUIRING BACNET ADDRESS SPACE ALLOCATIONS ARE TO REFER TO UTS FOR NETWORK AND DEVICE ID ALLOCATIONS.

27.9.1.2 Networks in Building group “1” will be coded 11001 to 11999 (1,000 possible networks)

27.9.2 BACnet Device IDs

27.9.2.1 BACnet device IDs will be numbered again according to Building Group and Building Group Number. There are up to 4,000,000 devices IDs.

27.9.2.2 Within each Building Group/Number there could be several buildings sharing these device IDs. All device ID’s will be allocated by UTS.

27.9.3 MAC Addresses

27.9.3.1 These will be assigned by the contractors, 1 to 128 on each network (they are sometimes set by DIP switches). UTS will not control BACnet MAC addresses on MS/TP networks. However BACnet/IP MAC addresses are the IP address so these are controlled by UTS.

27.9.4 IP Addresses

27.9.4.1 Only assigned to devices at the UTS IT LAN level (e.g. Building Controllers, Servers, or Workstations) – these will assigned by UTS IT department.

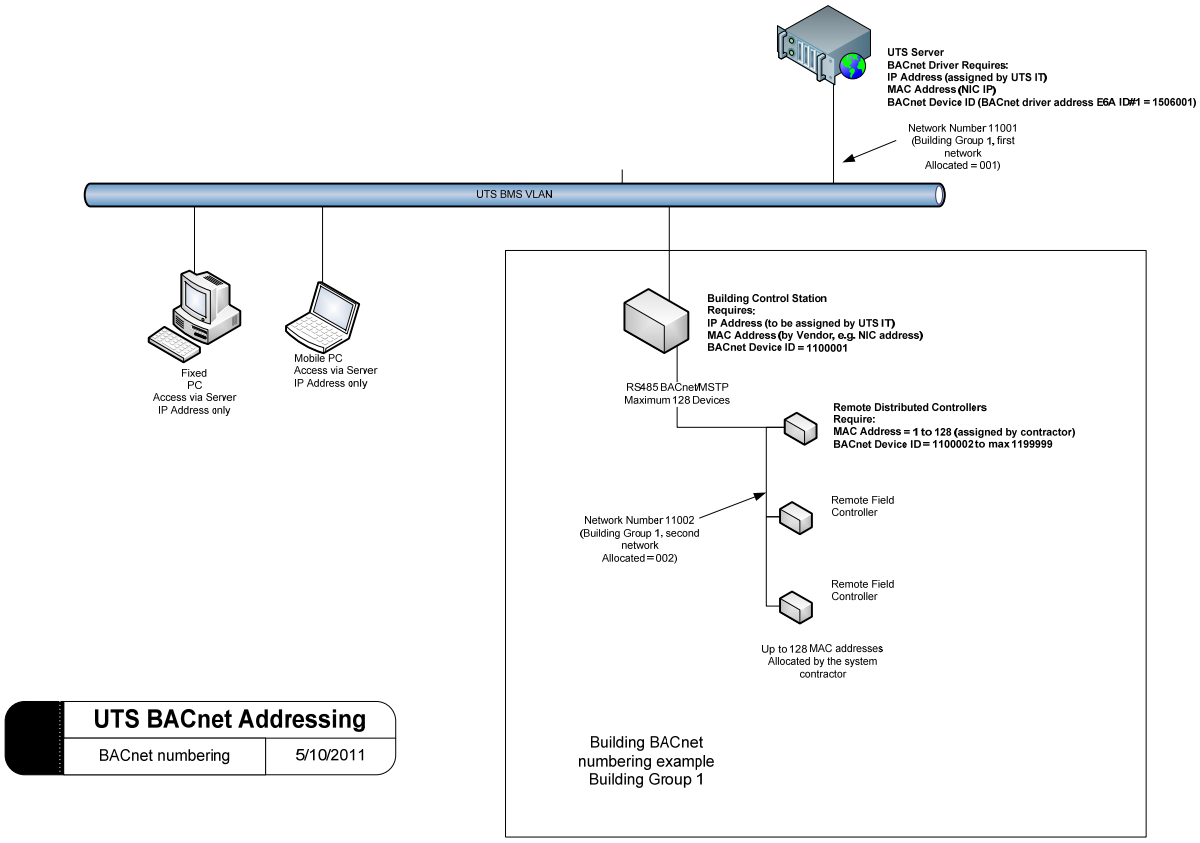


Figure 1. UTS BACnet Addressing – indicative only

27.10 APPENDIX B. GRAPHICS STYLE SHEETS

27.10.1 Format

27.10.1.1 Graphics to be supplied in UTS BMS Server format. Graphics may be loaded in a suitable station such that UTS can upload the graphics files to the UTS BMS Server. Points will be discovered and subscribed from the target system into the Server and graphics re-mapped to the Server Points.

27.10.1.2 Size: 15.6 inch Wide Screen Format for simple graphics, 24 inch Wide Screen Format for Complex Graphics –Vector Graphics preferred for scalability.

27.10.1.3 Resolution: 1600x900, or 1920 x 1080

27.10.1.4 Usable Area: As defined in General Dimensions sheet

27.10.1.5 Backgrounds: White

27.10.1.6 header: colours per attached style sheets

27.10.1.7 Points – Read Only : Display real time values in 11 Point Tahoma (BLACK) within an LT GREY BACKGROUND

27.10.1.8 Points – Read and Write : Display real time values in 11 Point Tahoma (BLACK) within an OUTSET Border.

27.10.1.9 Points – In Alarm: All points in alarm must “Colour and Blink” – Red Alarms RED, Yellow Alarms YELLOW, acknowledge must stop flashing, Return to Normal must return to nominal colour scheme

27.10.1.10 Clock shown in EST/DST 12pt BOLD SANS SERIF (INSET GREY BACKGROUND)to be placed top right of screen above RED colour bar

27.10.1.11 Standard hyperlinks - All graphics to have inbuilt reverse (back arrow) link, link to Building Front Page (prepared by others) and link to Campus Map (prepared by others).

27.10.1.12 Hyperlinking general – hyperlinks are required from Floor Plans to Schematics and tables and from Schematics to tables so that user can navigate top to bottom and horizontally in no more than 3 clicks

27.10.2 Style Sheet A – Floor Plans

27.10.2.1 CAD file input - Floor plans should derive from AUTOCAD architectural Plans

27.10.2.2 Details required - Show perimeters, rooms and internal structures, de-cluttered and remove unnecessary detail and layers. Sufficient to allow maintainers to identify the ROOM Location, Plant Location and identification of Plant Items

27.10.2.3 Room numbers - assigned by University Space planning (prefer direct from original AUTOCAD background) 11 Point Regular Tahoma BLUE

27.10.2.4 Air distribution - Show basic single line duct or pipework layout (sufficient to allow maintainers to rapidly identify which rooms are served and where air is routed) – 4 point lines for main ducts, 2 point lines for "tee-offs", lines to be colour coded to UTS approved scheme AHU. A commonsense approach should be applied to ensure that colour cluttering does not reduce clarity of floor plans or obscure significant details (such as room numbers, and other useful architectural detail).

27.10.2.5 Equipment Positions - Show positions of VAV's, FCU, and AHU (and other major plant) with hyperlink to detailed schematic

27.10.2.6 Colour Coding - Colour code to show zoning (Common colour for AHU and associated Zone Labels)

27.10.2.7 Hyperlinking - Show hyperlinked list of Plant on left hand navigation pane for quick navigation

27.10.2.8 Real time values -Temperature values may be overlaid on diagram (if space permits). Alternatively place temperature values in clearly labelled and colour coded table below floor plan

27.10.2.9 Font - Temp values to be in 11 Point Tahoma, INSET Border

27.10.3 Style Sheets B, C, D and E – Plant Schematics

27.10.3.1 Use Panes to show physical schematic, with Panes behind for detailed controls and Logs

27.10.3.2 User standard graphical objects by preference, unless it is necessary to represent a unique system or object clearly by other means. Any graphic design objects (line or diagrammatic art) must be supplied in PNG format. Photographic material must be provided in JPEG format.

27.10.3.3 If Photographic or schematic depiction of equipment is used – it must be accurate. If accurate graphics are not available, provide only a generally indicative functional object.

27.10.3.4 Three dimensional pipe is not required (pipes may use 4 pt lines). Colours - CHWFlow Blue (RGB0,0,255); CHWRet Lt Blue (RGB128,128,255); HWFlow Dk Red (RGB192,0,0);HWRet Lt Red (RGB255,64,64); CWFlow Dk Green (RGB0,128,0); CWRet Lt Green (RGB0,192,0).

27.10.3.5 Pipe corners must join accurately, if necessary to improve readability headers with blanking ends can be shown.

27.10.3.6 Labelling must clearly indicate where piping joins to other pages and hyperlinks provided.

27.10.3.7 Equipment to be labelled above graphic object (e.g. pump or fan etc) in 11 pt Tahoma BOLD Black

27.10.3.8 Display value tags (or labels) to use 11pt Tahoma BOLD BLACK

27.10.3.9 Real Time Data show below equipment or to the right of labels (11 pt Tahoma REGULAR black INSET for display only, OUTSET for user input or control). It is not necessary to use Labels where it is clear to the user that real time data is associated with plant and the function of the real data is clearly evident.

27.10.3.10 Status may be shown in "Animation". If animation is used, do not include status field point on display (unless essential to prove or confirm function)

27.10.3.11 Real Time data " display states" to be self explanatory (ie Filter "Dirty", not Filter Dirty "Active") where possible

27.10.3.12 De clutter and simplify where possible allowing quick identification of problems (ie show the exceptions clearly)

27.10.3.13 Fail to start alarms should show a RED alarm "colour and blink" on the Start/Stop control display point

27.10.3.14 Faults should show clearly as “Fault” or “Normal”

27.10.3.15 Start/Stop command of equipment should be indicated as “Start” or “Stop” (OUTSET if READ/WRITE)

27.10.3.16 Status of equipment (where animation not used) should be shown as “Running” or “Stopped”

27.10.3.17 System Enable should be shown as “Enabled” or “Disabled”

27.10.3.18 VSD control signals should be shown as “ value %” under the equipment

27.10.3.19 Control loops may be shown as dotted lines (LT Blue) indicating control action between Controlling Variable and Output. Setpoint may be shown with Label “SP” (11 Pt Tahoma Bold Black) under the Controlled Variable

27.10.4 Style Sheets F – Tables

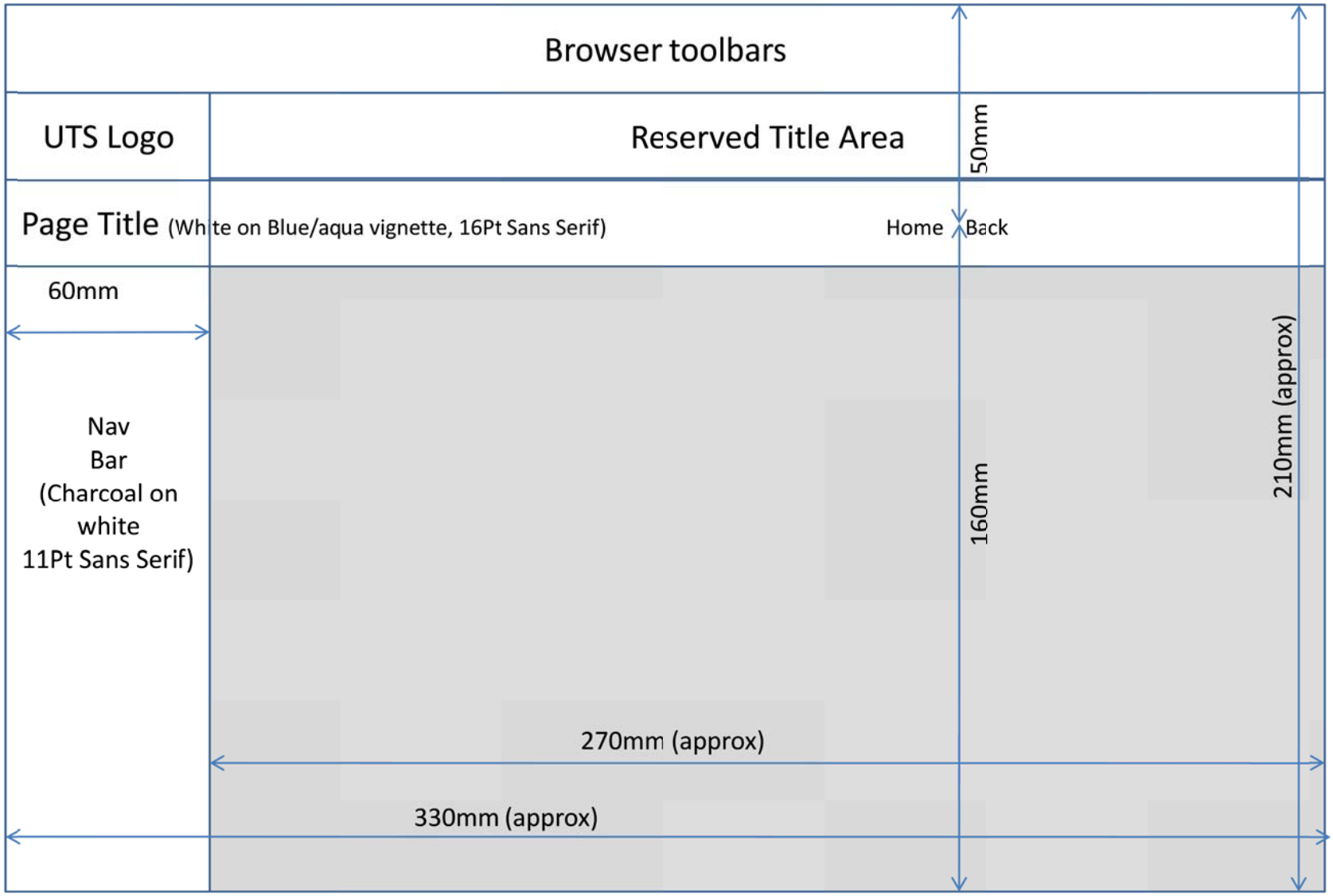
27.10.4.1 Tables are required to display group data such as all VAV’s attached to a specific zone

27.10.4.2 Hyperlinks to be created to allow navigation directly from relevant floors plans or Plant

27.10.4.3 Tables to include all operational variables as required to clearly indicate “at a glance” the relative position of temperatures, modes, setpoints, valves, dampers, and all other real time values as requires vertically aligned to permit maintainers easy review of all equipment

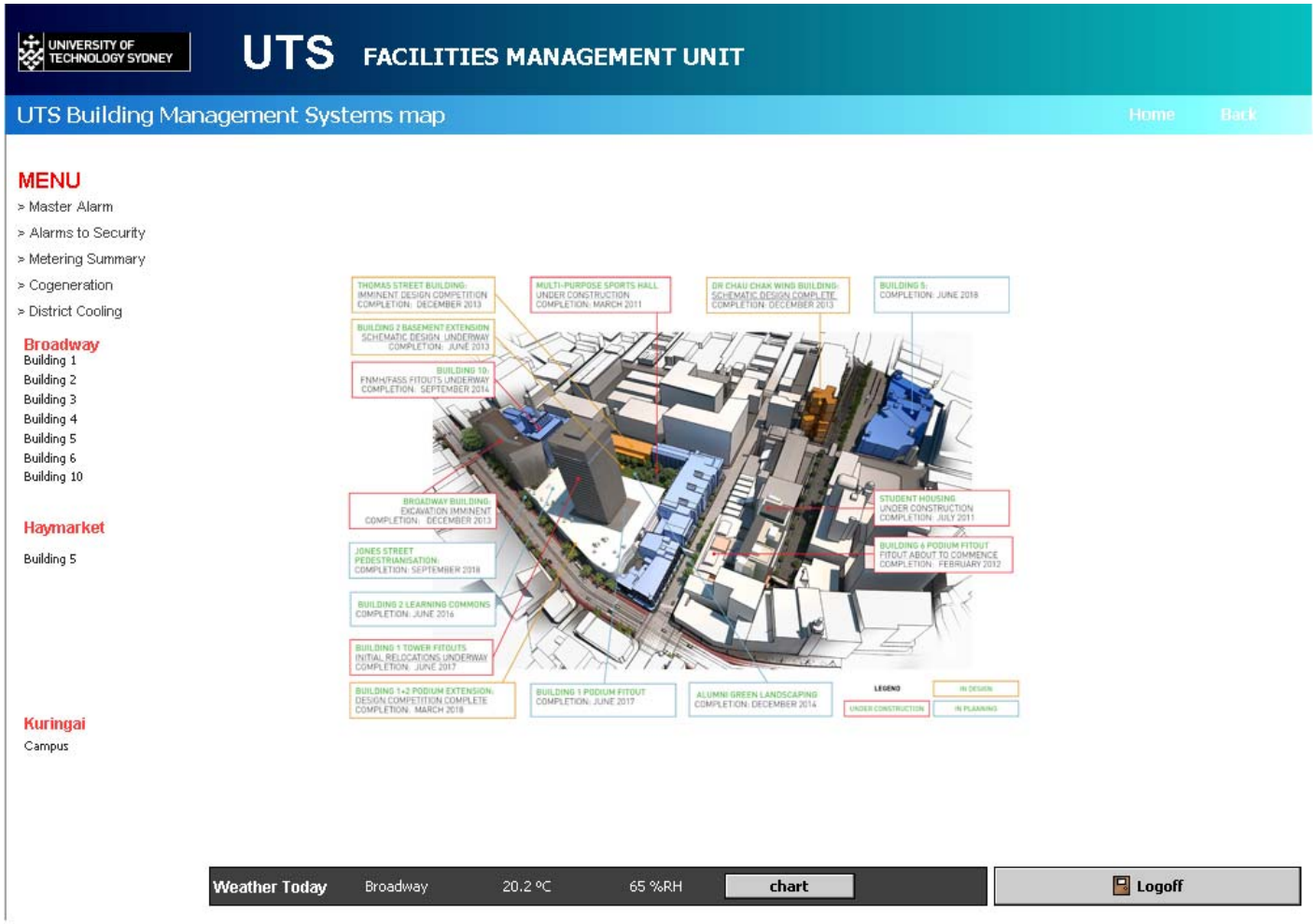
27.10.4.4 All table data is to be reference to Room Numbers and clearly colour coded to zone (where required)

