

01 – General Requirements

Version	Date	Authors	Summary of Changes
1.0	7 August 2012	Ben Crossling	New document
1.1	21 November 2012	Ben Crossling	Various changes across the document
1.2	15 January 2013	Ben Crossling	Reviewed and modified 1.12 & 1.13
2.0	05 February 2016	Neill Daly	General Revision
2.1	01 August 2016	Neill Daly	ITS Cabling Specification updated
2.2	11 January 2017	Neill Daly	Building Code requirements revised
2.3	09 June 2017	Neill Daly	National Construction Code 2016 added
2.4	25 September 2018	Sarah O'Callaghan	ITS Cabling Specification updated
2.5	13 October 2021	Sarah O'Callaghan	General Revision

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Purpose and Objectives

01.01 The Campus and Buildings Requirements Manual (the CBRM, the Requirements or the Manual) documents the minimum design and construction requirements for new, refurbishment or repurposed building works, landscapes and engineering/infrastructure projects on buildings, facilities and campuses of the Australian National University (the ANU or the University). The Requirements are prepared for the direction of a Consultant, Designer or Project Manager in the preparation of project specific documentation and in the delivery of project works.

01.02 The CBRM is intended to be read and distributed electronically. This does not preclude printing sections of the Requirements; however, the University takes no responsibility for the completeness and currency of printed/hard copy material distributed amongst the Consultant team. Notwithstanding any Consultants particular discipline or area of responsibility, each Consultant and/or designer shall consider the document in its entirety.

01.03 The CBRM is part of a suite of ANU documents which are intended to be applied across the full life-cycle of capital works projects. Documents outlining space allocation, signage, specific installation requirements for certain elements and project Hand Over requirements may be referred to within the Manual. Consultants and Project Managers with design and/or construction responsibility are required to become familiar with all or any relevant material.

01.04 Subject Matter Managers (SMM's) are responsible for preparing and maintaining the Requirements.

Scope

01.05 The ANU requires 'commonality' of material, plant and equipment across a number of systems to ensure Institutional continuity in operation, maintenance, spare parts and as far as practical local technical support. This includes carpets, furniture, lighting fittings, plumbing fittings, boilers, chillers, standby and other generators, air conditioning and refrigeration equipment, pumps, air compressors and other items.

01.06 In some sections the CBRM lays out performance-based criteria for building elements. Consultants specifications should be designed not to restrict competition, reflect bias to any brand, product or contractor, or act as a barrier to the consideration of any alternative unless sound reasoning exists. The reference to brand names is to indicate the performance and/or quality of the finished element; and/or product continuity for maintenance and economy of scale. The ANU has a preference for proprietary manufactured items over those items custom built (where a number of component parts would be utilised to create an equal or equivalent item).

01.07 The nomination of a product in the Manual does not relieve the Consultant from any duty of care in the assessment of suitability for a specific use. Where a product is considered unsuitable the Consultant is to formally advise the Principal's Representative (the Principal or the Principal's Project Manager).

01.08 Identification of a proprietary item does not necessarily imply exclusive preference for that item, but indicates the required properties of the item. The Consultants, Designers or Project

Managers may request to offer an alternative to any proprietary item. The request must be accompanied by all available technical information and describe how, if at all, the alternative differs from the proprietary item and how it will affect other parts of the System and performance of the Systems.

01.09 Except to the extent that the approval, if any, of the Principal includes a contrary provision, the approval is deemed to include the conditions that:

- use of the alternative must not directly or indirectly result in any increase in the cost to the Principal;
- the Consultant must indemnify the Principal against any increase in costs; and
- use of the alternative must not directly or indirectly cause any delay to the Project.

01.010 The Consultants should request, from the Principal's Representative, a list of approved plant and equipment. Design documentation including drawings, should be based the approved equipment.

01.011 Full technical specifications including local maintenance support (or documented evidence of a support network), details of the source of spare parts, their availability and nearest spare parts and service outlet shall be provided to the Principal's Representative for any deviation or design alternatives proposed. The Principal's Representative will seek formal approval to proceed on compliant and alternative proposals. The final determination of whether to proceed will be provided in writing from the University, via the Principal's Representative.

01.012 Colour schedules are to be approved by the Principal's Representative in consultation with relevant ANU stakeholders. All projects will require the submission of proposed colours and finishes (of relevant materials) indicating accurately the projects (or elements) intended finish.

Consultants Obligations

01.013 The Requirements do not relieve any person or company commissioned by, or contracted to, the University from the preparation of comprehensive specifications for inclusion in tender or construction documentation. Whilst the information contained in the relevant sections of the Requirements should be applied in the preparations of specifications, no part of the CBRM shall be used as a substitute for those specifications.

01.014 Extracts from the Manual may be incorporated within specifications where deemed appropriate by the Consultant. It is the Consultants responsibility to fully investigate the needs of the University, the particular application and to produce designs and documentation entirely fit for purpose and in accordance with the requirements described in the Commissioning Brief.

01.015 Where the Consultant is requested to confirm any details, deference to the University for any matter does not obviate Consultants statutory and contractual obligations.

01.016 Nothing in these requirements may in any way be construed as relieving the Consultant of their obligations to make proper enquiries and to advise the Principal's Representative of the technical requirements necessary to achieve the technical performance and general requirements described in the Brief.

01.017 In the event that the Consultant is subsequently of the opinion that any aspect of these Requirements are not suitable for the project, or a more appropriate solution may exist, the Consultant shall immediately notify the Principal's Representative and seek a written direction.

Deviation from the Campus and Building Requirements Manual

01.018 The Requirements are to be complied with unless formal approval is obtained from the Associate Director, Projects or delegate.

01.019 The Consultant will be required to certify that all requirements have been met. If any of the requirements have been waived, the request to vary and waiver should be attached to the certification.

Statutory Framework

01.020 As a basic requirement, work is to comply with external statutory requirements. However, higher standards may be required by the University in many instances and assumptions as to acceptable standards should not be made. Where the CBRM requirements conflict with legislature, standards and authority requirements, the highest standards are to take priority.

01.021 The CBRM is predominantly established and informed by the requirements of the campus, buildings and grounds of the Acton campus. As such, much of the statutory and authorities framework, relates to works in the ACT. However, Consultants engaged to undertake works in other jurisdictions should make enquiries as to state, local statutory and other authority requirements.

01.022 The Acton campus is located on Commonwealth land nominated a *Designated Area* of the *National Capital Plan* administered by the *National Capital Authority* (NCA):

- "Any alteration to buildings or structures, demolition, landscaping or excavation works in these designated areas require the prior written approval of the NCA or 'Works Approval.'" <https://www.nationalcapital.gov.au/index.php/works-approval>

Disability (Access to Premises - Buildings) Standards

01.023 The *Disability (Access to Premises – Buildings) Standards 2010*, as amended take effect subject to subsection 31(4) of the *Disability Discrimination Act 1992*.

The objects of these Standards are:

- to ensure that dignified, equitable, cost-effective and reasonably achievable access to buildings, and facilities and services within buildings, is provided for people with a disability; and
- to give certainty to building certifiers, building developers and building managers that, if access to buildings is provided in accordance with these Standards, the provision of that access, to the extent covered by these Standards, will not be unlawful under the Act, refer to <https://www.comlaw.gov.au/Details/F2011C00214>

National Construction Code

01.024 The National Construction Code (NCC) – 2016 applies to all works at the ANU.

01.025 A building, plumbing or drainage solution will comply with the NCC if it satisfies the Performance Requirements, **which are the NCC legal requirements.**

Australian Standards

01.026 All design and construction work shall comply with the relevant current Australian Standards and Codes of Practice unless otherwise required under any statutory or authority requirements. It is the Consultants responsibility to ensure all work covered by any Consultant documentation fully complies with the current editions of the relevant Australian Standards.

Environment Protection and Biodiversity Conservation Act

01.027 The heritage, environment and biodiversity requirements of the ANU arise from the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and its regulations and are enforceable.

Building Code

01.028 On 1 December 2016 the Building Code 2016 replaced the Building Code 2013. The Commonwealth has ceased the operations of the Office of the Fair Work Building Industry Inspectorate and transitioned the agency to the Australian Building and Construction Commission. Suppliers of design and construction services to the ANU will discuss any legislative requirements with the Project Coordinator prior to commencing any works for the ANU.

Services on ANU campuses

01.029 Consultants shall familiarise themselves with all campus infrastructure impacted on or effected by the Project. Services briefings and design review meetings with the Consultant and appropriate members of the design team and internal stakeholders will be arranged by the Principal's Representative.

01.030 Major infrastructure services such as electricity, sewer, water, natural gas, data and telephone have various ownership models across ANU campuses. The Consultant will engage with the local service authorities to carry out any proposed augmentation or relocation works in consultation with the Principal's Representative.

01.031 Generally the following services are available or in use at the Acton campus:

- Potable water networks with fire hydrants that vary from 595kPa to 1120kPa are available.
- Reticulated fire systems are available.
- A gravity sewer network is available.
- Storm and reuse water networks are available.
- Overhead and underground HV and LV electricity networks are available.
- Telecommunication networks comprising of voice and data are available.

- Computing and audio visual infrastructure is available.
- Natural gas networks comprising high and medium pressure are available.
- A Building Management System (BMS) is available.
- A Security Access System is available.

01.032 For other campuses the relevant information shall be obtained from relevant local authorities.

01.033 Consideration must be given to the ongoing maintenance and operational requirements for any new or upgraded facility and for the need to match existing elements.

Document Structure

01.034 The ANU Facilities and Services Division (F&S or the Division) are responsible for procuring, managing and maintaining the built, heritage and natural environments of the ANU. The CBRM is part of a suite of documents. For those responsible for, or commissioned to undertake delivery of, projects are to familiarise themselves with the objectives, intent and structure of the documents. Some or all of the documents may be referred to in contracts and commissions as is required by the scope of each project.

01.035 It is envisaged a project life cycle would necessitate accessing and application of the following documents in the course of a standard project.

Part I Brief, incorporating Statement of Requirements. Outlines the specific project scope, objectives, parameters, budget and project and includes any previously prepared relevant material specific to the project.

Scope of Works. Includes details on the specific nature of each individual engagement against each project stage and assigns accountabilities and responsibilities.

Part II Brief, the Campus and Buildings Requirements Manual.

Constituent Documents:

Commissioning Requirements: For some elements of buildings and building projects, in which various contracted project members will be responsible for ensuring compliance prior to the ANU occupying and utilising any project areas.

- Space Allocation Standards
- Signage Manual
- ANU General Electrical Specification

Part I Brief – Project Specific Statement of Requirements
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Part II Brief – Campus and Building Requirements Manual
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Section 02	Architectural Requirements
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Section 05	Roofing, Roof Fabric & Roof Safety
Section 06	Building Management Systems
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Section 09	Hydraulic Systems
Section 10	Mechanical Services
Section 11	Lifts, Cranes & Vertical Transportation Systems
Section 12	Security, CCTV & Access Control

Commissioning, Operations and Maintenance Requirements

Information Technology Services

01.036 ANU Information Technology Services (ITS) provides services and infrastructure to support and enhance teaching, learning, research and administration across ANU campuses and facilities.

01.037 F&S works collaboratively with ITS through all project stages to ensure the ITS requirements for technologically enabled and enhanced infrastructure are met. These requirements are outlined in the following documents for which the Project Team are to comply with, and adhere to, by applying the CBRM usage principles.

- [Cabling Specifications](#): 2018, Version 2.0 (Optical fibre—Single Mode, UTP, F/UTP Cabling—Category 5e and Category 6a)
- **Audio Visual Technology Standard**: ITS AV Services

Disability Access and Facilities

01.038 The ANU requires that all new buildings, surroundings and approaches comply with *AS 1428 Design for Access and Mobility*.

01.039 The ANU is committed to the provision of equal and dignified access to all students, staff and campus users. The CBRM contains general advice and there may be instances where design decisions will reflect the specific needs of the project.

01.040 The ANU requires consideration for access in specialist spaces such as libraries, laboratories (wet and dry) and teaching and learning spaces. Consultants and designers are to identify any area where the inclusion of accessible facilities requires ANU direction. ANU will endeavour to advise all/any project specific access requirements at project inception.

01.041 Section 23 of the Disability Discrimination Act (DDA) makes it unlawful to discriminate on the grounds of disability in providing access to or use of premises that the public can enter or use. For new building approvals or upgrades from May 2011 on, there are more specific Premises Standards, refer to <https://www.comlaw.gov.au/Details/F2011C00214>.

01.042 Consultants may include the services of an Access certifier/audit Consultant on certain projects. Where a Consultant is required to procure such services, as directed by the University, they will be advised at time of consultant commissioning. The University may elect to, at any project stage, seek independent advice on any solution designed or built to confirm compliance of the designed element/s.

ANU Disability Policy

01.043 The ANU [Disability Policy](#) outlines the University's objectives for equitable access for people with disabilities and the goals, targets, strategies and time frames for implementation of the plan. Consultants should ensure that the proposals are consistent with the Disability Policy.

Application of Standards

01.044 All new building projects at the ANU will comply with the intent and principles of the ANU Disability Policy.

01.045 In case of existing buildings there may be exceptions due to buildings of varying ages and the proposed scale of intervention. Exceptions may include (but may not be limited to) retrofit, repurposing and churn projects, repurposing of heritage buildings and the like. In such cases design decisions pertaining to access/ disability provisions will be taken after due consultation with the Principal's Representative. It is desirable that all such projects be reviewed by an Access Consultant or Building Certifier in early planning stages. The solution should however comply with the current relevant legislation.

01.046 ANU has considered the application of Standards in the case retrofit and refurbishment projects. The application of standards relates to the scale of intervention and nature of the project:

- **Full compliance:** every project should be evaluated against full compliance. However, this may not be feasible due to the scale of intervention and scope of the project.

- **Partial compliance with a management plan:** this would be applicable to instances where some components of compliance can be achieved as a part of the project scope while a management plan is put in place to address specific requirements.
- **Exemption:** in certain instances exemption against requirements of the premises standards may be possible due to the nature of the building or scope of work. For instance where the heritage values of the building are overriding any other legal requirements or the scope of works is too small.

General Considerations

01.047 Following is a list of general considerations for design. These need to be provided as specified in the current relevant codes and standards. The CBRM incorporates building accessible buildings and fitout in various sections

- Car parking and kerb ramps
- Access parking bay design
- Steps, stairs and ramps
- Pedestrian crossings and kerbs
- Accessible routes
- Ramps
- Corridors and paths of travel
- Floor finishes
- Doors, hatches
- Door hardware
- Joinery
- Handrails
- Toilets
- Signage
- Audiovisual provisions
- Miscellaneous objects
- Lifts

Accessible Campus

01.048 Accessibility should not only include buildings but shall extend to linkages between buildings to enhance the student experience of on campus study. While designing new projects or undertaking landscape works the connections between buildings should also be considered. Accessible connections and paths of travel should be provided between buildings. These should also have appropriate signage.

01.049 Provision of accessible parking is essential to provide an accessible campus. Accessible parking should be provided as per the current relevant standard from the AS 1428.

Sustainability

01.050 The ANU is not a conventional property developer since it will typically own a building from design, through refurbishment and or extension to demolition. Consequently the ANU directly benefits from whole of life efficiencies that are not realised to a typical property developer. In addition, the ANU is subject to aggressive emission reduction targets whilst growing its operations and has committed, via an [Environmental Management Plan](#), to achieving world leading environmental performance as an organisation. Membership of the 'Group of 8' provides significant external pressure to demonstrate effectiveness of their policies.

01.051 Ecologically Sustainable Design (ESD) initiatives are often 'value managed' out of the design and construction process as being too costly when the design and construction process is managed as a conventional property development. Consequently the ANU requires a building standard that requires building stock to improve environmental performance significantly faster than the NCC requires. This is complicated by the cost associated with achieving certification with more stringent standards such as Green Star. If the ESD initiatives are implemented throughout the design and construction process the direct cost of achieving a Green Star rating has no environmental benefit. In addition, many projects the ANU undertakes such as extensions, minor works and small structures are not eligible, or financially feasible to obtain a Green Star rating. The tendency is therefore that the projects that do not target a Green Star rating do not follow as rigorous an ESD framework. Therefore the ANU has chosen to develop Sustainability requirements of which ESD considerations are to be taken into account on all projects.

01.052 The goal is that the Sustainability requirements will facilitate implementation of ESD initiatives through:

- Improved internal ESD knowledge and expertise;
- Understanding amongst external service providers (design teams, builders & contractors) of the ESD requirements
- Capture of ESD improvement strategies when they arise during repair, refurbishment and new construction;
- Reduced cost in achieving ESD goals, enabling increased spending on ESD initiatives;
- Improving performance of existing building stock;
- Affecting a culture change from 'deemed to satisfy' to 'world's best practise'.

01.053 Whenever the ANU undertakes a building project that is intended to demonstrate world's best practise, and improve the knowledge and expertise of Facilities and Services a formal Green Star rating may also be undertaken. The alignment of the Sustainability requirements with the Green Star tools will enable the ANU to make this commitment, when appropriate, from a well-informed position.

01.054 It should be noted that the Sustainability requirements are the base level of ESD performance the ANU will require of all projects. All projects will be encouraged to go beyond these requirements and to achieve higher levels of ESD performance.

01.055 The Sustainability requirements have been developed in a number of categories which are embedded in the CBRM and are expected normal practice by all Consultants engaged on capital works projects.

01.056 The Sustainability requirements are intended to be used for maintenance, minor works and new construction activities at the ANU. Whilst the requirements are a comprehensive coverage of ESD issues, the scope of application will be defined by the nature of the work being undertaken. Separate operational processes will be developed and documented for the different types of work that are summarised below.

Major Works

01.057 Major Works covers all work that is delivered by Facilities and Services and typically involves major refurbishments and new extensions or stand-alone buildings.

Minor Works

01.058 Minor works typically involve small refurbishments or building upgrades in existing facilities to improve amenity or to adapt a space to a new mode of usage. Whilst they are termed 'minor' they can still have a significant cost and potential for environment impact.

Maintenance & Asset Replacement

01.059 Maintenance works are carried out in an ongoing manner at the ANU, either in response to failure or damage and requiring repair, or through a preventative maintenance program. The individual projects are typically small scale and numerous.

Sustainability Information Display (Applicable Works: Major; Minor)

01.060 An environmental information display must be located at the main entrance of the building in a clearly visible and accessible location and display information that clearly communicates building and site attributes that serve as an environmental learning resource to all building users and visitors. The building's environmental attributes are to be displayed in a manner that can be readily understood by building users, and meet the following criteria:

- A minimum of five (5) environmental features of the building must be displayed using a combination of text and graphics;
- Performance targets for energy and water consumption as well as greenhouse gas emissions must be provided.

01.061 A facility for displaying actual performance data must be provided. This can either be an electronic display that is regularly updated from the BMS or a space where performance data can be manually posted (e.g. cork/black/whiteboard space).

Workplace Health and Safety Requirements

01.062 The Consultant shall advise the Principal's Representative of any conflicts or omissions in the briefed requirements for the project that are specific to the Workplace Health and Safety (WHS) provisions for the type of activity to be undertaken in the building or the nature of any hazardous materials to be used by building users.

01.063 Where the Consultant commission includes developing the project brief, any WHS requirements stated or implied by the purpose for which the building is to be used shall be specifically identified within the brief and building specifications.

Design Obligations

01.064 The Consultant responsible for design shall, in developing the design for the project, take cognisance of WHS issues so that the use and maintenance of the building or facility will not incur infringement of relevant WHS Acts, Regulations and Codes of Practice and to ensure health and safety of all legitimate uses of the ANU's facilities.

01.065 For WHS purposes, the ANU comes under the Commonwealth legislation, regulations and Codes of Practice. ACT legislation may be taken into consideration, but where Commonwealth legislation exists, it shall override that of the ACT. Any discrepancies should be notified to the WHS Branch via the Principal's Representative.

01.066 Some aspects of the ANU's WHS expectations for Consultants can be found within the ANU's [Health and Safety Management Arrangements](#).

Safety in Design

01.067 Consultants are required to coordinate and report on Safety in Design. Workshops are to be coordinated and reported on at various design and documentation stages. An outcome of the workshops is to document any identified issues for rectification or highlight any areas of the design deemed to reflect good practice and noteworthy.

Heritage

01.068 The ANU has a diverse range of heritage places, many of these being operational buildings. The existence of heritage values in particular buildings provides both constraints and opportunities in their management. The heritage obligations of the ANU arise from the EPBC Act and its regulations and are enforceable.

ANU Heritage Strategy and Management Manual

01.069 The overarching requirements for heritage conservation and management of heritage (natural, historic and Indigenous) at the ANU is detailed in the ANU Strategy. This Strategy is a requirement of the EPBC Act and outlines the procedures for conservation, management, consultation, interpretation and record keeping for heritage.

01.070 The ANU Heritage Management Manual is an outcome of the Heritage Strategy, and provides practical guidance on the day to day management of heritage places at the ANU.

01.071 These documents should be referred to when making decisions about heritage buildings, and are available on the ANU Heritage Website (heritage.anu.edu.au).

ANU Acton Campus Heritage Study

01.072 The ANU Acton Campus Heritage Study was developed in 2012, this document is the primary reference document for the conservation and management of the heritage values of the ANU. The Heritage Study includes an assessment of the Acton campus and individual inventories for each building or group of buildings and major landscape features. The Study is available on the ANU Heritage Website (heritage.anu.edu.au), and should be considered a working document, as any changes made to the campus will be updated in the individual building inventories.

01.073 Each individual and/or group of buildings on campus is subject to a heritage assessment, with each individual building being prescribed a 'ranking' of significance and a 'level' of tolerance for change. These two rankings are integral in decision making about heritage places, as they provide guidance on the level of change each building can tolerate without adversely impacting upon its heritage values.

01.074 For example a building of 'exceptional' or 'high' heritage values would usually have a 'low' level of tolerance for change, whereas a building of 'low' or 'neutral' significance would usually have a moderate or substantial level of tolerance for change.

Individual Heritage Studies and Management Plans

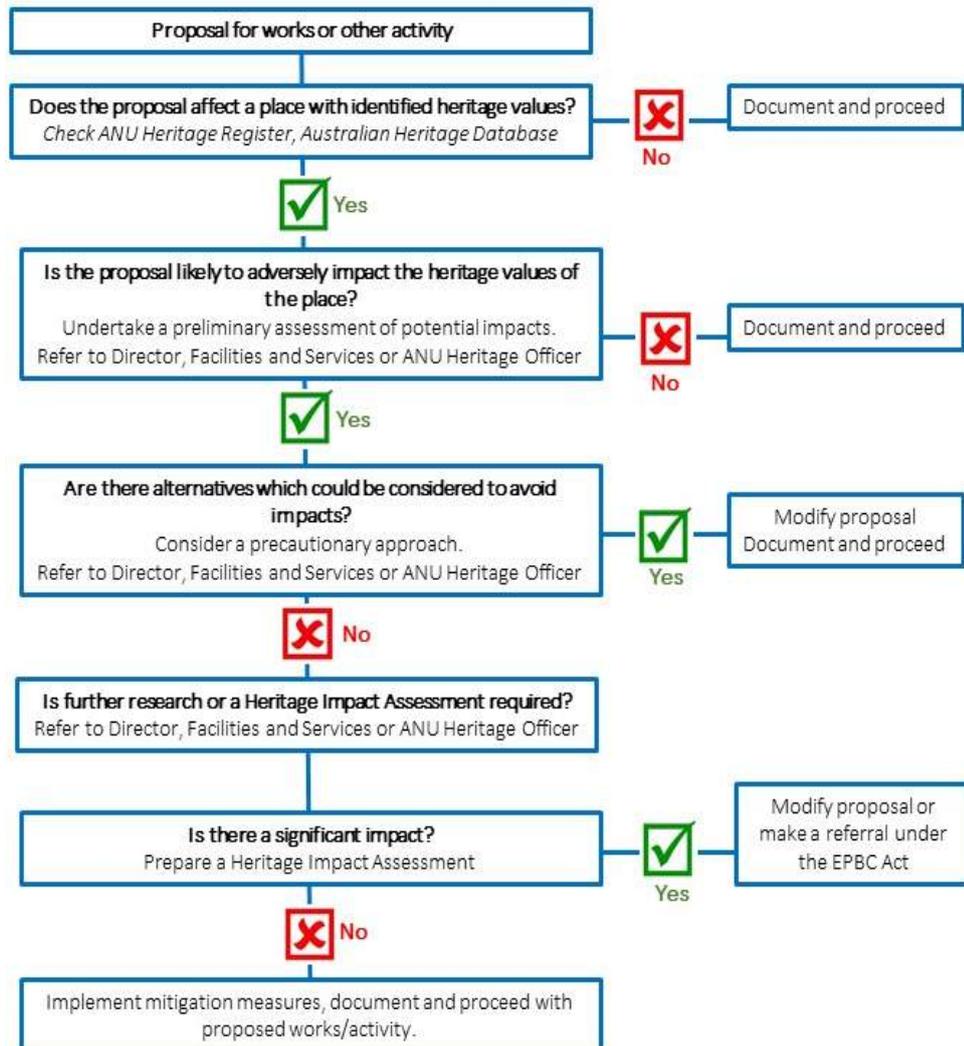
01.075 Several of the buildings and areas on campus also have individual heritage studies and management plans which include more detailed guidance on the conservation and management of their heritage values.

Procedures

01.076 When proposing to take an action on a building of significance the following procedure should be undertaken. However, it is essential to engage the advice of the ANU Heritage Officer in making these determinations.

01.077 Actions which may have an impact on heritage values may include demolition, refurbishment, changes to the setting of the building and replacement of original building fabric. Alternatives to any actions should be explored to ensure potential impacts can be mitigated, minimised or ideally eliminated.

01.078 If impacts cannot be appropriately mitigated, the action may be subject to 'Referral' to the Minister for the Environment under the EPBC Act. This is a formal process in which the Minister makes the determination on the likelihood of the action to impact upon heritage values, and the measures to be introduced to mitigate these impacts.



01.079

Contacts

- Director, Historic Heritage
- Department of the Environment
- Phone: (02) 6275 9123
- Email: jennifer.carter@environment.gov.au

Space Allocation and Accommodation

01.081 The ANU will where possible follow the Tertiary Education Facilities Management Association (TEFMA) [Space Planning Guidelines](#). The Space Planning Guidelines include spatial allocation and design guidelines for:

- Academic, Administrative and Research Staff;
- Specific disciplines and functions; and
- Ratios indicating efficient spatial allocation for broad areas and specific academic disciplines.

Space Data and Drawings Specifications

01.082 Consultants are to comply with the ANU's requirements and guidelines for the provision of space data and documents associated with the construction of new buildings and the reconfiguration and refurbishment of existing buildings and /or spaces within existing buildings.