27.10.5 Sizing at 1600x900 laptop

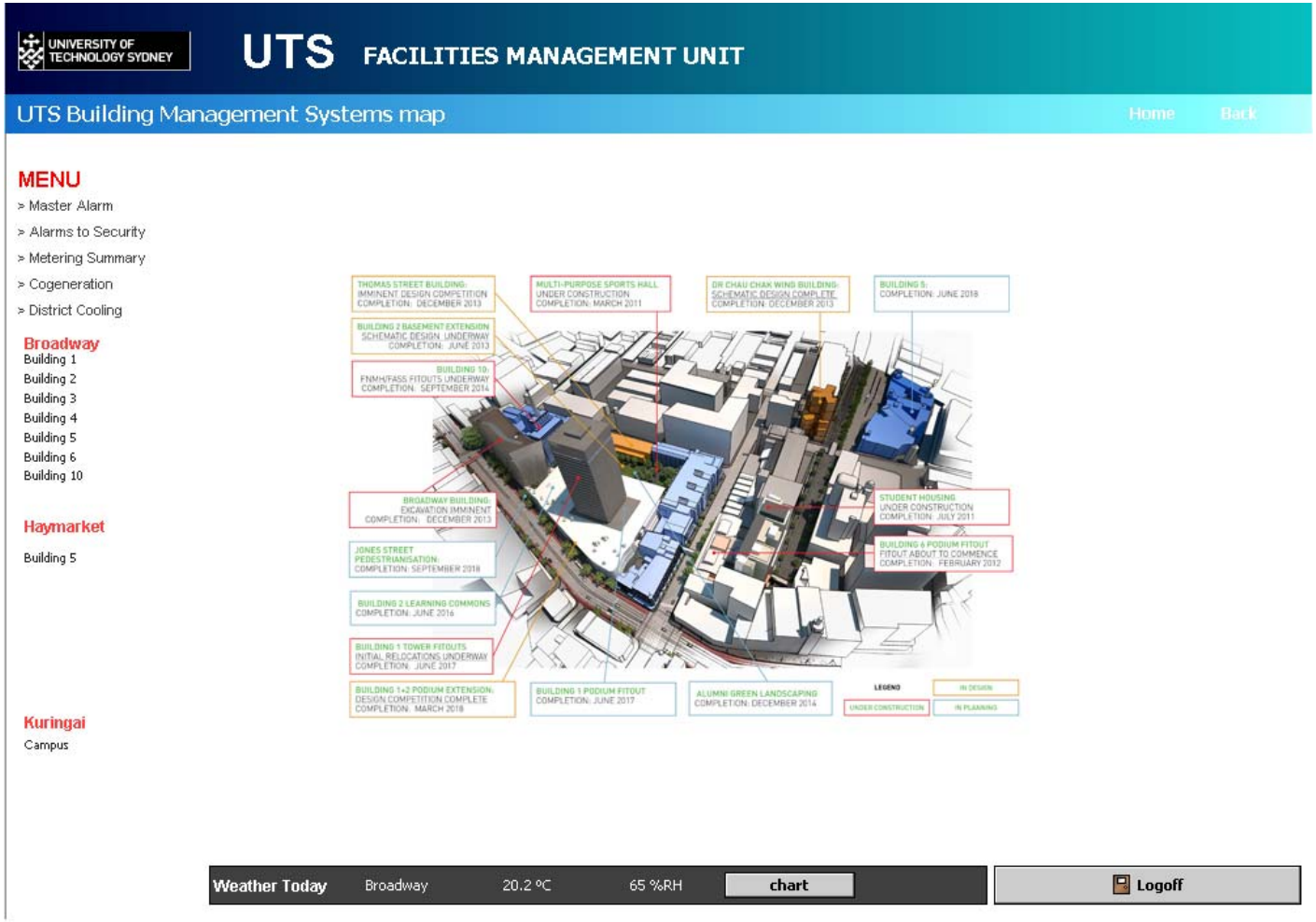


27.10.6

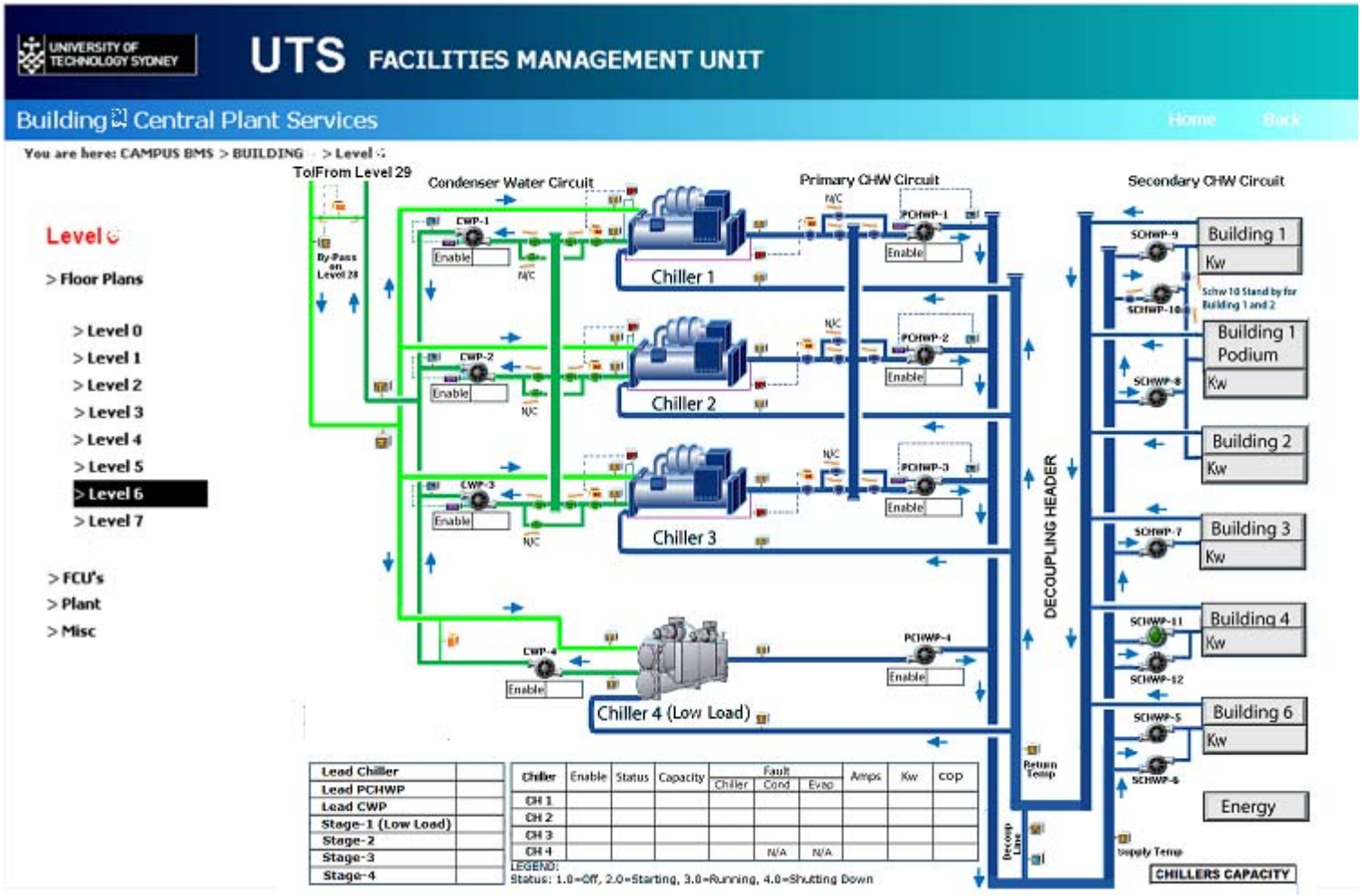
27.10.6.1 Style Sheet – Main Map



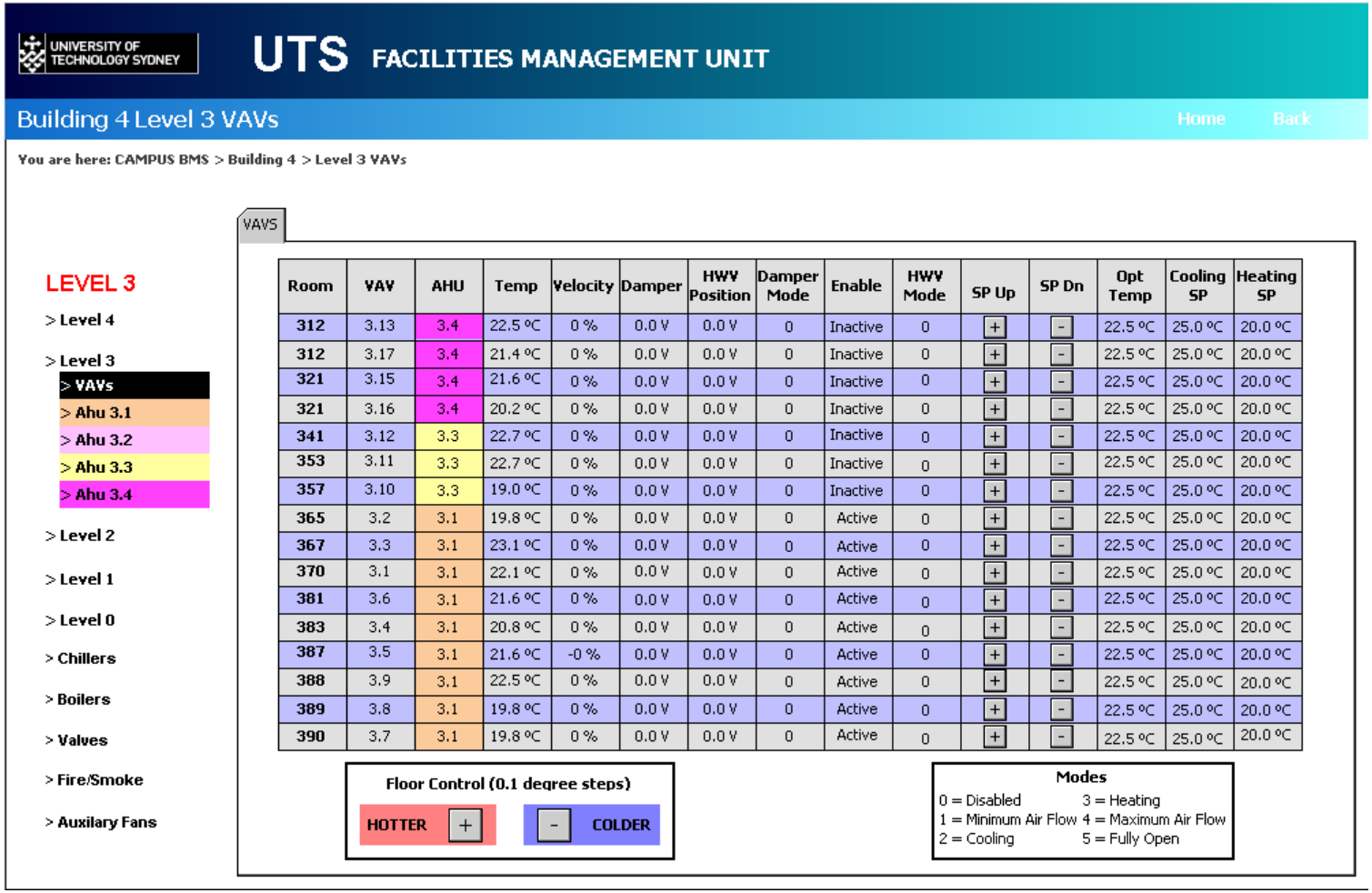
27.10.6.2 Style Sheet A – Floor Plans



27.10.6.3 Style Sheet C – Plant Schematics – Piped (large scale)



27.10.6.4 Style Sheet F – Tables



Room	VAV	AHU	Temp	Velocity	Damper	HWV Position	Damper Mode	Enable	HWV Mode	SP Up	SP Dn	Opt Temp	Cooling SP	Heating SP
312	3.13	3.4	22.5 °C	0 %	0.0 V	0.0 V	0	Inactive	0	+	-	22.5 °C	25.0 °C	20.0 °C
312	3.17	3.4	21.4 °C	0 %	0.0 V	0.0 V	0	Inactive	0	+	-	22.5 °C	25.0 °C	20.0 °C
321	3.15	3.4	21.6 °C	0 %	0.0 V	0.0 V	0	Inactive	0	+	-	22.5 °C	25.0 °C	20.0 °C
321	3.16	3.4	20.2 °C	0 %	0.0 V	0.0 V	0	Inactive	0	+	-	22.5 °C	25.0 °C	20.0 °C
341	3.12	3.3	22.7 °C	0 %	0.0 V	0.0 V	0	Inactive	0	+	-	22.5 °C	25.0 °C	20.0 °C
353	3.11	3.3	22.7 °C	0 %	0.0 V	0.0 V	0	Inactive	0	+	-	22.5 °C	25.0 °C	20.0 °C
357	3.10	3.3	19.0 °C	0 %	0.0 V	0.0 V	0	Inactive	0	+	-	22.5 °C	25.0 °C	20.0 °C
365	3.2	3.1	19.8 °C	0 %	0.0 V	0.0 V	0	Active	0	+	-	22.5 °C	25.0 °C	20.0 °C
367	3.3	3.1	23.1 °C	0 %	0.0 V	0.0 V	0	Active	0	+	-	22.5 °C	25.0 °C	20.0 °C
370	3.1	3.1	22.1 °C	0 %	0.0 V	0.0 V	0	Active	0	+	-	22.5 °C	25.0 °C	20.0 °C
381	3.6	3.1	21.6 °C	0 %	0.0 V	0.0 V	0	Active	0	+	-	22.5 °C	25.0 °C	20.0 °C
383	3.4	3.1	20.8 °C	0 %	0.0 V	0.0 V	0	Active	0	+	-	22.5 °C	25.0 °C	20.0 °C
387	3.5	3.1	21.6 °C	-0 %	0.0 V	0.0 V	0	Active	0	+	-	22.5 °C	25.0 °C	20.0 °C
388	3.9	3.1	22.5 °C	0 %	0.0 V	0.0 V	0	Active	0	+	-	22.5 °C	25.0 °C	20.0 °C
389	3.8	3.1	19.8 °C	0 %	0.0 V	0.0 V	0	Active	0	+	-	22.5 °C	25.0 °C	20.0 °C
390	3.7	3.1	19.8 °C	0 %	0.0 V	0.0 V	0	Active	0	+	-	22.5 °C	25.0 °C	20.0 °C

27.11 APPENDIX C - PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT (NORMATIVE)

(This annex is part of the BACnet Standard and is required for its use.)

BACnet Protocol Implementation Conformance Statement

Date: _____
Vendor Name: _____
Product Name: _____
Product Model Number: _____
Application Software Version: _____ **Firmware Revision:** _____ **BACnet Protocol Revision:** _____

Product Description:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

BACnet Standardized Device Profile (Annex L):

☐ **BACnet Operator Workstation (B-OWS)**
☐ **BACnet Advanced Operator Workstation (B-AWS)**
☐ **BACnet Operator Display (B-OD)**
☐ **BACnet Building Controller (B-BC)**
☐ **BACnet Advanced Application Controller (B-AAC)**
☐ **BACnet Application Specific Controller (B-ASC)**
☐ **BACnet Smart Sensor (B-SS)**
☐ **BACnet Smart Actuator (B-SA)**

List all BACnet Interoperability Building Blocks Supported (Annex K):

_____
_____
_____

Segmentation Capability:

☐ Able to transmit segmented messages Window Size _____
☐ Able to receive segmented messages Window Size _____

Standard Object Types Supported:

An object type is supported if it may be present in the device. For each standard Object Type supported provide the following data:

1) Whether objects of this type are dynamically creatable using the CreateObject service
2) Whether objects of this type are dynamically deletable using the DeleteObject service
3) List of the optional properties supported
4) List of all properties that are writable where not otherwise required by this standard
5) List of all properties that are conditionally writable where not otherwise required by this standard
6) List of proprietary properties and for each its property identifier, datatype, and meaning
7) List of any property range restrictions

Data Link Layer Options:

☐ BACnet IP, (Annex J)
☐ BACnet IP, (Annex J), Foreign Device
☐ ISO 8802-3, Ethernet (Clause 7)
☐ ATA 878.1, 2.5 Mb. ARCNET (Clause 8)
☐ ATA 878.1, EIA-485 ARCNET (Clause 8), baud rate(s) _____
☐ MS/TP master (Clause 9), baud rate(s): _____
☐ MS/TP slave (Clause 9), baud rate(s): _____
☐ Point-To-Point, EIA 232 (Clause 10), baud rate(s):_____
☐ Point-To-Point, modem, (Clause 10), baud rate(s): _____
☐ LonTalk, (Clause 11), medium: _____
☐ BACnet/ZigBee (ANNEX O)
☐ Other: _____

Device Address Binding:

Is static device binding supported? (This is currently necessary for two-way communication with MS/TP slaves and certain other devices.) ☐ Yes ☐ No

Networking Options:

☐ Router, Clause 6 - List all routing configurations, e.g., ARCNET-Ethernet, Ethernet-MS/TP, etc.
☐ Annex H, BACnet Tunneling Router over IP
☐ BACnet/IP Broadcast Management Device (BBMD)
☐Does the BBMD support registrations by Foreign Devices? ☐ Yes ☐ No
☐Does the BBMD support network address translation? ☐ Yes ☐ No

Network Security Options:

☐ Non-secure Device - is capable of operating without BACnet Network Security
☐ Secure Device - is capable of using BACnet Network Security (NS-SD BIBB)
☐ Multiple Application-Specific Keys:
☐ Supports encryption (NS-ED BIBB)
☐ Key Server (NS-KS BIBB)

Character Sets Supported:

Indicating support for multiple character sets does not imply that they can all be supported simultaneously.

☐ ISO 10646 (UTF-8)	☐ IBM™/Microsoft™ DBCS	☐ ISO 8859-1
☐ ISO 10646 (UCS-2)	☐ ISO 10646 (UCS-4)	☐ JIS X 0208

If this product is a communication gateway, describe the types of non-BACnet equipment/networks(s) that the gateway supports:

_____
_____

28 ITD COMMUNICATIONS INFRASTRUCTURE DESIGN GUIDELINES

GUIDELINES ONLY – NOT TO BE USED AS A SPECIFICATION – Final specification shall be approved by the UTS/ITD TFP.

This chapter is an excert from the **"**Information Technology Division Telecommunications Infrastructure Design Guidelines" version 4.1. The latest version of the **"**Information Technology Division Telecommunications Infrastructure Design Guidelines", which will be provided to all telecommunication contractors, shall supersede the information in this chapter.

28.1 Acceptance Criteria

Final acceptance of any new Telecommunications infrastructure installation requires successful integration into and connectivity with existing University of Technology Sydney (UTS) telecommunications infrastructure and compliance with and provision of the following.

28.1.1 Design

The final design of all aspects of any communications infrastructure installation shall be approved by the UTS Information Technology Division (ITD) Technical Services Manager (TSM) or delegate prior to tender release or work commencement.

28.1.2 Technical Services Manager delegates

Personnel delegated to act on behalf of the UTS/ITD TSM are: The UTS/ITD project manager, the UTS/ITD Telecommunications Facilities Planner (TFP) and the UTS/ITD Network Coordinator.

28.1.3 Performance Testing

Copies of all cabling test results shall be retained and provided to UTS/ITD TSM or delegate on completion of the installation. All cabling test results shall conform to the parameters proscribed by the relevant standards and system manufacturers. The University reserves the right to have test results audited by third parties to confirm their veracity. 10% of the final payment shall be retained until the University is satisfied that all test results and documentation meet the requirements detailed in the specification.

28.1.4 Witness Points

The UTS/ITD TFP or representatives of the Siemon company may carry out visual inspection at various stages throughout the installation.

28.1.5 Pre Installation Documentation

A complete single end to end manufacturer's warranty Commitment Statement / Pre-Registration Form shall be provided to the UTS Facilities Management Unit (FMU) project manager or the UTS/ITD TSM before commencement of work. This form shall be forwarded to the Siemon company prior to the start of the installation.

28.1.6 Post Installation Documentation

Documentation is required for all equipment supplied and will be used for the purpose of identifying, operating, maintaining and modifying the telecommunications infrastructure. Three copies of the following information will be required:

- As-Installed drawings of the floor-plan layout illustrating Telecommunication Outlet (TO) locations and cable pathways, installation schematic and detailed patch frame wall termination layout showing ID strip termination information. A single copy in CD/DVD format or by email to the UTS/ITD TFP is required in the current version of software as specified in the "UTS FMU As-built Drawings Standard".
- Patching records.
- Telecommunications cabling and fibre optic cable test results in native format**.** Test results presented in MS Excel or MS Word will not be accepted.
- System end to end single manufacturer site certification documentation.
- Submission of appropriate regulatory documentation is to be ensured by the Installer.
- A compliance declaration form (Telecommunications Cabling Advice TCA 1) is to be provided to the UTS/ITD TFP at the completion of the installation.
- The Installer shall provide a minimum 20 years System Warranty as outlined in the project scope.

The UTS/ITD TSM reserves the right to refuse connection of any installation to the University network if that installation's horizontal cabling test results have not been received by the UTS/ITD project manager.

The contents of the documentation shall be well structured and coherent. It should contain details of all equipment, cable, connecting hardware and pathways infrastructure. Each volume shall contain an index to the sections included. Explanations and descriptions shall be accompanied by photographs and drawings interspersed throughout the text. All documentation shall be in English.

Following the completion of the above, UTS ITD will accept hand-over of the cabling installation for integration into UTS infrastructure.

UTS ITD will update the cabling management database with details of the additional cables.

28.1.7 Certified Cabling System

UTS has adopted the Siemon company and its cabling system for the installation of structured cabling in its building and campus facilities.

The installation must satisfy the requirements of Siemon to obtain a Link or Channel Warranty as appropriate.

28.1.8 Relevant Certification for Suppliers

Any installer designing or installing structured telecommunications cabling for the University shall be current, approved and certified by the Siemon company. The installer shall provide evidence of the approved certification and ACMA registration. A minimum of 1 in 3 staff on site at any time shall be Siemon certified.

The Siemon Certified Installer(s) shall be onsite for the entirety of the installation. Credentials shall be presented on demand for verification.

The system shall also comply with the latest revisions (whether in draft or completed form) of the following standards:

28.1.8.1 Australian Standards

CCM Communications Cabling Manual.

AS/NZS 3000: 2000	SAA Wiring Rules
AS/NZS 3080:2003	Telecommunications Installations-Integrated Telecommunications Cabling Systems for Commercial Premises
AS/NZS 3080:2003	Amendment 1 Class E_A, Class F_A Channels, OM4, OS2, LC-D
AS/NZS 3080:2003	Amendment 2 Class E_A, Class F_A Links, Category 6_A, 7_A components
AS/NZS ISO/IEC 24702:2006	Telecommunications Installations-Generic cabling – Industrial premises
AS/NZS 3084:2003	Telecommunications installations-Telecommunications, Pathways and spaces for commercial buildings
AS/NZS 3085.1 2003	Telecommunications installations- Administration of communications cabling systems Part 1: Basic requirements
AS/NZS ISO/IEC 61935.1:2006	Telecommunications installations – Generic cabling systems – Specification for the testing of balanced communication cabling
AS/NZS ISO/IEC 61935.2:2006	Telecommunications installations – Generic cabling systems – Specification for the testing of patch cords in accordance with values set out in AS/NZS 3080:2003
AS/NZS ISO/IEC 14763-3: 2007	Telecommunications installations – Generic cabling systems- Specification for the testing of optical fibre communication cabling
AS/NZS 2967:2010	Optical Fibre Safety
AS/NZS 4703:2007	Electrical Wiring in Modular Furniture
AS 2834:1995	Computer Installations
AS/ACIF S008 2006	Requirements for authorised cabling products.
AS/ACIF S009 2006	Installation requirements for customer cabling (wiring rules).
ACA TCPR 2000	Communications Cabling Provider Rules 2000
ACA CRCPR 2000	Competency Requirements for Cabling Provider Rules 2000

Building Code of Australia

28.1.8.2 International Standards

ISO/IEC 11801:2002	Telecommunications installations-Integrated Telecommunications Cabling Systems for Commercial Premises
ISO/IEC 11801 Amendment 1.1	Class E_A, Class F_A Channel specifications.

If a conflict exists between applicable documents, then the order in the list above shall dictate the order of precedence in resolving conflicts. This order of precedence shall be maintained unless a lesser order document has been adopted as code by a local, state or federal entity.

28.2 Cable Pathway Infrastructure

The cable pathway infrastructure shall provide the physical means to support and protect the UTS facilities cable and shall conform to the latest revisions of AS/NZS 3084 and AS/NZS HB29. All proposed cable pathways for fibre optic and copper telecommunications cabling shall be inspected and approved by the UTS/ITD TFP before installation.

Pathways for the Fibre Optic Backbone and horizontal telecommunications cabling shall incorporate:

- 300mm cable ladder for internal vertical risers. The ladder shall be manufactured from galvanised steel with a minimum width of 300mm and 75mm side rails.
- Velcro ties shall be used to secure telecommunications cabling to the ladder at intervals not exceeding 150mm.
- 100mm white heavy duty PVC conduit for external cable locations, Inspection pits / draw boxes shall be installed at intervals not exceeding 40 metres.
- Pits at every underground conduit direction change.
- Catenary wire (horizontal only).
- Minimum bend radius required for the size of installed cables.
- Fire rating material where pathways penetrate fire rated structures.
- Electrical earthing as set out in Australian Standards AS3000.
- Nylon **/** PVC drawer wires within ducts.