01.083 The [Space Allocation Procedure](#) and [Space Allocation Guideline](#) applies to all designers commissioned by the ANU and has been developed to assist in the effective and efficient management and use of ANU resources and infrastructure.

01.01. The requirements and guidelines contained in this document have been developed in accordance with the:

- Tertiary Education Facilities Management Association (TEFMA) Space Planning Guidelines; and
- Group of 8 (Go8) Data Dictionary (Classification of Space).

01.084 At various project stages the Consultant will be expected to provide project documents for the Principal's Representative review. These documents will include drawings indicating:

- the general spatial and room arrangement for the purposes of reviewing compliance with the above-mentioned documents;
- confirmation the proposed built areas of the project are consistent with F&S expectations for the project; and
- the room naming and numbering applied to the project is consistent with University requirements for corporate systems and ongoing building operations and management.

Signage

General

01.085 ANU signage (internal and external) shall comply with the ANU Sign Manual (available from space@anu.edu.au) and the current ANU Parking and Traffic Statute (available from parking@anu.edu.au).

02 – Architectural Requirements

Version	Date	Authors	Summary of Changes
1.1	4 February 2009	Alec Gray	Section numbering altered.
1.2	5 February 2012	Solomon Elijah	Section and Numbering amended
1.3	4 March 2012	Solomon Elijah	Roofing, Roof Safety & Sealing amended.
1.4	10 October 2012	Barry Hughes	Added section 3.4 Cleaning
1.5	15 January 2013	Ben Crossling	Amended various sections and updated Project Lead references
1.6	31 January 2013	Solomon Elijah	Added Clause 3.3.2.10 & added a paragraph to Clause 3.4
2.0	05 February 2016	Neill Daly	General Revision
2.1	09 March 2017	Neill Daly	Ergonomic specifications & FFE amended
2.2	26 May 2017	Neill Daly	Automated External Defibrillators added

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Introduction

02.01 The Campus and Buildings Requirements Manual (the CBRM, the Requirements or the Manual) documents the minimum design and construction requirements for new, refurbishment or repurposed building works, landscapes and engineering/infrastructure projects on buildings, facilities and campuses of the Australian National University (the ANU or the University). The Requirements are prepared for the direction of a Consultant, Designer or Project Manager in the preparation of project specific documentation and in the delivery of project works.

02.02 Notwithstanding any Consultant's particular discipline or area of responsibility, each Consultant and/or designer shall consider the document in its entirety. The complete CBRM consists of the following Sections which may be referred to within this Section:

Campus and Building Requirements Manual	
Section 01	General Requirements
Section 02	Architectural Requirements
Section 03	Roads, Car Parking & Civil Works
Section 04	Soft Landscaping
Section 05	Roofing, Roof Fabric & Roof Safety
Section 06	Building Management Systems
Section 07	Electrical Services
Section 08	Fire Protection Systems
Section 09	Hydraulic Systems
Section 10	Mechanical Services
Section 11	Lifts, Cranes & Vertical Transportation Systems
Section 12	Security, CCTV & Access Control

Planning Principles

02.03 The Acton Campus Master Plan 2030 is built around a number of key themes. Rather than focus on specific projects, these themes set out interrelating areas, process and rules which will guide future development. The key themes are:

- Academic intent
- Functional elements
- Campus structure
- Built form
- Heritage
- Landscape
- Transport and movement
- Infrastructure
- A living campus

- Sustainability and the environment

02.04 Further information on the requirements and principles are laid out in the [Acton Campus Master Plan 2030](#) document.

Community

02.05 Provision of common areas for social interaction is an important component of social sustainability. In the context of an academic institution, it serves as an opportunity for cross pollination of ideas from related and disparate disciplines.

External Teaching Space

02.06 Teaching outside of conventional classrooms can be an effective method to alter students' learning patterns and perception of subject matter, irrespective of whether the environs are directly related to the subject matter being conveyed. Effective external teaching spaces require careful consideration of landscape topology, vegetation, egress patterns, noise sources and sound barriers (both architectural and vegetative) in the locality. The use of natural ventilation, and therefore the likelihood of noise from the external teaching space coupling back into the building must also be considered. Consequently it will not always be possible to include this initiative in all works.

Recreation Areas

02.07 Building social capital is important for organisation cohesion and optimal interaction between individuals. Consequently areas in which this occurs are an important component of the utility of a building to an organisation. Areas such as tea rooms, common rooms, barbeque areas and external seating areas are critical to enabling staff to relax, host functions and build relationships with personnel that are not directly related to their daily duties. If considered late in the design process the recreational areas are typically poorly utilised due to inappropriate placement (e.g. BBQ facility on the south side of the building). The placement of these areas should be considered early in the design process to optimally integrate with building usage patterns.

Transport

02.08 Whilst transport infrastructure is typically delivered as a campus-wide service there are several features that can be integrated into individual buildings that assist in the adoption of alternative transport options.

Provision for Electric Vehicles

02.09 In order to facilitate the uptake of electric vehicles it is important to incorporate the requirements in current planning. This has two distinct components. Provision of suitable electrical infrastructure to car parks to enable future creation of charge points; and provision of car parking spaces with charge points.

02.010 New capital works projects, regardless if civil and parking works are included, are to include provision within the switchboard for future installation of charge points.

02.011 As required within certain projects, an electric vehicle charge point may be required to be supplied, installed and commissioned as part of that project.

Cyclist Facilities

02.012 Secure bicycle storage is to be provided within the building footprint at the rate of:

- 10% of the peak number of students using the building at any one time (75% occupancy); and
- 10% of the building staff.

02.013 In addition to the bike storage facilities, suitable change rooms, showers and lockers must be provided as follows:

- Lockers must be provided at the rate of 10% of the building staff and be of adequate size to hang work clothing; and
- Showers and associated changing space must be provided at the rate of 2% of the building staff, with the minimum of 1 unisex shower per stand-alone building. This shower must not be used for compliance as a disabled access shower and must also be accessible for use by students.

Telecommuting and Videoconferencing

02.014 To reduce staff and student travel suitable tele/videoconferencing facilities must be provided.

02.015 IT infrastructure must be capable of supporting multiple staff members using a single user videoconferencing tool such as Skype, with provision of at least one meeting room per 500m² of building area capable of enabling a group of minimum 8 users to engage in video conferencing.

Daylight

02.016 Natural daylight has been demonstrated through numerous studies to provide substantial productivity and wellbeing benefits to building occupants. To ensure the comfort and wellbeing of staff and students in ANU buildings a minimum of 70% of the floor area of all offices, laboratories, teaching spaces (non-lecture theatre) and informal gathering spaces (e.g. tea rooms) must achieve a Daylight Factor >2.0%, achieved at desk-height level (720 mm AFFL (above finished floor level)).

02.017 Spaces which have a specific use that preclude the provision of daylight (e.g. Laboratories that utilise Class 3a, 3b or 4 lasers) need not comply with this initiative.

Shading

02.018 To avoid discomfort from direct glare and unwanted heat gain building facades must be designed such that for 80% of the working day (8:00 a.m. to 6:00 p.m.) there is no direct sun entry.

External Views

02.019 External views have demonstrated to play a significant role in occupant wellbeing by reducing eye strain and also providing psychological benefits. To meet this requirement:

02.020 Greater than 60% of work spaces* must have a compliant external view. Compliant external views are defined as:

- A direct line of sight to a buildings external line of glazing less than or equal to 8.0 m to the outdoors, or into an adequately sized and day-lit atrium.
- Line of sight must be greater than a 45 degree angle of incidence on vision glazing.
- No object greater than 1.5 m in height that will obscure the view.
- For an atrium to be considered as providing an external view the atrium must be naturally lit, and every dimension of the atrium must exceed 8.0 m.

* Work spaces are defined as spaces where staff or students typically spend 4 hours or more on any one day. Some work spaces in which the work to be performed precludes external views (e.g. Laboratory which utilises Class 3a, 3b or 4 Lasers).

Materials

Generally

Warranty

02.021 All building fabric, building elements and structural works are to have the minimum workmanship warranty as required by current legislation unless higher standards are specified within the various sections of the Manual.

Specific Design Requirements

Local Sourcing

02.022 To support local industries and to also minimise carbon emissions from transport all projects are to source materials from local sources where available and fit for purpose. Imported goods are only allowed if they provide a functional benefit to the building that cannot be sourced locally.

02.023 The maximum distances materials can be sourced from are provided in the table below.

Material Type	Example	Maximum Distance
Heavy weight and high density	Cement, sand, aggregate, steel, masonry, stone, tiles	500 km
Medium weight and medium density	Glass, timber, aluminium, carpet, plasterboard, furniture, electronic goods	1000 km
Light weight and low-density	Plastics, insulation, ceiling tiles, fabrics	2000 km

Approximate distances in km (by surface transport) to major Australian cities are as follows – Wollongong 250, Sydney 290, Albury/Wodonga 340, Newcastle 440, Melbourne 660, Brisbane 1200, Adelaide 1200, Hobart 1400, Perth 3700, Darwin 4000.

Selection of materials

02.024 Finishes are to be selected to minimise future maintenance. Paint finish to external walls will not be accepted unless approved by the Principal's Representative (the Principal or the Principal's Project Manager).

02.025 All materials shall be selected for their likely availability and colour consistency over a 20 year period.

Colours

02.026 In certain areas it may be useful to introduce primary colours to highlight features of the buildings. Approval for colour schemes is required from the Principal's Representative.

Campus and Building Waste

02.027 The ANU has an Environmental Management Plan (EMP) endorsed by the Vice Chancellor. The EMP outlines requirements for all ANU staff and students to reduce waste to landfill, financial costs and reduce our carbon footprint in accordance with best environmental practice. Inclusive are designs which ensure good sanitary control and elimination of offensive odours and vectors. The University recognises good waste and recycling facilities for its buildings as essential for maximising opportunities to reduce, reuse and recycle resources on campus. Effective waste and recycling practices and design will reduce life cycle costing to new and existing buildings, reduce unsightly bins in car parks and building entrance ways and reduce the likelihood of bad odours and vermin.

02.028 All ANU projects are required to consider recycling and waste collection and removal. Waste collection and removal is required to meet the requirements of the Cleaning, Waste and Recycling unit within Facilities and Services. General principles for building waste are to be applied to any design and project activity. The ANU expects building occupant and user awareness of several elements in the campus and building waste cycle. With the building occupants and users are to:

- self-sort; paper, cardboard, co-mingled and general waste; and
- access centralised stations located within the building; located in kitchens, common areas and/or resources areas. Individual staff bins are not required.

02.029 Projects are to comply with the conditions (where appropriate) of the [ACT Development Control Code for Best Practice Waste Management](#) through the production of a *Waste and Recycling Management Plan*.

02.030 A whole of (new) building is required to have the centralised station provision for paper, cardboard, co-mingled and general waste of which an approach might be a single location per floor, or approximate workgroup and the like. The provision of paper recycling should only be co-located with printers and office resources.

02.031 As provided for in specific project briefs where a project is of an adequate scale a dedicated Public Waste and Recycling Station is to be provided. Separate to occupiable areas attached or freestanding from the building collection of recyclable waste is to be provided and:

- are separate from, but adjacent to, a General Waste Facility;
- provide a clearly marked, sign-posted, convenient, level and guaranteed access route; and
- are sufficiently sized to accommodate the storage equipment for the following recyclables (where produced), as a minimum:
 - o Cardboard;
 - o Paper;
 - o Comingled;
 - o Polystyrene;
 - o Metals;
 - o Pallets;
 - o Used cooking oil; and
 - o Organic (compost) materials.

02.032 Adjacency of a Public Waste and Recycling Station to a General Waste Facility will assist in addressing the waste management principles and contribute to enhanced campus waste management. A General Waste Facility is to be a size which allows for all waste and recycling bins required for building occupancy. The structure should include a roller door or open side for waste removalist access and side door for people access. Restricted access doors will reduce illegal dumping and vandalism. A General Waste Facility will meet the following basic parameters:

- The room/s for storing waste and recycling must be located in a position that is safe and convenient for both users and waste collection staff.
- Collection vehicles must be able to service the development efficiently and effectively, with limited need to reverse.
- If height clearance proposed is less than 3.8 m, confirm the waste provider can adequately and safely access the station.
- A suitable refuse collection point must be nominated where waste loading operations can occur on a level surface away from pedestrian and cycle ways, gradients and vehicle ramps.
- The path for wheeling bins between a central waste storage point and the collection vehicle must be level and free of steps or kerbs. The maximum travel distance between the storage point and the collection point for bins is:
 - o 10 m – for bins including 240 L, 660 L and 1000 L mobile garbage bins.
 - o 3 m – for both 1500 L and 2000 L bulk/skip bins.
- Where collection vehicles are required to drive into a building to collect waste or recycling, adequate vehicle clearance is required. Access to a collection point within a building must enable all collection vehicles to both enter and exit the premises in a forward direction.
- Signage: ‘No parking – fines apply’ to be placed on the waste removalist access area either on door or to the side of access area. Appropriately painted roadway at front to prohibit parking and allow waste removalist access 24 hours. Inside facility appropriate signage above each bin for maximum recycling and waste management.
- Wall Protection: Where bulk/skip bins on wheels are to be housed bunding on the floor and/or protection strips at the height that bins may damage walls are required.

- Aesthetics: Placed at any point on the site which allows appropriate vehicular and user access, and for maintenance and servicing. Enclosure design to consider immediate site and context. There is no requirement for the structure to be visually pronounced.
- Drainage: A centre drain to sewer is required.
- Water and Lighting: Hose tap to be included to allow for cleaning of structure and appropriate lighting at entrance points as this structure will be accessed 24 hours.

Hazardous Materials

02.033 Consultants are to refer to the Hazardous Materials register for each building, site or precinct for use as a guide only to determine the likely presence of hazardous materials. For projects taking place within existing building stock, or a brownfield site, a comprehensive hazardous materials survey must be carried out on the project site, as defined by the relevant Environmental and Work Health and Safety (WHS) legislation; and whenever asbestos, lead or PCBs are found, they are removed in accordance with the following standards:

Asbestos	WHS legislation and relevant environmental legislation
Lead	<i>AS 4361 Guide to Lead Paint Management</i>
PCBs	ANZECC Polychlorinated Biphenyls Management Plan

Volatile Organic Compounds

02.034 Consultants preparing specifications are required to restrict paint, sealant and adhesive products to those that comply with the limits specified in this section. They are also required have product specific data sheet or MSDS which states the Total VOC (TVOC) content and test method used to determine the stated TVOC value.

Paints

02.035 Specified paint finishes are to be suitable for the intended material and location as referenced in *AS 2311 Guide to the painting of buildings*. The application of paint finishes are to be in accordance with AS 2311 and manufacturers specifications.

02.036 Any paint applied on-site, must meet the TVOC content limits outlined in Table 1.

02.037 TVOC values should reflect the final product as mixed and ready to use, inclusive of tints. Numerous paint suppliers do not comply with manufacturer recommendations on tints and consequently tints applied must be clearly documented.

Product Type/Sub Category	Maximum TVOC content
Walls and ceilings - interior gloss	75
Walls and ceilings - interior semi-gloss	16
Walls and ceilings - interior low sheen	16
Walls and ceilings - interior flat washable	16
Ceilings - interior flat	14
Trim - gloss, semi-gloss, satin, varnishes and wood stains	75
Timber and binding primers	30
Latex primer for galvanized iron and zincalume	60

Interior latex undercoat	65
Interior sealer	65
One and two pack performance coatings for floors	140
Walls and ceilings – exterior gloss	75
Walls and ceilings – exterior semi-gloss	70
Walls and ceilings – exterior low sheen	50
Any solvent-based coatings whose purpose is not covered in table	200

Table 1: TVOC limits allowed for paint products

Adhesives and Sealants

Any adhesive and sealant product(s) used in an internal application, and applied on-site, must meet the TVOC Content Limits outlined in Table 2. This includes both exposed and concealed applications.

Product Type	Maximum TVOC content
Indoor carpet adhesive	50
Carpet pad adhesive	50
Wood flooring and Laminate adhesive	100
Rubber flooring adhesive	60
Sub-floor adhesive	50
Ceramic tile adhesive	65
Cove base adhesive	50
Dry Wall and Panel adhesive	50
Multipurpose construction adhesive	70
Structural glazing adhesive	100
Architectural sealants	250

Table 2: TVOC limits allowed for adhesive and sealant products

02.038 Formaldehyde Minimisation

02.039 Formaldehyde is a common VOC found in most engineered wood products (e.g. Medium Density Fibreboard (MDF) and chipboard). To reduce the off-gassing of formaldehyde within buildings all engineered wood products must be low formaldehyde class E0 or better. This is required for all joinery, storage, doors and any other product that contains engineered wood products.

02.040 PVC Avoidance

02.041 The use of PVC is to be avoided wherever possible. Specifications must state this as a general principle, and specifically wherever possible. Common building and infrastructure services which utilise products that contain PVC and their alternatives are:

Service	Use	Alternative
Electrical	Cable insulation	Low Smoke Zero Halogen (LSZH) products.
	Conduit	HDPE, metal
Hydraulic	Pipes and connectors	HDPE, copper, XLPE
Mechanical	HVAC accessories (e.g. AC drip trays)	HDPE, metal
Interiors	Carpet, Furniture components	Sustainability furniture standards avoid usage.

Where PVC is to be used, PVC should be selected that complies with the 'Best Practice Guidelines for Lifecycle of PVC Building Products'.

Cladding**External wall materials**

02.042 External walls shall be of materials selected to suit the location of the building and to conform with:

- the existing structure; and
- surrounding buildings; or
- the creation of a specific design feature.

Concrete

02.043 Consideration should be given to external walls and the likelihood of pattern staining.

02.044 Water and weather marks down the wall face should be minimised.

Render

02.045 In-situ or pre-cast concrete panels, bricks or masonry are not to be rendered unless works of a minor nature are required to match existing and the like.

Timber

02.046 When using timber sheet, manufactured or board product, the design, including fixings and details are to comply with the manufacturer's specifications.

02.047 All board products will be appropriately sealed on all six faces/edges.

Metal cladding

02.048 Where metal cladding is specified, future maintenance issues, such as access to the external wall cavity, are to be considered.

02.049 Systems applied directionally, that require 'peeling' the building from one end to the other, are to be avoided.

Concrete

General

02.050 Types, locations colours and finishes of exposed concrete shall be confirmed with the Principal's Representative.

02.051 Applied or painted finishes to pre-cast and tilt-up panels will not be accepted, panels may be colour treated during fabrication.

02.052 The Green Building Council of Australia has considered the use and various substitutes available for concrete in buildings. Designers are to review the Green Building Council of Australia [documentation](#) for guidance on the provision of the most efficient way to reduce greenhouse gas emissions.

02.053 Where clay brick is used, to reduce the embodied energy of the brick, a minimum of 50% of the bricks used in the project must be:

- Post-consumer recycled;
- Extruded with at least a 30% reduction in mass; or
- Produced in a manufacturing process that reduces carbon intensity (e.g. kilns co-fired with landfill gas)

Specific Design Parameters

Floor slab design

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

Floor slab provisions

02.055 Make provision for vertical duct penetrations for infrastructure. Appropriate fire isolation must be provided between building levels.

Floor loads

02.056 Floor loads for special areas, e.g. library stacks, shall be determined following appropriate consultation. Provision shall be made for the installation of compact shelving units in areas specifically nominated by the brief.

02.057 Safe live load plates are to be provided on each floor as a part of each newly created floor, whether it be for a new building or a building extension. Plates are required in a conspicuous location indicating the maximum live load for which the floor on that storey has been designed.

Steel

General

02.058 All structural steel used is to be produced by a responsible steel maker, which is defined as a company which complies with both of the following initiatives:

- The steel making facilities where the steel for the project is being sourced have a currently valid ISO 14001 Environmental Management System (EMS) in place. Valid ISO 14001 Environmental Management System (EMS) certificates must be provided from the steel making facilities where the structural and/or reinforcing steels in the project were produced; and
- The steel maker supplying the steel is a member of the World Steel Association's (WSA) Climate Action Programme (CAP). A current CAP certificate from the WSA, confirming that the steel maker is a member of the CAP, must be provided. Certificates are valid for a period of two years and must be current at the time that the project purchases the steel

Specific Design Parameters

Galvanising

02.059 All exterior exposed ferrous material structural elements are to be hot-dipped galvanised after fabrication. Applied cold-galvanised paint systems are not acceptable, unless approved by the Principal's Representative.

Primer

02.060 Steel shall have at least one shop applied primer coat.

Masonry

General

02.061 Approval of concrete masonry units and brick exposed to view will be on the basis of compatibility in colour and texture with existing exterior building materials on campus.

02.062 The Consultant shall provide samples in order to obtain approval.

Specific Design Parameters

Internal walls

02.063 Internal load-bearing block or brick walls will be not be accepted, unless specifically required and approved by the Principal's Representative. Lift shafts, service shafts, fire rated elements and the like are excluded from this general ruling.

Block masonry

02.064 Block masonry produced for an individual project shall be from the same production run.

Wall design

02.065 Careful consideration will be given by the Consultant to design of walls, with regard to cavity wall construction, flashing details, control joints, mortar joint details and wall materials.

Coatings and finishes

02.066 Because of their inherent maintenance and renewal problems, the use of protective waterproofing agents, applied coatings and painted finishes will not be accepted. If accepted, the final paint coatings shall be verified with the use of admixtures in the mortar joints.

Light steel framing

General

02.067 A single proprietary system is to be used. Double timber studs are to be detailed around all doorways and openings.

Timber framing and timber products

Specific Design Parameters

02.068 Timber material must be fit for purpose and design, with consideration given to long term maintenance and intended final finishes.

Product sourcing

02.069 All timber products are to be either post-consumer recycled timber or Forest Stewardship Council/Australian Forestry Standard (FSC/AFS) certified. Timber can only qualify as post-consumer recycled timber if it has previously been used as part of a product or structure which has since been disassembled.

Composite wood products, laminates and veneers

Cut edges

02.070 Any cut edges are to be sealed with an appropriate clear/coloured water based sealant prior to fabrication.

Acoustic and thermal insulation

General

02.071 The thermal performance of a building envelope has a significant and ongoing impact on energy use and user comfort. Investment in improving the building envelope beyond minimum compliance will provide long term benefits.

02.072 Acoustics: Particular attention shall be paid to acoustics and noise transmission.

02.073 Partitions shall be filled with acoustic batts and/or double sheeted on one or both sides as necessary to achieve the necessary sound transmission loss between spaces.

02.074 Mastic sealants to be applied to all surface junctions to maintain the sound transmission rating.

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

02.076 To ensure adequate sound insulation, partitions shall extend from floor slab to underside of slab above if possible or acoustic ceiling insulation shall be detailed.

02.077 The majority of energy leaving a building envelope is via conditioned air leaking through the building fabric. Sealing the building consequently provides a significant increase in performance and therefore must be a high priority for design. Vapour should still be allowed to diffuse in and out of the structure to minimise condensation risks.

02.078 To ensure that appropriate building sealing is undertaken all major projects are required to undergo pressure testing during the building commissioning phase.

Insulation Ozone Depleting Potential (ODP)

02.079 All insulation must be zero ODP in manufacture and composition.

Thermal requirements

All buildings and campuses within the ACT are to be classed according to the National Construction Code (NCC), Climate Zone 7. The ANU requires on its Acton campus the building fabric thermal performance exceeds Climate Zone 7 for new and major building projects. Requirements for minor refurbishment projects are to be assessed individually.

Building Envelope Surface	Minimum Total R value
Floor (slab on ground)	2.0
Floor (elevated, open)	3.5
Roof and Ceiling	4.8
Wall (external)	3.8

Acoustic requirements

02.080 Acoustic requirements will be the subject of project specific briefs. As a minimum the requirements of the NCC for building fabric and infrastructure shall be met.

Weighted sound reduction index

02.081 The applicable weighted sound reduction index (RW) shall be selected to enable the proper functions of the occupancy of the rooms.

Limit noise transference

02.082 The provision of airlocks to limit noise transference should be considered.

02.083 Alternatively, solid core doors and acoustic rated frames and fittings, or where required, acoustic rated grilles, are to be considered.

Sound lagging

02.084 Internal waste water pipes are to be provided with sound lag material.

Acoustic requirements for non-plant equipment

02.085 Where non-plant equipment is to be designed and specified within a project, consideration should be given to the noise generated by this equipment. Potential ambient and structural borne noise issues, and specific WHS requirements, may determine that acoustic attenuation is required on equipment.

02.086 Plant equipment is that which is required to run systems and services for the building's overall operation. Non-plant equipment is that which is specific (or a fixed or mobile tool) to aid an activity, function or research which takes place in a room/area. On provision of this information to the Principal's Representative, direction will be provided.

02.087 Where required, post construction, some statutory workplace testing may be sought to ensure acoustic compliance of this equipment.

Internal walls, partitions and finishes

General

02.088 The design of walls/partitions must include consideration of the following:

- Acoustic attenuation;
- Light weight design to facilitate demounting; and
- Partitions/walls adjacent to main corridors shall have a lining treatment on the corridor side that can resist abrasion.

Flexibility

02.089 Buildings shall be designed to be as flexible as possible. Internal load bearing walls shall be minimised and restricted to areas such as the building core for stairwells, lift shaft and toilets. All other internal walls and partitions shall be non-load bearing and fully demountable within the limits of economical design.

Materials

02.090 Partitions and internal walls may be of plasterboard on light steel or timber framing, painted or unpainted concrete masonry, or equivalent, as required by the application.

Skirtings

02.091 Black vinyl skirtings of a minimum 100 mm height shall be provided to all internal partitions irrespective of type except where:

- metal skirting duct is used;
- walls are tiled; or
- other floor finishes are turned up walls.

Steps, stairs and ramps

General

02.092 Contrasting coloured stair nosings are required to aid all stair users both ascending and descending. Illuminated contrasting strips are required in all new external stairs and must be result in a flush fitting.

02.093 Open risers are not acceptable.

02.094 Single steps are not acceptable. The size of treads and risers must be consistent in any flight and in any area.

Goings and riser sizes

02.095 The NCC sets out goings and riser size ranges, *AS 1428 Design for access and mobility* further restricts this range.

02.096 Steps with ramped treads between risers are not acceptable.

Safe access to and from steps and stairs

02.097 Users entering and/or leaving steps and stairs directly from or into adjacent circulation spaces can lead to collision problems. Adequate passing space is to be provided.

Requirement to ensure safety under stairs

02.098 Stairs that are not filled underneath are a collision hazard for all users, particularly cane users. Cane users following a wall edge get confused if their cane goes underneath a stair. Open under-crofts also cause cleaning and maintenance problems.

02.099 They should generally be avoided but if that is not possible, mitigation strategies are to be considered.

Protrusion of handrails and steps into circulation area

02.0100 The top and bottom treads of stairs, or handrails, must not protrude into circulation spaces. The first risers should be well set back from the clear circulation space.