28.2.1 Inter-building Conduits

An underground conduit system, where applicable, shall be installed to enable the installation of backbone cabling between the building under construction and the Campus Distributors to ensure compliance with the two hierarchical levels of cross-connects in the backbone cabling system. Pits and / or pull-boxes shall be installed at a minimum of every 40 metres along the conduit route and at every change in direction. Draw wires shall be installed within the conduits. A minimum of two (2) 100mm conduits shall be installed.

28.3 Cables

28.3.1 Fibre Optic Cables

28.3.1.1 Physical cable requirements

The mechanical and environmental specifications for optical fibre cable shall meet the mechanical and environmental requirements specified in IEC 60793-2-50 type B1 and ITU-T G.652. Riser backbone cables shall utilise bundles of OM4 and OS2 fibre-optic cores and conform to the following configurations:

- Tight buffered LSZH jacketed riser rated.
- Approved multi and micro-ducts for distribution of air blown fibres.

28.3.1.2 External / Inter-building

External fibre optic backbone reticulation will conform to the following configurations:

- Loose tube construction, polyethylene jacketed with a sacrificial nylon sheath to minimise the ability of rodents and other pests to damage the cable. The cable can be gel filled or of a dry core construction but must be suitable for use in outdoor applications and must have a suitable water blocking capability. Each tube shall be filled with fibre cores that have a 250μm buffer. The cable shall be suitable for direct burial and shall have no metallic elements and a qualified operating temperature range of -10 to +70C.
- Approved multi and micro-ducts for distribution of air blown fibres.

28.3.1.3 Fibre Optic Backbone Cabling Structure

Fibre Optic backbone cabling design shall conform to the hierarchical star topology. There shall be no more than two hierarchical levels of cross-connects in the backbone cabling. See figure 1.

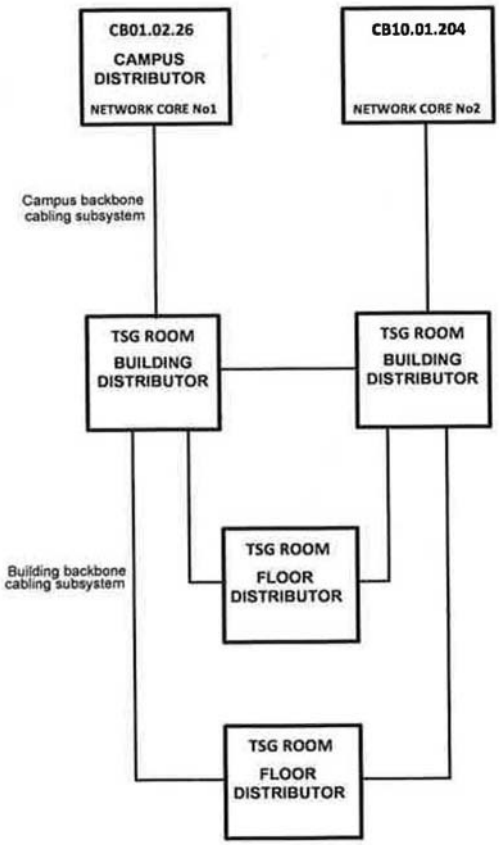


Fig. 1

28.3.1.4 Backbone Cabling

Adequate fibre optic backbone cabling shall be installed from the floor distributor TSG rooms to the building and campus distributors. OM4 and/or OS2 fibres shall be installed. The core counts and termination details shall be determined in the planning stages.

28.3.1.5 Backbone Redundancy

28.3.1.5.1 Campus Backbones

There shall be provided a second separate Campus Backbone fibre optic cable link for each building to each of the Network Cores (CB01.02.26 and CB10.01.204). The second Campus Backbone fibre optic cable shall be routed via a completely separate physical pathway from the first Campus Backbone fibre optic cable to provide maximum physical redundancy. See figure 1.

28.3.1.5.2 Building Distributors

In each building, two TSG rooms shall be designated as Building Distributors. Both building distributor shall be linked directly with fibre optic cables. See figure 2.

28.3.1.5.3 Communications Risers

Each building shall be provided with two separate communications risers. The main riser shall directly connect and be routed through the TSG rooms. The secondary riser shall be located away from the TSG rooms. See figure 2.

28.3.1.5.4 Building Backbones

All TSG rooms shall be connected via fibre optic building backbones to both Building Distributors via the main and secondary communications risers. Where required, multi-pair voice grade copper backbones shall also be provided. See figure 2.

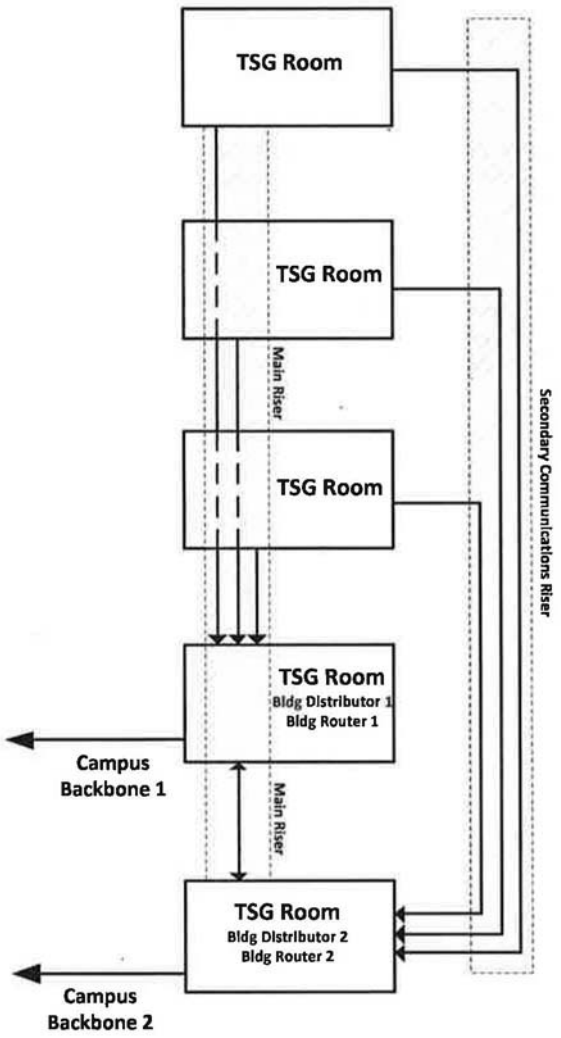


Fig. 2

28.3.1.6 Backbone Distances Limitations

The following distance limitation should apply to fibre optic backbone cables:

Campus backbone subsystem
OS2 – 2000 m.
OM4 – 2000 m.
Building backbone subsystem
OS2 or OM4 – 300 m.

28.3.1.7 Cable Specifications

28.3.1.7.1 Multimode

Multimode fibre, where used, shall be 850nm Laser Optimised 50 micron (850 LO 50) OM4.

28.3.1.7.2 Singlemode

Single mode fibre, where required, shall be OS2.

28.3.1.8 Acceptance

Prior to acceptance for any fibre optic cabling acquired for installation, specifications for the proposed cable shall be forwarded to the UTS/ITD TFP to ensure compliance with the above specifications.

28.3.1.9 Connectors

28.3.1.9.1 Multi-mode

All multi-mode fibre cores shall be terminated with SC connectors.

28.3.1.9.2 Single-mode

All single-mode fibre terminations shall be carried out with a fusion spliced pigtail that has been factory machine polished with SC style Angle Polished Connector (APC) fitted to a minimum of 1.5m of 900 μm tight buffer single-mode fibre. Each factory terminated pigtail must have a qualified return loss performance of -65dB or better.

The connector shall be an 8 degree angle polish ferrule made of zirconia ceramic. The ferrule shall have a rounded finish leading to the angled mating surface. This rounding of the ferrule will allow easier cleaning and prevent the cleaning material from being caught on the sharp chip edge. The connector hole shall have a diameter of not greater than 126μm and concentricity better than 1μm.

Connectors shall have a crimp sleeve for retention of aramid yarn (when used with 3mm jacketed fibre).

28.3.1.9.3 Fibre Optic Patch Leads

- Multi-mode OM4 patch leads shall be aqua.
- OS2 patch leads shall be yellow.
- OS2 SC APC couplers and patch lead connectors shall be green.
- Optical fly lead and patch lead lengths shall be selected to suit site requirements - some attached equipment may require SC/APC to LC fly leads.
- Cable management shall be provided to facilitate a well-organised installation.

28.3.1.10 Testing

The testing of a polished connector shall proceed only after completing a thorough visual inspection with a suitable microscope to ensure that no chips, cracks or scratches are visible.

The testing of installed campus and building backbone subsystem fibre optic cabling shall be in accordance with AS/NZS ISO/IEC 14763.3:2007.

Testing shall be carried out using a light source and power meter (LSPM) and the three patch cord referencing / zeroing method. See figure 3.

All reference cords used in testing shall be shall be produced by a reputable manufacturer. Hand- made cords are not acceptable. Reference cords used in testing shall be inspected and approved by the UTS/ITD TFP.

The light source shall have suitable mode conditioning or a qualified mandrel / test cord combination shall be used. The method of establishing Launched Modal Distribution (LMD) should be recorded as part of the test documentation.

The launch and tail cord shall present reference connectors at the interface to the link under test.

The LSPM field calibration cord shall have reference connectors at both ends.

The optical attenuation allowance for the two interface connectors of an optical link is 0.3dB per connector for OM4 and 0.5dB for OS2.

Each link or channel shall have an optical attenuation budget (light budget) calculated for it. The measured loss of the optical attenuation shall not exceed that calculated.

Four parameters essential for compliance to the above standards and UTS requirements that shall be met and reported are:

- Optical Attenuation
- Propagation delay
- Length
- Continuity

28.3.1.10.1 Optical Attenuation

- All cores shall be individually tested (no loop-back).

- Permanent link testing shall be carried out.
- Optical attenuation shall be determined by LSPM.
- LSPM testing shall be carried out in both directions and a minimum of two wavelengths. For MMF, 850nm and 1300nm. For SMF, 1310nm and 1550nm.
- The two patch cord test method **shall not** be used.

28.3.1.10.2 Propagation Delay

Can be determined by:

1. Formula - Propagation Delay (ns) = Length (m) x 5ns/m.
2. Tester with propagation delay functionality.

28.3.1.10.3 Length

Can be determined by:

1. Sheath markings.
2. LSPM with length reporting capability.

28.3.1.10.4 Continuity

Deemed to be established when LSPM testing.

3 Test Cord Method

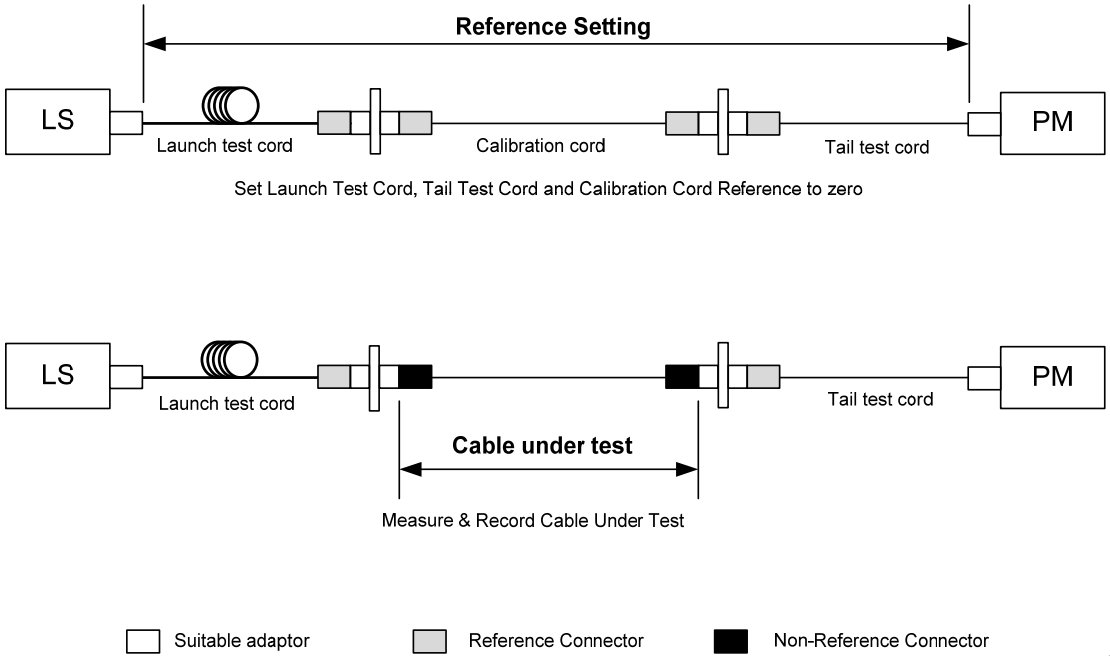


Fig.3

28.3.1.11 FOBOTS

To ensure that fibre optic cable terminations are installed in a manner that provides for adequate administration of cabling patching and documentation, all aspects, including FOBOT type, density and location of any proposed fibre optic terminations shall be approved by the UTS/ITD TFP.

28.3.1.12 FOBOT Labelling

Fibre Optic Breakout Tray (FOBOT) individual fibre optic ports are to be labelled with a suitable machine printed label. The numbering scheme for these FOBOT's will be as follows:

FP01 to **FP99**.

Confirmation of the FOBOT labelling sequence and label location is to be obtained from the UTS/ITD TFP or project manager.

28.3.1.13 Documentation

All proposed fibre optic backbone cabling shall be identified with a UTS ITD cable number supplied by the UTS/ITD TFP before installation. Fibre Optic backbone cable test results shall relate to this identifier.

28.3.2 Horizontal Telecommunication Cabling

The Horizontal Cabling System extends from the TSG room (Equipment Room) system cables and patch panels to the Telcommunications Outlet (TO).

ALL terminations for horizontal cabling shall conform to the T568A wiring scheme. Where an area has existing structured cabling, the contractor shall determine the suitability of the existing cabling for certification as described below. If the existing cabling is determined to be acceptable, the contractor is required to test and certify this cabling as part of the overall certification for the structured cabling for that area. Some areas with existing cabling may only require test and certification.

28.3.2.1 Convergence

The telecommunications cabling system should be viewed as a "universal cabling system" that should act as a transport system for multiple information services, systems and IP applications such as:

- Wireless Transmission
- Voice and Data
- CCTV and IP-CCCTV
- MATV and IPTV
- Safety Systems
- Audio
- Lighting Control Systems
- Building Management Systems
- Building Automation Systems
- Access Control & Intrusion Detection
- Control and Monitoring Systems

28.3.2.2 Consolidation Points and MUTOs

The possible inclusion of Consolidation Points (CP) and Multi-user Telecommunication Outlets (MUTOs) shall be considered by the UTS/ITD TFP in the design of horizontal copper telecommunications cabling distribution to simplify work-area reconfigurations or where ease of user connectivity is desired. The CPs and MUTOs shall be located in accessible areas that are not obstructed by work areas or other impediments. The CP locations shall be clearly identified.

28.3.2.3 Warranty

All horizontal telecommunications cabling installations are to be certified and warranted by the Siemon Company for a period of 20 years or greater.

Testing and Certification SHALL be carried out by a certified installer and proof of current status of certification with the Siemon Company is required. Testing and Certification carried out by third party companies is <u>not</u> acceptable.

28.3.2.4 Class E_A

Siemon Class E_A / Category 6A F/UTP is the UTS standard for horizontal telecommunications cabling in all Greenfield sites and projects.

Siemon LS0H Category 6A F/UTP cable shall be installed (Part No 9A6L4-A5).

Class E_A installations in the TSG room shall terminate onto **angled** 19" 24 port Category 6A / Class E_A patch panels. The patch panels shall be mounted in 2 post style racks. The racks shall be purpose designed for data cabling termination and routing and shall be fitted with adequate vertical and horizontal wire management channels. The style and configuration of the racks shall be approved by the ITD TFP.

The racks shall also house the data switch equipment. The switch ports shall be interconnected to the patch panel ports with Category 6A patch leads. See figure 4.

RU Number	Component			Description
45	VERTICAL WIRE MANAGER	2RU horiz wire manager	VERTICAL WIRE MANAGER	Patch lead management
44				
43		FOBOTS		OS2 and/or OM4 fibre optic terminations
42				
41				
40		24 port angled patch panel A		Cat6A F/UTP terminations
39		24 port angled patch panel B		
38		24 port angled patch panel C		
37		24 port angled patch panel D		
36		24 port angled patch panel E		
35		24 port angled patch panel F		
34		24 port angled patch panel G		
33		24 port angled patch panel H		
32		50 pr voice tie cable and wire manager		Voice tie cable & management
31				
30		2RU horiz wire manager		Patch lead management
29				
28		switch		By UTS
27		switch		
26		switch		
25		switch		
24		switch		
23		switch		
22		switch		
21		switch		
20		spare		
19		spare		
18		spare		
17		spare		
16		spare		
15		spare		
14		spare		
13		2RU horiz wire manager		Patch lead management
12				
11		24 port angled patch panel J		Cat6A F/UTP terminations
10		24 port angled patch panel K		
9		24 port angled patch panel L		
8		24 port angled patch panel M		
7		24 port angled patch panel N		
6		24 port angled patch panel P		
5		24 port angled patch panel Q		
4		24 port angled patch panel R		
3		**19" UPS** (if required)		UPS
2				
1				

Fig.4 Category 6A installation 2 post rack layout

Unless otherwise requested, two (2) horizontal Class E_A cables shall be installed at each work area and terminated onto 2 x 8P8C jacks. The UTS reserves the right to vary the cable count to each work area where and when required.Variations on this number shall be approved by the UTS/ITD TSM or delegate.

The length of each individual run of horizontal telecommunications cabling from the cross-connect to the work area outlet **shall not exceed 90 metres**. Properly installed and approved fire-stop systems shall be used in all penetrations to prevent or retard the spread of fire, smoke and gases through the building.

28.3.2.5 Class D and Class E Installations

UTS sites that have previously been cabled with Class D or E installations shall retain that class for all cabling moves, changes and additions.

The horizontal telecommunications cabling installed for class D and class E installations, unless otherwise directed, shall be Belden Mediatwist 1872A or Siemon Category 6 UTP (Part number 9C6X4-E3).

28.3.2.6 Cable termination

Horizontal and system cables shall be terminated on wall-mounted IDC Patch Fields for each project in an area designated by UTS staff.

Cross connections will be via IDC frames that can accommodate between 576prs and 900prs per vertical frame. These will be made up of 9 x 64pr or 9 x 100pr wiring blocks. The design and performance of the wiring block must ensure that Category 6 component level performance is still achieved when unjacketed, category 5e/6 **4 pair** cross connect wire is used to connect equipment and outlet ports across the IDC frames.

Installation of IDC frames for telecommunications cabling cross connects shall ensure:

- The distribution frames shall be installed in an orderly and tidy manner such that any progressive patching changes may be made with ease and without degrading the orderly arrangement of the frame layout.
- Horizontal cable managers shall be mounted between each 64pr or 100pr block and vertical wire managers between each 576pr or 900pr IDC frame.
- An extra horizontal cable 'trough' shall be located at the base of each vertical IDC frame to prevent patch cables contacting the floor and for extra cable management for patch cords running between vertical frames.
- IDC type frames shall be supported by a suitable backboard. The backboard shall be stood-off from the wall by at least 60mm to allow manageable routing of cables into the IDC verticals.
- Frames shall be terminated in such a manner as to allow for 25% spare capacity for future expansion.
- Provision shall be made on both sides of the distribution frame to allow the installation of one additional frame.
- Labels applied to the IDC frame shall be colour-coded in compliance to the guidelines defined for the cabling system installed.
- Patch leads, where used for patching data connections, shall be factory terminated and tested by the manufacturer of the proposed system and be configured as 4 pair IDC to IDC and 4pr IDC to RJ45 as required. All patch cables shall be hung uncoiled for a period of 24 hours prior to use to reduce coiling and twist.
- Patch leads, where used, shall be supplied in different lengths to reduce slack on the frame. The longest lead shall be sufficient to interconnect the most distant cross connect points on a distribution frame. Leads shall be installed such that the distribution frame does not become congested with excess lengths.
- Provision of 20% extra capacity shall be provided on IDC termination fields for future expansion.

28.3.2.7 IDC Frame Patching

Category 6 or Category 5e, 4 pair unjacketed, cross-connect wire shall be used for patching data connections on IDC frames from active equipment verticals to horizontal verticals. The cabling systems manufacturer's written support of this capability shall be supplied. Confirm grade of cross-connect wire to be used with the CFP.

28.3.2.8 IDC Frame System Tie Cables

System tie cables installed on IDC cross connect verticals shall terminate on the "Active equipment" vertical(s). The cable used shall be Siemon solid conductor IC5 or IC6.

28.3.2.9 Student / Public Access Computer Laboratories

Due to increased security requirements within these laboratories, specialised cabling systems have been defined to reduce cabling tampering. There are two (2) acceptable methodologies, either of which shall be employed after consultation with the UTS/ITD TFP or project manager. These are:

1. To ensure the data fly-leads at the desktop level cannot be removed, a consolidation point (CP) enclosure shall be mounted on a wall within the Computer Laboratory at a height of 1.8 meters. The horizontal cabling for the Computer Laboratory shall terminate within this cabinet on 64pr or 100pr IDC termination blocks equal to those used as the cross connect IDC frame. Stranded fly-leads are required to be installed from the CP to the workstations and appear as a flying lead, 1 meter in length, from an opening at the rear of the desk of the workstation to allow connection to a computer system placed on that

workstation. This fly lead will be terminated onto the IDC frame at the CP and have an 8 way modular (RJ45) plug at the desk end. The fly-lead is to be factory terminated and tested by the manufacturer of the proposed system and be less than 20 meters in total length.
The CP enclosure is to have a lockable door and dimensions are to be approx. 300mm (h) x 200 mm (w) x 160 mm (d). Multiple enclosures may be required to ensure fly-lead lengths are maintained within 20 meters.
All fly-leads should be contained within UTS approved trunking to each workstation to avoid the possibility of tampering.

2. Secure tamper proof fly leads. Using this method, solid horizontal cabling shall be terminated directly at the lab bench top using a standard jack (no CP required). Siemon LockIT fly leads shall be used to connect PC lab desktop equipment to the TO.

All computer laboratory telecommunications cabling shall originate from the nearest TSG room. Local distribution enclosures for telecommunications cabling terminations and hub / switch accommodation shall not be installed or included in PC laboratory design.
All computer laboratory GPOs supporting desktop equipment shall be located beneath the bench level at a location so as to not only minimise tampering and access by students but also enable power connection to desktop equipment via standard industry length power cords.

28.3.2.10 Wireless Access Points (WAPS)

Complete wireless coverage of ALL areas shall be included in all Greenfield sites and projects' designs. Consideration shall be made for the inclusion of sufficient TOs to enable adequate wireless coverage. Consult the UTS/ITD TSM or delegate to discuss the scope and scale of any required wireless infrastructure fit out.

28.3.2.11 IP67 Rated Outlets and Leads

In some areas there will be a need to supply and install IP67 rated outlets and leads. In this case, the outlets used must be by the same manufacturer as the installed system and must be certified under the same system warranty.

28.3.2.12 Testing Procedures

28.3.2.12.1 Four Pair Copper Telecommunications Cabling

- All Class D, E and E_A field testing shall be in compliance with the relevant AS/NZS standards relevant to this subject.
- Auto test settings provided in the field tester for testing the installed cabling shall be set to the ISO11801 or AS/NZS 3080 limits.
- Test settings selected from options provided in the field testers shall be compatible with the installed cable under test.
- Test result 'circuit ID' field is to reflect the installed cable's cable ID that occurs at the work area TO e.g. 15.09.B-1A

28.3.2.13 Labelling

Machine printed wraparound identification labels shall be placed upon both ends of cables during installation to ensure that cables can be easily identified in the field.

28.3.2.13.1 IDC Labelling

Labelling for horizontal telecommunications cabling wall outlet and IDC frames shall conform to the following example:
The designation strips for wall mounted and 19" rack mounted IDC termination strips are to be colour coded as follows:
Horizontal telecommunications cabling - LIGHT BLUE
Active data - PURPLE
Active voice - RED
Termination information is to be printed in black onto coloured paper.
See figure 5.

28.3.2.13.2 Modular Patch Panel Labelling

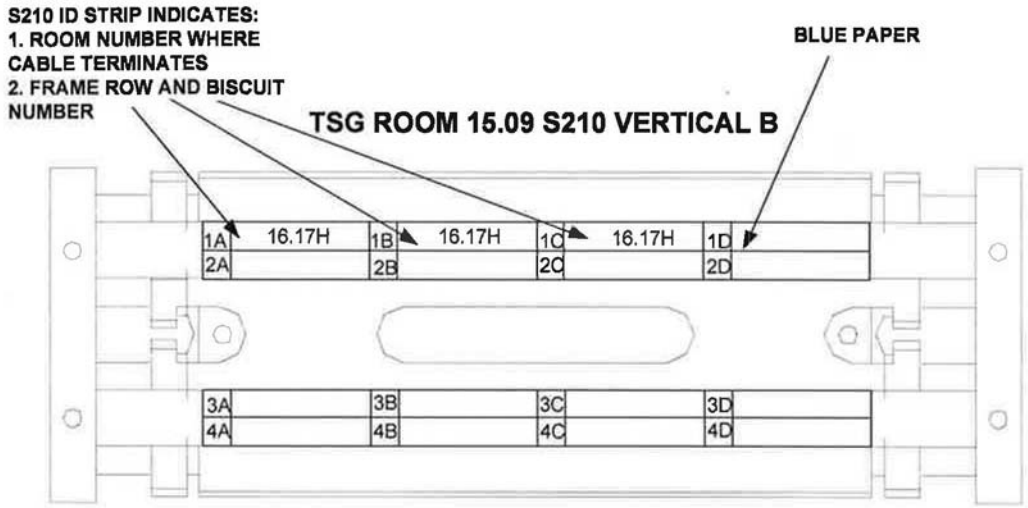
Class EA / Category 6A and Class E installations terminating onto 19" modular patch panels shall be labelled as per the following:
Work Area TO label
TSC room ID – patch panel ID – patch panel jack ID e.g. 4.27B-A-14

TSG Room Labelling
Label clearly each 19" modular patch panel "A" to "Z". Identifiers "I" and "O" shall not be used. See figure 6.

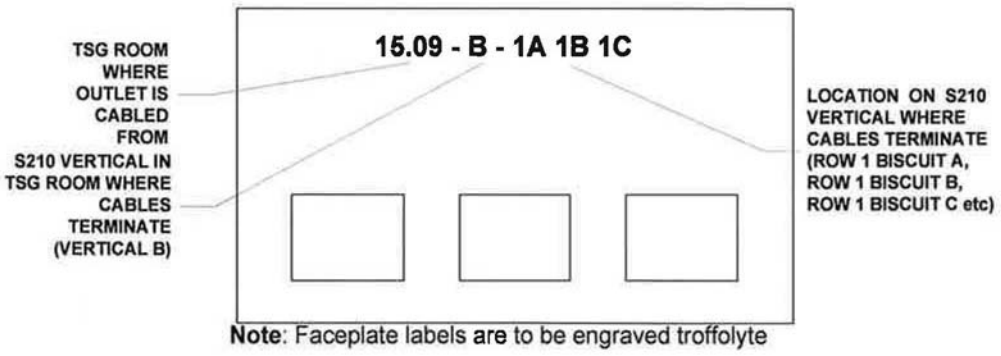
28.3.2.13.3 System tie cabling labelling

Label system tie cables for IDC cross connect verticals as per the following:
IDC vertical ID strip ports shall be numbered "001" to "nnn"
At the 8P8C plug end of the system tie cable, apply a machine printed adhesive wrap around label with the same number / identifier as its IDC port. See figure 7.

IDC LABELLING SCHEME



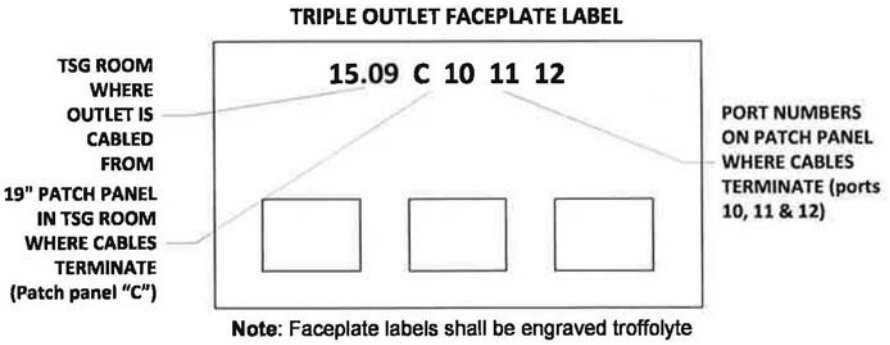
WORK AREA FACEPLATE LABEL FOR ROOM 16.17H TRIPLE OUTLET (CABLES 1A, 1B, 1C)



Note: Faceplate labels are to be engraved troffolyte

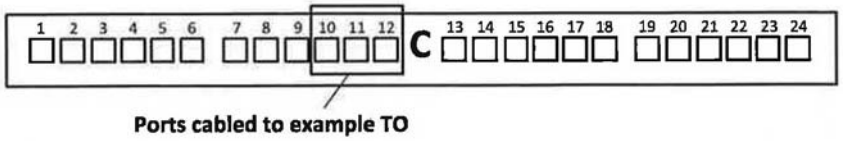
Fig. 5

19" MODULAR PATCH PANEL LABELLING SCHEME



Note: Faceplate labels shall be engraved troffolyte

Patch panels in TSG room CB01.15.09

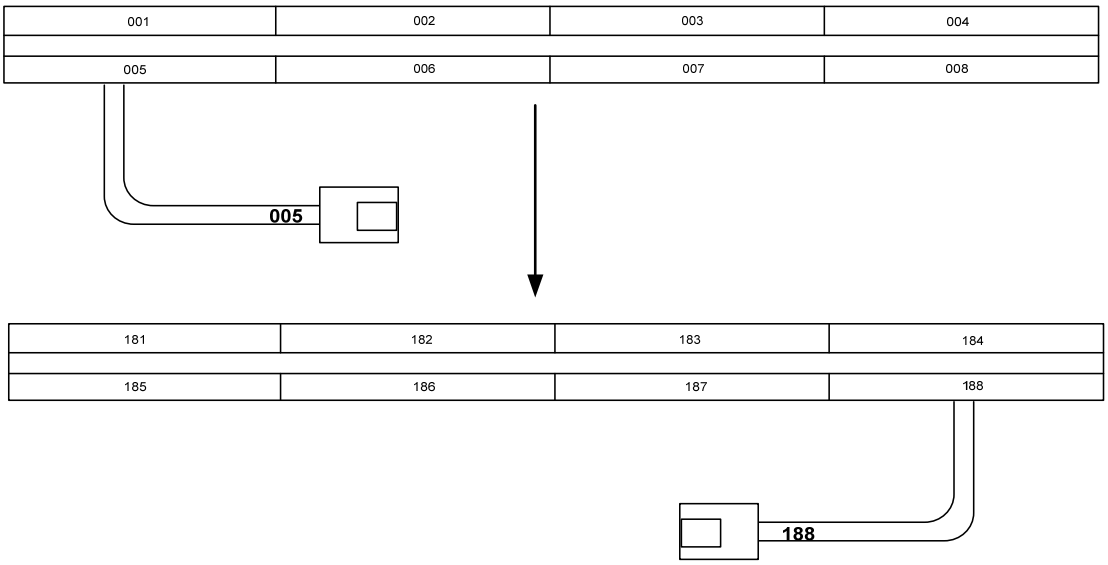


Ports cabled to example TO

Fig. 6

SYSTEM TIE CABLING LABELLING

Label the ID strip biscuit locations 1 to “n”. Apply a machine printed adhesive wrap around label to the equipment port RJ45 end with same number that appears on the ID strip biscuit location.



28.3.2.14 Documentation

A hard copy and an electronic copy of As-built files shall be provided for all telecommunications cabling installations. These files shall conform to the current UTS CAD guidelines. See link below for UTS CAD guidelines.

http://www.fmu.uts.edu.au/for/consultants/docs/CADDrawingStandardP-ST0108.pdf

28.4 TSG Rooms

Technical Services Group (TSG) rooms accommodate building or campus serving telecommunications facilities and shall be equipped to provide for all IT infrastructure and telecommunications equipment including cabling cross connects, data, voice, audio visual, security and building management equipment. The TSG room shall be dedicated to the TSG services functions only. Access to the TSG rooms shall be restricted to authorised service personnel. TSG rooms shall not be used for any purposes other than the accommodation of TSG equipment and infrastructure.

28.4.1 TSG Rooms – Capacity, Access and Locations

TSG room location and size should be based upon the adequate accommodation of equipment and cabling requirements for all services that are housed within.

Access to TSG rooms shall not be via other rooms or spaces. TSG rooms shall be accessed directly from main thoroughfares or corridors.

28.4.2 Unacceptable TSG Room Locations

Locations subject to:

Water infiltration, steam infiltration, humidity, heat (direct sunlight), corrosive atmostpheric or adverse environmental conditions.

Or locations adjacent to:

Electrical sub-stations, mechanical rooms, washrooms, custodial closets, storage rooms.

28.4.3 TSG Room Fit-out Standard

28.4.3.1 Enclosures

Enclosures shall be of a minimum of 42RU in height (46RU (2200mm) is preferred) and 800mm in width and depth. Enclosure colour: RAL 7035 Light Grey. Enclosures shall also comply with:

- Frame construction to be of Aluminium extrusions and non-welded frame (Lightweight construction with high strength and stability).
- Enclosure suites shall be bayed together using the manufacturer's baying clamps.
- All enclosures shall be fitted with front and rear lockable perforated steel doors.
- All enclosures shall be fitted with front and rear adjustable 19" mounting rails.
- Two (2) Vertical Mount Power Rails – 16way IEC C 13 sockets, with 10A C 14 input plug, Black, OU per enclosure.
- The top of each enclosure shall be fitted with a fan tray unit. A minimum of 2 fans shall be provided.
- A single enclosure shelf shall be provided for each enclosure.
- A minimum free working space of 1200mm at the front and 1000mm at the rear of the cabinets is to be provided.
- The front 19 inch mounting rails shall be recessed approx. 150mm to accommodate large 19 inch wire managers.
- Suitable wire managers shall be used to route equipment cables to switch(s) ports. Cable routing shall be done in a manner that is conducive for future additions and adequate switch(s) ventilation. Cable manager size and type shall be determined by the number of cables to be managed per installation. Cable managers must be approved by the ITD TFP prior to installation.

28.4.3.2 Two Post Open Frames (Racks)

Proposed solution shall meet the following requirements:

- Rack shall be 45 RU high and 19" wide.
- Frames shall be of powder coated welded steel construction.
- Racks shall contain cable entries, sized to suti the cables specified and positioned to suit site conditions.
- Provide at least 300mm vertical cable management space on any side to suit the size of cables entering and leaving the racks.
- Must comply with racking specifications IEC 297, DIN 41494 and EIA-310-D.
- 19" mounting is achieved through steel M6 Caged Nuts and steel M6 x 12 Screws, which have a high torque capacity guaranteeing durability.

Siemon and Chatsworth Part Numbers:

Two-post 45RU Siemon RS-07 Rack System Part No RS-07 with following accessories:

- 2RU jumper trays Part No RS-RWM-2
- Vertical cable management channels Part No RS-CNL
- Vertical patching channels Part No VPC-12

Two-post 45RU Chatsworth Open frames Part No. 55053-703 (or similar) with front and rear vertical cable management ducts.

- 2RU Upper jumper tray Part No. NCAUJT-2RU-170
- 2RU Lower jumper tray Part No. NCALJT-2RU-130
- MCS-EFX 12 inch double sided cable manager Part No. 40097-703
- MCS-EFX 6, 10 or 12 inch double sided cable manager Part No. 40095-703, 40096-703 or 40097-703
- 2RU extended finger cable manager Part No. SK-6681-719

28.4.4 Active Equipment

The total number of network switch ports required shall be captured at the project planning stage to ensure that all IP based services are adequately provided for. Sufficient rack / enclosure space for the required active network equipment shall be allocated. A minimum of twenty percent (20%) allowance for expansion of network ports shall be provided.

28.4.4.1 Active Equipment Tie Cables

Active equipment tie cables shall be of solid conductor construction and factory terminated by the manufacturer. Equipment cables shall be routed via cable trays up

both sides of the enclosure where possible. Cables shall be secured with velcro style cable ties.

28.4.4.2 IDC Patching

IDC patch cables and cross-connect wires shall be neatly routed from the active field to the horizontal field in a neat, tidy manner. At all times the supplied wire managers shall be used. Excess cable length shall be neatly contained in the vertical wire manager. Horizontal wire managers shall be installed.

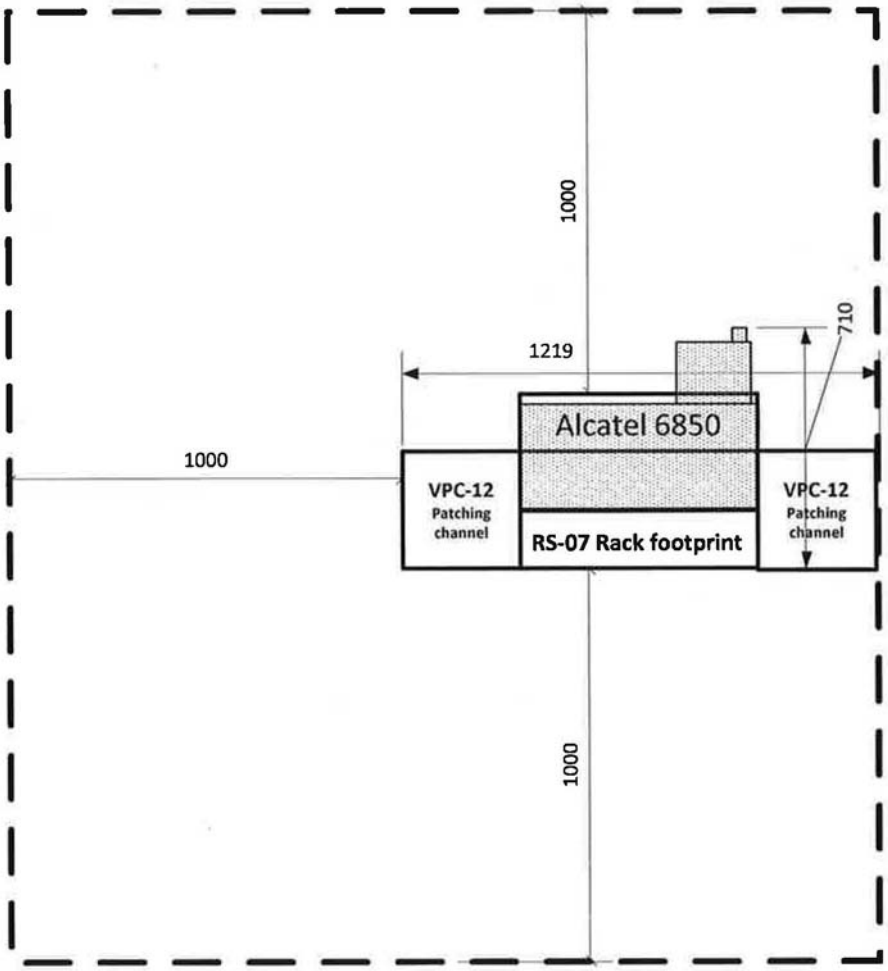
28.4.4.3 Position and Access

The TSG Room should be positioned centrally on the building floor to minimise cable runs and should be located away from any mains switchboards / meters or any other equipment likely to emit EMI.
Access to the room shall be by an electronic keypad connected to the UTS security system with 24 hour monitoring.

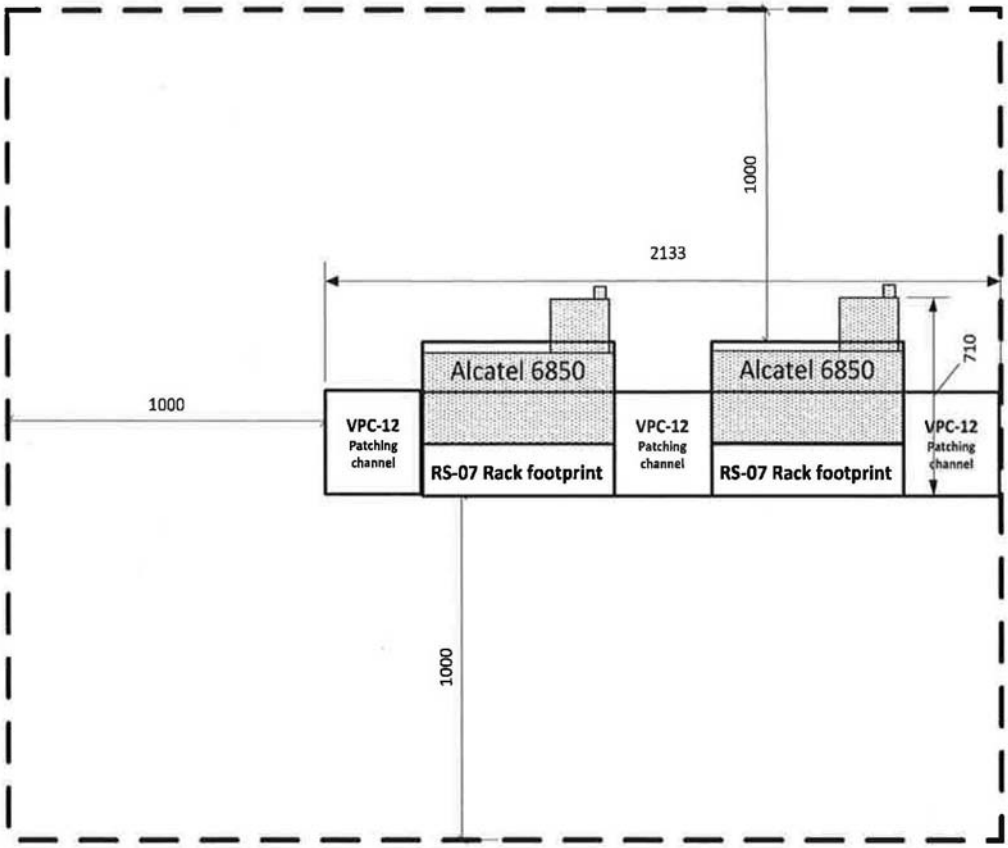
28.4.4.4 Layout

The following diagrams are a guide for the required TSG room size and work space clearances for the proposed number of racks or enclosures.