External stairs, stairwells and ramps.

02.0101 For all external handrails, fully welded stainless steel handrails are preferred. Other materials may be accepted with approval from the Principal's Representative.

02.0102 Landscape steps are to be a minimum of 300 x 150 mm (tread x riser) and are to comply with the NCC.

Ramps

02.0103 Definitions to be applied to both internal and external walkways, ramps and other slopes.

Type	Gradient	Maximum length
Kerb ramp	Gradient maximum 1:8	maximum length 1520 mm
Ramp	Gradient 1:14 → 1:19	maximum length 9.0 m
(landings may be provided at these intervals)		
Walkway	Gradient 1:20 → 1:33	maximum length 15.0 m >1:32 maximum length 25.0 m = 1:33

(landings may be provided at these intervals)

Other	Gradient less than 1:33	No maximum length
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Handrails

02.0104 For vertical level changes greater than 600 mm, but less than 1000 mm, seek direction from the Principal's Representative to determine the requirements for a fully compliant handrail/balustrade. In fire egress stairwells, hot-dip galvanised handrails will be installed, proprietary systems may be specified.

- Handrail to wall clearance of greater than 50 mm is required to avoid jamming hands or fingers.
- Handrails must be continuous if a landing is less than 4.0 m long or the landing is not straight.
- Handrails must not encroach into a circulation space.
- Handrails are to have a minimum 100 mm turndown at both ends.
- Handrails are to be continuous with no vertical sections.

Tactile ground surface indicators (TGSIs)

02.0105 Drawings are to clearly indicate the location and contrast colour for all TSGIs.

Doors, hatches and door hardware

Generally

Door openings

02.0106 A minimum clear opening of 900W x 2100H mm is required. In the case of double swing doors one leaf must meet the requirements. In the case of auto doors the total opening must meet the requirements. In rooms accessed by loose equipment, trolleys and other items, offset type hinges are required to increase the size of the opening, these doors are also to be fitted with a skirting plate to protect the door face.

Door construction

02.0107 These doors must generally be of solid core construction, and of minimum thickness of 38 mm, unless requested otherwise.

Door closers

02.0108 Surface mounted door closers are required.

Door maintenance requirements

02.0109 Recessed sliding doors require access panels for future maintenance where the door cannot be accessed through other means.

02.0110 Mechanical door systems shall have sufficient room for future maintenance and for replacing worn out parts.

Aluminium doors in shopfront systems

02.0111 These must be wide-stile type to suit standard backset door hardware; narrow-stile doors will not be accepted; the bottom rail is to be specified as a deep section.

02.0112 Exterior doors and jambs

- Exterior doors
 - o aluminium and glass; or
 - o marine-grade ply
- Jambs
 - o galvanised steel
 - o aluminium

Exterior door access operator switches

02.0113 Must be weatherproof.

Door finishes

02.0114 **Interior:** Wood doors shall be finished in polyurethane non-water based product, tops and bottoms must be sealed.

02.0115 **Exterior:** Paint is to be oil based.

Visual definition to main building access

02.0116 Give definition to main access doors by using contrasting glass or doorframes, approved glass markings or by differentiating the ground plane.

Access toilet doors

02.0117 All access toilet doors are to have electronic opening and closing activated by control panels as detailed below. Generally, as per *Dorma Privacy Door System*. All text style, sizing, braille and signage to be to applicable standards and codes. Locate panels in appropriate locations. Indicator lamps to be 25 mm.

02.0118 Override unlock key switch (to be located in the lower left of the External Panel) is to match automatic door keying, refer to [Section.12 Security, CCTV & Access Control](#).

02.0119 Plates to use polycarbonate membrane that is vandal resistant, UV stabilised and antigraffiti coated. External panel dimensions to be approximately 230W x 210H mm and internal panel approximately 230W x 265H mm.

02.0120 Function to be:

- When vacant (door closed, *Vacant* lamps on) external *Push to Open* button will open the door.

- Once inside internal *Push To Lock* button will close the door, lock it, disable the external *Push To Open* button and illuminate the *Occupied* lamp.
- To exit internal *Push To Open* button is pressed, door unlocked and opened.

02.0121 After a suitable time door to close automatically, *Occupied* lamp to turn off and *Vacant* lamps on.

02.0122 Access toilet signage to be provided adjacent door, must include braille and indicate door opening relative to signage (LH or RH). Electronic door lock to be Mortice as per electronic locks section of this document.

02.0123 Duress Alarm and button panel to also be provided within Access Toilet, refer to [Section.12 Security, CCTV & Access Control](#).

Specific Design Parameters

Door swing

02.0124 Doors protruding into spaces and not opening flat to a wall are collision hazards, particularly when approached end on. If at all possible, doors should be designed to open against a wall or fixed furniture.

02.0125 Doors that are designed to be latched open must open flat against a wall.

Clear space at sides

02.0126 Wheelchair users, and many other users, have difficulty negotiating doorways unless clear space is provided around the door.

02.0127 Ensure the opening clear-space provisions are met. Check the doorway assuming user is approaching in every possible direction, design for the most clearance in all cases.

Encroachments into doorway clear space

02.0128 Encroachments into clear space are often overlooked or in-filled with items such as fire hose reels cupboards.

02.0129 Ensure any fixture such as fire services, columns or plumbing fittings do not reduce the full clear space. Ensure the design allows for the placement of loose items such as bins, so they are not placed in the clear area.

Doorframes and frameless doors

02.0130 All frameless doors must have the edges identified so that they can be visually located.

Double swing doors

02.0131 Double swing doors are not acceptable unless they are held open (such as a fire door) or one of the two doors is normally latched open. In the latter case, the opening leaf of a double door should comply with all other door requirements including minimum width.

Airlocks

02.0132 Airlocks are to be as large as is practicable. If the door is of solid construction, viewing panels are required.

Fire-rated doors

02.0133 Generally sliding smoke doors and mechanisms will not be acceptable due to maintenance requirements and cost.

02.0134 The following are required in addition to components required for regulatory compliance:

- hinges – minimum of 3;
- smoke seals – double doors require a seal system;
- door closers – to take into account extra weight of door; and
- magnetic door holders – including a door press to release switch.

Sound retardant doors

02.0135 The requirements for sound retardant doors will be as detailed by the specific project brief.

Veneers

02.0136 Face veneers shall be select premium-grade.

02.0137 It is preferred that faces be 'matched' for grain direction and colour uniformity. When used in an external location, marine-grade veneers are to be specified.

Finish

02.0138 Transparent finished wood doors shall have tops and bottoms sealed with enamel sealer appropriate for exterior application immediately after trimming. It is preferred that clear or stained doors will be finished at the factory.

02.0139 Wood doors scheduled for paint finish shall be paint-grade.

02.0140 Door hinges are not to be painted.

Door stops

02.0141 Provide a skirting-mounted cushion door stop or if inappropriate, an aluminium/rubber door stop to each door not fitted with a door closer and wherever else the door may strike a wall (alternatively refer to coat hooks below).

02.0142 Do not install door stops at less than 50% of door.

Threshold plates

02.0143 Only proprietary threshold plates and seals are permitted and these must have a rise of no more than 5 mm and be specifically designed as accessible plates.

Coat hooks

- 02.0144 One coat hook is to be provided to every door to individual offices, at nominally 1800 mm (AFFL).
- 02.0145 Combined hat and coat hook with integral rubber door stop.
- 02.0146 Material: zinc alloy cast
- 02.0147 Finish: satin chrome

Hinges

- 02.0148 All external doors are to be fitted with a minimum of three stainless steel fixed pin hinges.

Viewing holes

- 02.0149 View holes are not acceptable.

View panels

- 02.0150 Where a solid door occurs in the following locations, these doors are to be fitted with a view panel (normal or fire rated door):
- in a major thoroughfare (fire doors included);
 - corridor and corridor junctions;
 - meeting and seminar rooms; and
 - all wet laboratories (including research facilities).

Revolving doors and turnstiles

- 02.0151 Revolving doors and turnstiles are not acceptable.

Power actuated swing or sliding door finishes

- 02.0152 Casing colour to be powder-coated aluminium, APO grey or black.

Fire door controls

- 02.0153 The unit should be suitable for installation on fire doors.
- 02.0154 Specific requirements for auto door operation are detailed in [Section.12 Security, CCTV & Access Control](#).

Security

- 02.0155 Compatible with relevant campus electric locking systems as advised by IPC.
- 02.0156 Internally a four-position mode switch to select the following functions,
- 02.0157 Auto/Exit/Open/Lock. Keyed mode and emergency exit switches are to be provided.

Automatic door exit controls

02.0158 Afterhours exit buttons are to be clearly placed at consistent accessible heights and locations. The button is to be mounted far enough away so wheel chair users can access without having to worry that the door will impede their travel. The button must be of a colour that contrasts with the background.

Door hardware and furniture

02.0159 In refurbishment projects, styles of hardware shall be consistent with existing fittings within a building. Hardware should be selected from the 'standard' range offered by suppliers as nominated in the Requirements and replacement components should be available off the shelf.

Handle type

02.0160 Lever handles are required in all situations.

Handle positioning

02.0161 Lever handles must not be closer than 40 mm to the door stop or jamb or any jamb moulding.

Positioning of Locks and Hardware on Doors

02.0162 Fitting of electromagnetic locks to the head region of a door assembly shall only be allowed if central height fitting cannot be achieved.

Cupboards or Cabinets with expensive or attractive equipment

02.0163 Shall be constructed of a metal framework with covering panels that will not allow unauthorised entry. The metal framework is to be rigid in construction and be securely bolted to the floor of the room. All concealed hinges to equipment cupboard doors shall be bolted through the panel with smooth heads on the outer side and lock nuts on the inside. The second leaf of the hinge shall be welded or bolted to the metal framework of the cupboard.

Doors with electric locking devices

Closers

02.0164 All doors fitted with electric locking/latching devices must have door closers installed to provide an aid in the lock down process.

02.0165 Doors with closers shall comply with AS 1428. The maximum opening force is to be 20 N.

Lock and Keying requirements

02.0166 A master keying system shall be specified to permit the opening of the main entrance doors by all individual room door keys, unless otherwise advised.

02.0167 The ANU has standardised its keying system and hierarchy. Consultants shall ensure that the keying system specified complements other systems in use and shall be referred to the Principal's Representative prior to supply.

02.0168 An ANU authorised Locksmith is required to prepare the keys and locking systems of the Project.

02.0169 Magnetic key card locks may be used in cases of limited multiple access.

02.0170 The system shall be designed to allow a grand master key to open all doors in the building, except the plant rooms, the lift motor room and the fire services cupboard. Locks on service doors shall be as follows:

Cleaners Room	Keyed to grand master key only and dedicated "cleaners key". This removes the external doors and any restricted internal areas from the access by the cleaner.
Plant Rooms and Service Ducts	Lockset shall be cylinder mortise type selected from Lockwood 3570 series to suit the existing keying system operated by ANU Facilities and Services.
Fire Safety Equipment	As required by the Emergencies Act 2004 (ACT), ACT Fire and Rescue or ordinance.
External Access Doors	Shall be provided with electronic access control. A minimum of one external door must be provided with a key override and shall be keyed to the External Doors keying system for the location and building. All external doors are to be provided with secondary locking devices keyed to the External Door keying system for the location and building
Automatic Doors	Control key switches shall be keyed to the Automatic Doors keying system for the location and building.
Equipment cupboards and cabinets	Cupboards and cabinets that are to contain expensive or attractive equipment are to be fitted with locks to doors and panels. These shall be of the security deadlock variety, similar to a Lockwood 303 Single Cylinder Deadlock, keyed to the relevant University system.
Services cupboards, hatches, panels	Service cupboards, hatches and panels for general, electrical, hydraulic and mechanical services including distribution switchboards are to be keyed to the Maintenance keying system for that location. Cupboards containing fire indicator panels are not to be fitted with locks.
Fire Services	Fire indicator panel, sprinkler valve box and booster enclosures are to be keyed to nnn key.
Maintenance Areas	The following areas shall be keyed to the Maintenance keying system for the location.

		<ul style="list-style-type: none"> - Roofs - Plant rooms - Utilities enclosures - Valves/Hydraulics Cages - Lift Maintenance and Motor Rooms - High voltage equipment and assets
Security Cupboards / Rooms	System	The Gallagher Security Controller cabinets predominantly are supplied with a key barrel. Locks can be installed to suit master key provided to ANU Security
Communication rooms		Communications rooms are managed by ANU Information Technology Services (ITS) and are keyed to a specific system

Windows and Glazing

General

02.0171 Windows are to be designed in accordance with all relevant codes. The use of double-glazing or low-E glass coupled with thermally broken metal frames should be considered in all projects.

02.0172 Particular attention should be given to construction, location and sizing of windows to minimise heat energy transfer to and from the building in conjunction with efficient use of day lighting.

02.0173 Timber windows are not acceptable unless to match existing, for example in a project with heritage overlays and implications. Aluminium window construction shall be specified. All workable and movable parts shall be compatible non-ferrous metal. Specify standard powder-coat or anodise colours.

Windows

02.0174 All exterior windows shall be non-operable. All interior window sills shall be sloped, and all windows shall be sealed to ensure ease of cleaning and decontamination. Window systems shall use energy efficient glass. Consistent visual appearance on the exterior of the building shall be maintained by the type of window treatment selected. Appearance, function, heat gain, and loss air filtration, safety, structural requirements, suitability for the environment, operation and maintenance experience shall be considered.

02.0175 Window treatments shall meet all functional and aesthetic needs and standards. Light tight treatments shall be provided in all spaces that require room darkening based on program needs, such as conference rooms and laboratories that may need to be darkened. If windows are provided in nonhuman primate areas, the room shall be capable of becoming light tight, accomplished through the use of adjustable shutters, blackout shades, or blackout panels. Integral devices within the window air space are preferred.

02.0176 Fenestration shall be designed considering relevant Australian Standards, heating, ventilation, and air-conditioning requirements, aesthetic appearance, and the comfort of all users of the facility. Window design and construction should be based on the standards, guidelines.

Glazing

02.0177 Glazing for windows, door glazed panel, skylights and curtain walls shall meet the requirements for energy conservation identified in CBRM. All glazing designs should be evaluated for aesthetics, building function, energy conservation goals, shading characteristics, light transmittance, thermal characteristics, and reflectance. Low emissivity (Low-E) insulating glass shall be used unless other glazing types are shown to be more cost effective. Care must be taken to evaluate each building elevation individually. Glass sizes and thickness shall be based on wind loading and thermal conditions of the geographic area where the building is located.

02.0178 Glazing for Impact Safety

02.0179 Because of the size and shape of glazing in some locations, glass panels may be mistaken for a means of entry or exit and therefore may be subject to human impact. The requirements of *AS 1288 Glass in Buildings* shall be followed.

Window furnishings

Curtains and blinds

02.0180 Curtains and blinds are generally required in offices and centrally managed learning spaces and are to be supplied and fitted under the project. Provision shall be made in the project for adequate battens, pelmets and the like to allow fixing.

02.0181 Vertical venetian blinds are not acceptable.

Fly screens

02.0182 If fly screens are required by legislation the mesh must be stainless steel. The screens should form part of the window system and be easily removed from the inside for cleaning.

Thermal performance of windows, exterior doors, glazed panels, and skylights

02.0183 The use of glass shall be carefully studied in relation to energy conservation goals and building function. All new windows, glazed exterior doors, glazed panels and skylights shall be double glazed with a continuous thermal break. Condensation should not be apparent on glass when the indoor design temperature is 22C at 30% relative humidity. All windows, glazed exterior doors, glazed panels and skylights will have energy performance rating factors as evaluated in accordance with the NCC and relevant standards.

Provisions for Window Cleaning

02.0184 The need for window cleaning and maintenance, including replacement of glazing shall be considered during design. Provisions for window cleaning equipment must be included in the design for all facilities.

Ceilings

General

02.0185 Ceiling systems are to be selected based on their suitability for the function of the applicable area. Generally, suspended two way exposed grid ceilings systems with drop in tiles of a plasticised plasterboard type are preferred. Inaccessible or difficult to access ceiling systems shall not be specified other than to areas that have no ceiling access requirements.

02.0186 Ceilings are to be provided in all occupied and occupiable areas of a building.

02.0187 Ceiling fixtures: Where fixtures or fittings such as light fittings and thermal alarms are to be mounted on tiles, approved backing pieces shall be provided.

02.0188 Light fittings and other fittings not capable of being supported by the suspension system shall be suspended from the structural frame.

02.0189 System ceilings comprising exposed aluminium or timber slats are not to be used.

02.0190 Adequate access shall be made for lighting where ceiling heights are above 2.4 m, particularly in lecture theatres and laboratories, to allow servicing and maintenance activities to be carried out.

02.0191 Ceiling spaces will have a minimum of 300 mm clear within the ceiling soffit above.

02.0192 Unless otherwise stated, ceilings are not required to be provided in:

- Plant and Equipment Rooms
- Switchboards Rooms
- PABX/ Communications Rooms
- Workshops

Suspended ceilings

02.0193 Ceiling systems shall generally be a two-way grid exposed T-bar of pre-painted aluminium with 1200 x 600 mm module. Ceiling tiles shall only be mineral fibre or plasterboard.

02.0194 Plasterboard ceilings on proprietary metal channels shall be provided with ceiling access hatches, where required.

Ceiling access hatches

02.0195 Where a fitted plasterboard ceiling is designed and specified, ceiling access hatches are to be provided.

02.0196 Lift out mineral fibre ceiling tiles are not acceptable as access hatches.

02.0197 Safe access to the hatch is to be accommodated in the design.

02.0198 The minimum size is to be 600 x 450 mm.

02.0199 All ceiling access hatches are to be non-hinged 'drop-in' type, designed to carry weights associated with accessing the ceiling space and trafficable ceiling spaces.

02.0200 Every ceiling or separated ceiling compartment is to have a ceiling access panel.

02.0201 Generally, the location of these panels is to be in a public part of the building, placing the panels within individual offices should be avoided.

02.0202 Placement of the panels should occur:

- adjacent to major ceiling mounted mechanical equipment, including fire dampers, other major ceiling plant, valves; and/or
- adjacent to ceiling enclosed audio-visual equipment (the Principal's Representative is to acquire the ANU ITS detailed audio visual requirements).

Floors

General

02.0203 Traffic patterns, use of the space and maintenance requirements must be considered in the selection of floor coverings.

02.0204 Trim, transition strips and floor mouldings shall have a bevelled-type design.

02.0205 Adhesive used for flooring shall be compatible with the product and approved by the manufacturer.

02.0206 Adhesives used shall be low in off-gassing.

Design Guidance

- Some floor surfaces in particular areas may be unsuitable. It is important that materials, including composite, surface texture, and colour are provided, to the University, at the design phase, to ensure their functionality in regards to cleaning.
- Floor covering should flow through the building in quantity. Any isolated areas will increase cleaning costs.
- Carpeted areas bordering wet areas (kitchens, toilets) will quickly incur staining as wet area are mopped regularly. This needs to be designed out.
- Consider extending resilient floor finishes up wall surface beyond 100 mm.
- Communications rooms generally: flooring to be anti-static vinyl.
- Cleaners cupboards generally: flooring to be resilient.
- Wet laboratories generally: flooring to be resilient.

Stock

02.0207 In some projects there may be a requirement to include in the specification an allowance for an additional spare supplies of each floor covering used, which the University will hold in stock. The amount is to be agreed in discussion with the Principal's Representative.

Joints

02.0208 Between dissimilar floor finishes. Shape is to be specified in the brief.

02.0209 Foyers and service counters: visual indicators in foyers

02.0210 To assist visually impaired people, routes through foyers to reception desks are to be clearly defined using contrasting colour or differently textured floor finishes, such as resilient finishes against carpet.

02.0211

Colours

02.0212 Colour of all floor finishes shall form part of the overall colour scheme for the building and shall be selected in consultation with the Principal's Representative.

02.0213 Consideration should be given to the specification of darker hues and colours in high traffic areas and wet areas where non-slip finishes are required.

Floor finishes

Terrazzo

02.0214 Renovation of terrazzo floors or of adjacent areas shall protect existing terrazzo from damage. Patching of existing terrazzo shall be carefully completed with matching aggregate and cement, or with the use of 'transition' strips between the existing and new installation.

Specific Design Parameters

02.0215 Exterior terrazzo is not acceptable.

02.0216 The Consultant shall consider expansion joint design and placement in coordination with structural movement of the building.

Tiles

02.0217 Where a 'non-slip' finish is required, floor tiles are not acceptable, and an appropriate slip-resistant vinyl shall be specified.

02.0218 Grouts shall be selected for long-term service and cleanability, as well as for flex and tensile strength.

02.0219 Floor drain design shall be coordinated with tiling layout, and the tile shall be cut neatly around the floor drain.

Timber floors

02.0220 Due to its inherent high maintenance needs, timber flooring is not recommended for use in facilities, with the exception of gymnasium floors or special performing-arts areas.

02.0221 Protection of timber floors

02.0222 In renovation projects involving buildings with wood flooring, the floors shall be protected from damage during works.

Specific Design Parameters

02.0223 Where a timber floor is required, the substructure and type of finish seal are to be appropriate for future intended use. Expansion and contraction of the wood in different temperatures and humidity must be allowed for.

02.0224 The timber selected must yield long-term service and relatively low maintenance.

02.0225 Moisture containment and vapour barriers must be provided if required in concrete slab substrate areas and over crawl spaces.

02.0226 Pine is not acceptable.

Carpet

02.0227 The manufacturer environmental performance and life cycle costs of carpet are complex and investigated in detail by 3rd party certification organisations. Consequently Sustainability defines and will periodically review the 3rd party accreditation for carpet procurement. The current required certification required is one or more of the following:

- Carpet Institute of Australia Limited, Environmental Certification Scheme (ECS) v1.2
- ECS Level 4 accreditation required
- GECA 50-2011 v2 - 'Carpets'
- GreenTag GreenRate v3.1 Level A

Broadloom carpet

02.0228 Unless agreed to by the Principal's Representative, broadloom carpets are not acceptable.

Carpet tile

- ACCS grading: commercial heavy duty and stairs
- anti-static warranty: minimum 10 years
- wear warranty: minimum 10 years
- dimensional stability warranty: minimum 10 years
- to be selected from manufacturers standard range
- to be coloured from solution dyed nylon
- to be direct stuck to a suitably prepared substrate in accordance with the manufacturer's instructions
- non-solvent based adhesives are to be used.

02.0229 Consideration should be given to both recycling salvaged carpet tiles, and the use of recycled carpet tiles.

Entrance mats (walk-off matting – where required)

02.0230 Generally entrance mats shall be purpose made matting, laid inside the entrance doors extending 6.0 m from the threshold.

02.0231 The use of entrance mats should be considered in the context of a transition zone.

02.0232 Where a building has a (weather) protected lead-up path, the requirement for the matting may be reduced.

02.0233 Where heavy soiling is probable e.g. entrances for trades or agricultural practical areas, the matting are may be extended.

02.0234 Architectural entrance features may be provided with a contrasting colour. Luminance contrast of floor coverings is to be considered at all major building entry ways.

02.0235 Slab recesses to accommodate entrance mats should be avoided where possible.

Specific Design Parameters

02.0236 Entrance matting should not impede people with disabilities (wheelchair users) and be specified according to the following criteria:

- Consideration of a modular carpet tile manufactured for walk-off areas
- non-slip surface;
- wearability and service life (no rotting or mildew);
- ability to clean foot traffic on textured nylon or polypropylene surfaces without 'tracking';
- replacement of parts;
- colour fastness of 'coloured' mats;
- drying capability of mats;
- drainage of recessed area;
- maintenance and cleaning of recessed areas and mat;
- stability of the mat system (no 'rattling' of slats when walked upon); and
- fire resistance.

02.0237 Tripping hazards are not acceptable.

Vinyl

02.0238 Slip-resilient flooring is to be specified with the proposed material to be reviewed by the Principal's Representative.

02.0239 The use of inconsistent materials or finishes for different zones or functional areas complicates navigation for all users. Introduce different floor textures to indicate particular areas or important changes of function.

Specific Design Parameters

02.0240 All vinyl is to be fit for purpose. In addition it must be:

- homogenous;
- anti-static in areas subject to static electricity discharge and specialty areas;
- fixed to the floor using adhesives in accordance with the manufacturer's instructions;
- welded as per the manufacturer's instructions;
- coved 100/150 mm up wall (where integrated in wet areas), or 100/150 mm black PVC skirting; and
- no sealing of the product shall be required to be undertaken.

02.0241 Note: pencil coving is not acceptable.

Linoleum

02.0242 The specification of linoleum may be considered on certain projects. The specific project requirements for non-slip areas and acoustic should be considered with the environmental profile of the project and the ongoing maintenance and cleaning requirements of the product.

02.0243 Only those products rated as commercial heavy duty should be considered.

02.0244 No sealing of the product shall be required to be undertaken.

Rubber

02.0245 The specification of rubber may be considered on certain projects. The specific project requirements for non-slip areas and acoustic should be considered with the environmental profile of the project and the ongoing maintenance and cleaning requirements of the product.

02.0246 Only those products rated as commercial heavy duty should be considered.

02.0247 No sealing of the product shall be required to be undertaken.

Joinery

General

02.0248 Cabinets and countertops should be designed in such a way that they are easily disassembled and moved for re-use.