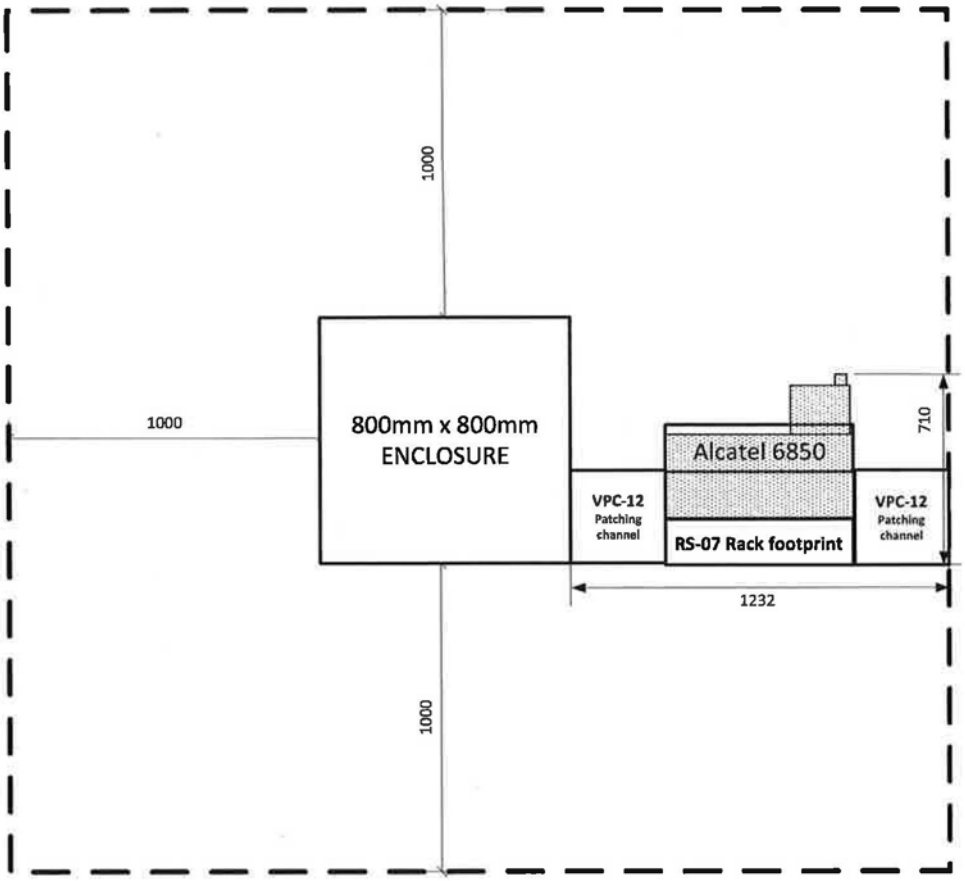
TSG Room Single Communications Rack footprint with preferred clearances



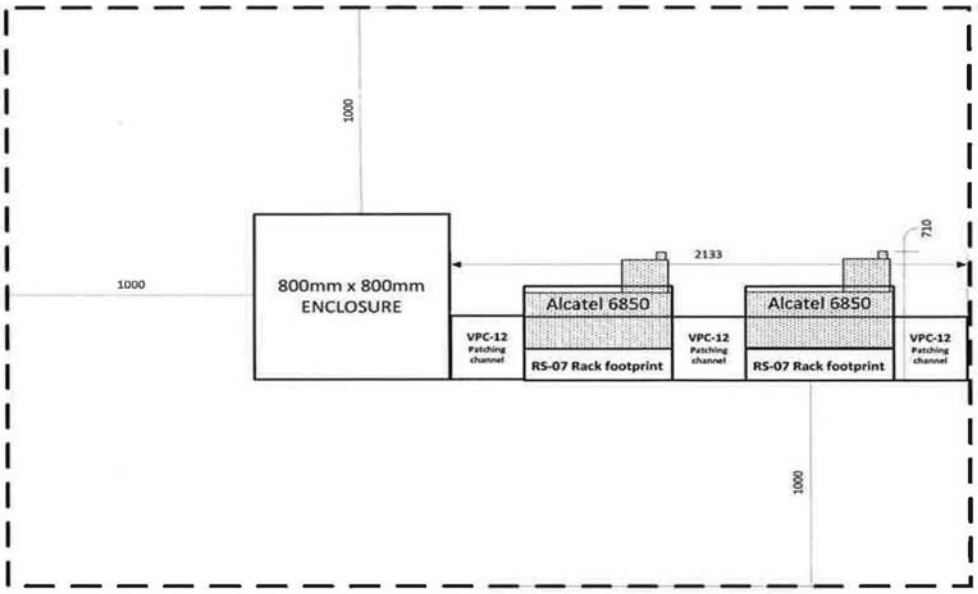
TSG Room Dual in-line Communications Rack footprint with preferred clearances



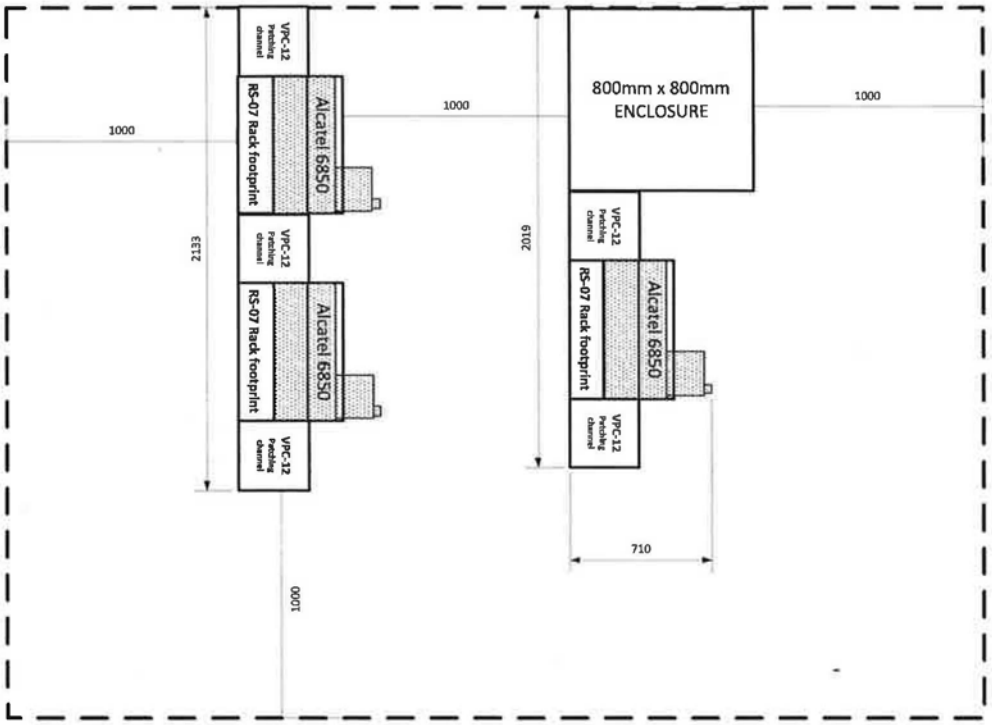
TSG Room Single Communications Rack and Single enclosure footprint with preferred clearances



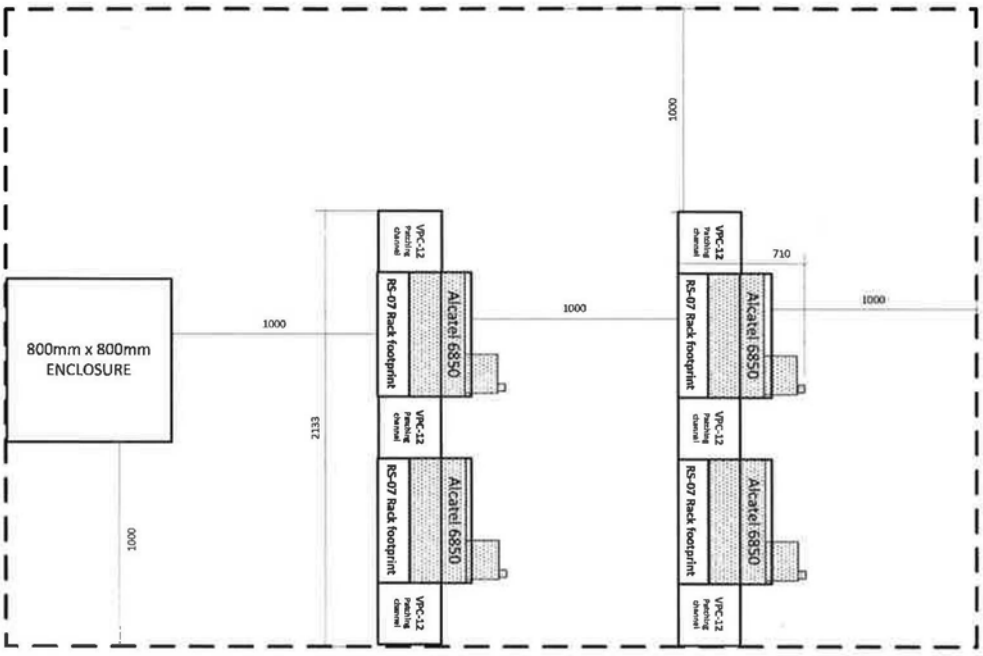
TSG Room Dual in-line Communications Rack and Single Enclosure footprint with preferred clearances



TSG Room Three Communications Racks and Single Enclosure footprint with preferred clearances



TSG Room Four Communications Racks and Single Enclosure footprint with preferred clearances



28.4.4.5 TSG Room Classes

There are 4 classes of TSG rooms. These classes are based on the number of enclosures / racks installed within each room and the level of associated equipment. The illustration above describes a class 'A' TSG room. Other classes are to follow this overall design. The class definitions are:

Class A – Four enclosures / racks or more installed as a suite(s).

This is a full TSG room fit-out providing equipment accommodation for data, voice, security, audio visual and BMS. Approximate required floor space – 5 metres x 3.2 metres.

Class B – Three enclosures / racks installed as a suite. Approximate required floor space – 4 metres x 3.2 metres.

Class C – Two enclosures / racks installed as a suite.

Due to space constraints owing to existing building design, project limitations or an absence of some TSG service requirements, class B or C is to be employed. Approximate required floor space – 3 metres x 3 metres.

Class D – One enclosure / rack or wall mounted enclosure.

This design is to be employed where there is only a requirement for data and voice only. Voice services delivered by voice-grade UTP backbone only. This configuration is typically used to overcome horizontal telecommunications cabling distance limitations.

28.4.4.6 Fibre Patching Distribution

FIBRE DUCTING - FIBRE PATCHING DISTRIBUTION

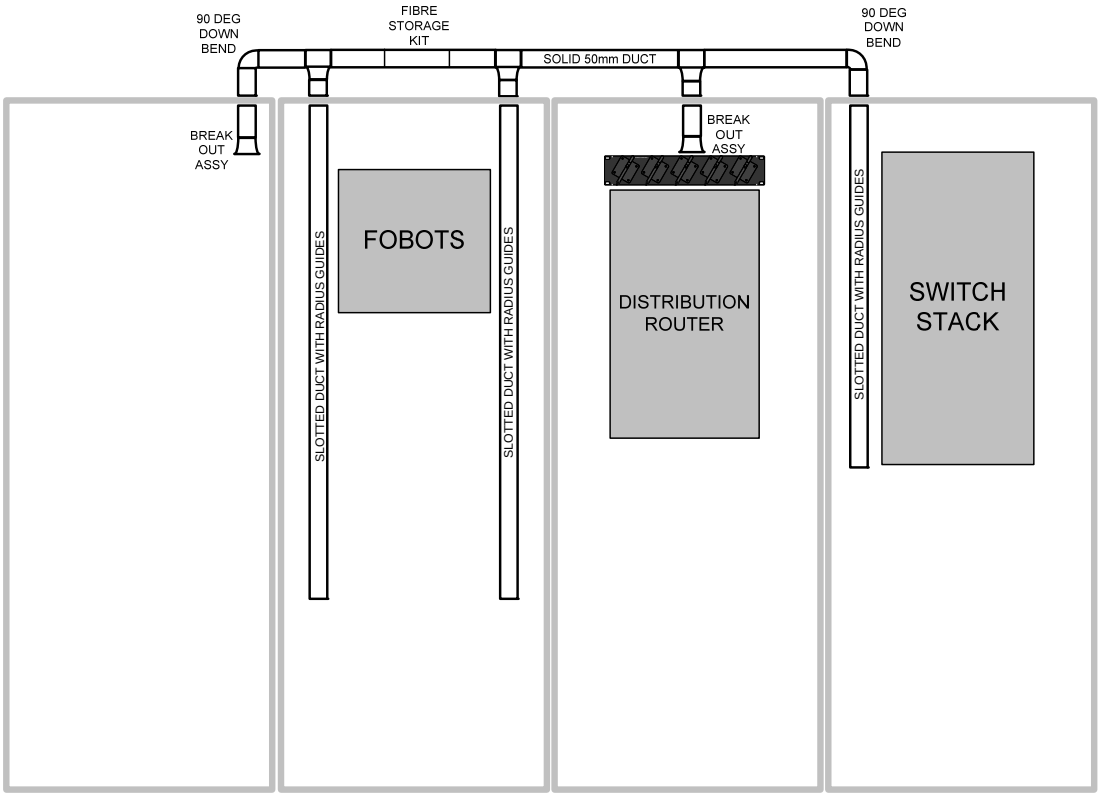


Fig. 7

TSG room equipment enclosures / racks suites shall be fitted with 50mm yellow Noryl plastic ducting certified to UL94V0 that is purpose built for the distribution of fibre optic patch leads only. Figure 7 outlines a basic configuration. The duct shall be located on the top of the suite and shall be attached with suitable fittings. Appropriate penetrations shall be made in the enclosures to allow reticulation of the ducting within the enclosures. Due to each project's individual design requirements, the final design of the ducting is to be approved by the UTS/ITD TFP. The duct shall be used for the distribution of fibre optic patch leads only; no other cables shall be routed within the fibre duct.

28.4.4.7 Uninterruptible Power Systems (3 Phase input & 3 Phase output)

Applicable Standards

The following standards apply to the UPS equipment

- IEC/AS 62040 UPS Systems
- The UPS shall be CE marked in accordance with EEC directives 73/23 (low voltage) and 89/336 (electromagnetic compatibility)
- IEC 60896 Stationary Lead Acid Batteries

System Type

- The UPS shall implement a double conversion static system type
- The UPS shall be configured for operations as N+1 parallel redundant configuration

System Ratings

- UPS System Required: 2 x 30kVA
- Total kW required for each UPS from 0.9 lag to 0.9 lead: 24kW
- Battery autonomy for each UPS at full load: 12 minutes
- System Configuration: N+1

Input Supply Requirements

Supply Voltage	415/240V AC
Maximum supply Voltage Variation	
Continuous	305 to 477 Volts
Transient	100%
Number of Supply Phases	3 + Neutral + Earth
Supply Frequency	50 Hz
Maximum Supply Frequency Variation	40 to 70%
Rated input current	38 Amps
Maximum continuous input current including full load, mains intolerance and energy storing charging	51 Amps
Input Current Limit	100-125% (adjustable)
Permissible Supply Fault Level	25 kA RMS Symmetrical
Instantaneous Inrush Current at Switch on	100% of the units input current at rated output
Input Total Harmonic Current Distortion	<3%
Input neutral requirement	Full rated
Earth leakage current requirements	Earth leakage current is <700mA + load or typically <2000mA
Maximum allowable mains voltage unbalance	100%
System Efficiency	
Full Load	91% per UPS at UPS rated load
75%	90.5% per UPS at 75% UPS rated load
50%	89% per UPS at 50% UPS rated load
25%	84% per UPS at 25% UPS rated load
System Input Power Factor	
Full Load	0.99pf per UPS
75%	0.99pf per UPS
50%	0.98pf per UPS
25%	0.97pf per UPS

Battery Bank Performance

Battery Type — Valve Regulated Sealed Lead Acid

Recharge Times after discharge to minimum terminal voltage:

- 90% stored energy capacity…….. 10 hours
- 95% stored energy capacity…….. 11 hours
- 100% stored energy capacity…... 12 hours

System Autonomy (per UPS unit at specified conditions

and time including compound life deterioration factor)	12 minutes (SOL) with internal batteries
Annual life deterioration factor (compounding)	2%
Operating temperature range for lifetime and rating calculations	25 C
Rated lifetime	10 years
Warranty	5 years full
Pro-rata warranty period	5 years Pro-rata
Minimum terminal voltage per cell during discharge	1.7 Volts

Steady State UPS System Output Ratings

Output Voltage with balanced load	415 + or - 1% (steady state)
Output Voltage with 100%, 50% and 50% Load on each phase respectively	415 + or - 2 % (unbalanced loads)
Connected Equipment Load Power Factor Range	Each UPS shall provide 24kW
Overall Load Power Factor to be served	between 0.9 lag to 0.9 lead without any de-rating
Permissible Load Imbalance	100%
Phase Displacement for Balanced Load	120 + or - 1 degree
Phase Displacement for 100% Unbalanced Load	120 + or - 1 degree
Voltage Imbalance for Balanced Load	+ or - 1% from average
Voltage Imbalanced for 100% Unbalanced Load	+ or - 2% from average
Output Total Harmonic Voltage Distortions	
Total	4.5% maximum

Transient System Output Ratings

Transient system ratings shall be classification 1 for Output dynamic performance in accordance with applicable standards

Output Voltage Regulation for:

- Static Transfer
- 50% Load Change } + or - 5%
- Drop out or return of incoming supply

Recovery time constant to nominal (steady state) voltage	10 ms
Overload capacity	125% for 10 minutes 150% for 1 minute

Output Frequency Regulation for:

- Automatice Bypass Transfer
- 50% Load Change } + or - 1% max.
- Drop out or return of incoming supply

MONITORING

The following interface cards shall be required:-

- SNMP card which has the capacity to send SMS and email alerts
- Relay Card / Modbus Card

28.4.4.8 Uninterruptible Power Systems (Single Phase Input & Single Phase Output)

System Type

- The UPS shall be true online UPS.
- The UPS shall provide power factor correction, frequency conversion, unlimited external battery connectivity and equipped with internal automatic and manual bypass capability and also with optional external bypass.
- UPS System Required: 6kVA
- Dimension (mm) : 221 W x 547 D x 430 H
- Battery autonomy for each UPS at full load: 21 minutes

A minimal capacity of 6KVA UPS with a minimum of 21 minutes battery autonomy shall be installed. The UPS supply and output shall be via a suitable wall mounted distribution panel. The UPS 240V output shall be distributed via 15 amp switched

ring-lock captive floor mounted outlets adjacent to each equipment enclosure or on outlets secured on a dedicated overhead cable ladder. Power cables servicing UPS outlets should be contained in PVC conduit and fastened to the floor or cable tray.

The UPS shall be supplied and fitted with an SNMP card which has the capability to send SMS and email alerts and a relay / Modbus card.

A wall mounted UPS by-pass switch shall be supplied with a wall mounted connection diagram. A wall-mounted load centre / distribution panel shall be installed for UPS output distribution.

All queries concerning UPS installation should be cleared and confirmed with the relevant UTS/ITD project manager or the UTS/ITD Telecommunications Facilities Planner.

28.4.4.9 Internal Cable Pathways

300mm communications ONLY cable trays shall be mounted on the floor beneath the cabinet suite and shall link with vertical 300mm cable trays installed to the wall mounted IDC patching fields.

28.4.4.10 Telecommmunications Outlet

A double telecommunications outlet shall be installed adjacent to the UPS and wall mounted telephone in addition to any outlet plates specified in a Scope of Work for equipment permanently installed in the communications cabinet.

28.4.4.11 Wall Mounted Telephone

A wall-mounted phone shall be installed with a handpiece cord of sufficient length to reach the front of all enclosures within the room. The telephone shall be connected to the UTS voice network system.

28.4.4.12 Environmental Control (HVAC)

The TSG room should be supported by the site's HVAC facilities. As a minimum, a suitable split system unit shall be installed to provide adequate temperature control. The environmental control system shall be able to meet the standards shown in the table below:

Environmental Factor	Requirement
Temperature	18 C to 24 C
Relative Humidity	30% to 55%
Heat Dissipation	750 to 5,000 BTUs per cabinet

28.4.4.13 TSG Room Monitoring

A monitoring system is required to alert UTS Security, Building Services and the UTS/ITD CFP if any of the TSG room environmental factors exceed their specified limits.
The monitoring system is to also:

- Visually record all access events to the TSG room with date / time information. Access monitoring should be instigated upon opening of the TSG room door.
- Include a "wet floor" sensor / alarm where there is an access floor within the TSG room and stand alone air-conditioning equipment or overhead plumbing is present.

28.4.4.14 Lighting

Lighting in the telecommunications room / closet shall be a minimum of 500 lux (50 foot candles) at floor level. The light switch shall be easily accessible when entering the room.

28.4.4.15 Fire Suppression

Fire suppression equipment shall be installed in accordance with BCA requirements. All TSG room cable pathways shall be fire-stopped.

28.4.4.16 Active Voice or Data Equipment Cabling

Cables are to be installed to link Ethernet hub ports in the active data cabinets to the wall mounted IDC patching fields.

28.4.4.17 Telecommunications Grounding, Bonding and Earthing

Communication grounding, earthing and bonding shall be installed in accordance with the latest revision of the following standards:

- AS/ACIF S009
- AS 3000 (SAA Wiring Rules)
- AS/NZS 3080

All TSG room equipment enclosures, power rail earths and box steel support frames shall be bonded to the building protective earthing system at a common point. They are not to be bonded to the TRC. Enclosures shall be bonded at the appropriate enclosure earth bar.

28.4.4.17.1 Earth System Installation

The TSG room earthing system shall be designed and / or approved by a qualified electrician. The earthing system shall adhere to the requirements of the AS/NZS 3000:2007 and AS/ACIF S009:2006 and shall be installed in accordance with best industry practices. Installation and termination of the main bonding conductor to the building service entrance earth, at a minimum, shall be performed by a licensed electrical contractor.