02.0249 All joinery units are to have backs.

02.0250 Particleboard is not permitted for use in any joinery application, including cabinets and countertops.

02.0251 All joinery is to be designed with minimal joints and concealed nails and fasteners.

02.0252 Where adjustable wall shelving is to be specified, confirm with the user the expected loads prior to specifying.

02.0253 Refer to [Doors, hatches and door hardware](#) for interior timber door and door finish hardware requirements.

02.0254 All joinery must comply with the Sustainability requirements of *Sustainable Timber* and *Formaldehyde Minimisation*. In addition all joinery must be designed such that it can be easily disassembled for reuse, recycling or re-processing. The disassembly requirement is:

- Joinery must be readily disassembled, using non-specialist tools, into elemental components for re-use, recycling or re-processing (e.g. mechanically fixed, not glued).
- Each joinery item must enable at least 75% (by mass) to be readily disassembled

02.0255 Minimum requirements for kitchens/kitchenettes/tea rooms

- space for a refrigerator – size to be determined
- cupboard and benchtop space, including doors and drawer units
- space/shelf for a microwave
- stainless steel sink and at least one integral drainer
- sufficient bench space and power outlets for appliances, e.g. microwave, kettle, toasting ovens

02.0256 Joinery minimum requirements

Element	Requirement
Countertops	<p>32 mm nominal, moisture resistant (MR) MDF in wet areas</p> <p>Where any finish is applied to the outside face, the underside shall be sealed to prevent warping or distortion of the board product</p> <p>It is preferred that no melamine surfaced high-pressure decorative laminate seams are located within nominally 600 mm of sink edge</p> <p>Timber veneers in wet areas are not acceptable</p>
Edging	<p>Countertops should not be melamine pre-finished material</p> <p>Doors and drawers are to have post-formed or ABS edging</p> <p>Open/exposed shelf edge is to have ABS edging, or timber where a veneer is specified</p> <p>Shelving with cupboards is to have melamine edging</p> <p>All edges are to be finished</p>
Carcass	Carcass ends and divisions 16 mm melamine MDF
Drawer carcass	<p>Proprietary drawer systems should be considered in all cases</p> <p>Minimum 12 mm melamine MDF</p>
Drawer front	To match remaining joinery, minimum 16 mm MDF
Drawer bottoms	4 mm ply
Drawer slide mechanisms	<p>For all drawers, proprietary item ball bearing runners are to be specified, with the capability to carry the anticipated loading</p> <p>Proprietary items of a commercial grade or whole unit, shall be specified to enable future renovations, disassembly and re-use. Drawer slide mechanism must have 30 kg weight capacity</p>
Doors	<p>18 mm nominal MDF</p> <p>Where any finish is applied to the outside face, the inside shall be sealed to prevent warping or distortion of the board product</p>

	All doors are to be provided with handles
	All doors are to be fitted with nominal 165 degree hinges
Splashbacks	All wet area installations are to have a splashback; where integrated the junction is to be post formed, with an MR.MDF substrate, extending to a height of at least 150 mm vertically behind the source, and extend at least 900 mm horizontally past the source
Kickrails	All joinery is to have a kick rail, recessed at least 40 mm
Shelving, exposed and in cabinets	Generally 18 mm MDF, 18 mm MR.MDF to underneath sink areas; shelving where possible to be adjustable Where shelving is equal to or greater than 900 mm in length, a stiffening member is to be applied to the underside of the shelf Where adjustable shelving is designed, only metal heavy-duty shelf plugs are to be supplied
Hardware	Plastic handles are not acceptable
Timber veneers	Grain in adjacent panels shall be matched as to direction, density and hue
Melamine surfaced high-pressure decorative laminate finishes	Colours to the approval of the Principal's Representative Product, gauge and surface finish to the approval of the Principal's Representative

Service counters

02.0257 Service counters must provide an access section for wheelchair or seated users on both sides of the counter.

02.0258 Wheelchair leg space is required at an access counter for both the staff member and the client.

Plumbing, kitchen and sanitary fittings

02.0259 Numbers of toilet facilities required are to be generated from the NCC. At least one toilet in each building must be an access toilet but final numbers are to be determined in consultation with the Principal's Representative.

Standard public/staff/student toilets	All single toilets and multiple toilet facilities are to include the plumbing and hydraulic fittings listed in Section.09 Hydraulic Systems .
Walls	All walls are to be tiled floor to ceiling with ceramic wall tiles.
Partitions	Divisions, doors, frontals and nibs to be manufactured from purpose designed proprietary wet area partition system inclusive of all proprietary accessories for that system

		<p>Cubicle dimensions are to be a minimum 900W x 1500D mm if a concealed cistern is used or 1800 mm deep for a wall mounted cistern, division panels minimum 1500 mm high, mounted 300 mm AFFL</p> <p>The minimum dimension for the partition frontals is nominally 150 mm wide. This then allows for a nominal door dimension of 750 mm</p> <p>Ceiling suspended with frontals attached to a steel beam in the ceiling via steel rods and brackets concealed within the frontal blades. If floor mounting is required, stainless steel legs are acceptable provided installed on top of the floor covering</p> <p>Painting is not acceptable</p> <p>Door hardware shall be hat/coat hook (incl. door stop), turn-bolt and indicator, satin chrome finish</p> <p>Hinges shall be safety lift off gravity hinges, clear anodised, set in hold open position</p>
Hand towel dispensers		<p>The ANU will provide standard wall mounted hand towel dispensers to be installed by the project</p> <p>Where a project is to install a wall-recessed hand towel dispenser, a product with a lockable integrated bin capable of dispensing <i>KLEENEX Optimum Towel (Code: 4456)</i> shall be specified</p>
Toilet paper dispensers		<p>The ANU will provide twin-roll wall/partition mounted hand towel dispensers to be installed by the project</p>
Mirrors		<p>A mirror with minimum dimensions of 400W x 1000H mm is required to each hand basin location</p> <p>The mirror is to be a fixed item; however must be capable of being removed for replacement</p>
Soap dispensers		<p>The ANU will provide soap dispensers to be installed by the project</p>
Hand dryers		<p>Where required, electric hand dryers are to supplement dispensed paper towel</p> <p>The specification of electric hand dryers should be in consultation with the Principal's Representative</p>
Window mounted exhaust fans		<p>Exhaust fans in windows are not acceptable</p>

Kitchens, kitchenettes and tea rooms

02.0260 Accessible kitchens and student common rooms

02.0261 Kitchens do not have to comply with AS 1428 in its entirety but should have accessible components as directed by the Principal's Representative.

Benchtops

02.0262 Kitchen benchtops not to have timber edges.

White goods

02.0263 Provision of white goods to be discussed and agreed with the Principal's Representative.

Cleaner's cupboards

02.0264 All projects must make adequate provision for cleaner's cupboards.

Sinks	Purpose made proprietary item, ceramic or stainless steel with integral hinged stainless steel grate
Hose cock	Wall mounted hose cock located above the sink at a height to enable filling of buckets and the like
Wastes	Generally not required
Exhaust fans	Exhaust fans in windows are not acceptable Exhaust fan should preferably be switched with room lights or local switch and must exhaust to outside as per <i>AS 1668 The use of ventilation and airconditioning</i> in buildings requirements
Shelving	Provide a minimum of 1.2 lineal metres of shelving on adjustable wall mounted slats. Shelving material to be 18 mm MR.MDF ABS sealing to all edges
Power	Install 1x double GPO at 1200 mm AFFL

Domestic bathrooms

02.0265 If required the fittings are to be agreed with the Principal's Representative.

Loose furniture

Furniture Design

02.0266 The following risk-based planning principles apply to the matching of users to new workstation environments.

- Significant change to the workplace environment is to be guided by a risk assessment.
- A file record reflecting consultation and decisions will be kept by the ANU Injury Management Branch.

- Following the risk assessment, all requirements are to be documented with identified and credible risks to users will be given due weight in the assessment of new furniture and equipment.
- Workplace design, equipment and furniture should improve health and safety for employees; not introduce new hazards.
- The needs of the prospective occupants, users and stakeholders will be considered and detailed throughout an iterative design process. Workplace and furniture design should match the physical requirements and tasks of the users.
- Maximise the flexibility of workstation setups to allow reconfiguration in the future.

02.0267 Decisions on task furniture, or installations concerning significant ergonomic risk, will remain within ANU.

02.0268 The manufacturer environmental performance and life cycle costs of furniture are complex and beyond the scope of construction projects. Minimizing the environmental footprint of the product life cycle is investigated in detail by 3rd party certification organisations. In addition the footprint can be practically minimised by reusing furniture that would otherwise be sent to landfill or disassembly and subsequent recycling. Since 3rd party accreditation schemes periodically update their standards and new accreditation schemes are created Sustainability defines will periodically review the 3rd party accreditation for furniture procurement. The current required certification required is one or more of the following:

- Supplier of furniture to confirm >80% by mass of the furniture is reused; OR
- Furntech/AFRDI Standard 150, either level A or B;
- Good Environmental Choice Australia (GECA) 28-2011 v2 - 'Furniture and Fittings';
- GreenTag GreenRate v3.1 Level A.
- Furniture, fixtures and fitting from buildings which can be reused

02.0269 The ANU has established a furniture reuse program on campus. Consultants are required to notify the ANUgreen office prior to commencing refurbishments to allow ANUgreen to assess and remove any University property which is fit for reuse and deployment in other ANU offices.

High-Use Interactive Workstations

02.0270 Some new work area installations may be for high intensity work and may involve complex risk components. Control workstation environments for IT, security or constant counter interaction workplaces would usually fall into this category. In such circumstances:

- A clear consultative framework consistent with the guiding principles should be put in place at an early stage;
- Risk factors and complexity should be identified for assessment by specialist ergonomists prior to informed decisions being made.

Ergonomic Specifications

Desks

02.0271 Sit-stand Desk Specifications:

- Minimum height adjustability range of 650 to 1200 mm
- Electronic operation preferred to manual wind mechanism where single replacement desks are to be purchased.

Desktop

02.0272 Desktop should have rounded corners if the desk is directly adjacent to an access or egress point, neutral colour, non-reflective finish, and a smooth surface.

02.0273 Recommended thickness is >25 mm, maximum thickness 33 mm.

Height adjustment

02.0274 Adjustment mechanisms should be able to be operated by the desk user and not create manual handling risks. They should be reliable, designed to encourage use, accessible, and labelled to indicate clearly the controls for movement. Look for designs that are not prone to accidental operation or interfere with the leg access

02.0275 Fixed height desks, desks with adjustable keyboards or “technician adjusted” desks are not to be purchased as primary workstation desks.

02.0276 If the workstation is not adjustable, a wide step should be provided for shorter workers and the bench raised for taller workers. This bench raise would be a raised platform to sit on the bench for specific tasks for taller workers (e.g. microscopes, pipette use, laptop use), generally 850 to 900 mm AFFL, dependent on type of task to be performed.

Work Surface Area

02.0277 The work surface area should be adequate for tasks to be performed at the workstation, and accommodate all required equipment.

- For **sole tasks (computer work only)**, the surface should have minimum dimensions of 1200 x 750 mm.
- For **mixed tasks (e.g. computer and clerical work)** the work surface should have minimum dimensions of 1500 x 750 mm.
- Large monitors may necessitate the need for larger space where a deeper desk may be required.
- Corner or split desks should measure 1800 x 1800 x 600 mm and should be finished with a 45° splay corner, rather than a squared corner and keyboard sleeve.

Leg Space

02.0278 Allow sufficient leg space under the work surface to allow free leg movement without obstruction from items such as CPU holders, drawer units, boxes, desk adjustment handles.

02.0279 Under desk: Knee clearance 450 mm deep, leg clearance 600 mm (at 150 mm AFFL), minimum width 800 mm.

Modesty Panels

02.0280 Where not next to a wall, workstations should have a modesty panel

02.0281 The panel should finish not less than 300 mm AFFL when the work surface is in its lowest position

02.0282 The panel should not interfere with workstation height adjustment.

Standing Height Benches

02.0283 Ideally these should be adjustable to suit a range of users.

Chairs

02.0284 Refer to the ANU Procurement Guidelines for chair sourcing and supply advice.

02.0285 Advice from the Principal's Representative must be sought regarding task chair suitability.

Task Chairs – Relevant Working Specifications

02.0286 Chairs must comply with Australian Standards and have Furntech/AFRDI 'blue tick' certification (minimum Level 5 certification).

02.0287 Fabric seat and back to be commercial extra heavy duty.

Arm Rests

02.0288 For most keying activities chairs should **not** have arm rests

Weight Rating

02.0289 The known user population profile will help determine ratios for heavier duty chairs.

02.0290 Weight rating to minimum 110 kg, however a range up to 135 kg may suit some populations. If 110 kg is chosen as the baseline, at least 10% of purchased pool should have a heavy duty kit for heavier weight rating.

High Chairs and Drafting Stools

02.0291 High chairs and drafting stools must comply with Australian Standards and have Furntech/AFRDI 'blue tick' certification (minimum Level 5 certification).

02.0292 Fabric seat and back (if used in office environment).

02.0293 Specific requirements for chairs/stools to be used in wet laboratory environments are:

- a. No porous materials and fabrics are to be specified for chairs in laboratory environments.
- b. Floor glides or wheels with brakes are to be installed.

02.0294 For high counter workstations/workbenches compressed seat height adjustability above the floor should be 540 to 730 mm.

02.0295 Where high chairs are used for extended periods a footstool should be provided.

Counters

- If the counter is also a screen based workstation there must be enough space for screen and associated equipment, including sufficient space for user to be positioned at a comfortable distance from the screen. A minimum desk depth of 800mm is required.
- There should be a section of the desk where comfortable reach distances for the user and customer (with consideration to security requirements) are possible. This depth should be maximum 500 mm if sitting and 600 mm if standing.
- To accommodate both requirements of desk depth for screen and shorter depth for reach a corner curved desk design with computer positioned at the wider end is recommended.
- Roughly equal eye-level positions for operator and customer are necessary. If the client is standing and the staff member seated, neck injury may result for the staff member who will repeatedly extending their neck to see the customer.
- There should be an appropriate surface for customers (e.g. space for displaying or signing documents)
- On the customer side the counter should be not lower than 1020 mm and not higher than 1200 mm.
- Counters shall, in all feasible locations, be design with the inclusion of an electronic sit-to-stand workstation on the staff side.
- The design of a counter should be guided by the type of work and the duration of work to be conducted at the counter. Counters shall be designed to accommodate the following tasks:
 - o Counter attendance for only short periods
 - o Frequent absence from counter to perform other tasks
 - o Tasks performed at the counter are brief and repetitious
 - o Attendance at counter required for significant periods
 - o The sequence of movements and durations of tasks requires operator to be seated; e.g. cashiers, booking clerks
 - o Attendance at the counter required for varying periods
 - o Lengthy tasks may be undertaken at the counter, but frequent absences are also required e.g. short term interviews and enquiries

ANU Historic Furniture

02.0296 The University has an extensive collection of custom built timber furniture designed by eminent Australian designer Frederick 'Fred' Ward and his counterparts in the ANU Design Section. Many of the early buildings on the campus including University House, Chancellery, R.G. Menzies Library, and John Curtin School of Medical Research (Wings A and B) had purpose built furniture designed to meet the décor at time of construction of the buildings. The furniture is however found all over the Acton Campus.

02.0297 There is a great volume (hundreds of pieces) of Fred Ward furniture currently in storage and thousands of pieces in use across the university as office, accommodation and occasional

furniture. Much of the furniture, while aesthetically pleasing, does not meet WHS and ergonomic standards required by ANU, however this furniture was recently assessed as a significant intact collection, and must be conserved under all circumstances.

02.0298 If any buildings are refurbished, consultation must be undertaken with the Principal's Representative on the use, disposal or restoration of any pieces of Fred Ward Furniture.

Appliances

02.0299 Many electrical appliances can be rated under the Energy Star rating system and include:

- Air-conditioners;
- Clothes dryers;
- Clothes washers;
- Dishwashers;
- Refrigerators/Freezers;
- Televisions.

Where such appliances are purchased they must achieve the within ½ a star the highest rating possible in their class (e.g. if the highest rating possible for a dishwasher was 4 stars all dishwashers purchased must be 3.5 stars and above).

Fixed furniture and equipment

General

02.0300 Furniture and fittings of a fixed type and those of sliding, rotating or special nature which generally occur in large lecture theatres shall be designed and installed under the project.

02.0301 Special requirements are set out in the brief or will be determined in conjunction with the Principal's Representative.

02.0302 The cost of notice boards in common areas and directory boards for major building entry points are to be included in the project.

02.0303 Where possible furnishings shall be loose fitted to enable the most flexible environment.

Built-in furniture

02.0304 All built-in furniture, cupboards and laboratory benches shall be supplied as part of the project. Details to be determined in conjunction with the Principal's Representative.

02.0305 Fixed furniture and equipment typically receives frequent use and shall be designed with this in mind. The Consultant should also consider mounting these items to walls and floors in order to achieve low maintenance.

02.0306 All items to have a factory finish, with no painting required.

Monitor Arms

- All monitors should remain on the adjustable stand provided by the manufacturer, unless there is insufficient space on the desk for the stand;
- Articulated arms have proved more reliable in user operation than cam-locking pole-mounted monitor arms, which involve manual handling risks;
- Significant purchases of monitor arms should be assessed from a manual handling viewpoint as well as from a sound engineering angle.

Fasteners

02.0307 Should generally be concealed.

02.0308 Exterior fasteners should be stainless steel 'vandal-proof type' or galvanised.

Bookshelves

02.0309 Generally built-in bookshelves are not acceptable. Free standing bookcases are preferred.

02.0310 Bookcases are to be a maximum height of 1.8 m.

Directory boards and room names

02.0311 Directory boards and direction systems will generally be inclusive of room numbers and names. The Principal's Representative will provide guidance on room numbering and naming on provision of labelled plans by the Consultant. Provision shall be made in the design to allow space for directory boards in lobbies and other public spaces as briefed.

Compact Shelving Units

02.0312 When specified in the brief, a compact shelving unit shall be installed but the load capability of the floor is to be determined during the design phase. Tracking is to be epoxied in place.

02.0313 Fixing tracks with mortar is not allowed.

Visual display/presentation boards

Whiteboards

02.0314 White porcelain-type boards, for use with felt-tipped markers.

02.0315 To have a continuous aluminium trim frame, and have a full width aluminium pen trough.

Pinboards

02.0316 The boards to have a continuous aluminium trim frame, or, where an entire wall is to be covered, the pin-board is to be stuck directly to the wall in place of the normal wall covering.

Blackboards

02.0317 Blackboards are no longer to be specified, unless required within the project brief.

Projection screens

02.0318 Projection screens for slides, overhead projection or film are to be provided as part of the project. The requirements of size and location shall be determined in conjunction with the Principal's Representative.

Colour, signage and lighting

02.0319 Signage and colours must comply with the **University Signage Manual** and protocols.

Colour

02.0320 Contrasting colour refers to the visibility of one feature against its background.

02.0321 Contrast does not necessarily require the use of bright colours. For luminance contrast refer to AS 1428.

Intensity

02.0322 Do not use red and green to provide contrast. Red and green have the same intensity value and do not provide good contrast for the blind and visually impaired people or for general users when the light levels are reduced.

02.0323 Where contrast is supplied as a visual clue for the non-sight impaired user, ensure colour selection takes into account the intensity value of each colour.

02.0324 Consultants will be expected to demonstrate that appropriate contrast colours are specified.

Highlighting elements

02.0325 Use contrasting colours on step nosings, and other elements that may pose a risk to visually impaired users.

Placement of signs

02.0326 Signs must be placed so they are visible but clear of circulation spaces.

Natural lighting

Do not locate viewing areas, such as teaching points, information counters or reception desks so that users need to look into glare induced by sun-facing windows.

First Aid Requirements

Automated External Defibrillator (AED)

02.0327 An AED be accessible from a Wall Cabinet within a buildings main entrance/lobby.

02.0328 An AED listed at a scheduled building, be accessible not only to the occupants of that building, but to anyone within a 150 metres radius of the building.

02.0329 An AED locality not be obscured by columns or plants.

02.0330 An AED shall be housed in a dedicated AED Wall Cabinet, with open door alarm necessary in raising awareness of an emergency situation.

02.0331 An AED shall be located at a convenient height for access and near eye level, no higher than 48 inches, best practice is 1200mm from bottom box to finish floor level).

02.0332 An AED shall be clearly marked and highly visible, to Include where necessary workplace signage to identify where the closest AED is as followed,

02.0333 The ANU preferred AED units is the ZOLL AED+ plus Semi Auto (With black carry bag), Red Cross Alarmed Cabinet, with one CPR-D-Padz and one Pedi-padz II in the cabinet.

02.0334 Signage to include 3D wall sign and 8.5"x11" wall mounted sign as minimum.



03 – Roads, Car Parks and Civil Works

Version	Date	Authors	Summary of Changes
1.0	13 August 2010	Alex Chryss	
1.1	8 February 2012	Solomon Elijah	Changed Title, Clause Numbers & Header
1.2	10 September 2012	Adam Taylor	Changed title, added Design Philosophy
1.3	20 September 2012	George Abraham, Adam Taylor & Alex Chryss	Incorporated amendments to Clauses
1.4	21 November 2012	Ben Crossling	Added relevant Australian Standards and provided an Link to the Park & Traffic Statute
2.0	05 February 2016	Neill Daly	General Revision

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Introduction

06.01 Roads and footpaths within the Australian National University (the ANU or the University) do not fall under the jurisdiction of the Australian Capital Territory (ACT) Road Transport Authority, but are subject to ACT road transport legislation.

06.02 Under the Acts 'public road' means any street, road, lane, thoroughfare, footpath, or place that is territory land open to, or used by, the public.

06.03 The Campus and Buildings Requirements Manual (the CBRM, the Requirements or the Manual) documents the minimum design and construction requirements for new, refurbishment or repurposed building works, landscapes and engineering/infrastructure projects on buildings, facilities and campuses of the ANU. The Requirements are prepared for the direction of a Consultant, Designer or Project Manager in the preparation of project specific documentation and in the delivery of project works.

06.04 Notwithstanding any Consultant's particular discipline or area of responsibility, each Consultant and/or designer shall consider the document in its entirety. The complete CBRM consists of the following Sections which may be referred to within this Section:

Campus and Building Requirements Manual	
Section 01	General Requirements
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Section 03	Roads, Car Parking & Civil Works
Section 04	Soft Landscaping
Section 05	Roofing, Roof Fabric & Roof Safety
Section 06	Building Management Systems
Section 07	Electrical Services
Section 08	Fire Protection Systems
Section 09	Hydraulic Systems
Section 10	Mechanical Services
Section 11	Lifts, Cranes & Vertical Transportation Systems
Section 12	Security, CCTV & Access Control

Design Philosophy

06.05 To create a pedestrian and bicycle-oriented campus, where people choose to walk and cycle and perceive the landscape as safe, pleasant and easy to navigate by foot and bike. All projects on campus should apply the Planning Principles of Theme 7. Transport and Movement as documented in the [Campus Master Plan 2030](#). Works should also support the uptake of active transport modes, including public transport and the realisation of the following targets from the ANU's [Environmental Management Plan](#) of:

- Increasing green commuting to 80% by 2015, and minimising single-occupant vehicles; and
- Reducing fleet vehicle emissions 20% by 2015 and continuing to off-set 100% of fleet emissions.

Design Principles

- Paths which get pedestrians and cyclists to where they need to go on campus and link to off-campus pedestrian and bike access points, via relatively direct routes, unhindered by safety hazards and permanent physical obstacles. This will require improvements to existing paths which:
 - o are disjointed; intersected by vehicle driveways;
 - o end abruptly in the middle of nowhere; and/or
 - o require pedestrians to cross roads multiple times because of obstructions and discontinuations.
- Clear way finding signage and maps in the landscape.
- Increased priority for pedestrians and cyclists in areas where they intersect with vehicle traffic. This includes the introduction and realignment of crossings to allow for safe and easy crossing of roads along major pedestrian corridors. It may also include the introduction of more 'shared zones' with a clear hierarchy of priority:
 - o pedestrians first;
 - o followed by cyclists; and then
 - o vehicle traffic.
- Minimise conflict between pedestrians, cyclists and vehicles by, where possible, segregating their paths of travel along longer corridors, such as the pathways along Sullivan's Creek.
- Improve the experience of walking on campus through improvements to path shading, distribution of drinking water stations and benches adjacent to pedestrian paths and thoroughfares.
- Street lighting to minimise dark spots at night and staff, students and visitors feel safe and confident to walk through campus at night.
- Traffic-calming to slow vehicle traffic on campus and encourage slower speeds for bike traffic in pedestrian areas.
- Improve links to and accessibility to internal and external public transport stops.
- Sheltered and clean public transport stops along internal bus routes.

Specific Design Requirements

06.06 Consultants shall design in accordance with these guidelines noting the differing requirements which may need to be applied for those projects located outside the ACT. For projects in other states Consultants are to confirm all requirements with the Principal's Representative (the Principal or the Principal's Project Manager).

Shared Use Zones

06.07 The Acton campus is predominantly a pedestrian environment. Areas which have been designated shared zones should be clearly distinguished from roads to send a clear message that vehicles must slow down and that different give-way rules apply within these zones. This should ideally involve a visibly distinct look, including different pavement type and colour, removal of traffic lane marking, as well as traffic-calming to slow vehicles approaching the shared zone. Clear signage should also be installed to advise all users that the priority is:

- Pedestrians first;
- Cyclists second; and then
- Vehicles.

Footpaths / Cycle Paths

06.08 As a general guideline the minimum width for new pedestrian paths is 1.8 m. The width may need to be wider depending on volumes of traffic. Where necessary segregation of pedestrian and bicycle traffic would be preferable.

06.09 As a general guideline the minimum width for new cycle paths is 2.5 m. The width may need to be wider depending on volumes of traffic.

06.010 Cycle paths are to be hot mix asphalt.

06.011 Pathways shall not have benches, bins, etc., in the line of pedestrian path of travel.

06.012 Inspection pits and manhole cover lids may be located within footpaths only in cases where it is absolutely unavoidable.

06.013 Cycle/wheelchair ramps to be provided to kerbs at all intersecting pathways/roadways carparks and adjacent to buildings

06.014 All pavements to be constructed using Australian standards.

06.015 All pavements to use design specifications to enable pavement to withstand being traversed by vehicles without failing.

06.016 For concrete pavement only two types of standard finishes used throughout the Acton campus; lightly washed exposed aggregate and plain concrete with broom finish.

06.017 If concrete pavement is to be divided into geometric or other shapes using elements such as brick pavers the slab must be continuous under the lines of division to minimise cracking.

06.018 Main concrete joints to be constructed using dowel joints. Keyed joints are prohibited.

Roadways and Vehicular Traffic Calming

06.019 The finished surface for all new roads and/or road refurbishment projects is hot mix asphalt.

06.020 The preferred traffic calming device is a speed hump constructed in concrete with the surface flush with top of kerb (Noting this will require the design and installation of additional storm water drainage pits).

06.021 If it is not feasible to install additional drainage the preferred alternative design is to shape the concrete speed hump to retaining existing gutters.

06.022 The installation of speed humps with drainage channels and grates between kerb and speed hump is prohibited.

Car parking

06.023 The number of parking bays will be determined taking account of local authority requirements and other project needs such as visitor parking. The University has specific signage requirements for car parks and may need to include the provision of voucher machines. These costs are to be included in the project budget.

06.024 Bay widths and bay delineator types shall be in accordance with Australian Standards.

Accessible parking bays

06.025 Accessible parking bays are required where directed by the Principal's Representative. The University has specific signage requirements for accessible bays.

Accessible parking bay directional signage

06.026 All car-parking areas should have signage at their entries clarifying whether or not the area includes access parking.

Accessible parking bay numbers

06.027 Access parking bays are to make up a minimum of 2% of any main car-park area, unless these parking spots are re-allocated to higher use access areas as directed by the Principal's Representative. Flexibility in the design of parking bays is recommended. For example, provide several wider bays that can be adapted to access parking bays, if later required, by changing signage.

Accessible parking bay location

06.028 Access bays must be located as close as is practicable to accessible routes and likely destinations, including essential teaching and learning locations. A maximum of 120.0 m travel should be allowed between access bays and likely destinations.

Accessible parking bay design

06.029 At least one access-parking bay should be 4.2 m wide for special-purpose cars. This bay can overlap with other use areas. The aim is to ensure parking is designed and sized to allow access to and around vehicles.

Accessible parking bay cross slopes

06.030 Cross slopes are potentially more hazardous than longitudinal slopes. Cross slopes are more likely to cause ankle injuries for pedestrians and problems for wheelchair users. Cross slopes in access parking bays are to be a maximum of 1:40.

Accessible parking bay surfaces

06.031 Irregular surfaces are trip hazards for all users and are difficult for wheelchair users to negotiate. Access parking bays are to be sealed, even and free from irregular levels or tree roots. Maximum allowed level difference is 4 mm.

Kerb ramps

06.032 Car-parking areas must be serviced with accessible kerb ramps with no more than 10.0 m travel distance from car to ramp. Accessible kerb ramps should be clearly visible and should be located near access parking areas.

Wheel stops

06.033 The choice of car park furniture to restrict access and/or dictate car park layout are as follows:

- Large or small galvanised steel rails
- Wheel stops
- Concrete kerb

06.034 Wheel stops or single 'raised' kerbs should be avoided. If unavoidable, wheel stops should be positioned so they are not hazardous. They should be clear from paths and kerb ramps. If possible, road islands should be used in preference to wheel stops. Only low profile wheel stops are to be used.

06.035 The use of treated pine logs in car parks is prohibited.

Obstructions

Car overhangs

06.036 Car noses or tow bars protruding onto pedestrian paths must not reduce the width of those paths below minimum allowable widths. Extend path widths so that car noses or tow bars do not compromise minimum allowable widths. Consider the use of garden beds, lawn or changes in path texture to separate the accessible path from the car park. Wheel stops can be used as a last resort.

Overhead obstructions

06.037 Overhead obstructions including trees and branches are to be a minimum of 2.5 m above ground level in parking areas. Stair landings or other built overhead obstructions must not be over a path or surface of the same material and texture as the path.

Doors and windows

06.038 Doors or awning windows must not open onto paths, ramps or landings unless they allow for minimum clear access widths to be maintained. They should not open onto any part of a path but must be over clearly delineated surface.

Protruding objects

06.039 Ensure paths and ramps are clear of objects that a cane can go underneath or that protrudes into a delineated pathway. If this cannot be achieved, then provide tactile pavers around base of the objects. Paths are to be clear of obstructions such as light poles.

Kerb ramps

06.040 Kerb ramps must not reduce the unobstructed path width. Kerb ramps are to be constructed to the local government standard details, and meet all requirements for tactile indicators. Kerb ramps widths (not including feathering or curving to blend with kerbs) are to be the full width of the paths they associated with.

Free standing objects

06.041 Freestanding objects must not protrude more than 500 mm into a walkway and must not reduce the clear width of the walkway.

Wall-mounted objects

06.042 Wall-mounted objects must not protrude more than 100 mm into a walkway and must not reduce the clear width of the walkway.

Fire service equipment

06.043 Fire service equipment, such as fire extinguishers and hose reels, must be recessed into walls wherever possible or set clear of walkway clear space as noted elsewhere.

Vending machines

06.044 All vending machines are to be set back 900 mm from clear circulation space.

Surface mounted grated drains

06.045 Refer to Section.09 Hydraulic Systems for surface mounted grated drains.

Grate locations

06.046 Grates must not be located at the bottom of stairs.

Street Furniture

06.047 As with all hard landscape infrastructure components the size and diversity of the Acton campus makes it impractical to adopt a uniform approach to selecting a pallet of street furniture for use throughout the campus.

06.048 Table settings and benches: ANU has a range of table settings and benches that are used as standards for use in outdoor areas **XXX – GG to provide.**

06.049 Bollards:

- Concrete ball shaped bollards for permanent locations
- Frustrum shaped bollards for locations where bollards need to be removed on occasion.

06.050 NB The use of bollards that are installed by being bolted to a concrete slab is prohibited.

06.051 Bicycle racks: ANU uses a standard inverted 'U' shaped bicycle rack that is installed by being bolted to a concrete slab.

Public transport

Public transport pick-up points

06.052 Bus stops and taxis ranks are to be located on accessible paths. Public transport pickup points should be accessible for all users.

Slopes at public transport pick-up points

06.053 Cross and longitudinal slopes in waiting and loading zones of public transport pick-up areas are to be a maximum of 1:40. Maximum slopes in waiting and loading areas are the same as those for paths.

Kerbs at public transport pick-up points

06.054 Tactile and contrasting colour indicators, 300 mm wide, are to run the full-length 600 mm back from the kerb, in public transport pick-up areas.

Set down and pick up areas

Road side set-down areas

06.055 Set-down areas or lay-by widths are to be located on the driver's side of the road and are to be a minimum of 3.2 m wide, located where directed by the Principal's Representative. Cross slopes are to be no more than 1:40. Set-down areas should accommodate all users, including the users of access parking bays.

Other requirements in set down areas

06.056 Set-down areas are to be provided with kerb ramps and access footpaths. They should also be provided with campus maps and seating as directed by the Principal's Representative.

Destination clues

Provide clear tactile clues

06.057 All users, particularly blind and visually impaired users, may become disorientated and lost if clear clues to destinations are not provided. Give clear visual and tactile clues to major destinations along routes using texture, lighting, contrast or other design solutions.

Identify pedestrian crossings and kerb ramps

06.058 A defined pedestrian crossing must meet the statutory requirements. A crossing must include tactile markers either end, where the crossing meets a path.

Civil Works

Site works

06.059 Service trenching

06.060 Where existing drawings are provided, the data should be taken as 'indicative only'. Consultants are required to take all steps to determine for themselves the location of underground services.

06.061 Spare conduits

06.062 Spare conduits are to be provided under concrete paths as nominated by the Principal's Representative.

06.063 Service trenching reinstatement

06.064 Where disturbed by service trenching or the like, the returned below ground materials (soil, sub-bases for example) must match or improve on the existing materials.

06.065 Where trenching must cross footpaths or roads, the preferred method is under-boring; however, if not possible, existing surfaces are to be re-instated to match the existing or adjacent materials/works.

04 – Soft Landscaping

Version	Date	Authors	Summary of Changes
1.1	5 August 2010	George Abraham	Annex B added: Unacceptable Practice
1.2	9 September 2010	George Abraham	13.3 text added: AS 4970: Protection of trees on development sites.
1.3	9 September 2010	Mel Walker	<i>TreeNet</i> database updated to <i>ANU Tree database</i> and associated changes.
1.4	August 2011	George Abraham/ Melinda Walker/ Jeff Albrecht	
1.5	9 February 2012	Solomon Elijah	Section & Clause Numbering, Headers & Footer changed.
1.6	19 November 2012	Melinda Walker	Sections 17.8.1.3 & 17.8.1.6 amended.
1.7	11 April 2013	Melinda Walker	Section 17.8 redrafted.
2.0	05 February 2016	Neill Daly	General Revision

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Introduction

04.01 This section of the Campus and Building Requirements Manual (the CBRM, the Requirements or the Manual) covers soft landscaping and vegetation.

04.02 The CBRM documents the minimum design and construction requirements for new, refurbishment or repurposed building works, landscapes and engineering/infrastructure projects on buildings, facilities and campuses of the Australian National University (the ANU or the University). The Requirements are prepared for the direction of a Consultant, Designer or Project Manager in the preparation of project specific documentation and in the delivery of project works.

04.03 Notwithstanding any Consultant's particular discipline or area of responsibility, each Consultant and/or designer shall consider the document in its entirety. The complete CBRM consists of the following Sections which may be referred to within this Section:

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Liaison

04.04 The Consultant commissioned to consider and prepare soft landscape designs specific to a built or natural environment project is required to consider, design and document:

- Broad landscape guidelines and site specific issues;
- Preliminary plans and concepts;
- Development of landscape details; and
- Final landscape plan proposals.

04.05 The Consultant commissioned is advised at various project stages the ANU Project Coordinator is required to consult with the ANU Gardens and Grounds staff. The consultations are required to review the project proposals and to provide the Gardens and Grounds staff opportunity to provide feedback to the proposed design and its elements

04.06 The Project Coordinator will brief Gardens and Grounds on the landscape component of new projects at an early stage in the design development process. Gardens and Grounds will generate a soft and hard landscape user brief specific to each project for consideration by the Consultant.

04.07 The University landscape features a diverse range of landscape themes there are no definitive plant selection guidelines. Consultants and designers will be advised on appropriate plant selection for all projects undertaken on the campus.

Landscape Distinction

04.08 The most significant characteristic of the Acton campus of the ANU is the landscape – a mix of native and exotic plantings, with the Sullivans Creek waterway reinforcing this natural environment. Over the last ten years there has been a significant amount of new buildings and other work on the campus that has sometimes impacted negatively on the quality of the landscape. Procedures have been developed with the aim of protecting the landscape and ensuring that damage to it is minimised. The purpose of this document is to clearly articulate the aims, methods and procedures to protect the landscape during any works that have the potential to cause damage.

04.09 The Requirements are applicable to the whole landscape of the campus including lawns, planting beds and native grassland. However, because of their visual significance, their age, and the time it may take for damage to them to become apparent, it is damage to trees that is of most concern, and towards which these Requirements are largely directed. The major causes of damage to trees are vehicles and machinery (directly by damage to trunks and branches, or indirectly by soil compaction in the root zone) and new service reticulation (particularly through trenching within root zones). The Requirements seek to minimise such damage by:

- Surveying and classifying all trees on campus, to provide a database for informed advice and action.
- Making reference to this database a precondition for all work on the campus that has the potential to damage trees.
- Requiring the responsible Consultant to seek the appropriate approvals before carrying out any such work on the campus.

04.010 Emphasis is placed on prevention of landscape damage, through following correct procedures, rather than on penalties after the damage has occurred.

Habitat

04.011 The ANU has developed a [Biodiversity Management Plan](#) which should be consulted where any work has a potential habitat impact. Habitat is to be conserved or improved over the course of a project and any impact on the landscape properly rehabilitated.

04.012 Habitat improvement can be achieved by many initiatives:

- selecting appropriate plant species and creating habitat structures (rocks, logs and the like) in the landscape;
- creating an appropriate niche ecology as part of the landscaping of the site; and
- improving the site hydrology through integrating an in-built stormwater/greywater collecting system, with the intent of reusing the water in on-site landscaping, to improve resilience of the local landscape.

Landscape Planting Plan and Soil Specifications

04.013 The Requirements of the ANU for the planting plan and soil specifications shall be determined in consultation with the Principal's Representative (the Principal or the Principal's Project Manager).

Grass Types

04.014 The use of *Poa labillarderi* is prohibited for use on the campus.

Landscaping Water Use

04.015 No permanent non-potable irrigation systems are to be installed in landscaping.

04.016 Landscaping must be designed to retain water such that healthy, robust soil ecology is maintained:

- water infiltration to ground water is to be maximized;
- water movement is slowed and takes the longest practical path toward waterways, providing the greatest ecological benefit; and
- avoid excessive water-logging that will result in prolonged anaerobic soil conditions.

Soil

04.017 Maintaining and improving soil quality is the highest priority underpinning all grounds maintenance activities on the campus. Compacted or disturbed areas of soft landscape within, adjacent to or associated with a construction project must be refurbished as part of the project scope of work. The process of soil refurbishment is based on the relief of soil compaction and the incorporation of additives such as gypsum and organic matter.

04.018 The specifications for soil works as part of a project's landscape component are to include 'hold points' in the construction process for appropriate inspections to areas of installation and restoration works.

Topsoil

04.019 All topsoil removed during the construction process is utilised such that it remains productive. This requires:

- all topsoil impacted by the construction works is separated and protected from degradation, erosion or mixing with fill or waste; and
- 95% of all topsoil (by volume) retains its productivity. For example, it is returned to the top 100 mm of a natural soil substrate as quickly as is feasible.

Topsoil is to remain and is to be reused on ANU grounds.

Edge Treatments

04.020 In general, edge treatments such as timber strips or concrete mowing strips are not required as a division between grass areas and garden beds. The requirement for mowing strips along building edges will be assessed as required.

Indoor Plants

04.021 Indoor plants are not be specified or installed as part of a project.

04.022 It is the responsibility of building users and occupiers who install indoor plants post project to maintain (including cleaning) indoor plants and associated elements.

Trees

04.023 Designers for projects with a landscape component will consider the strategic selection and placement of trees as shading devices, to assist in reducing the energy costs for buildings and improve the internal environment. Examples of this could include:

- the provision of deciduous trees (at an appropriate distance from a façade);
- the consideration of foliage to cool air; and/or
- the selection and placement of plants to improve the air quality.

Tree Protection or Removal

04.024 The selection and specification of established trees of appropriate species and sound structure are beneficial components of the built environment and a potential asset to any development site.

04.025 Trees on development sites shall be protected in accordance with *AS 4970 Protection of trees on development sites*.

04.026 Development proposals should endeavour to retain existing trees wherever possible and practical to do so. Any trees that require removal shall be identified to the Principal's Representative and prior approval obtained before designs proceed.

04.027 The ANU has a comprehensive survey of trees within the Acton campus for reference purposes. The requirements of this section of the CBRM apply to all other Campuses.

04.028 The Consultant is required to ensure that all trees within a construction site that are to remain are identified and appropriate tree protection measures are undertaken to prevent damage or destruction during construction. The proposed methods for tree protection should be discussed and documented prior to work commencing on site.

Tree Survey Database

04.029 A digital survey of all trees on the Acton campus currently exists, each tree has been rated according to the following categories. Information pertaining to the location, species, and category of trees on the ANU Acton campus is stored on the Tree Survey database.

Exceptional Trees	These are the most significant and valuable trees on the campus because of their age, rarity and prominence within the landscape. Except in exceptional circumstances, no activity involving disturbance of the Tree Protection Zone (TPZ) of these trees will be allowed, other than that carried out by Gardens and Grounds staff, or contractors under their immediate supervision. In exceptional circumstances, application may be made for a specific Works Approval for such activity, from the National Capital Authority.
High Quality Trees	These comprise the bulk of mature, healthy trees on the campus. Any work within the TPZ of high quality trees will require the specific approval of the Principal's Representative.
Medium Quality Trees	This class covers trees that tend to be immature. Whilst every effort should still be made to minimise damage to such trees, (as they are the ANU high quality trees of the future), their value to the landscape is less than that of the previous two classes of trees. The level of protection to be accorded to such trees will be at the discretion of the Principal's Representative.
Low Quality Trees	Trees that have been placed in this category are usually small trees, mostly new plantings. The level of protection to be accorded to such trees will be at the discretion of the Principal's Representative.

04.030 In all cases where work may impact on the TPZ of a tree (irrespective of its particular classification), the Principal's Representative is to be consulted before any work commences.

04.031 The criteria by which trees are categorised are detailed in the ANU Tree Management Plan:

<https://services.anu.edu.au/campus-environment/sustainability-environment/gardens-grounds>

Irrigation

04.032 The ANU requires the landscape forming part of each project be suitably irrigated according to the plant species, soil type and topography.

04.033 In general micro or low volume irrigations systems are not to be installed as part of any new landscape areas.

04.034 The installation of irrigated lawns is to be restricted to areas where a high quality lawn surface is required to provide amenity for staff or students. Irrigated lawns are to have automated underground irrigations systems installed. The use of Hunter irrigation products is preferred to maintain continuity throughout the campus.

04.035 Where an irrigation system is required, the installation shall form part of the project and is to be fully documented. Irrigation systems will be designed and installed by a suitably qualified and experienced irrigation specialist taking consideration of water efficient design principles, such as using low flow sprinkler heads and/or drip irrigation. Consideration should be given to using rain sensors and soil moisture probes to limit unnecessary irrigation events.

04.036 As a general requirement Buckner (or equal equivalent) brass quick coupler valves shall be installed at 20.0 m spacing throughout garden beds to be used for plant establishment only.

04.037 All proposed irrigation designs should be presented to the Principal's Representative for comment.

04.038 All irrigation systems must be supplied with non-potable water and sign posted accordingly. In instances where recycled waste water is used all valve boxes and sprinkler heads shall have lilac coloured lids/tops.

04.039 Irrigation systems shall be separately metered and shall not form part of the cold water supply for a particular project. Refer to [Section.06 Building Management Systems](#).

04.040 The ANU prefers electronic control devices control irrigation systems. Consultants are to discuss the matter with the Principal's Representative. In general Hunter components (or equal equivalent) are to be used including gear drive pop up sprinkler heads, solenoid valves and electronic control boxes shall be used so as to standardise components across campus.

04.041 All electric solenoid valves are to incorporate an isolation valve, Philmac (or equal equivalent) of ball valve of equal size. Lilac coloured handle for recycled water, blue handle for potable water.

04.042 Irrigation controllers to be housed in lockable metal enclosures.

04.043 Automatic irrigation systems, drip or sprinkler, are to incorporate Hunter rain-clip sensors (or equal equivalent).

04.044 Larger projects to incorporate Hunter flow-clip sensors (or equal equivalent) downstream of the master valve in the event of a rupture or leak occurring as this will automatically shut-off the water flow and save water.

Process

Procedures for Obtaining Clearances

04.045 The earlier that the issue of landscape protection is considered and addressed in any project; whether the project be a new building, building extension or an underground service; the more easily will the requirements for such landscape protection be integrated into the program and budget of that project. Therefore the emphasis should always be on addressing this issue earlier rather than later.

- **New building project in feasibility and planning phase:** Consultants are to consider the impact on the existing environment. A preliminary tree report produced by the ANU is required to guide the development design layout so that the proposed building footprint has a minimal impact on the trees and landscape. It is crucial that service easements are also considered at this stage. Once the design has been reviewed and finalised, the ANU will produce a final tree report for the Campus Planning Committee and the National Capital Authority, detailing the overall impact of the project on the trees and landscape.
- **Buildings and Projects already under construction:** Where it has become apparent that work will be required within the drip line of a significant tree (and this work was not identified in the course of previous approvals) specific application will need to be made to the Principal's Representative.
- **New sub-surface services reticulation:** The Principal's Representative will obtain confirmation from the Consultants of the impact, if any, on significant trees at the planning stage.

Landscape Protection Plan

04.046 Where required by the project, Consultants will prepare a Landscape Protection Plan (LPP). The scope of the LPP will vary according to the nature of the project. Generally the LPP will take the form of a site plan marked up with notes relating to the various landscape protection issues. Amongst the issues that may need to be addressed in the LPP are:

- **Site features:** Site features requiring particular protection include underground irrigation, lawn areas and/or significant trees and sensitive landscape sites. Such features may need to be protected by fencing, and the Consultants will be responsible for ensuring project specific documentation indicates protection to these areas including areas are not entered or used for any purpose associated with the project.
- **Site access:** This is to be agreed on the basis of minimizing landscape damage while providing convenient access. Where boom gates are installed, they will be used to regulate each entry/exit to the site. Where heavy or special vehicle access is required suitable damage minimization measures are to be undertaken such as timber boards positioned in wheel traverse areas over 'soft' landscape.
- **Contractor vehicle parking:** Consultants are required to provide project specific documentation indicating the extent of the site, the site enclosure and the site parking. If this area encompasses existing soft landscape features, strategies to minimise damage/compaction will be required.

Individual Tree Protection

04.047 The following procedures for protecting individual trees will form part of the LPP for any project impacting on a significant tree or significant trees. In addition, even where a LPP is not required, these procedures are to be implemented and followed whenever activity is taking place within the drip line of any tree deemed worthy of retention.

04.048 In order to protect significant trees, the following procedures are to be followed:

- a preliminary tree assessment should be carried out at the beginning of the project of all trees on-site. All trees and landscapes potentially affected by the project should be reported on by the Consultant as the basis for deciding which trees are suitable for retention;
- an arboricultural impact assessment will be prepared once the final layout is complete. It will include the following main elements:
 - o identification of trees to be removed, retained or transplanted;
 - o identification of possible impacts on trees to be retained;
 - o determination of TPZs for trees to be retained. Refer to AS 4970 for determining the TPZ (ANU requires the minimum TPZ is calculated at DBH x 12);
 - o a tree protection plan (drawing) showing the TPZs for trees being retained. The tree protection plan should be included in subsequent construction documentation; and
 - o measures necessary to protect the trees throughout all construction stages.

04.049 A list of tree protection measures are listed in AS 4970. These measures are identified in the arboricultural impact assessment and tree protection plan. A process for monitoring should be identified in all stages of development works.

- **Identifying a TPZ:** Where there is the likelihood of a project impacting on existing trees, the Consultant must ascertain if any significant trees are likely to be affected. The size and shape of a particular protection zone will vary according to individual tree species and the site. The zone will be determined by an Arborist prior to commencing the project and will remain in place until project completion.
- **Pruning:** Prior to establishing a TPZ, trees to be protected will be pruned by ANU Gardens and Grounds. No project activity to undertake any additional pruning will be allowed.
- **Establishing the TPZ:** In addition to AS 4970 the following measures are required (long term projects only):
 - o Mulching – 100 mm of composted mulch cover over the ground within the TPZ in order to retain soil moisture and encourage microbial activity.
 - o Drainage – the natural drainage patterns around the root zone should not be altered.
 - o Signage: to be supplied and erected by the Gardens and Grounds Section

Landscape Construction

04.050 The ANU may decide to use their internal grounds maintenance resources for certain parts of the construction of new landscape works or alterations to existing. Such scope of works will be identified to the Consultant at time of commissioning.

Landscape Protection during Construction

04.051 The ANU requires the Consultant to take responsibility for the preparation of documents which indicate the processes and methods for the protection of existing landscapes from construction-related activities and construction personnel vehicle parking. Parking arrangements that are agreed with the Principal's Representative shall be clearly documented for construction purposes.

Definitions

For the purposes of this document, the following definitions are used:

Arborist

A specialist in the care and cultivation of trees. The ANU has a dedicated Arborist.

DBH

Diameter of tree trunk at breast height; nominally 1.4 m above ground level.

Drip Line

The area of ground directly below the outer edges of the canopy.

Root Zone

The space within the soil occupied by the root system of a tree. Unless otherwise defined by the Principal's Representative, the root zone will be assumed to be equivalent, in plan, with the TPZ.

Significant Tree

A tree that has been categorised as Exceptional, High or Medium quality (see definitions in the following Section).

Tree Canopy

The space that is occupied by the branches and leaves.

Tree Protection Zone

A defined area of ground where no activity is to be undertaken. Unless defined otherwise by the Principal's Representative. This zone will comprise a circular area, with its centre as the trunk of the tree. Refer AS 4970.

05 – Roofing, Roof Fabric & Roof Safety

Version	Date	Authors	Summary of Changes
1.1	9 January 2011	Barry Owers	
1.2	8 February 2012	Solomon Elijah	Section and Numbering amended
1.3	27 February 2012	Barry Owers	Compiled roofing and roof safety together
1.4	28 February 2012	Barry Owers	Changes to 22.13 Drainage from roof gutters
1.5	16 March 2012	Barry Owers	Designs, drawings requirements.
1.6	21 March 2012	Barry Owers	Section 22.4 Box gutters
1.7	1 October 2012	Barry Owers & Andrew Smith	Height Safety Specifications
1.8	21 December 2012	Barry Owers	Clause 22.2.4 added
1.9	21 January 2013	Solomon Elijah	Clauses 22.1.1 & 22.1.15 amended
2.0	05 February 2016	Andy Smith	General Revision
2.1	27 February 2020	Andy Smith	General Revision
2.2	10 August 2021	Andy Smith	General Revision

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Introduction

05.01 The Campus and Buildings Requirements Manual (the CBRM, the Requirements or the Manual) documents the minimum design and construction requirements for new, refurbishment or repurposed building works, landscapes and engineering/infrastructure projects on buildings, facilities and campuses of the Australian National University (the ANU or the University). The Requirements are prepared for the direction of a Consultant, Designer or Project Manager in the preparation of project specific documentation and in the delivery of project works.

05.02 Notwithstanding any Consultant's particular discipline or area of responsibility, each Consultant and/or designer shall consider the document in its entirety. The complete CBRM consists of the following Sections which may be referred to within this Section:

Campus and Building Requirements Manual	
Section 01	General Requirements
Section 02	Architectural Requirements
Section 03	Roads, Car Parking & Civil Works
Section 04	Soft Landscaping
Section 05	Roofing, Roof Fabric & Roof Safety
Section 06	Building Management Systems
Section 07	Electrical Services
Section 08	Fire Protection Systems
Section 09	Hydraulic Systems
Section 10	Mechanical Services
Section 11	Lifts, Cranes & Vertical Transportation Systems
Section 12	Security, CCTV & Access Control

Specific Design Requirements

05.03 Roofs should not be used as plant areas. Where roof mounted equipment is required, install:

- on a structurally sound steel platform to be designed with a limited amount of roof penetrations and all height safety built into this structure; or
- on a structurally sound waterproofed concrete slab formed as the whole or part of the roof structure.

05.04 Consultants are to consider minimising the number of roof penetration which could present a potential roof leakage point.

05.05 Polycarbonate is not to be used as a roof sheet material.

- 05.06** Fibreglass is not to be used as a roof sheet material.
- 05.07** The Consultant shall consider Safety in Design principles for roof construction, roof access and roof maintenance.
- 05.08** Internal box gutters are not acceptable, stringent design standards are applicable to gutters located on the inside edge of external wall parapets.
- 05.09** No downpipes are to be incorporated in structural building elements such as columns.
- 05.010** Roof, gutter and stormwater water noise must be considered and mitigated where issues are anticipated.
- 05.011** Overflows are to be provided to all roofs and gutters as a safeguard against flooding. Overflows are to discharge clear of building lines and pedestrian paths or bridges.
- 05.012** As a minimum roofs and roof drainage systems are to be designed for a 1:100 year return rainfall intensity. Specific projects may be assessed as a higher risk.
- 05.013** Where a patio, deck, balcony etc. has openings into a building structure floor drains must be installed centrally with spoon/strip drainage installed along walls and doorways. Facade overflows need to be installed 50mm lower than the finished Floor Level.

Roof Penetrations Generally

- 05.014** When a roof penetration is required only a complete composite proprietary roof flashing system is to be specified for sealing pipes and penetrations. The system is to include all internal and external gaskets and boots.
- 05.015** Each proprietary roof flashing kit installed is to have a 20 year warranty.
- 05.016** For single pipes and penetrations only specify products suited for that purpose shall be used.
- 05.017** For roof penetrations where a set of condensing pipes can be grouped and passed through the roof fabric specify only Deks Top Hat Roof Kit or equal equivalent.
- 05.018** Metal covers must be installed over all roof penetrations and expansion joints to protect from Hail damage and vermin control.