Each equipment cabinet / rack requires its own earthing connection to the TSG room earthing infrastructure. A minimum of a #10 AWG (6mm2) green-yellow insulated copper conductor shall be used for this purpose. Each enclosure or rack shall have a suitable connection point to which the rack framework earthing conductor can be bonded.

Rack earth bus: A dedicated copper earth bar shall be attached to the rack. A bond between the earth bar or strip and the rack should exist. The mounting screws should be of the thread-forming type, not self-tapping or sheet metal screws.

Every structural member of the cabinet or rack shall be earthed. This is achieved by assembling the cabinet or rack in such a way that there is electrical continuity throughout its structural members, as described below:

1. Welded racks: the welded construction serves as the method of bonding the structural members of the rack together.
2. Bolt-together (bayed) racks: special consideration shall be taken while assembling bolted racks. Earth continuity cannot be assumed through the use of normal frame bolts used to build or stabilize equipment cabinets. Bolts, nuts and screws used for rack assembly are not specifically designed for earthing purposes. Additionally, most cabinets are painted. Since paint is not a conductor of electrical current, paint can become an insulator and negate any attempt to accomplish desired earthing. Most power is routed over the top or bottom of the rack. Without a reliable bond of all four sides of the rack, a safety hazard in case of contact with live feeds exists. Removing paint at the point of contact with assembly hardware is an acceptable method of bonding. This method is labour intensive but effective. An alternate method is the use of internal-external tooth lock washers. With the bolts tensioned, an acceptable bond can be made. Two washers are necessary to accomplish this: one under the bolt head contacting and cutting paint and one under the nut.

It is recommended that rack-mounted equipment be bonded and earthed via the chassis, in accordance with the manufacturer's instructions. Provided the rack is bonded and earthed as detailed in the previous section, the equipment chassis should be bonded to the rack using one of the following methods:

1. To meet the chassis earthing requirements, the manufacturer shall supply a separate earthing hole or stud. This should be used with a conductor of proper size to handle any fault currents up to the limit of the circuit protection device feeding power to the equipment unit. One end of this chassis earthing conductor will be bonded to the chassis hole or stud, and the other end will be properly bonded to the copper earth bar or strip.
2. If the equipment manufacturer suggests earthing via the chassis mounting flanges and the mounting flanges are not painted, the use of thread-forming tri-lobular screws and normal washers will provide an acceptable bond to the rack. If the equipment mounting flanges are painted, the paint can be removed, or the use of the same

thread-forming screws and aggressive internal-external tooth lock washers, designed for this application, will supply an acceptable bond to safety earth through the rack.

Although ac powered equipment typically has a power cord that contains an earth wire, the integrity of this path to earth cannot be easily verified. Rather than relying on the ac power cord earth wire, the equipment shall be earthed in a verifiable manner such as the methods described above.

28.4.4.18 TSG Room Power

There shall be 2 x 240V captive power outlets supplying each equipment enclosure. The first shall be connected to raw building power and labelled with CB identification. The second shall be supplied by the UPS output. All power cabling shall be reticulated via dedicated cable trays.
Each equipment enclosure shall be fitted with 2 x 8 way power rails with one power rail connected to the UPS output and the second to be connected to the raw building power captive outlet. The power rails shall be labelled indicating their supply.
Additional convenience duplex GPOs should be placed at 1.8 m (6 ft) intervals around the perimeter walls.

28.4.4.19 Voice System Cabling

Voice system backbone cables shall be Category 3 multi-pair cables of sufficient pair capacity. They shall be cabled directly from the Building Distributor / PABX room MDF and terminate on the bottom of the TSG room active equipment IDC frame vertical.

29.1 Overview

29.1.1 Purpose

This guideline describes the UTS Energy Monitoring System (EMS) and defines the scope of work and technical specifications for Projects integrating new electrical metering installations at UTS City Campus and Student Housing .

The document is designed to provide a high level guide to Projects developing scope to connect new building metering to the Central Energy Monitoring System.

This specification does not replace the consulting engineer's detailed technical specifications, nor does it stipulate the quantity and location of metering required to provide adequate coverage of energy services in new buildings.

29.1.2 Scope

This document covers the basic requirements for new buildings, in particular electrical and communications works to enable connection of metering to the Alerton Optergy EMS.

It provides selected details of equipment and standards used within the EMS, to assist designers in the task of integrating new metering equipment into the EMS.

Project guidance to the integration architecture is provided to assist in connection to the EMS.

A future version of this document will provide guidance on the integration of water and gas meters.

29.1.3 References

1. University of Technology Sydney - Specification for Energy and Water Sub-Metering 30 June 2011| REF: J/N 109355
2. National Institute of Standards and Technology (NIST). GSA Guide to Specifying Interoperable Building Automation and Control Systems Using ANSI/ASHRAE Standard 135-1995, BACnet
3. American Society of Heating Refrigeration and Air-conditioning Engineers. BACnet PICs (protocol Implementation Conformance Statement)
4. Alerton Optergy 2 System Description
5. NABERS. NABERS Energy and Water for offices (version 3.0)
6. Ethernet Direct. Datasheet. BMM-101 Single Port Modbus Gateway
7. Standards Australia . AS 62053.22 (2005) Electricity Metering Equipment (AC) Static meters for active energy (Classes 0.2S and 0.5 S)
8. Standards Australia. AS 62053.23 (2006) Electricity metering equipment (AC) – Particular Requirements – static meters for reactive energy (Class 2 and 3).
9. Standards Australia. AS 60044.1-2007. Instrument Transformers (IEC 60044-1 Ed. 1.2 (2003) MOD)
10. Standards Australia. AS 60044.1-20017/Amdt 1-2012. Instrument transformers – Current transformers
11. www.modbus.org
12. www.bacnet.org

29.1.4 Definitions and Abbreviations

AEST, Australian Eastern Standard Time
BACnet, Interoperability protocol ISO 16484-5
BACnet Operator Workstation (B-OWS), network level workstation
BACnet Advanced Workstation (B-AWS), advanced operator workstation
BMS, Building Management System
CAN, Campus Area Network
EMS, Energy Monitoring System (the Alerton Optergy System)
FMO, Facilities Management Operations (UTS)
NTP, Network Time Protocol
Project, The UTS Project team, Architects, Developers, Consultants, Builders and trades responsible for the new building or refurbishment requiring a connection to the EMS.
PMO, Program Management Office (UTS)

SMS, Short Message Service
SMTP, Simple Mail Transfer Protocol
TSG, Technical Services Group (usually refers to a "TSG" room – a comms room)
THD, Total Harmonic Distortion
VPN, Virtual Private Network
VSD, Variable Speed Drive
UTC, Coordinated Universal Time

29.2 Architecture

29.2.1 Description of the EMS

29.2.1.1 The Energy Monitoring System (EMS) implemented in UTS is the Alerton Optergy 2 (Aurora) system.

29.2.1.2 The Optergy system consists of a protected Server, hosted in the Building 1 Data Centre, and gateway devices that collect data from smart meters via the Campus Area Network (CAN).

29.2.1.3 The EMS also collects data from gas meters, water meters, thermal meters, and Variable Speed Drives (VSDs) and other energy related outputs.

29.2.1.4 The electricity meters are connected to the load side of Main Circuit Breakers, or Sub-Main Circuit Breakers by appropriately sized and selected Current Transformers, fuses, barrier terminals and shorting links.

29.2.1.5 Water and Gas meters are connected to the EMS using pulse meters. The pulses are fed to a network gateway device that converts the pulse into a readable register, which is read by the server over the CAN.

29.2.1.6 Thermal Meters and VSDs are linked to the EMS either directly using BACnet or MODBUS, or by the EMS interrogating the local BMS. The interrogation via BMS is to be used only where it is not possible or practicable to provide a direct link.

29.2.1.7 The university has adopted MODBUS for the connection of new electricity meters. The meters connected by a daisy chain buss (wired in EIA-485 compliant 2 wire communications cable) to a Modbus RTU to Modbus TCP gateway located in the nearest TCG room.

29.2.1.8 The gateway used is type BMM-101[1] (see equipment specification). The gateway must be configured to allow the EMS to access the Modbus meters by polling the gateway directly from the UTS Campus Area Network.

29.2.1.9 Any other system requiring data from the meter (such as the BMS) must poll the BMM-101 gateway. It is not permissible for a local BMS or other system to directly access the meters on the daisy chain buss.

29.2.1.10 Where EIA-485 communications is used to link meters, the communications design must provide for correctly specified shielded twisted pair cable, properly terminated and capable of operation at not less than 76kbits/sec.

29.2.1.11 The EMS is linked to the Campus time and SMTP mail servers to receive time synch and to allow notifications to be emailed to users.

[1] BMM-101 is a tradename of Ethernet Direct

29.2.2 Scope required to integrate Electricity, Water or Gas Metering to the Campus EMS

29.2.2.1 The Project (designer) is required to design a metering layout (including any Greenstar[2] requirements) to meet the objectives of the Project and document the design sufficient for the Contractor to implement the system.

29.2.2.2 The Project shall supply, install and commission electricity meters, water meters, gas meters and other metering as applicable, communications networks, gateway devices, and EMS programming compatible with the Alerton Optergy 2[i] system.

29.2.2.3 The new metering shall be configurable to provide the full functionality available in the existing UTS EMS system.

29.2.2.4 The following diagram shows the system required. The existing Alerton EMS server will be configured by the Project to include all new metering added or existing metering deleted or changed by the Project.

29.2.2.5 The Project shall ensure that any additions or modifications to the EMS are checked for design compatibility, capacity, reliability and maintainability by the UTS delegate.

29.2.2.6 The UTS delegate may refer designs to UTS for inspection (including by the EMS vendor) to ensure that the EMS design integrity are not compromised.

29.2.2.7 The gateways shall be compatible Ethernet direct BMM-101 type equipment and shall be located in the Switchroom (or TSG room where directed) or other location approved by UTS in a steel panel with power supply and power feed from the nearest essential services outlet.

29.2.2.8 A CAN ethernet data port shall be supplied within 5 metres of the gateway.

29.2.2.9 The gateways shall be connected to the data port using an approved CAT5e patch lead.

29.2.2.10 All communications with the meters shall be routed through the gateway.

29.2.2.11 Any requirement of the BMS or other local system to communicate with electricity meters shall pass through the gateway using Modbus/TCP protocol.

29.2.2.12 The EMS shall poll the BMS for Thermal meter data or VSD data via BACnet. Direct polling of the thermal meters or VSDs by the EMS is the preferred method of access, unless the BMS must use this equipment for local control, making direct access by the BMS impractical.

29.2.2.13 The metering scope provided in new buildings shall include the configuration of the EMS server to provide the displays, alarms and reports detailed in the Software Section of this guide for all new metering. This shall include (but is not limited to):

29.2.2.14 Schematic presentations and reports by hierarchical location of meters (such as by Main Switchboard then Distribution Board, then local Switchboard),

- Schematic presentation and reports by Building level, functional area (such as conference centres etc.) and presentation of data by service use (such as Mechanical, Light and Power)
- Smart meter analysis including Voltage, Current, power, power factor, reactive power, THD and other factors
- Energy, water and gas trend logging and charting

[2] Greenstar is a tradename of the Green Building Council Australia

- Variance reporting and alarming against set targets, including but not limited to exceeding electricity maximum demand, or consumption over user selectable time period, power factor, voltage, current or THD out of limits, gas used against MDQ, or a proportion (such as 75%).
- Water and gas consumption by building, level, area and use with detection of abnormal conditions such as time of use, excess use in period, rate of use and leakage.
- Allow users to filter reporting against parent/child metering configuration and groupings (i.e. Total HVAC for Building 1)
- Reports, schematics and alarms required for UTS users shall be prepared in conjunction with UTS stakeholders to ensure that the minimum reporting requirements are met. Reports shall include charts, usage reports, billing reports, leak reports, issue and alarm reports and all other as required to meet the requirements of the Project and the UTS stakeholders.
- Include setting up notifications (by email) for alarms to UTS Users

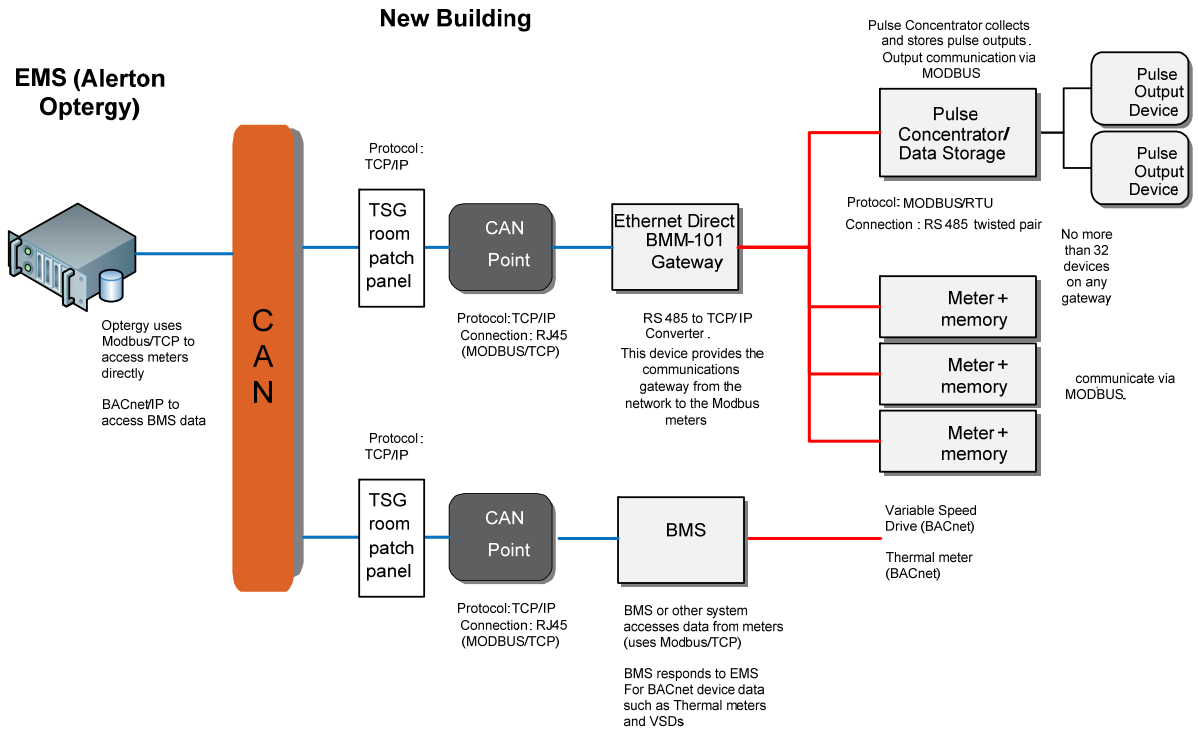


Figure 1. EMS Schematic

29.3 Equipment

29.3.1 Electricity Meters

29.3.1.1 The Project shall ensure that Greenstar rating requirements (where they exist) are clearly identified. The Project shall ensure that meter quality, layout and coverage meets these requirements. As a guidance distributed loads of 50 Amps and over require metering.

29.3.1.2 The smart meters specified by the EMS are designed for energy monitoring. Where Projects require energy sales, the Project shall ensure that regulations governing the sale of energy are considered. This may require consideration of the location and type of metering installed to meet the requirements of the Australian Energy Regulator.

29.3.1.3 Where revenue meters are required (for UTS or tenant retail energy sales), these meters shall be supplied fitted with Modbus ports and the Modbus data made available through the specified BMM-101 MODBUS/TCP gateway by connecting the meter to the nearest Modbus gateway.

29.3.1.4 The Project is required to organise with the energy retailer for the upgrade of revenue electricity meters to include MODBUS communications capability.

29.3.1.5 The electricity meters shall be fitted to 96mm cut-outs in the fascia of the switchboard. Where this is not practical, the meter shall be fitted into an adjacent panel meeting the requirements stipulated in the Equipment section.

29.3.1.6 The electricity meters adopted by the EMS are of the MODBUS Smart meter type IME NEMO 96HD[3]. They are mounted either in the switchboard, or in dedicated panels where this is not possible for access or WHS reasons.

29.3.1.7 Electrical meters generally for Sub main metering shall be specified in accordance with Standards Australia AS 62053.22 (2005) Electricity Metering Equipment (AC) Static meters for active energy (Classes 0.2S and 0.5 S) and AS 62053.23 (2006) Electricity metering equipment (AC) –Particular Requirements – static meters for reactive energy (Class 2 and 3).

29.3.1.8 UTS require sub main loads to be measured as 4 wire unbalanced loads. The meter will calculate the neutral current.

29.3.1.9 The smart meters shall store interval data, and shall be configured to cover fifteen minute data capture of each phase voltage, each phase current, neutral current, 3 phase active power, 3 phase reactive power, 3 phase maximum demand, power factor, 3 phase active and reactive energy, and harmonics analysis.

29.3.1.10 The interval data shall be stored at 15 minute intervals for a minimum of 1 week in the event of a loss of communications from the server to the meter but where power is available to the meter. The meters shall incorporate a memory module to store data, such that the EMS can read the stored data.

29.3.1.11 Each meter shall be configured in accordance with the requirements of the EMS. The EMS meter configuration will be provided to the Project by UTS. This will include meter addressing to ensure that all meters are uniquely identified across the Campus.

29.3.1.12 The naming convention used to identify meters shall be standardized in accordance with UTS direction. All labelling on meters shall reflect this standard.

29.3.1.13 The meter shall be fitted with non-volatile memory allowing retention of data during periods of prolonged communications loss (at least one week).

[3] NEMO 96HD is a tradename of Instrumenti Misure elettriche SpA

29.3.1.14 Scheduled data polling – polling of meters and storage registers will be scheduled to occur once per day for the latest meter data. This will be conducted at a suitable time when network traffic is low, such as overnight. The polling schedule will be controlled via the EMS software.

29.3.1.15 Adhoc data polling – The EMS software will enable users to interrogate a meter manually in order to obtain the most current information, or to diagnose connectivity issues. It is anticipated that this type of data transfer will be minimal and will not adversely affect network performance.

29.3.1.16 The EMS server will time sync the meters every 24 hours during upload operations. The EMS server itself is time synchronized to the University Network Time Protocol (NTP) servers.

29.3.1.17 The meter must support the following:

- LCD display on the front of the meter for ease of set-up and operation, and in the event that manual reading of the meter is required, all critical values can be easily obtained from the meter
- Support –/1A or –/5A current transformer operation
- Accuracy for Voltage +/- 0.2% (80 to 500V phase voltage)
- Accuracy for Current +/- 0.2% (10 to 120 % line current)
- Accuracy for Active energy class 0.5 (EN/IEC62053-22)
- Accuracy for Reactive energy class 2 (EN/IEC62053-23)
- Voltage measurement range 3-phase - 80…500V 50/60Hz
- Voltage measurement range Single phase - 50…290V 50/60Hz
- Programmable CT ratio 1…9999 (max CT primary 50kA/5A or 10kA/1A)
- Programmable VT ratio 1…10 (max VT primary 1200V)
- Programmable display contrast and backlight intensity. Backlit to be programmable to auto off when not in use to increase life of backlight.
- Field updatable firmware.
- Resettable parameters - min + max voltage, current demand, current max demand, active, reactive, apparent power max demand, hours run, partial active energy, partial reactive energy
- Measurement and storage of apparent power maximum demand such that EMS can retrieve average and maximum demand held by meter for each month
- Where neutral current is not measured explicitly meter must provide a calculated value

29.3.2 Current Transformers

29.3.2.1 CT selections shall be encapsulated in Epoxy Resin and extended range type of Class 0.5s or better. Adequate consideration shall be given to dimensions of bus bars, cables, access for installation, range, overload, voltage and other factors.

29.3.2.2 Current Transformers shall be specified in accordance with AS 60044.1 (2007) as amended.

29.3.2.3 Split CT's shall not be used unless approved by UTS.

29.3.2.4 The Project is to ensure appropriately sized CT rating for each load and select the minimum size (based on full load usage) to maintain the highest level of data accuracy.

29.3.2.5 Associated equipment including meter protection fuses/CB, meter test blocks and wiring, etc.

29.3.2.6 Primary input current between 5A and 10,000A, secondary input current 5A and 1A

29.3.2.7 Sensing current range 10mA to 10A and input voltage 18V to 700 V AC

29.3.2.8 Shorting links and barrier terminals shall be fitted to permit disconnection of the meters and CT's for maintenance or replacement.

29.3.2.9 Current signals from the CTs shall be clearly colour coded to the phase and labelled at each end of the cable to indicate the phase and secondary orientation of current signal (e.g. Red S1 and S2).

29.3.3 Water and gas meters

29.3.3.1 For water and gas metering, the Project shall provide a pulse measurement device that will convert the water or gas meter volt free pulses (at a minimum of 100Hz, 25% duty cycle) to a Modbus value that can be accessed by the EMS server through the gateway.

29.3.3.2 Where the water and gas meters are available via BACnet controllers, the Project will configure the EMS Server to access these BACnet variables.

29.3.3.3 As a guidance water distribution branches using over 2,500 kL /annum, and gas appliances using over 500 GJ/ annum require metering

29.3.4 Thermal energy flow meters

29.3.4.1 Thermal calculators shall be selected and calibrated to provide an accuracy of 1% or better. Temperature measurements used in the calculation of thermal energy shall be accuracy of 0.05 degrees Centigrade or better.

29.3.4.2 Flow meters shall be non-invasive such as magnetic or ultrasonic type.

29.3.5 **Variable Speed Drive**

29.3.5.1 The EMS shall record rpm, Hz, kW and kWh from the VSD's selected for monitoring by the EMS.

29.3.6 Gateway Device

29.3.6.1 The gateway device is required to permit multiple master polling of the meters.

29.3.6.2 The BMM-101 device is designed to allow simultaneous polling of meters by the EMS server or other masters to communicate with the Modbus serial network.

29.3.6.3 Since Modbus serial networks can only handle one query at a time, queries from difference masters are queued and processed one by one.