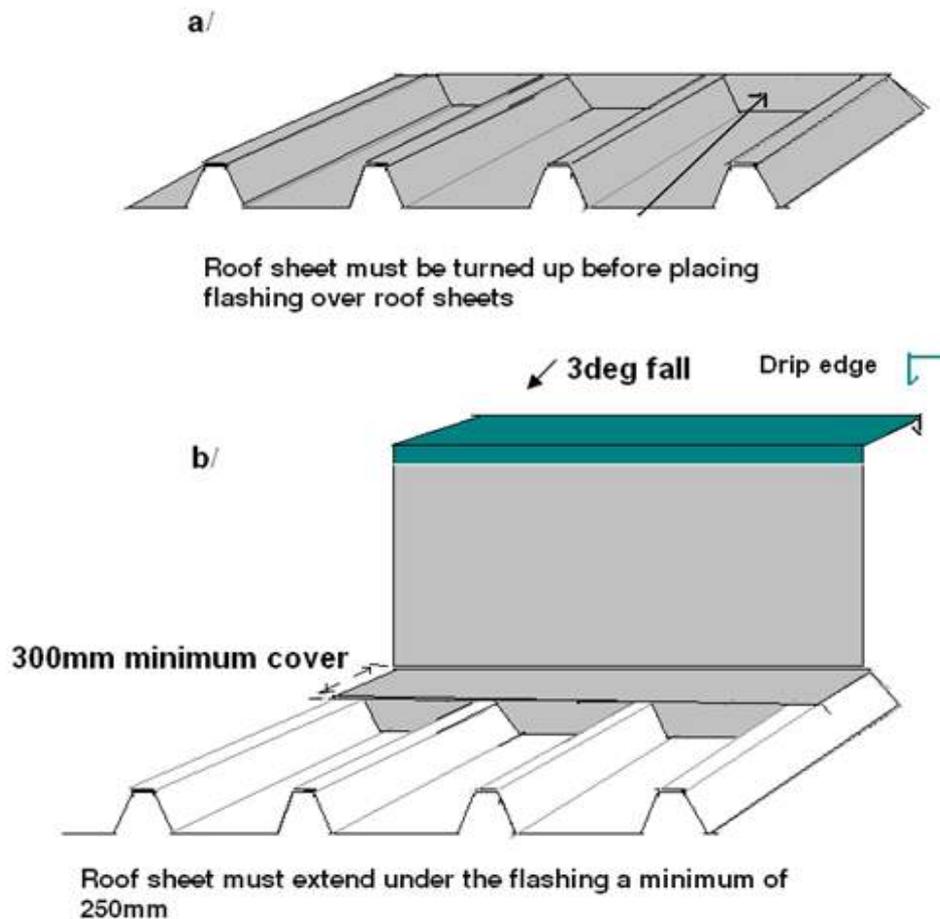
Roof Sheeting and Flashing Specifications

- 05.019** For all roof sheeting and flashing the following specifications apply:
- roof sheets shall be a minimum of .48 BMT (base metal thickness). Specify the heaviest gauge available in the product range;
 - roof sheets should be 700 series Stramit or Bluescope with proprietary purpose made accessories including concealed fixing brackets. (Roof sheets with no screws, helps eliminate roof leaks.);
 - use only the manufacturers standard colour range;
 - flashings and gutters to be .60TCT (Total coated thickness);
 - all fixings should be class 3 or 4;

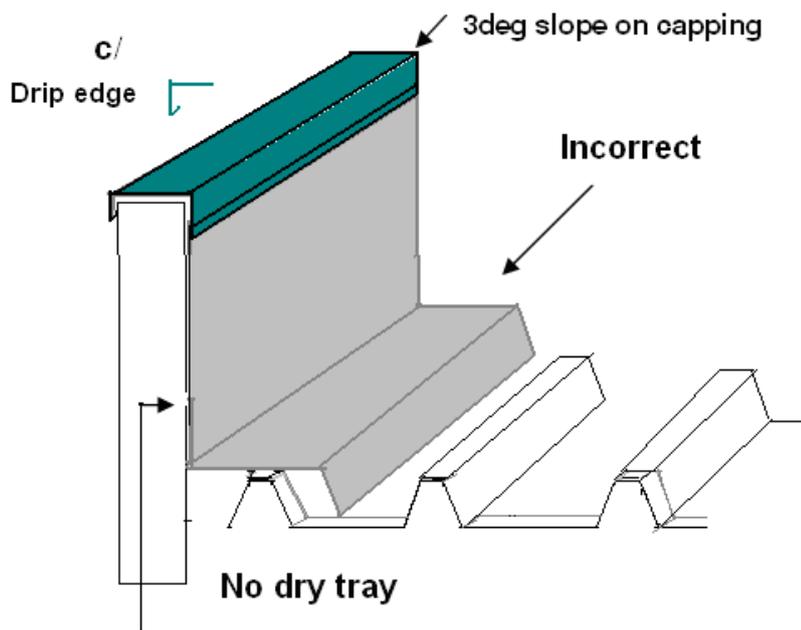
- do not use aluminium rivets, unless it is an existing aluminium roof. Use only blind steel rivets;
- syphonic drainage shall not be used in areas where there is any chance of leaf litter. (This covers most ANU buildings and environments.);
- due to the large amount of traffic on our roofs, battens or C-sections supporting the roof sheeting shall not exceed 800 mm at the top end and bottom of the roof sheets. the intermediate supports shall not exceed 1000 mm;
- ensure that roof sheets are protected when welding or cutting;
- use a cold cut saw blade or tin snips when cutting out sheet metal;
- on completion of roof work, all metal fillings, pop rivets, screws, pieces of metal and any other excess materials to be removed. Ensure roof is left neat and tidy; and
- roof sheets under no circumstances should have a fall of less than 5 degree. A greater degree is better.

05.020 Due to the amount of equipment placed on ANU roofs, it is essential to follow these guidelines. Roofs should not become plant rooms as increases in roof penetrations will increase the potential for roof leaks.

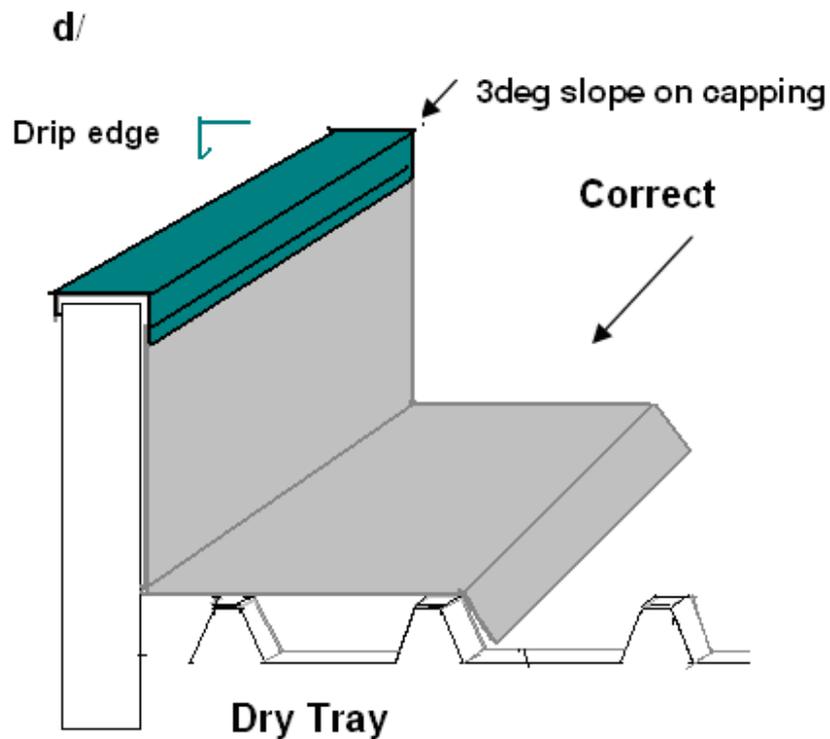
Apron Flashings

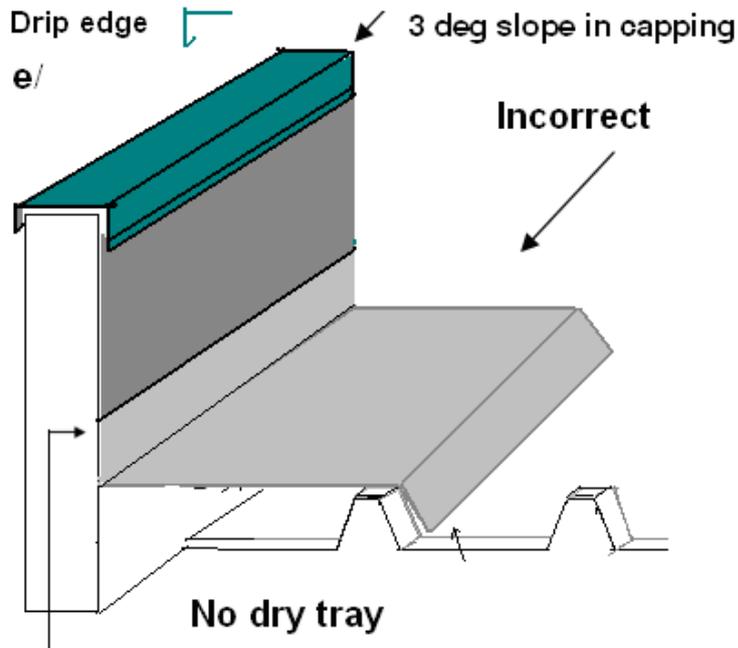


Apron Flashings to be installed with a dry tray

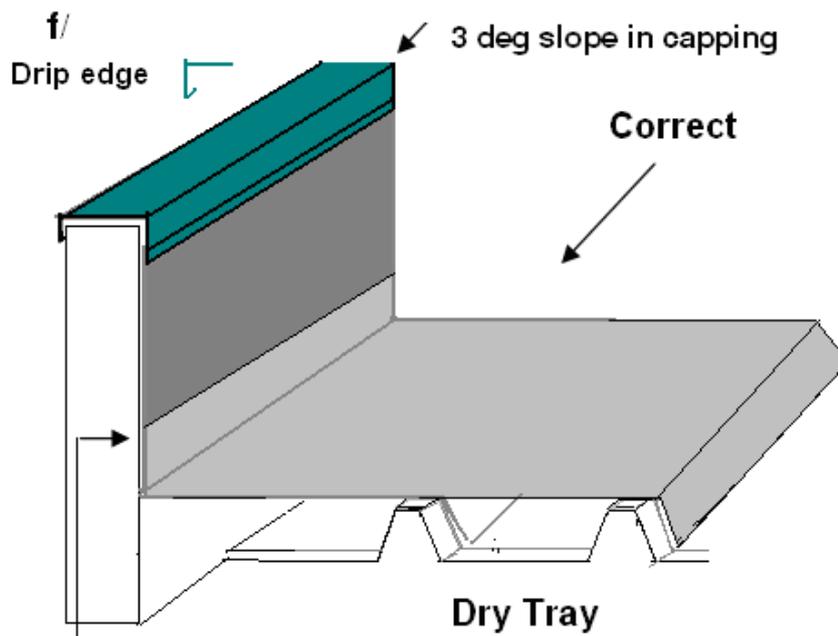


Note- This can be a full section or over lapped as shown





Note- This can be a full section or over lapped as shown



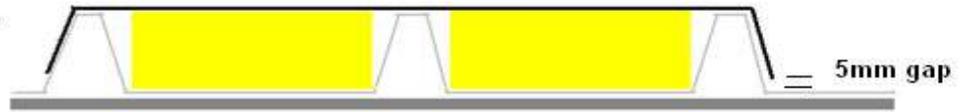
Note- This can be a full section or over lapped as shown

Back Trays

Correct method of installing a back tray

a/
End view

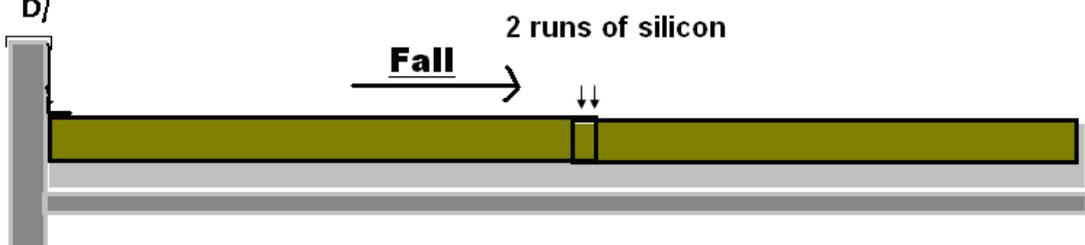
Suitable support for back tray
timber or high density
polystyrene.



• Note- Tray must have a support unless the width of the tray is under 75mm

Side view

b/



**150mm lap with the high side lapped
over the low side**

c/

End Finish

Lower end of backtray



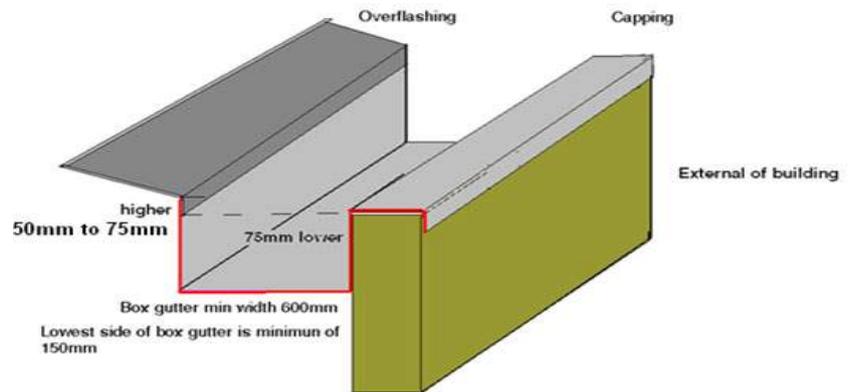
Ends of bent down to suit the profile of the roof sheet.

Requirements for Box Gutters

05.021 The sizes indicated below are minimum sizes. Larger sizes may be required and are to be calculated to accommodate a 1:100 year return rainfall intensity.

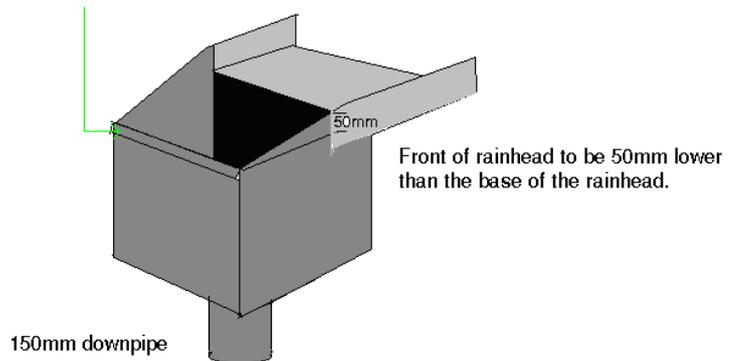
On buildings that require box gutters the internal section of the gutter is to be 75 mm above the external side of the box gutter.

The box gutter is to be made in one piece extending over the external wall or fascia.



Rain head preferred concept from a box gutter.

Ensure free flow of water from a rain head

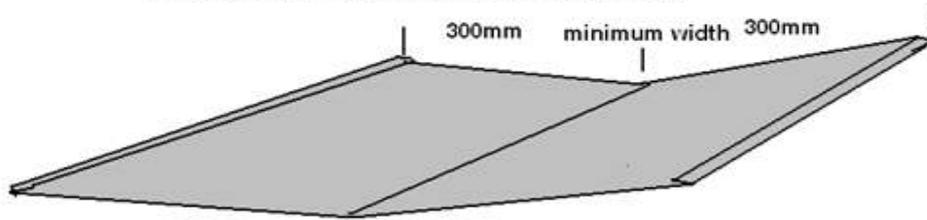


Note:

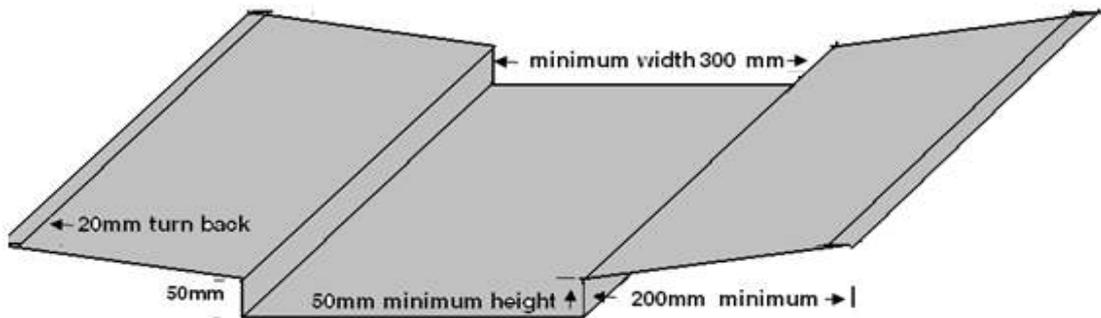
- Box gutters with rain head outlets can be used on buildings that have roof and gutter upgrades.
- The removal of water from the box gutter is of prime importance. Do not reduce the flow from the gutter to the rain head.
- Standard proprietary gutter hail guards systems only are to be used on the ANU building stock.
- Walkways can be used as hail protection devices if the systems are install 2.5 Metres away from the Box gutter.

Valley Box Gutters

a/ **Conventional vee shape valley gutters**
 Only to be used on roofs over 22deg pitch



b/ **Valley box gutters to be used on all roofs under 22deg pitch**
 Size of the valley box gutter depends on roof area, rain fall and the amount of leaf litter.

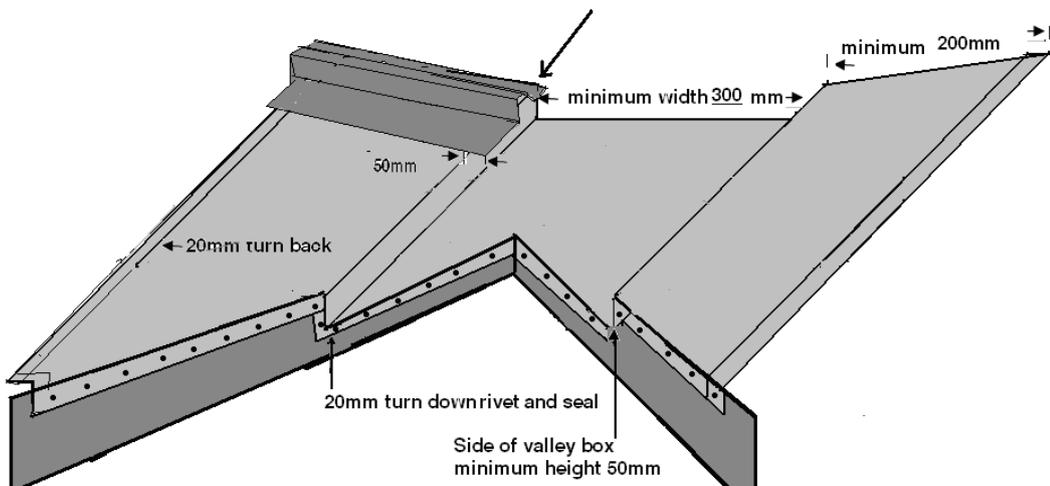


Box valley gutter to be cut into the back of the box gutter or external gutter.

Size of the valley box gutter depends on roof area, rain fall and the amount of leaf litter.
 Refer to A.S.3500

Roof sheet not to extend into the box section any more than 50mm to allow for easy cleaning

c/

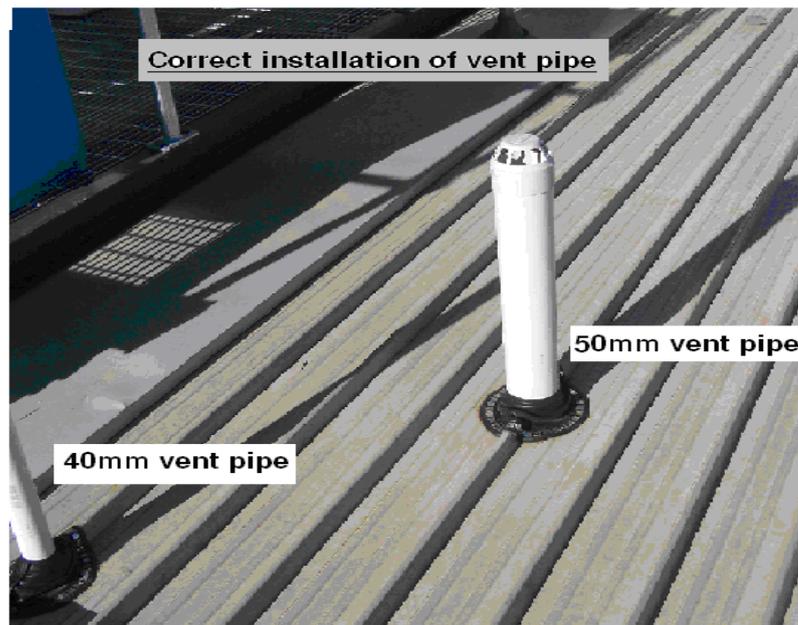
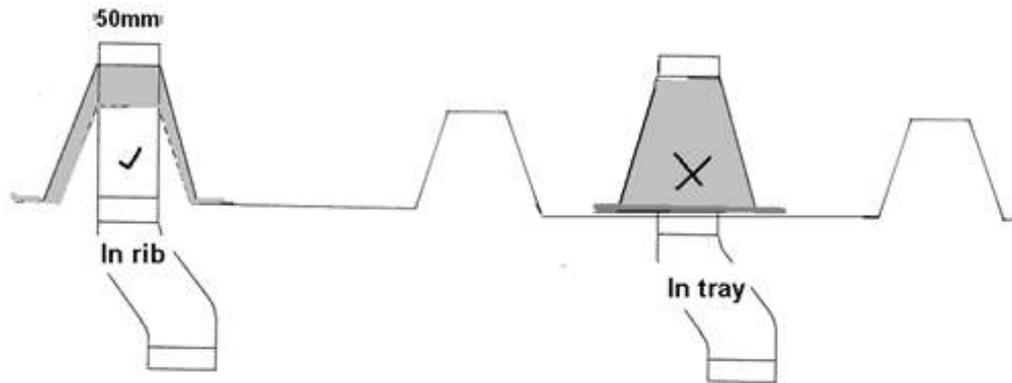


Vent Pipes

05.022 Only one proprietary roof flashing kit shall be used for each single pipe/ conduit that penetrates the roof. Fluted flexible electrical conduit will not be accepted. Only smooth surfaces shall be flashed in this way.

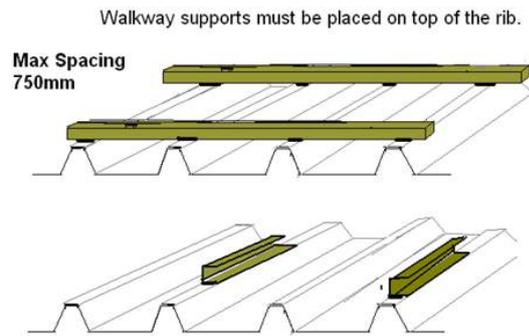
Pipe Penetrations

Pipe work in general to go through the rib of the sheet so water flows from the roof unrestricted

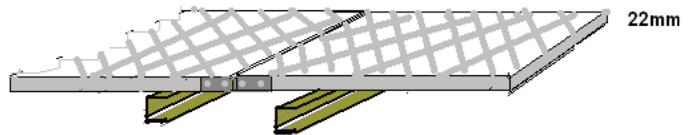


Walkway Supports

- a) If walkways are specified in aluminium, they are to be 22 mm in thickness or greater.



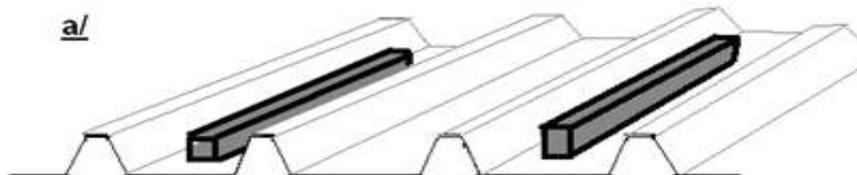
- b) Where ever a walkway joins, a support must be placed as close as possible either side of the join. Supports are to be placed no more than 250 mm apart.



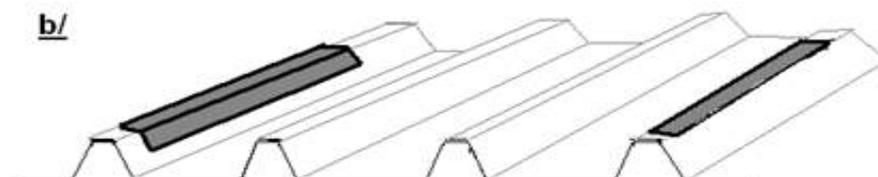
Support of Equipment on Roofs

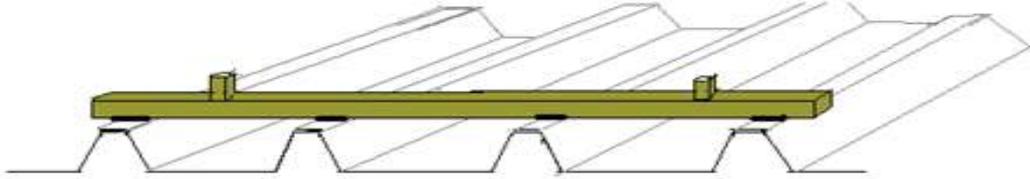
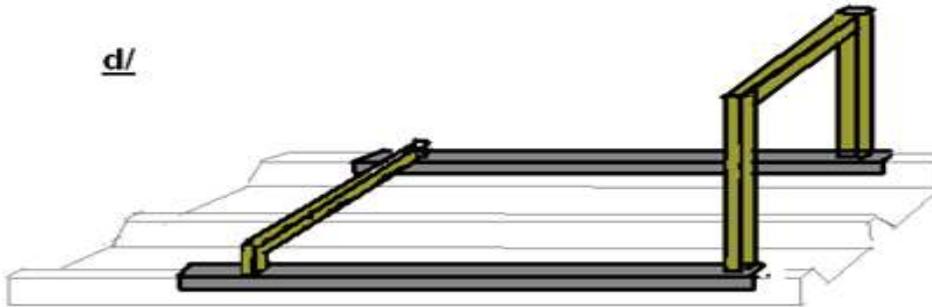
Note-When there are multiples of equipment a platform should be used

Never place the supports in the tray of the roof sheet, this restricts the flow of water and traps leaf matter

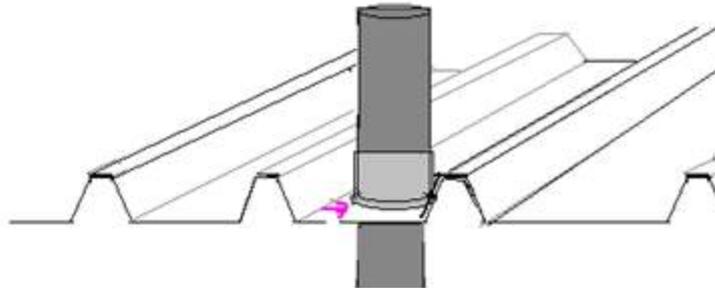
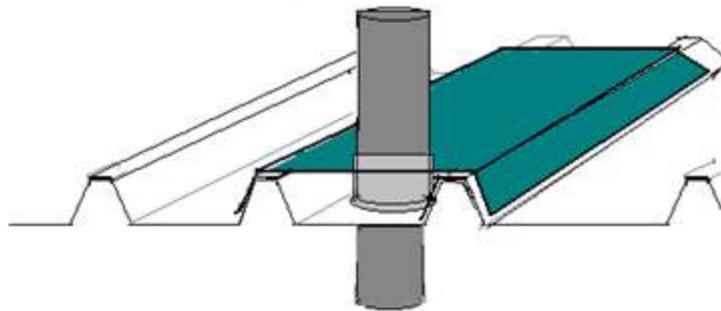


Place a rubber seal between the two metal surfaces

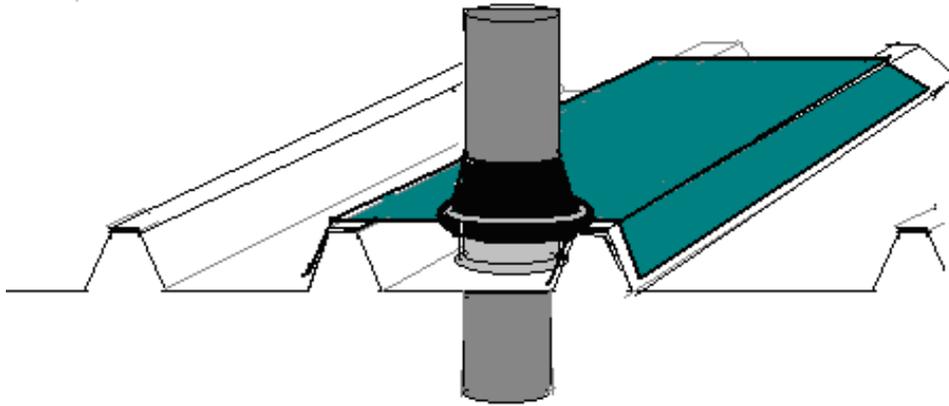


Some examples of the correct support on roof sheets**Ensure there is structural support with in the building frame work to carry the load intended****c/****d/**

Roof Penetrations

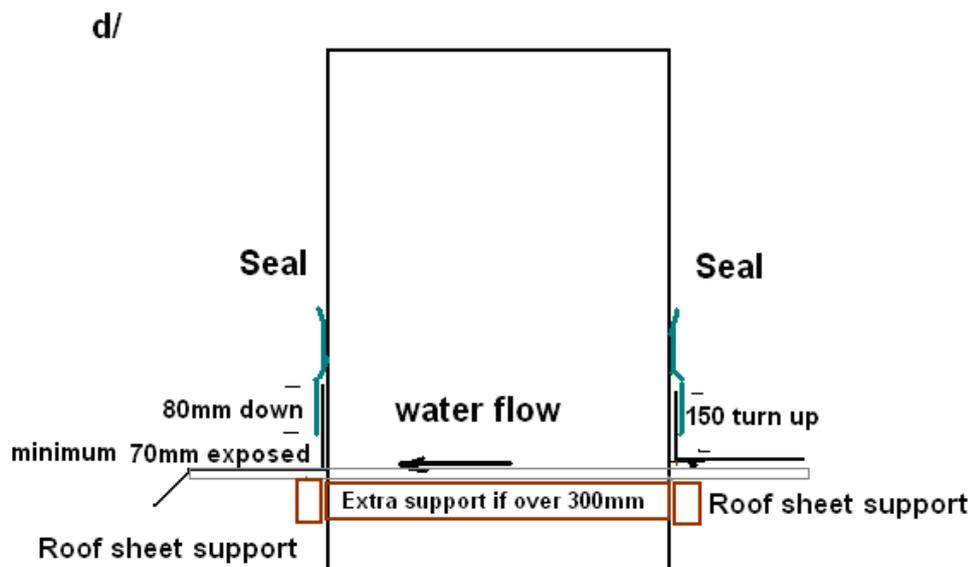
Exception to dry tray rule**a/ Seal flange to tray so that it is water tight****b/ Install back tray**

c/ Install Dektite

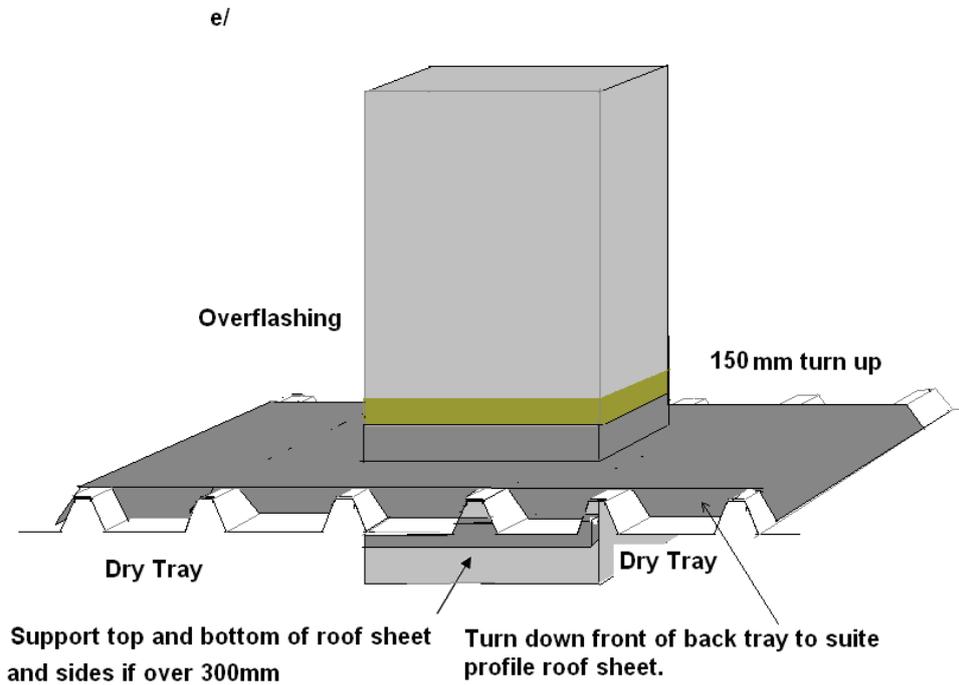


This would only be suitable for pipes or tubing up to 100mm.

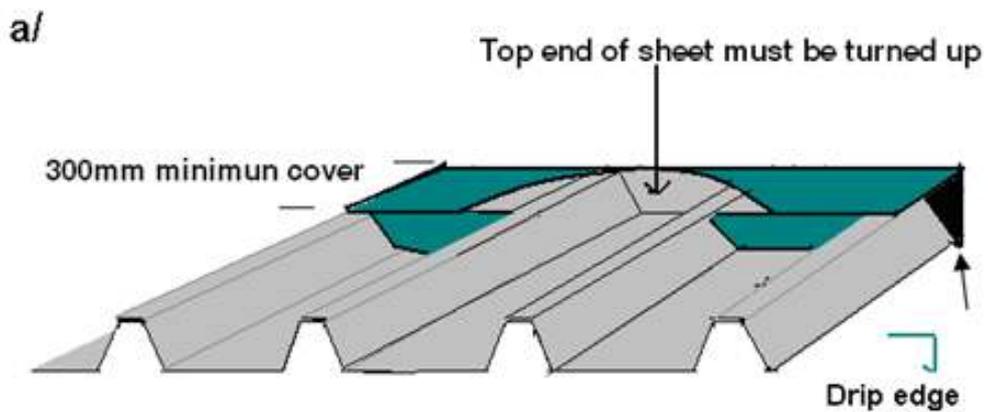
Cross section of a roof penetration

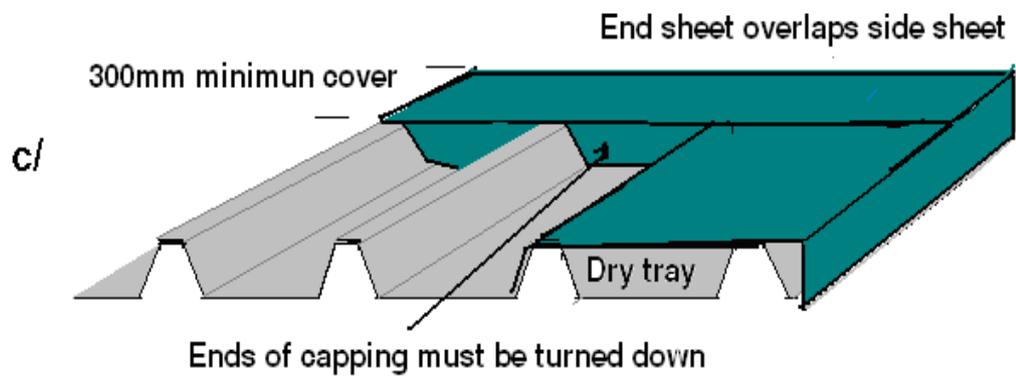
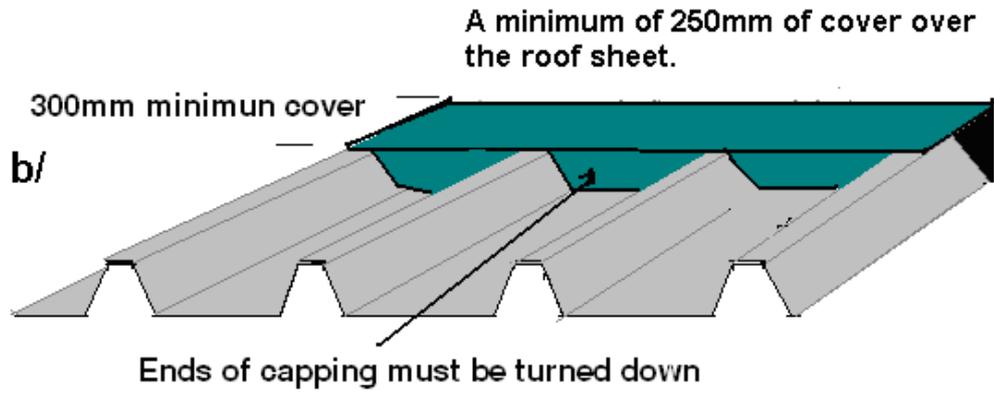


For Larger roof penetrations

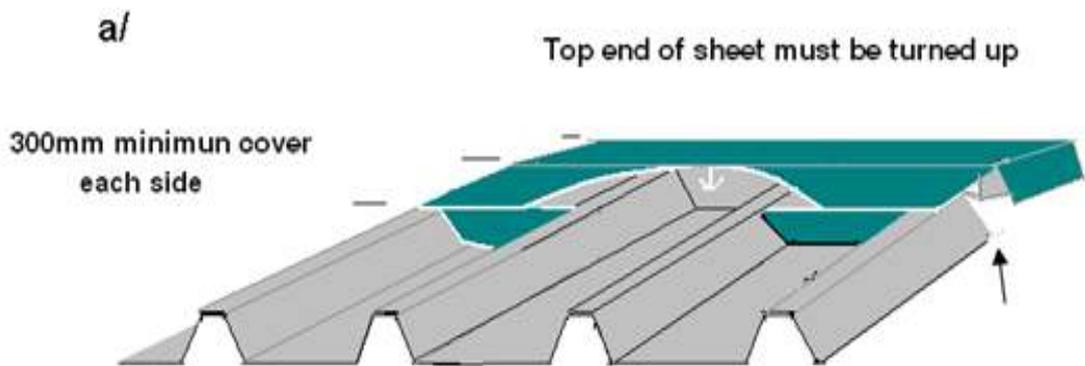


End Capping/Barge Capping





Ridge Capping

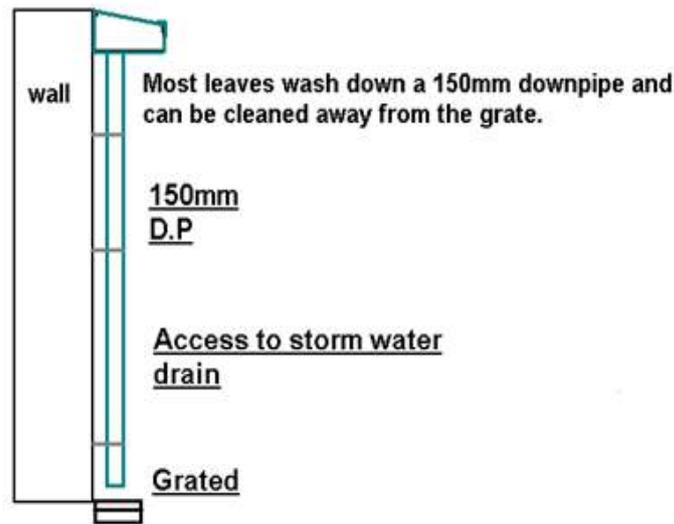


Roof Drainage from Gutters

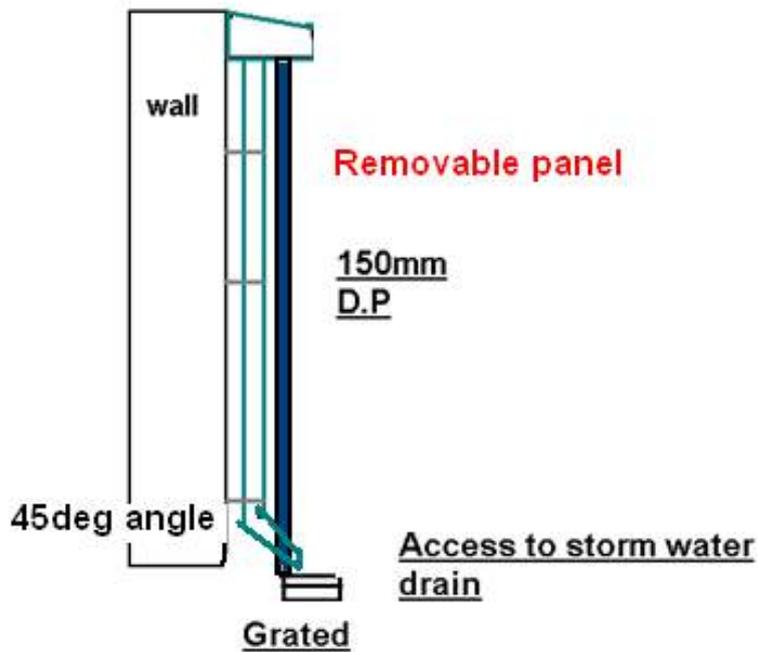
a/ Syphonic systems for roof drainage should not be used where there is any chance of leaf litter.

b/ Recommended down pipe size to be 150mm with grated drain at ground level

c/ Residential buildings such as individual dwellings, 90mm round or 100mmx75mm to be the minimum size and a grated drain still required



d/ Internal downpipes may only be used as per details below.



Mechanical Plant on Roofs

- 05.024** Where possible, the best location for such plant is not on the roof, as this increases the probability of roof leaks. If such plant is to be placed on the roof, it should be placed on waterproofed concrete roofing slab sections designed to bear the structural live loading of such equipment.
- 05.025** If mechanical services equipment has to be located on metal deck roofs that have no designated concrete slabs to accommodate the plant, well designed structural steel platforms with galvanised finish shall be provided to accommodate and distribute the weight of mechanical services equipment such as chillers, boilers, air handling units, fan coil units, fans, fume scrubbers, cooling towers, process cooling units, storage tanks, pumps, air cooled condensing units, refrigeration condensing units and switchboards.



- 05.026** In the specific situation where multiple air cooled condensing units are to be installed, these should be placed on a platform as indicated. This general principle shall be used to accommodate all items of mechanical services equipment.

Spread the weight over the ribs of the sheet so as not to restrict water flow.



Incorrect



Correct

Rubber boots to roof flashing kits should be pulled up correctly and not placed in the middle of the tray (pan) of the roof sheet.

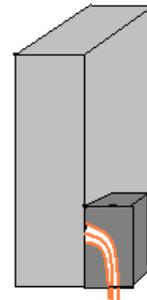


Incorrect



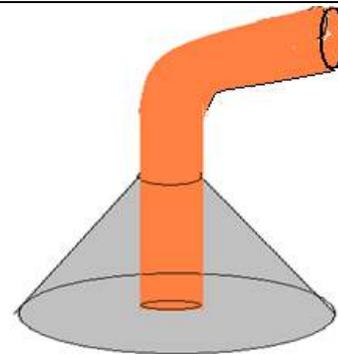
Correct

Have pipe and conduits enter as close to the condenser as possible and install metal protective cover

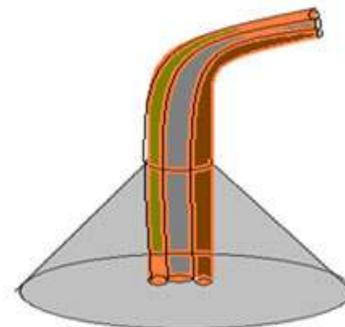


Single pipe or conduit is the only time a proprietary roof flashing kit is to be used without a protective cover

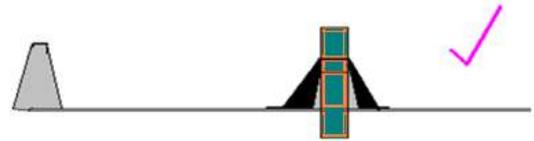
Protection from potential damaged caused by birds must be provided



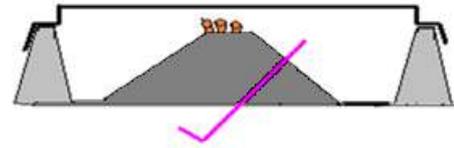
Must have a metal protective cover, or encased in a PVC or metal pipe and elbow



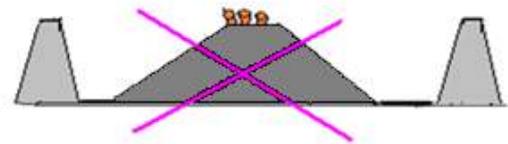
Correct installation using a proprietary roof flashing kit



Correct installation of an over flashing



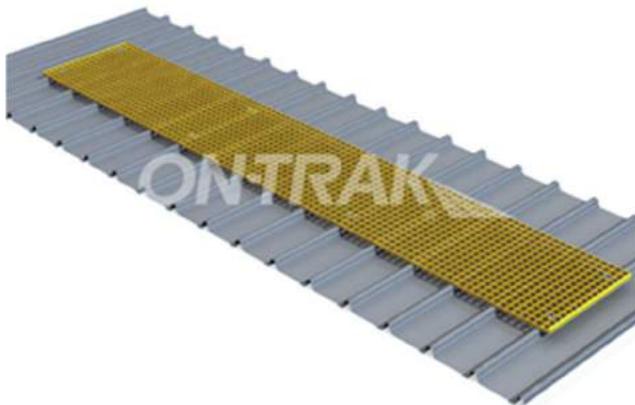
Installation of penetrations and flashing should not result in restricted water flow from the roof deck/surface



Roof Safety Requirements on ANU roofs and PV Panels

05.027 Where a roof on the ANU campus is to have PV (Photovoltaic system) installed here are some simple commonsense guides.

- PV panel must have a clear space of 3M Safe Zone from the edge of all roofs
- Clear exit and maintenance path between every four panel blocks will be needed
- Walkway made from FRP Fiberglass Reinforced Polymer (ON-TRAK Yellow) is to be install between and around PV panels
- PV panel must have a clear space of 3M Safe Zone from the edge of all roofs



- Roof safety static Lifelines is to be installed 2.4 metres from the edge of the roof and beside the walkway- Non-propriety systems are to be used only
- All walkway is to be installed with Trak-Tite mounting clips where possible
- No Anchor points and safety Lifelines are to be used in the middle of the PV panels(No height safety equipment is to be used over panels)

05.028

ANU Height Safety Specifications

05.029 All Current Australian Standards, Work Health Safety laws and compliance with manufacturers installation requirements are to be followed.

05.030 The Height Safety designers shall work with the architect's concept on alterations to the building design to eliminate risks and reduce the need for specialist multiple height safety systems. Consider Safety in Design principles for roof safety construction, roof access and roof maintenance at the Concept stage of the structure.

05.031 ANU with only except non-proprietary items, all roof safety system are to be installed and certified by an accredited installer.

05.032 On completion of any whole roof safety system on new/refurbished/existing roof an independent Height safety consultant (Facilities and Services to nominate) will provide a report and recommendation specifically for the University's handover process with all cost to be paid by the principle contractor. Note section Commissioning, Operations & maintenance requirements section (Roofing and Roof safety) of the CBRM

05.033 All ANU safety lines and roof safety components are to be an off the shelf non-proprietary system/asset for ongoing rectification of the system;

05.034 All systems where possible should be capable of two person operation, where lines are very short a single person capability will be accepted, providing this is clearly indicated on system data plates.

05.035 All safety Anchors components are to be a off the shelf non-proprietary system/asset for ongoing rectification of the system;

05.036 The first man up Strop must be used where entry to the roof is from a ladder/ladder hatch; reduces the amount of entry access anchors required. Attachment end should be secured with a strop hook when not in use to ensure it can be accessed from a safe area for next use.

05.037 The University's preference is for internal roof access via compliant roof access stairs

05.038 Roof access hatches are to be a compliant non proprietary product with dry pan back trays flashings to be used only, with support timber/foam used under the flashings. Guard railing are to be proprietary aluminium roof mounted system, power coated only to match the roof colour. Walkway are to be fitted on the excite points and continued around the roof, this eliminates trip and slip hazards on a safe path to any roof mounted systems, gutters etc. where a roof safety system is installed this must be on the lower side of the walkway and will nominate the potentially hazardous area.

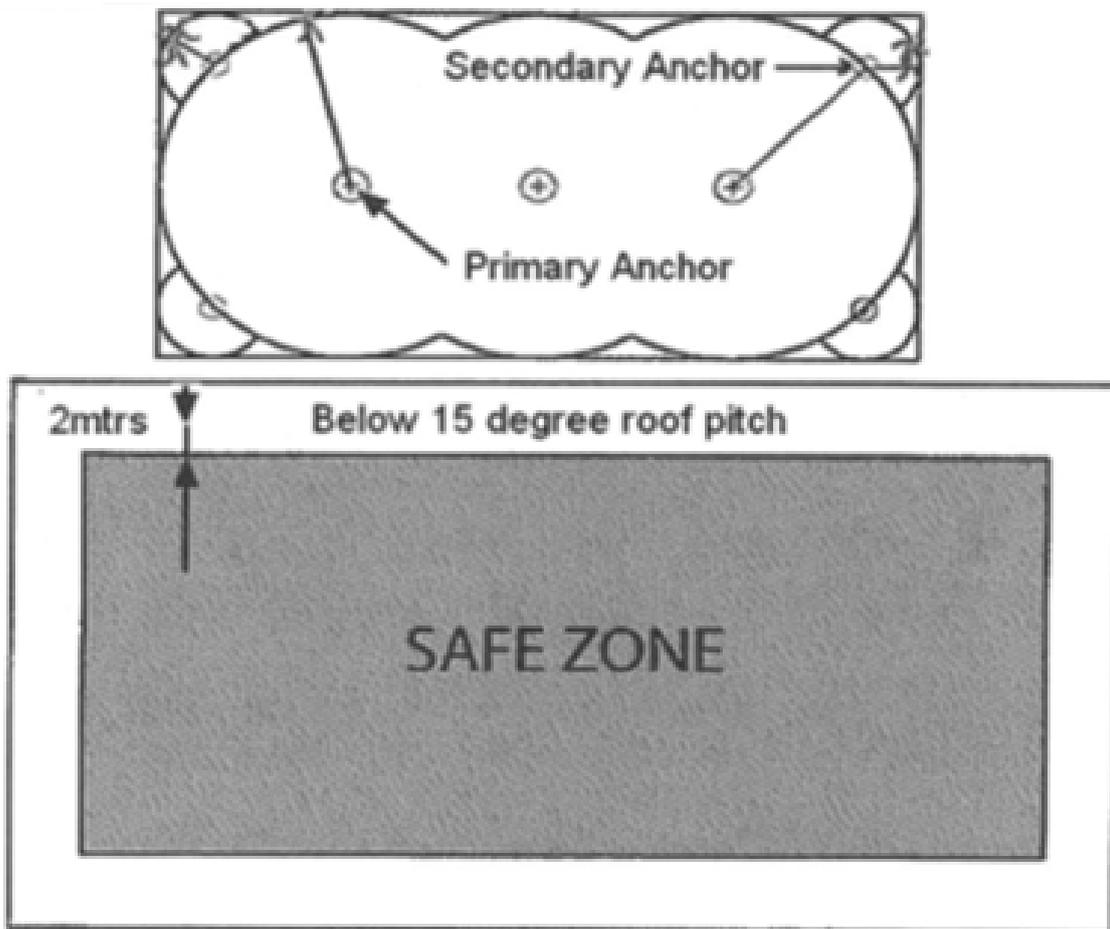
05.039

Personal Protection Equipment (PPE)

05.040 One full PPE Roof safety system kit is to be supplied with every new system installed

Roof Safety Layout and Roof Safe Area

05.041 Examples of roof safety layout and roof safe area.



05.042 When designing a roof safety system on the ANU building stock, every safe zone must have trafficable access walkways installed from the access point around the roof perimeter back to the access point 2.5 metres from any on the roofs edges (this also acts as a hail prevention add). All height safety systems must be on the lower side of the walkways as a rule. Any asset placed in the safe zone must have its own risk assessments to eliminate any height safety and created by these assets, roof safety system are not to be used as an option for any items in this safe zone. E.g. where a skylight is present cover/mesh installed, signage

etc. , mechanical plant installed on roof must have a platform installed , guardrails, access steps etc. Eliminating the hazards all together in this space must be a design specification.

Correct Installation of Safety Systems

05.043 Included below are pictures and diagrams illustrating ANU requirements. The aim is to have continuity throughout the ANU. Facilities and Services are responsible for the maintenance of ANU roofs while reducing the amount of ongoing maintenance required.