29.3.6.4 Overview Specifications

- **Manufacturer: Ethernet Direct**
- **Model: BMM-101**
- **Type: Single Port Modbus Gateway**
- **Output**: 64K bytes for BMM-101
- **Input**: 8K bytes per port
- **Serial Connection:** DTE – BD-9 male
- **LAN:**10/100 Mbps Auto-detecting – 10 Base T, 100 Base TX
- **Serial Interfaces:**
- **RS-232** - TX, RX, RTS, CTS, DTR, DSR, DCD, GND
- **RS-422** – TX+, TX-, RX+, RX-, RTS+, RTS-, CTS+, CTS-,GND
- **RS-485** - Data +, Data –, GND
- **Data Rate:**110 bps to 230.4 k bps
- **Parity:** none, even, odd, mark, space
- **Data Bits:**5, 6, 7 or 8
- **Stop Bits:**1, 1.5 or 2
- **Protocol:** TCP, IP, ARP, DHCP, Telnet, HTTP, UDP, ICMP
- **Management:** Manager software, Serial Console, Telnet, Web server
- Firmware upgradeable
- **Dimensions:**3.35 x 4.5 x 0.90 in (8.5 x 11.5 x 2.3 cm)
- **Power Requirements:**9 ~15 VDC, 500 mA
- **Operating Temperature:**-10 to 60 °C
- **Storage Temperature:**-20 to 80 °C
- **Humidity:**0 – 90% Non-Condensing
- **Approvals:** CE, FCC

29.4 Commissioning, support and documentation

29.4.1 Verification

The project shall:

29.4.1.1 Verify communication to each meter from the EMS

29.4.1.2 Complete successful EMS remote reading of meter data and verification of stored values against those stored within the meter register (Meter values = stored values)

29.4.1.3 Validate of the meters' communication to the remote metering system in accordance with the NABERS validation protocols.

29.4.1.4 Confirm correct operation of scheduled data polling over a period of 7 days at the EMS.

29.4.1.5 Complete successful retrieval of data from storage database for each meter to the EMS.

29.4.1.6 Provide access details and logins/passwords to any software components required by the EMS to connect or maintain the interface to metering

29.4.1.7 Demonstrate the end-to-end system, including dashboards, meter hierarchy, historical data, scheduled polling and ad hoc polling.

29.4.1.8 Conduct user training for up to 5 UTS staff. All for two full days of training on site at UTS.

29.4.2 Support and documentation

29.4.2.1 The Project shall ensure that changes to the EMS are supported and maintained. This shall include any adjustments to support and maintenance arrangements for the EMS to accommodate new metering connections and configuration.

29.4.2.2 The Project shall update all EMS documentation to ensure that it remains current, including all Operations and Maintenance manuals associated with the existing EMS, configuration records, commissioning and equipment records.

29.5 Software

29.5.1 Meter software

29.5.1.1 All IME NEMO 96HD meters shall be loaded with the software version noted in the Appendix A – Configuration. Changes to meter software shall be agreed with UTS.

29.5.1.2 All meter addressing shall be unique and the meter addresses submitted to UTS for approval. The Project shall ensure that meter schematics are submitted for inspection of meter configuration and addressing.

29.5.2 Gateway software

29.5.2.1 All BMM gateways shall be loaded with the version of software noted in Appendix A. While this may change from time to time, the Project must ensure that gateways are installed with the minimum Software version required.

29.5.2.2 BMM Gateway addressing shall be approved with UTS (including UTS ITD) to ensure that all gateways are accessible from the EMS Server.

29.5.3 EMS software

29.5.3.1 The Project shall program the EMS with all meters, parameters, k-factors, alarms, graphics, reports and other configuration as required by UTS.

29.5.3.2 Computing and Storage Capacity – the current EMS storage capacity is sized to accommodate a minimum of 3 years of interval data for existing meters.

29.5.3.3 The Project shall procure any additional storage requirements for 7 and 10 years and include any costs to upgrade the capacity of the Computing environment in the Data Centre.

29.5.3.4 The Project is required to update the EMS data analysis and reporting software to enable it to collate, summarise and examine the data to be collected by the Project, and convert it into usable information that will enable staff and contractors to:

- Access data from all connected meter/data points from the EMS
- Understand and review current and historical usage patterns
- Review the performance of buildings or energy sub-systems available
- Identify usage anomalies using KPI's, targets, comparisons to historical patterns, or other expected behaviours
- Investigate the time, duration (and hence the cause) of usage anomalies
- Summate tenant usage by meter and generate invoices based on a pre-defined "tariff"
- Adapt the system and reports to changes in procedures, required outputs and changes to building operations

29.6 Functional requirements

The Project will include for any works associated with the setting up and commissioning of the EMS to suit the particulars of the Project, including:

29.6.1 Project Graphical User Interface

29.6.1.1 Update the EMS to include a Project (building) portal for remote access via the Internet, to enable users to view reports, and download raw data if necessary. The interface itself shall be designed to provide a simple and intuitive user interface, and enable users to run saved and adhoc reports, view raw data, select the meter(s) they wish to report on, etc.

29.6.1.2 The Project shall configure the system:

- Set up users, roles and responsibilities in the EMS
- Build, save and deploy new reports and configure dashboards
- Set up report schedules and mailing lists
- Configure exception tests/thresholds and alarms
- Manage the meter list, and add new meters
- Build, edit and report virtual meters, and create new reporting elements by applying equations and logic to existing reportable items.
- Access the underlying data storage and configure data capture

29.6.2 Chart and Table Based Reports

29.6.2.1 The Project shall create reports, to enable effective monitoring and analysis of at each meter. Users shall have the ability to generate reports containing tabular data, charts, or both. Chart based reports should be customisable where users can alter the chart type (where suitable), add, remove or reorder series.

29.6.2.2 The Project shall set up as required (to meet its specification):

- Chart functions including the ability to stack meters, change the time-scale to zoom in/out through appropriate selections on the chart (e.g. dragging a box over the desired portion to enhance).
- Drill through reports, where users can link ad hoc reports together so that when a figure or chart item is clicked on, the reporting software will "drill through" to another desired report using appropriate report criteria. For example, a user viewing a maximum monthly demand report for a list of meters may wish to click on a meter to drill through to an interval data report showing the week in which the maximum occurred.
- Push Reports, where users can be set up to receive nominated reports on a regular basis, or based on exceptions as required. This may extend to the ability to bundle specific reports together into 1 output – for example, create a single file with a 7-day interval data chart for each sub meter.
- Download and save reports in a variety of common formats for record keeping, distribution or further analysis. Typical formats include text files (.txt, .csv), Microsoft Excel (.xls, xlsx), and Adobe Portable Document Format (.pdf)
- Capability of test files (CSV) to be uploaded on a building by building basis for input into the metering reporting system
- Ability for users to print reports via a local printer in a meaningful way (e.g. appropriate page management), and to email reports.
- Provide users with the ability to create 1 or more dashboards, which may contain snapshots or links to frequent reports, list relevant exceptions or alarms, including email alarms, and provide traffic light status reports.

29.6.3 Meter Hierarchy

29.6.3.1 A core requirement for the configuration of the EMS reporting for the Project is the ability to suitably arrange the meters into a hierarchy that reflects the energy/water flows throughout the site. Meters and sub-meters are being installed at various "levels" throughout the Project, from incoming revenue meters, through to main switches, sub-mains and individual equipment.

29.6.3.2 It is important that the EMS be configured so that users are able to easily understand the meter hierarchy, indicating the physical and virtual meters. This may be represented by any suitable means, including a tree, or tagged and filtered meter list.

29.6.3.3 Through the hierarchy, users shall be able to generate reports (either aggregated or sub-divided) at any given point in the hierarchy. The hierarchy will remain visible so that users can quickly traverse the campus, and will clearly indicate item currently being reported.

29.7 Supplied by UTS (i.e. UTS Furnished Materials)

29.7.1 UTS will provide the existing EMS for the use of the project, including:

29.7.2 EMS Data Collection, Storage and Reporting Software (the Alerton Optergy 2 software), including necessary licenses, connected to the UTS Campus Area Network, commissioned and in readiness to accept new meter connections.

29.7.3 Review and approval of any new meter connections.

29.7.4 Configuration Management of the EMS

29.7.5 Initial user training (not including additional Project requirements)

29.7.6 Appropriate hardware and software documentation and help files

29.7.7 Examples of reporting solution including standard and customisable reports and tools

29.8 Appendix A – Software versions

Item	Description	Software Version
EMS	Alerton Optergy 2	TBA
Gateway	BMM-101 Modbus/TCP Gateway	V1.9 or later
Meter	IME NEMO 96HD	TBA

[i] Optergy is a brand name of Alerton Australia Pty Limited

30 STUDENT ACCOMMODATION

30.1 Introduction

The purpose of this section is to provide designers of student accommodation projects with information of sufficient content as to enable them to produce a finished product, which satisfies the expectations of both client and users.

30.2 Existing Accommodation Buildings

Designers are encouraged to visit and study existing UTS and other student accommodation projects which will provide the designers with a prototype standard of general accommodation, types of finishes, services, furniture, fitments and fixtures. Visits may be arranged by contacting the appropriate Project Manager at FMU.

30.3 Planning

Each site will have specific and different characteristics of location, streetscape, socio-economic demographics, size, shape, topography and orientation. Design solutions will be expected to respect and enhance their context while conforming in general principle with the intent of these guidelines.

30.4 Building Design

Each residential building will contain a similar type and disposition of accommodation. Spaces common to each development will depend upon the nature of the project; low, medium or high rise but generally the following will apply:

30.4.1 Access

Wherever possible access to the apartments should be directly off a common controlled lobby to allow for better management and monitoring of people leaving and entering the building. In the event that this is not possible, access may be gained via a secure, controlled external space such as a courtyard. Direct access from the street into any space in an apartment is unacceptable.

For accessible requirements refer to Section 24 Accessible Environment Policy. Where level access is required through an external door, covered entry or paved area the finished ground surface shall be sloped away from the door to prevent water ingress. Where grated drains or elongated openings are installed in pavements their grating bars and disposition shall be transverse to the dominant direction of travel.

30.4.2 External Requirements

Main entry
Car parking (to meet the minimum requirements of the Local Authority)
Landscaping courtyards for active & passive recreation with seating (note: could be located on the roof)
Bicycle racks
Barbecue area
Garbage area

30.4.3 Internal Requirements

Main Entry lobby
Cleaner's storage area/s
Storage room
Multi Purpose room
Common room/s with unisex toilet and kitchenette
Resource room
Laundry facilities
Reception/office
Security room

A number of apartments each generally containing: shared living/dining area, shared kitchen, individual bedrooms (6 or less preferred), water closets, shower rooms and storage cupboards.

Refer to Subsection 30.10 Apartment Configurations for detailed requirements

30.5 Space Planning Consideration

Consideration must be given to how the building envelope and its finishes will impact on its neighbourhood. Setbacks, landscaping and colours of external finishes shall be given appropriate consideration.

The spaces created between buildings and by the building itself should be planned as positive spaces with a quality that encourages active and passive usage and adds to the character of the streetscape.

The hierarchy of spaces leading from the communal to the private should be arranged according to a gradient of required intimacy. A sequence should be created which starts at the entrance, progresses through the public and common areas, leads through shared private areas and finally arrives at the individual private space.

Common spaces such as the main entry lobby, multi purpose room, laundry area, common rooms and external recreation areas should be grouped to logically support and enhance their usage.

Private common spaces such as living rooms may open on to controlled external recreation spaces but in that event security becomes an important issue.

30.6 Retail

Depending on the location and other characteristics of the site, options for incorporating retail areas may be considered with a view to being self-managed by UTS or leased to private operators. The intention of including these would be to increase the overall financial viability of the project and/or enhance the amenity of the development. Examples might include a café, business centre or convenience store

30.7 Space Standards

The following schedule is provided as a guide for the purpose of preliminary submissions.

Room	Area (m^2)	Remarks
Main Entry Lobby	As required	Sufficient space for groups to congregate and interact
Security Room	7	
Multi Purpose Room	60 minimum	0.4sqm per bedroom served
Unisex Toilet	5	
Common Rooms	30 minimum rooms.	0.3sqm per bedroom served; Maximum 180 beds to be served by one common room
Resource Room	35	1 computer station for each 10 bedrooms served or part thereof
Cleaner's Room	3	One on each floor
Cleaner's Store	6	
Storage Room	25 minimum	0.15sqm per bedroom served
Laundromat	40 minimum	To accommodate 1 commercial washing machine and 1 commercial dryer per 35 beds served, 5% to be accessible [minimum 1]
Kitchen – Multi Bedroom Apts.	6 minimum	1.5sqm per bedroom served
Living/Dining Room – Multi Bedroom Apts	20 minimum	3.5sqm per bedroom served
Bedroom	12	
Bedroom for Persons with Disabilities	13.5	
Shower Room	3	Refer to section 30.10 Apartment Configurations
Toilets	2	
Toilets for persons with Disabilities	4	

Bedsitter Unit	24	Living/Dining/Bedroom/Kitchenette Ensuite	18.5 5.5
One Bedroom Apartment	40	Living/Dining Bedroom Kitchen Ensuite	15.5 13.5 5.5 5.5
Caretaker's Residence (2 Bedroom Apartment)	60	Living/Dining Bedrooms x 2 Kitchen W.C Bathroom	20.0 24.0 5.5 2.5 6.0

30.8 Room Sizes

The area of each bedroom shall be a minimum of 12 m^2. Unusable or 'left over' space shall not be included for the purpose of calculating area. Note that bedrooms designated for use by people with disabilities should be larger to allow for wheelchair circulation and additional storage.

Designers shall take into account shape, circulation, openings, furniture, fitments and equipment when planning spaces.

Designers must submit indicative furniture and fitment layouts for approval at schematic design stage.

30.9 Spatial Disposition

Generally spaces should be arranged in a logical and efficient manner with a minimum amount of corridor and unusable space.

Circulation across rooms will have an impact on furniture layout and should be studied accordingly.

Rooms should be bright and airy with good natural light and with light ceiling and wall colours. Rooms should be designed to accommodate a number of furniture arrangements.

Common areas in each apartment should be open plan while individual bedrooms should have a sense of privacy and retreat.

Toilets and bathrooms should be located away from and out of sight of living areas, with natural ventilation preferred.

Windows should be positioned to take advantage of any views of interesting streetscape or landscaped courtyard.

Functional and useable balconies may be introduced as appropriate however they should be provided with sun shading and protection against the elements and safety railing to better than minimum standards, depending on circumstances up to 1.8m barrier.

30.10 Apartment Configurations

The UTS preferred design is for self catered apartments of 4-5 bedrooms. Other configurations of apartments in excess of 5 bedrooms may be acceptable depending on the design and specific characteristics of each site, and there being no disadvantage in terms of comfort and amenity to those apartments. Ideally a mix of different apartment sizes is preferred.

At least 60% of the complex shall comprise apartments containing 4 bedrooms or above. 3 bedroom apartments are to be avoided.
At least 5% of the complex shall comprise studio or 1 bedroom apartments. For accessible unit requirements refer section 24 Accessible Environment Policy.
Every complex shall comprise a 2 bedroom apartment to accommodate a caretaker.

30.10.1 Multiple Bedroom Apartments

Multiple Bedroom Apartments shall comprise:

- shared living/dining area
- shared kitchen
- individual bedrooms
- water closets [at rate of 1 per 3.5 bedrooms or part thereof]
- shower rooms [at rate of 1 per 3.5 bedrooms or part thereof]

- 1 storage cupboard
- basin required in each wc and shower room

30.10.2 Bedsitter Units

Bedsitter units shall comprise:

- combined living/dining/kitchenette and bedroom
- ensuite with water closet & shower
- 1 storage cupboard
- basin required in each wc and shower room

30.10.3 One Bedroom Apartments

One-bedroom apartments shall comprise:

- combined living/dining area
- kitchen
- 1 bedroom
- ensuite with water closet and shower
- 1 storage cupboard
- basin required in each wc and shower room

30.10.4 Caretaker's Apartment

Caretaker's apartment shall be located near the main entrance to the complex, in close proximity to the security counter in the entry lobby and comprise:

- combined living/dining area
- kitchen
- 2 bedrooms
- 1 water closet
- 1 bathroom
- laundry facilities
- 1 storage cupboard
- basin required in each wc and shower room

30.11 Work Health and Safety

Generally comply with the relevant A.S. codes and authorities having jurisdiction over the works. Particular issues to be addressed shall include:

- Access and egress with particular regard to people with ambulatory disabily and vision impairment
- Comfort of the occupants by means of a healthy building in which the construction materials, design and operation are environmentally benign and non-allergenic.
- The safety of the occupants and visitors with regard to electrical shocks, fire spread and smoke development, slips (on floor surfaces) trips, falls (both human and material), collision and collapse (adequacy of fixings etc).
- Designers will be required to participate and provide input into Safety Design Workshops to identify areas of potential hazard and address methods of reducing risks by design.

30.12 Building Materials

Designers should avoid:

- Untested purpose made components
- Large areas of external paintwork

Designers should consider the use of:

- Materials without applied finishes such as bricks, blocks, stone or concrete
- Materials supplied with factory finishes such as tiles, vitreous glazed panels, colorbond, powder coated or anodised finishes.

30.13 Services

Designers should make allowance for the following during early design stages:

- Employ natural ventilation wherever possible, avoid reliance on mechanical ventilation
- Consider flexibility of power and data points with regard to furniture layouts. Conduit ducts at skirting or chair rail level should be considered in the bedrooms. Conduits that are cast into slabs then chased down walls to a point are expensive to relocate.
- Where mechanical ventilation is unavoidable provide adequate horizontal and vertical duct space

- Consider headroom implications of false ceilings or bulkhead ducts
- Allow adequate plant room space
- Flexibility in the design to accommodate any future changes

30.14 Acoustics

The units provide a home for students for extended periods and it is therefore essential that there be a good level of sound attenuation grading from public areas, through shared areas such as living rooms and finally to the private areas of the bedrooms. In achieving the required levels of noise reduction, the BCA should be used as a minimum to determine Rw ratings.

To provide a satisfactory level to residents, the following maximum allowable ambient sound levels shall be:

- 35 dba in living areas
- 30 dba in bedrooms

The level of ambient sound from air-conditioning, ventilating and other mechanical equipment, traffic noise and any other intrusive noise must be neither so high that is objectionable nor so low that the resulting quiet causes intruding speech and other activity noise to be objectionable.

The level of noise is described here by the Noise Rating, as defined by Australian Standard AS 2107-2000. This is very similar to Noise Criterion which is often used in the air-conditioning industry.

30.15 Building Envelope

- The building envelope should comply with the following:
- All exterior materials, components and finishes shall be durable with an expected maintenance free life of 50 years.
- All necessary precautions shall be specified to ensure adequate waterproofing of all elements of the building.
- Flashings and damp proof courses shall be in lead, alcor, zincalume or other approved material. Do not flash in material not approved by the Project Manager.
- Apply graffiti proof coating to the external walls to a height of 2.4 metres above ground level.
- Metal deck roof sheeting where used shall be colorbond finished with a base metal thickness in the higher range. Provide supports at 75% of the manufacturer's maximum allowable spacing. Box gutters should be avoided. Provide substantial sumps and overflows. Provide hail and leaf guards to the gutters.

30.16 Floor Coverings

Floor coverings should be selected from the following:

- CARPET: 40 oz (min) loop pile 100% pure wool broadloom laid on heavy duty rubber underfelt. Carpet seams shall be guaranteed flat, tight and ravel free for the life of the carpet.
- CARPET TILES: In units for persons with ambulatory disabilities. Modular carpet tiles of equal quality to the broadloom carpet and laid by the direct stick method to the floor.
- VINYL SHEET: 2mm thick homogeneous sheet equal to Tarkett.
- TIMBER: 19 mm thick, selected hardwood T & G floor boards laid on timber battens, finished with 3 coats of 2 pack polyurethane or equal approved proprietary brand timber flooring system.
- MAT WELLS: Recessed mat wells and mats shall be provided to all doors accessed from the exterior of the building. Equal to Latham Type RDCC.
- STAIR NOSINGS: Carpeted stairs shall have nosings equal to 'Protect-a-tred' 26mm x 25mm. Stair nosings on public stairs shall be in a contrasting lighter colour than the stair tread.
- TILES: Non-slip floor tiles shall be used wherever tiles are specified.

30.17 Doors and Windows

Flyscreens shall be provided to all opening windows and sliding doors. Windows should be able to be locked in a semi open position to provide secure ventilation.

The design of the windows shall facilitate the provision of easy access to clean both sides of the windows from inside.

All glazing shall be in safety glass.

Provide robust hardware and locks to all doors and openable windows. In addition, provide locking bolts to all external sliding aluminium doors (not being egress).

30.18 Timber Doors and Hardware

All timber doors shall be solid core supplied with a paint quality timber veneer. Doors showing split or lifting veneer on edges shall be rejected. Provide stainless steel kick plates to all doors in accessible units.

Where space is tight or doors open out onto a corridor from the laundry, cupboard or similar space, consider using bifold doors. Avoid sliding timber doors.

30.19 Painting

All exposed external surfaces excluding required natural and prefinished surfaces shall be painted or given an applied finish.

All exposed internal surfaces including the inside of cupboards where not prefinished shall be painted or given an applied finish.

Need to look at protection from termites and situation of garden in relation to wooden beams.

30.20 Furniture, Fitments, Fittings and Equipment

All FF & E items shall be designed or selected to give good quality service over the long term. All items must be sturdy, easily maintained and with finishes and fabrics that will withstand robust usage.

The size of pieces of loose furniture will have a significant impact on living, dining and bedroom spaces and should be selected to give an uncluttered appearance.

Steel or metal-framed furniture is preferred over exposed timber frames and should be of domestic style and appearance.

Access under items for easy cleaning or vacuuming is desired.

TABLE 1

Furniture provisions and required warranty periods								
Item	**1bed Apt**	**2bed Apt**	**3bed Apt**	**4bed Apt**	**5bed Apt**	**6bed Apt**	**7bed Apt**	**W'ty yrs**
Wardrobes	1	2	3	4	5	6	7	10
Lounge Chairs 2.5		1	1	2	2	3	3	10
Lounge Chairs			1		1		1	10
Coffee Tables		1	1	1	1	1	1	10
Dining Tables – 2	1	1						10
Dining Tables – 4			1	1	1			10
Dining Tables – 5								10
Dining Tables – 6						1	1	10
Dining Tables – 8								10
Dining Chairs	2	2	3	4	4	6	7	10
Bed Base	1	2	3	4	5	6	7	10
Mattress	1	2	3	4	5	6	7	10
Desk	1	2	3	4	5	6	7	10
Desk Chair	1	2	3	4	5	6	7	10
Shelf Unit	1	2	3	4	5	6	7	10
Mobile pedestal	1	2	3	4	5	6	7	10
Pinboards	1	2	3	4	5	6	7	10
TV/DVD Cabinet						1	1	10
Television						1	1	1
Plasma TV								1
DVD								1
Vacuum Cleaner	1	1	1	1	1	1	1	1
Iron	1	1	1	1	1	1	1	1
Ironing Board	1	1	1	1	1	1	1	1
Refrigerator – 240 litres	1	1	1					1
Refrigerator – 500 litres				1	1			1
Refrigerator – 400 litres						2	2	1

Cook Top –2	1							1
Cook Top –4		1	1	1	1	2	2	1
Oven								1
Kettle	1	1	1	1	1	1	1	1
Toaster	1	1	1	1	1	1	1	1
Microwave	1	1	1	1	1	1	1	1
Kitchen Exhaust	1	1	1	1		1	1	1
Dishwasher						1	1	1
Benches dbl								10
Table outdoor								10
BBQ outdoor								1
Heater outdoor								1

30.21 Security

For major refurbishments and new buildings a security risk assessment and a security plan is required to be submitted to the UTS project manager for approval prior to commissioning.

Security requirements will depend on the location, complexity and size of the building as well as the physical disposition of its spatial elements. General requirements are:

30.21.1 Access Control

A lockable door access system (e.g. swipe card / pin access) should be available for building entry, apartment entrances and bedroom doors. The system to be installed shall be at the level of the University's Access and Alarm Management System with swipe operation and an identifiable audit trail. Swipe pads to be mounted at 1 metre above floor level to facilitate operation by persons with disabilities. Access and Control system shall be (or capable of, in the case of non UTS managed properties) connected to the University's Access and Alarm Management System located in Building 1 in the Broadway Campus.

30.21.2 Security Cameras

Security cameras shall be installed at the entrance to the premises, fire stairs, common rooms, corridors, lifts, car park etc. Cameras shall be linked to a central security monitoring station in the Security Room.

30.21.3 Screen Doors/Windows

All ground floor openings, including doors, windows (both fixed and opening) should be fitted with high quality robust security screens (openings in the security screens shall not exceed 125 mm x 125 mm). Security screens must be paint finished galvanised steel and hinged or removable for cleaning of glass. Security screens shall be secured with Alan Key fixing to prevent unauthorised removal. Matching screens must be provided for any openings onto balconies.

30.21.4 Door Furniture/Keys

Door and external screen furniture must be of commercial quality. Locks unless otherwise specified are to be by electronic locking system equal or equivalent to 'Saflok MT', Multi Technology card reader.

30.21.5 Fire Systems

Each building must be provided with a system of fire protection in accordance with the relevant codes and standards. All buildings must be equipped with automatic fire alarms connected via the building's Fire Indicator Board and the Site Fire Indicator Board to the local Fire Service.

Provide smoke detectors for all areas and thermal alarms to kitchens, laundries and common rooms.

30.22 Building Services

General requirements include:

- Provide a central services room of $4m^2$ minimum
- Provide verifiable test results for mechanical installations
- All cables, pipes, ducting and the like shall be fully concealed unless approved by the Project Manager

- Allow for a margin of 20% in increased demand for electricity supply and design total system to meet this increase. Indicate locations of main switch room, MDF and MDB at design development stage.
- Provide structured cabling into the Resource Room. For further requirements, refer to the Design Guidelines for UTS Building and refurbishment projects.
- Each room requiring a mechanical venting system shall be provided with a separate fan.
- All rangehoods over cooking appliances shall be commercial quality and extract fans shall be ducted to outside of the building.
- Air changes in enclosed rooms requiring mechanical ventilation shall be made with doors closed. Provide suitable relief air grilles in the door or other approved relief air system.
- Provide separate mechanical venting and discharge to outside for all clothes driers
- Provide a thermal/smoke detection system to all areas.
- All fire hose reels, hydrants, control panels etc. where exposed to view shall be recessed
- Provide a water-isolating valve for each unit.
- Lifts shall be large enough to accommodate trolleys, furniture etc. and all internal surfaces shall be of materials that are impact resistant and easily cleaned.
- Small Cleaner's Rooms/Cupboards shall be provided in appropriate locations throughout the development to provide access to a cleaner's sink.
- A Cleaner's Store shall be provided in a central location with easy access to the lifts, for the storage of cleaning implements and bulk supplies.
- A secure area of approximately 25 sq. m. shall be provided for the long- term storage of spare furniture, spare parts for maintenance etc.

30.23 Data and Communications

Structured cabling shall be provided throughout the facility. Structured cabling outlets (Data/Voice) shall be provided to all rooms, common rooms, offices, communal areas and other areas as specified in the Room Data Sheets. All cabling shall be terminated in Patch Panels in a small secure services room which shall contain all communications equipment and function as the central point for the installation. The services room may be an adjunct to the storage room.

The Data and Communications system from the facility shall be (or in the case of externally managed properties be capable of being) linked to the University's main system in the City Campus.

30.24 Room Data Sheets

Room Data Sheets shall be completed by the designer and submitted to the Project Manager for approval at design development stage.

CB01 BUILDING SPECIFIC DESIGN GUIDELINES

6.2.12 Schedule of Standard Carpets

City Campus

Standard

Supplier	Godfrey Hirst Carpets
Design	Kingsgate Town
Weight	40oz
Colour	Plutonium
Fibre	90% wool, 10% nylon

Existing

Supplier	Godfrey Hirst Carpets
Design	Kingsgate Town
Weight	40oz
Colour	Mineral Blue
Fibre	90% wool, 10% nylon

Public Spaces Standard

Supplier	Cavalier Bremworth
Design	Karatex Encore (#239)
Weight	40oz
Colour	Lights Down 37/239
Fibre	100% wool

7.2 Ceilings Types

	Ceiling Type	**Grid**	**Note**
Corridors existing	Vinyl or Tissue Gyprock Panels 1200x 600	1200 x 600 mm Armstrong Peakform 24mm Face Gridsteel/white	Match existing
Offices existing	Vinyl or Tissue Gyprock Panels 1200 x 600	1200 x 600 mm Steel/white	Match existing
Corridors/Offices new	Armstrong Fine fissured Square Edge 1200 x 600 H3570B	1200 x 600mm Steel/white	For new work

CB02 BUILDING 2 BUILDING SPECIFIC DESIGN GUIDELINES

6.2.12 Schedule of Standard Carpets

City Campus

Standard	
Supplier	Godfrey Hirst Carpets
Design	Kingsgate Town
Weight	40oz
Colour	Plutonium
Fibre	90% wool, 10% nylon
Existing	
Supplier	Godfrey Hirst Carpets
Design	Kingsgate Town
Weight	40oz
Colour	Mineral Blue
Fibre	90% wool, 10% nylon
Public Spaces Standard	
Supplier	Cavalier Bremworth
Design	Karatex Encore (#239)
Weight	40oz
Colour	Lights Down 37/239
Fibre	100%
Public Spaces Level 2	
Supplier	Tascot
Design	Wilton, Special, Designtex
Weight	170g/m^2
Colour	As per Hand Trial
Pattern	28830
Fibre	100% wool

7.2 Ceiling Types

	Ceiling Type	**Grid**	**Note**
Corridors existing	Armstrong Fine fissured Square Edge H3570B 1200 x 600 Armstrong Fine fissured Tegular 1200 x 600 H3574B	1200 x 600mm Steel/white	Match existing
Offices existing	Armstrong Fine fissured Square Edge H3570B 1200 x 600 Armstrong Fine fissured Tegular 1200x600 H3574B	1200 x 600 mm Steel/white	Match existing
Corridors/Offices new	Armstrong Fine fissured Square Edge 1200 x 600 H3570B	1200 x 600mm Steel/white	For new work

CB03 BUILDING 3 BUILDING SPECIFIC DESIGN GUIDELINES

6.2.12 Schedule of Standard Carpets

City Campus	
Building 3	
Supplier	Godfrey Hirst Carpets
Design	Kingsgate Town
Weight	40oz
Colour	Plutonium
Fibre	90% wool, 10% nylon

CB04 BUILDING 4 BUILDING SPECIFIC DESIGN GUIDELINES

6.2.12 Schedule of Standard Carpets

City Campus

General Corridors & Offices

Supplier	Godfrey Hirst Carpets
Design	Sussex
Weight	40oz
Colour	Black Magic
Fibre	100% wool

General Corridors

Supplier	Godfrey Hirst Carpets
Design	Sussex
Weight	40oz
Colour	"Pavement"
Fibre	100% wool

Feature Carpet Levels 1 & 7

Supplier	Gibbon Group
Design	Tretford
Weight	40oz
Colour	Charcoal (620)
Fibre	100% goats hair

Feature Carpet Levels 2

Supplier	Gibbon Group
Design	Tretford
Weight	40 oz
Colour	Lichen (566)
Fibre	100% goat hair

Feature Carpet Level 3

Supplier	Gibbon Group
Design	Tretford
Weight	40 oz
Colour	Brilliant Blue (516)
Fibre	100% goat hair

Feature Carpet Level 4

Supplier	Gibbon Group
Design	Tretford
Weight	40oz
Colour	Aeagean (614) alternate use Lagoon Blue in corridors
Fibre	100% goats hair

Feature Carpet Level 5

Supplier	Gibbon Group
Design	Tretford
Weight	40 oz
Colour	Chilli (616)
Fibre	100% goat hair

Feature Carpet Level 6

Supplier	
Design	Gibbon Group
Weight	Tretford
Colour	40 oz
	Orange squash (585) alternate use Burnt
Fibre	Orange in corridors
	100% goat hair

7.2 Ceiling Types

	Ceiling Type	Grid	Note
Corridors/ Offices existing and new	Armstrong Fine fissured Tegular 1200 x 600 H3574B	1200 x 600mm Steel/white	For existing and new work

CB05 BUILDING 5 BUILDING SPECIFIC DESIGN GUIDELINES

6.2.12 Schedule of Standard Carpets

Standard	
Supplier	Feltex Carpets
Design	C6764-33 Reflections/Bijou lights
Weight	40oz
Colour	Plutonium
Fibre	100% wool
Preferred	
Supplier	Arrow Corporate Flooring Systems Tascot Tri-Loop 500 (9002 Rock Salt) DSG278, HT20,887 DSG643,HT20,925
Weight	24oz
Supplier	Arrow Corporate Flooring System Tascot Tri-Loop Flexiplan, Special Hand Trial no. 20, 878 and 2052 100% pure new wool
Weight	54 oz
Public Corridors Blocks B and C	
Supplier	Ontera Modular Carpets Pty Ltd
Design	SKU 461-77161
Weight	
Colour	
Fibre	Dupont nylon
Classrooms Block C (Level 1)	
Supplier	Ontera Modular Carpets Pty Ltd
Design	SKU377-57548 Envisions
Weight	
Colour	Ebony Manhattan Rockerfellar 313)
Fibre	Dupont nylon
Classrooms Block C (Level 2)	
Supplier	Ontera Modular Carpets Pty Ltd
Design	SKUB23-58328 Envisions
Weight	
Colour	Caspian Manhattan Maddison (315)
Fibre	Dupont nylon

7.2 Ceiling Types

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	Ceiling Type	**Grid**	**Note**
Block A			
Corridors/Offices existing and new	Armstrong Fine Fissured 2nd look one, 1200 x 600 H3580B	1200 x 600mm Steel/white	Match existing pattern
Block B			
Corridors Offices existing and new	Armstrong Fine Fissured 2nd look one, 1200x600 H3580B	1200x600mm Steel/white	Match existing pattern
Lecture Theatres existing and new	Armstrong Fine fissured Square Edge 1200 x 600 H3570B	1200x600 Steel/white	For existing and new work
Block C			
Corridors and offices	Armstrong Fine fissured	1200 x 600mm	For existing and new

existing and new	Square Edge 1200x600 H3570B	Steel/white	work
Student Liaison office 1.102	Armstrong Fine Fissured 2nd look one, 1200 x 600 H3580B	1200 x 600mm Steel/white	Match existing pattern
Block D			
Corridors/Offices Existing and new	Armstrong Fine Fissured	1200x600mm steel/white	Match existing pattern

CB06 BUILDING 6 BUILDING SPECIFIC DESIGN GUIDELINES

6.2.12 Schedule of Standard Carpets

Standard	
Supplier	Feltex Carpets
Design	C6764-33 Reflections Bijou Lights
Weight	40oz
Colour	Plutonium
Fibre	100% wool
Preferred	
Supplier	Arrow Corporate Flooring Systems Tascot Tri-Loop 500 (9002 Rock Salt) DSG278, HT20, 887 DSG643, HT20, 925
Weight	24oz
Supplier	Arrow Corporate Flooring Systems Tascot Tri-Loop Flexiplan, Special Hand Trial no. 20, 878 and 2052 100% pure new wool
Weight	54oz

7.2 Ceiling Types

	Ceiling Type	**Grid**	**Note**
Corridors/Offices existing and new	Armstrong F/F Tegular 1200x400 & F/F Tegular Armstrong fine fissured Tegular 1200 X 600	1200x400mm Steel/white	For existing and new work

CB10 BUILDING 10 SPECIFIC DESIGN GUIDELINES

1 INTRODUCTION

1.1 Overview

Building 10 (CB10), formerly known as the Fairfax Building, was acquired by University of Technology Sydney in 1998 has 14 storeys in total (including 2 levels of basements), comprises a tower to the east fronting Jones Street and a 5 storey podium to the north fronting Thomas Street. The building underwent major renovation in 2001-2003 inserting a full height atrium into the podium and converting to university use with the tower floors given over to commercial leasing. Over the next ten years a number of fit-out projects were undertaken and trended towards the tower floors being re-purposed for university use. In 2013-2014 the base building, primarily concerned with levels 00, 01 and 02 and linking to the adjacent new building CB11 were undertaken and the elevators were upgraded. The space between CB10 and CB11 forms an arcade laneway with a glazed roof above Level 7.

1.2 Summary of key issues impacting renovations

- Sulman award winning design
- Fire engineered strategy
- Potential site for campus tri-generation plant

3 ARCHITECTURAL CONTROLS

3.1 Aesthetic

All refurbishments and additions to CB 10 should enhance and complement its existing architectural quality. In particular, materials and finishes selected for spaces connected to the atrium are to be consistent with the ambience of the atrium space. Design solutions for public spaces are to provide students with a quality experience.

3.2 Amenity

Rooms and spaces for teaching, learning, research, administration and recreation are to have high level of environmental quality. Design solutions should consider opportunities of natural light and ventilation, realising the benefits of the existing atrium and the arcade.

3.3 Plant and Equipment

Appropriate consideration should be given to plant and equipment in relation to adequate maintenance access, safety in design principles and possible future expansion.

5 INTERNAL WALLS, PARTITIONS AND FINISHES

5.1 Finishes

Finishes are to match the minimal palette and design quality. Any timber used is to be Select grade blackbutt to match existing.

5.2 Toilet and Shower Areas

Cubicle partitions are to be 100mm clear of the floor to provide privacy.

6 FLOORS AND FLOOR FINISHES

6.2 Floor Finishes

Finishes are to match the minimal palette and design quality. Any timber used is to be Select grade blackbutt to match existing. Stone tiling should be specified to match existing and project programs need to take into account any long lead times that may apply.

6.2.12 Schedule of Standard Carpets

General	
Supplier	Godfrey Hirst Carpets
Design	Kingsgate Town
Weight	40 oz
Colour	Onyx

Fibre	90% wool, 10% nylon
Executive offices	
Supplier	Gibbon Group Pty Ltd
Design	Tretford
Colour	534 Anthracite
Fibre	80% Goat Hair + 15% Nylon + 5% Viscose
Student Centre Level 2	
Supplier	Gibbon Group Pty Ltd
Design	Tretford
Weight	2.75kg/m^2
Colour	512Dapple Grey
Fibre	80% Goat Hair + 15% Nylon + 5% Viscose
Student Centre Back of House Meeting Rooms and Office Level 2	
Supplier	Gibbon Group Pty Ltd
Design	Tretford
Weight	2.75kg/m^2
Colour	580 Lettuce Leaf
Fibre	80% Goat Hair + 15% Nylon + 5% Viscose
Meeting Rooms Level 2	
Supplier	Gibbon Group Pty Ltd
Design	Tretford
Weight	2.75kg/m^2
Colour	570 (red) Pomegranite discontinued substitute Chilli
Fibre	80% Goat Hair + 15% Nylon + 5% Viscose
Meeting Rooms Level 3	
Supplier	Gibbon Group Pty Ltd
Design	Tretford
Weight	2.75kg/m^2
Colour	5161 (blue) Brilliant Blue
Fibre	80% Goat Hair + 15% Nylon + 5 % Viscose
Meeting Rooms Level 4	
Supplier	Gibbon Group Pty Ltd
Design	Tretford
Weight	2.75kg/m^2
Colour	585 Orange Squash-Light traffic /soil or 559 Burnt Orange –Heavy traffic/soil
Fibre	80% Goat Hair + 15% Nylon + 5% Viscose
General Areas Level 5 & 6	
Supplier	Godfrey Hirst Carpets
Design	Kingsgate Heather
Weight	40oz
Colour	Plutonium (charcoal)
Fibre	100% wool
Supplier	Godfrey Hirst Carpets
Design	Kingsgate Heather
Weight	48oz
Colour	Fairfax Blue (special) or Reef 40oz
Fibre	100% wool
Supplier	Godfrey Hirst Carpets
Design	Kingsgate Heather
Weight	48oz
Colour	Fairfax Red (special) or Sienna 40oz
Fibre	100% wool
Note: all Tretford Broadloom is available in carpet tiles.	

7 CEILINGS AND CEILING FINISHES

7.2 Ceiling Types

Areas	Ceiling Type	Dimensions/Finish	Note
Corridors/offices existing	Armstrong ANF Square edge H3628	Grid:1200 x 600mm Finish: Steel/white	Match existing
Student Centre front of house area Student Centre Meeting Rooms	Suspended timber ceiling - Woodform Concept click ceiling system	Batten size: 32 x 32 mm Batten spacing: 57mm centres Finish: Blackbutt – natural accent. Black insulation backing	Match existing
Student Centre back of house workstations	Keystone perforated plasterboard acoustic panel	Size: 2400L x 1200W mm Finish: RAL 9016	Match existing
	Central recessed service zone -Flush plasterboard on suspended framing system.	Width: 350mm Finish: RAL 9006	Services coordinated within central recessed service

9 FURNITURE AND FITTINGS

9.1 Maintain Design Quality

All furniture and fittings should meet and enhance the design quality. Fittings should be fully co-ordinated and integrated with flush or recessed detailing.

10 DOORS, HARDWARE AND LOCKS

10.1 Maintain Design Quality

Door panels and hardware finishes are to be integrated into the design of the wall. Door panels to be full height where possible.

11 SANITARY FITTINGS AND FIXTURES

11.1 Floor Wastes

Tile-insert type floor waste to be used for tiled floors. Alternatively stainless steel strip drains can be used where appropriate.

12 PIPED SERVICES AND STORAGE TANKS

12.1 Cooling Towers

Cooling towers are located on CB11 and work to service both CB10 and CB11. Any additional pipework runs between the buildings are to be concealed.

12.2 Gas Meter and Mains

The gas meter and mains supply is located behind the green wall on the south facade. Any additional works should consider maintenance access and pedestrian movement.

16 FIRE SERVICES

16.1 Fire safety and strategy

The fire safety provisions within the building are designed with alternative solutions to meet the BCA performance requirements. In particular, any modifications to the atrium fire safety provisions and the Level 2 fire passage must be approved by fire safety engineer and UTS.

17 SECURITY

17.1 Fixtures and Access Control Devices

All ceiling fixtures are to be co-ordinated within service zones, above access panels, or recesses. Finishes are to match ceiling or recess – custom colours are to be made available. Electro-magnetic devices and card readers for access control are to be fully co-ordinated prior to installation by security contractors.

20 PAINTING

20.1 Colour Schemes

Area	Colour
Walls	RAL 9016
Doors & Frames	RAL 7044

21 SIGNAGE

21.1 Glazing Decal

Signage applied to glazing to be a translucent film graphic on clear glass, instead of vinyl graphic shown in the UTS Sign Standards. The intent is to integrate with the graphic wall in Student Centre front of house area.

25 ENVIRONMENTAL SUSTAINABILITY

25.1 Maintain Green Star Rating

Additional works within CB10 must demonstrate minimum 4 Star rating under Green Star Education Technical Manual. It is recommended that all CB10 projects target higher rating practice where appropriate.

26 HERITAGE ASSETS

26.1 Heritage

The key character features to be retained/respected are:

- Jones Street, Thomas Street and Wattle Street facades;
- Level 2 lift lobby at Jones Street entry;
- Heritage features in association with Fairfax boardrooms and SOCOG (Sydney Organising Committee for the Olympic Games) on Level 14.