- Contractors are to comply with all Australian Standards, authorities and State Government Regulations/Requirements as well as ANU installation practices.
- Seek technical advice from the Principal's Representative (the Principal or the Principal's Project Manager) before installing an anchor points
- Only of the shelf non-proprietary roof safety items are to be used for ongoing rectification of the system
- ANU Preferred Roof Safety system assets are SafetyLink and SAYA systems

Location of Harness Anchor Points

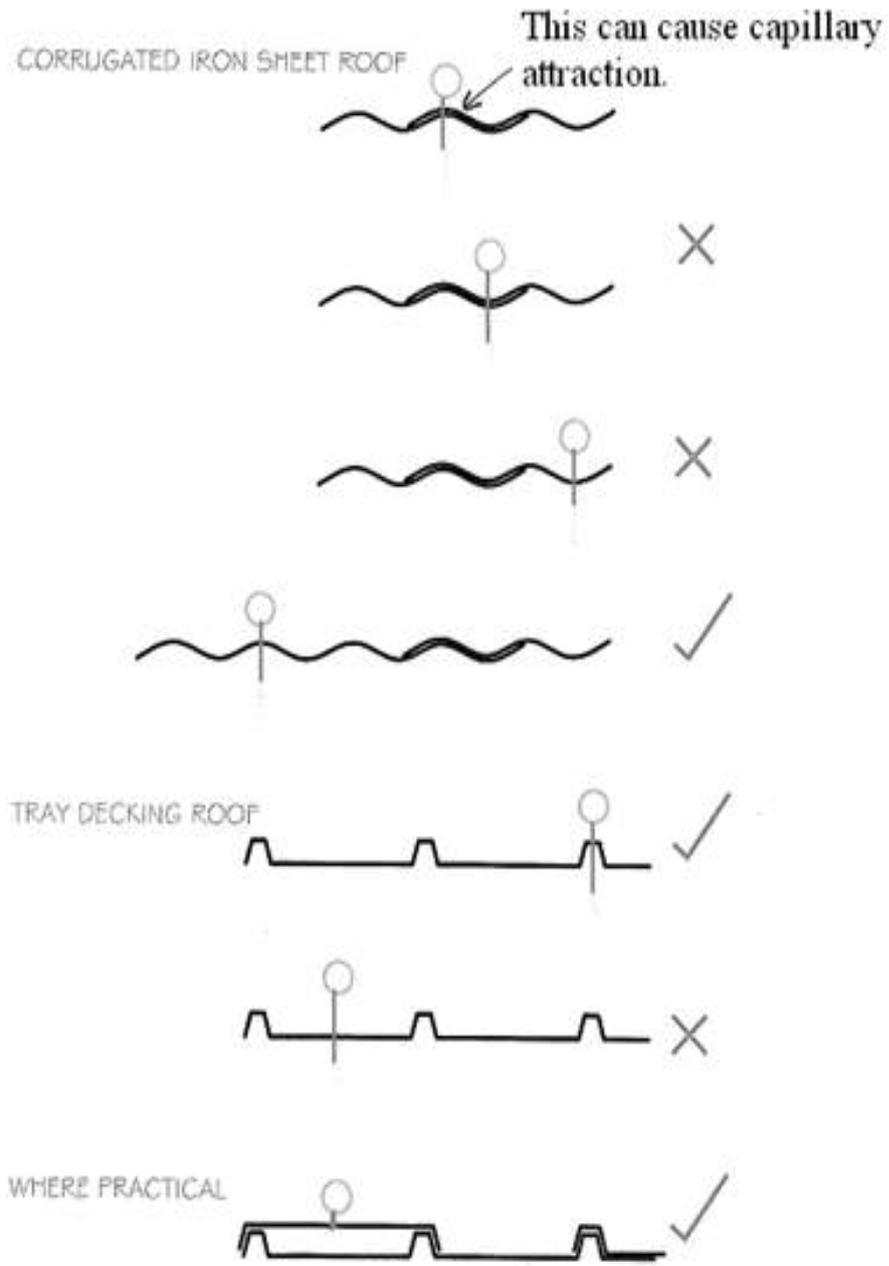


Figure 1

Indicates preferred method of no fixing in the tray.

This applies to anchor points as well as static points.

**Figure 2**

Indicates static line which is the ANU preferred method for safety systems.

**Figure 3**

If fixing into the structure under the roof sheet, go through the rib of the sheet as indicated.

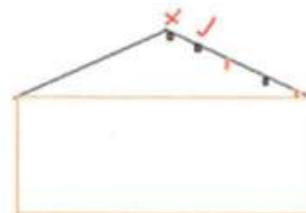
**Figure 5**

Fixing into the pan must be carried out using a stainless steel plate as indicated.

Note: Do not use a proprietary roof flashing kit designed for pipework.

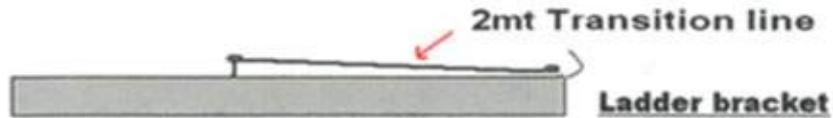
**Figure 6**

Do not place fixing plate too high on the roof as indicated

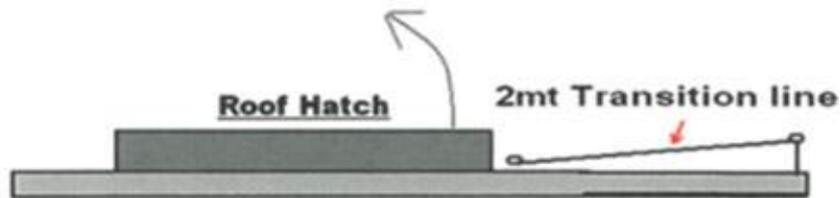


Roof safety systems certification

- 05.044** All roof safety systems must be certified on an annual basis in accordance with the relevant State or Territories requirements.
- 05.045** All safety lines and roof safety components are to be off the shelf proprietary system/asset for ongoing rectification of the system
- 05.046** Preferred method of roof entry is via internal access doors from stairs when a ladder access or roof hatch system is required then the following notes /photos are required,

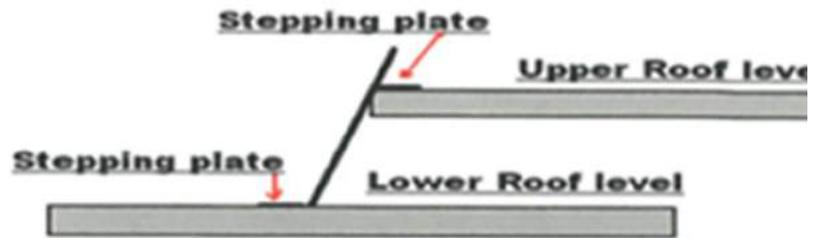


If hatch is 2mts or closer to the edge where you step out.



Supply and install a locating hook for easy access

05.047

Fixed Ladder Installations

- Adhere to applicable Australian Standards.
- Step-through styles extend to 1000 mm above upper roof level.
- Only have ladder at 90 degrees if no other option.
- Stepping plate to be 900 x 600 mm.

**Skylights and Walkways**

- 05.048** Cages/protective mesh over skylights are an ANU standard on any trafficable roof
- 05.049** Cages are to be Aluminium with the Proprietary systems are to be SAYA (protex) and or Spektra.
- 05.050** protective mesh must be Aluminium or Stainless Steel have specification
- 05.051** Walkway are to be standardised with FRP (Fibre Reinforced Polyester) walkway grating and use Traktile mounting clips (No roof penetrating)
- 05.052** Safety yellow is to be used in non-visual areas and Grey is to be used in visual areas.
- 05.053** Where Guardrail systems are to be used then a high quality proprietary aluminium walkway can be used, painted surfaces are not permitted on any guardrail/walkway system and only powder coated surfaces are to be used if the roof colour is to be used on any safety equipment.

Signage Requirements

05.054 Signage must be provided by contractor for certifying contractor’s safety system;

05.055 If there are skylights there must be signage in two locations

Skylight Signage at the entry point this will give the person a visual hazard awareness before starting the roof access process



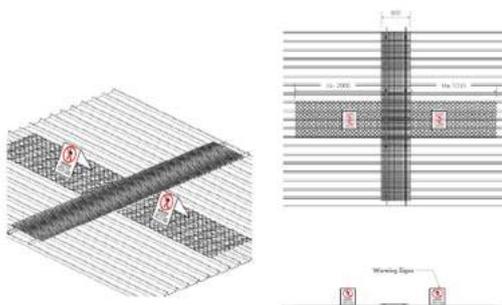
Skylight signage at the asset is a standard ANU requirement



05.056 Where a Sheet of clear roof material (Laserlite, polycarbonate etc.) A standard brittle roof sign is below, fall protection will be needed over this material via guard rails, Aluminium mesh etc

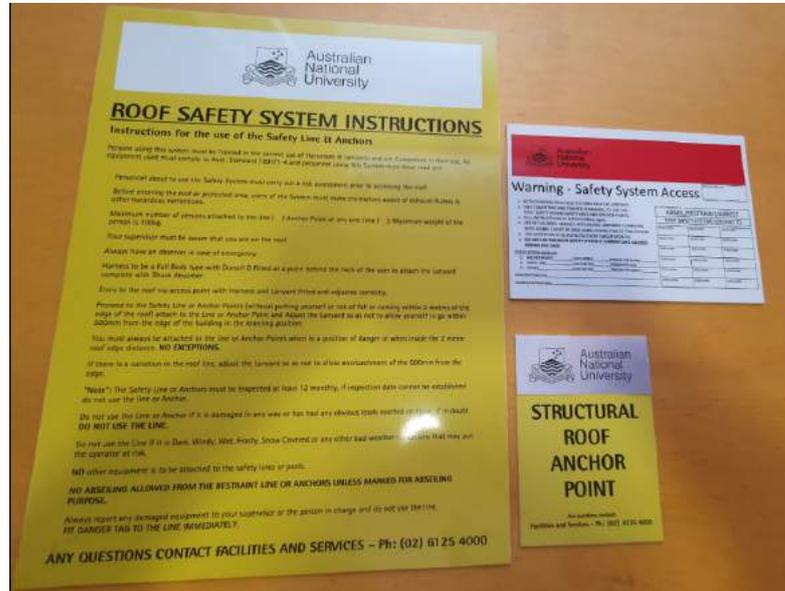


05.057 All fragile roofing material will need visible and clear signage with guardrail and FRP(Fibre Reinforced Polyester yellow) walkway access pathway over the brittle roof area eg



05.058 The ANU has three standard ANU signs which will be provided for the contractor to install at the entry points to the roof access as shown in below

05.059 ANU standard compliance plaque needs to be install and updated an an Annual base Roof Safety System Instruction and process sign and ANU structural roof anchor point



Maintenance and Recertification

05.060 To be completed as per Australian Standards, State based legislation and Manufacturer requirements.

05.061 Height safety and fall protection systems on the ANU building stock must be certified by a qualified licenced person only

05.062 The minimum requirement to be given after a recertification is Compliance certificate clearly nominating the Inspecting Company, ANU Building name with the number, dates of inspection, expiry date, clear asset identification numbers on the elements, roof plan with assets clearly marked, reportable items listed, recommendations if required and System Status.

05.063 When compliance have changed or been superseded provide a quote and the relevant regulation upgrade to the business contact to upgrade the site requirements.

06 – Building Management Systems

Version	Date	Authors	Summary of Changes
1.0	2012		New document
2.0	05 February 2016	Rajeel Naicker	General Revision
2.1	16 June 2016	Rajeel Naicker	Control types defined

Introduction	1
Main Server	3
Master Controller or Main Plant Controller	4
Field Controller or Application Controller	5
BMS Cable and Field Hardware Labelling	6
Alarms: BMS Alarm Template	6

Introduction

06.01 The Campus and Buildings Requirements Manual (the CBRM, the Requirements or the Manual) documents the minimum design and construction requirements for new, refurbishment or repurposed building works, landscapes and engineering/infrastructure projects on buildings, facilities and campuses of the Australian National University (the ANU or the University). The Requirements are prepared for the direction of a Consultant, Designer or Project Manager in the preparation of project specific documentation and in the delivery of project works.

06.02 Notwithstanding any Consultants particular discipline or area of responsibility, each Consultant and/or designer shall consider the document in its entirety. The complete CBRM consists of the following Sections which may be referred to within this Section:

Campus and Building Requirements Manual	
Section 01	General Requirements
Section 02	Architectural Requirements
Section 03	Roads, Car Parking & Civil Works
Section 04	Soft Landscaping
Section 05	Roofing, Roof Fabric & Roof Safety
Section 06	Building Management Systems
Section 07	Electrical Services
Section 08	Fire Protection Systems
Section 09	Hydraulic Systems
Section 10	Mechanical Services
Section 11	Lifts, Cranes & Vertical Transportation Systems
Section 12	Security, CCTV & Access Control

06.03 The ANU currently has four major types of Building Management System (BMS) on the Acton Campus. The current BMS controls and monitors heating, cooling and ventilation in administration and critical laboratory environments. In addition, routing of critical laboratory alarms is facilitated through the BMS. The BMS also controls street and certain car park lighting.

06.04 The University aims to reduce Campus facility operating costs and recurrent capital expenditure. Over time the ANU will progressively mitigate and/or eliminate risks associated with past traditional building services, strategies and systems and the lack of full integration capability.

06.05 ANU will move from a traditional BMS setup towards an Open System integration. The term Open System refers to integrating multiple services to the Integration Platform then to one uniform front end, refer Figure.01. The base building BMS controls or DDC will utilise BACnet protocol to communicate via the University's WAN to its respective servers and the integration platform.

06.06 The University is aware of multiple vendors providing BACnet control systems but requires systems installed that are consistent and common to extant systems and components. These systems will provide maintenance staff, building managers and laboratory managers visibility to their building systems to assist in building management and energy usage monitoring.

06.07 Currently, ANU Facilities & Services accepts the only proprietary controllers with full capability to comply with the requirements listed in this section.

06.08 Any deviation from these manufacturers requires formal approval from ANU Facilities & Services Division.

06.09 Automated Logic and StruxureWare controls are the two preferred control types on campus.

06.10 Except to the extent that the approval, if any, of the Principal includes a contrary provision, the approval is deemed to include the conditions that:

- use of the alternative must not directly or indirectly result in any increase in the cost to the Principal;
- the Consultant must indemnify the Principal against any increase in costs; and
- use of the alternative must not directly or indirectly cause any delay to the Project.

06.11 The Consultants should request, from the Principal's Representative, a list of approved plant and equipment. Design documentation including drawings, should be based the approved equipment.

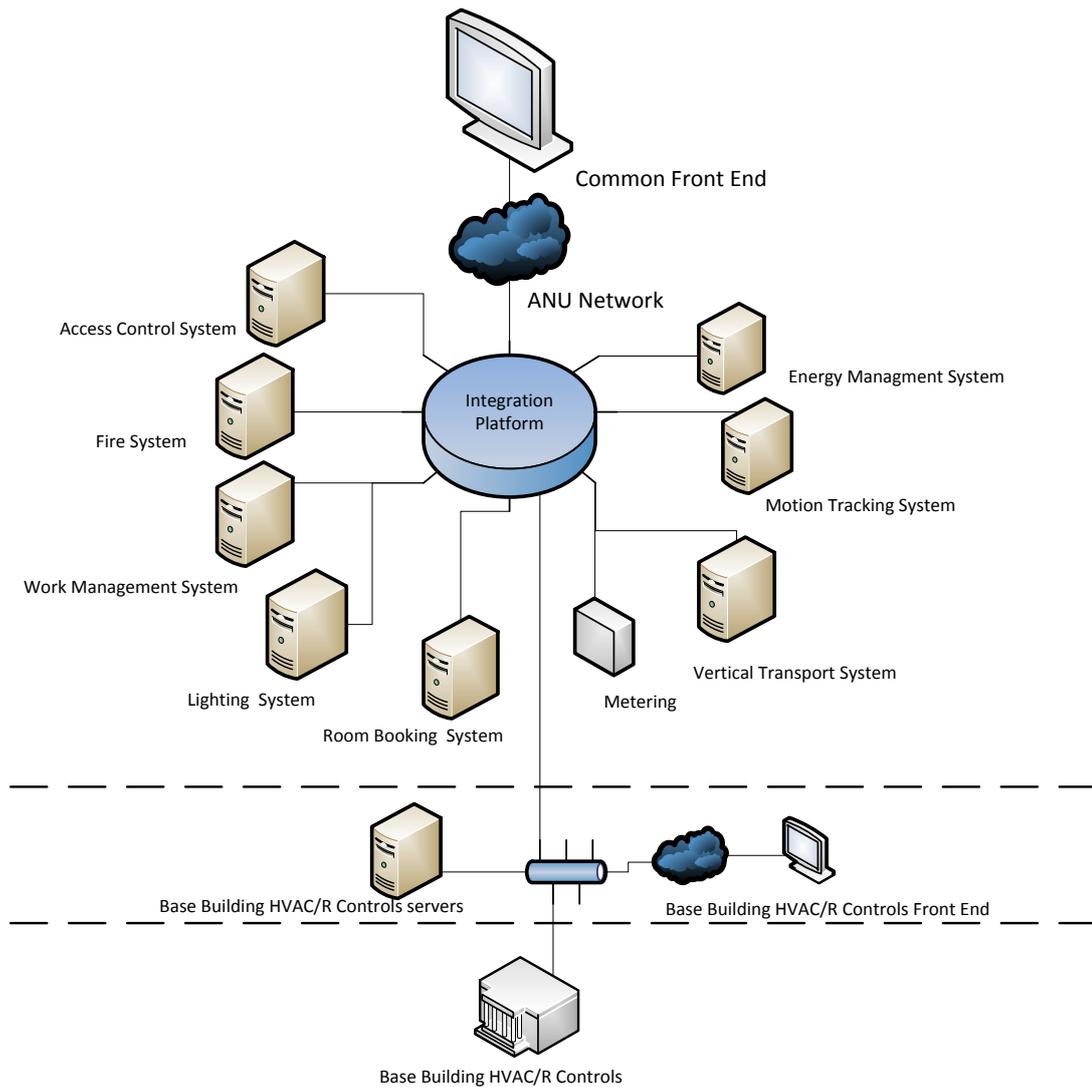


Figure.01

Main Server

06.012 Main Server refers to an enterprise application that will communicate with the Master and Field Controllers. Enterprise applications must run on a virtual server.

1. **Graphics**
 - a. All graphics on the Main Server must be presented in HTML5 format only;
 - b. should support animation;
 - c. should have all features listed under Master Controller;
 - d. ANU Power Users should be able to fully edit graphics;
 - e. graphics should be vector based (optional);
 - f. graphics should automatically scale to suit screen;
 - g. graphics should be in HTML5 format;
 - h. ANU Power Users should be able to control all points on graphics via web access; and

- i. Multi-layer graphics.
2. **Code:** All code should be written in block format only. Users should be able to modify and troubleshoot all code from Field and Master Controllers from the Main Server.
3. **Time Schedule:** All Time Schedules are to be presented in Microsoft Outlook Calendar format or horizontal/vertical bar format. Adding exception Time Schedules must not exceed four clicks. Time Schedules should be written and held in local Field Controllers in BACnet schedule format.
4. **Firmware:** Users must have the ability to push firmware updates to the Master Controller via the Main Server.
5. **User Access:**
 - a. Users must be able to access the Main Server graphics by entering one IP address on an internet browser.
 - b. Multiple users must be able to access the Main Server graphics at once. 50 users should be able to access the graphics at once.
 - c. Roaming PCs with client software to access Main Server graphics is **not permitted**.
6. **Security:** Power Users must be able to block certain users from viewing certain buildings and commanding certain points.
7. **Licensing:** ANU must be informed about all license costs prior to system installation. Enterprise licenses **shall not** be on any external hardware, USB Dongle for example.
8. **Trending logs-** Trend logs must be captured in an SQL database.
9. **Time sync** –via the ANU NTP server.

Master Controller or Main Plant Controller

06.013 Master Controller refers to the controller that connects to the Campus WAN to communicate to the Main Server.

06.014 Master Controllers should have the ability to be a Complete Stand Alone Controller. Complete Stand Alone Controllers should have the following features:

1. **Web Access:** Users should be able access the controller by entering an IP address on any Internet Browser in the ANU local network. This feature is to be used ONLY if connection to Main Server is lost.
2. **Graphics**
 - a. All graphics related to the controller should be stored in the Master Controller;
 - b. graphics must be visible via web access;
 - c. graphics should be vector based (optional);
 - d. graphics must automatically scale to suit screen;
 - e. graphics must be in HTML5 format;
 - f. users must be able to control all points on graphics via web access; and
 - g. multi-layer graphics.
3. **Code:** All code should be written in block format **only**. Script code is not permitted.
4. **Time Schedule:** Users must have the ability to change schedules via web access and add time exception. Time Schedules must be written and held in local Field Controllers in BACnet schedule format.

5. **Alarms:** controller must have the ability to send email alarms (SMTP) without relying on the Main Server or a third party software. Refer to [Section.12 Security, CCTV & Access Control](#).
6. **Security:** Automatic log off option and HTTPS option during web access.
7. **Trend Logs:** User should have the ability to view and export trend logs via web access. The preferred format is CSV.
8. **Native Protocols:** BACnet/IP, Modbus TCP, Webservices (optional).
 - a. Gateways and extra-low voltage (ELV) devices must comply with ISO/IEC 14908.4.
9. **Time Sync:** via Main Server.

Field Controller or Application Controller

06.015 Field Controller are controllers that connect to the Master Controller and other Field Controllers via a local LAN.

1. **Code:** All code should be written in block format **only**. Users should be able to upload modify and troubleshoot all code from the Main Server.
2. **Exposed Points:** Controllers should have the ability to expose all BACnet points.
3. **One Master Point of Control:** There should be one point in the Field Controller that controls the whole plant. For example the Time Schedule point in the controller should turn off the fans and drive all valves and loops to zero. There should be **only one** master room temperature set point.
4. **Native Protocols** – BACnet/IP, Modbus TCP. Webservices (optional on approval).
 - a. Gateways and ELV devices must comply with ISO/IEC 14908.4.

Naming Format	Campus(Acton)_Building Number(BLD)_Level_Plant_Point Example: Acton_Bld 124_level01_FCU_FanEnable
Device ID / Instance Number	Contact the Principal's Representative (the Principal or the Principal's Project Manager) for more information.

MS Cable and Field Hardware Labelling

06.016 Cable labels should follow the following naming convention:

Naming Convention: McFcPtPn

MasterController_FieldController_Point Type_Point number

Example: 0102BI03

01	Address for the Master Controller
02	Address for the controllers on the Rs485 LAN (local to the master controller)
BI	Binary input or output. (BI,BO,AI,AO,UI,UO)
03	Point number on controller number 02.

06.017 This naming convention should be consistent from controller to field hardware. Cable number should also be placed on the field hardware with hardware name. Example Room temperature sensor should have labels "Room temp 01 " and "0102BI03 " on the face plate and sensor cable should have label "0102BI03".

06.018 If points are wired directly to master controller then field controller address will be 00.

Alarms: BMS Alarm Template

- Items in **red** should be changed to suit.
- Items after // should be removed.
- Emails should be brief and to the point. **DO NOT USE POINT NAMES FOR ALARM DESCRIPTION.** For example, do not use **ANU_L1_SFTYSHWER_FLT** for Level 1 Safety Shower Fault.

Email header	<p>To: <i>bmsalarms@anu.edu.au or other email address</i></p> <p>Cc: <i>Building manager or other email address</i></p> <p>Subject: <i>***CRITICAL ALARM*** or General Alarm (do not change format in Subject line)</i></p>
Email body	<p>*****NO ACTION REQUIRED*****NO ACTION REQUIRED*****</p> <p>Building Name : <i>xxxxxxxx</i></p> <p>Building Number : <i>xxxxxxxx</i></p> <p>Issue: <i>Enter alarm description</i> // Example: Safety Shower level 1 activated.</p> <p>Please perform following action</p> <p>DURING HOURS Mon-Fri: 0900-1700</p> <p>***DO NOT LEAVE MESSAGES, ROTATE THROUGH PHONE NUMBERS UNTIL SOMEONE ANSWERS***</p> <p>FIRST CALL: phone number (Person's name and title)</p> <p>SECOND CALL: phone number (Person's name and title)</p> <p>THIRD CALL: phone number (Person's name and title)</p> <p>AFTER HOURS Mon - Fri: 1700-0900, weekends and public holidays</p> <p>***DO NOT LEAVE MESSAGES, ROTATE THROUGH PHONE NUMBERS UNTIL SOMEONE ANSWERS***</p> <p>FIRST CALL: phone number (Person's name and title)</p> <p>SECOND CALL: phone number (Person's name and title)</p> <p>THIRD CALL: phone number (Person's name and title)</p>

07 – Electrical Services

Version	Date	Authors	Summary of Changes
1.0	29 February 2012	Jim Pollard	See V1 summary below
2.0	05 February 2016	Neill Daly	General Revision
2.1	9 February 2021	Sarah O’Callaghan	General Revision

Preamble	2	Emergency Alarm and Communication Systems	5
Introduction	2	Loading	6
Campus and Building Requirement Manual	2	Metering	6
		Indoor Lighting	6
Scope	3	Outdoor Lighting	7
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Preamble

07.01. This document contains the Electrical Design Guide, a section of the Campus and Building Requirements Manual (the CBRM, the Requirements or the Manual) which briefly describes the design objectives for the Australian National University (the ANU or the University) electrical installations.

07.02. A separate electrical specification which establishes a base level of quality for ANU electrical installations is available and is to be integrated in all designs, titled the ANU General Electrical Specification.

07.03. The ANU is committed to energy efficient design and long-term, low maintenance costs. Consultants shall familiarise themselves with the existing services and systems on the campus' on which they may be involved with prior to the commencement of feasibility and planning.

Introduction

Campus and Building Requirement Manual

07.04. The CBRM documents the minimum design and construction requirements for new, refurbishment or repurposed building works, landscapes and engineering/infrastructure projects on buildings, facilities and campuses of the ANU. The Requirements are prepared for the direction of a Consultant, Designer or Project Manager in the preparation of project specific documentation and in the delivery of project works.

07.05. Notwithstanding any Consultant’s particular discipline or area of responsibility, each Consultant and/or designer shall consider the document in its entirety. The complete CBRM consists of the following Sections which may be referred to within this Section:

Campus and Building Requirements Manual	
Section 01	General Requirements
Section 02	Architectural Requirements
Section 03	Roads, Car Parking & Civil Works
Section 04	Soft Landscaping
Section 05	Roofing, Roof Fabric & Roof Safety
Section 06	Building Management Systems
Section 07	Electrical Services
Section 08	Fire Protection Systems
Section 09	Hydraulic Systems
Section 10	Mechanical Services
Section 11	Lifts, Cranes & Vertical Transportation Systems
Section 12	Security, CCTV & Access Control

Scope

07.06. This section of the CBRM addresses the following electrical services:

Inclusions

- Liaison with electrical supply authorities
- High voltage where applicable
- Power supplies, consumers mains and sub mains
- Earthing
- Electrical safety
- Switchboards
- General light and power
- Lighting and lighting controls
- Emergency lighting
- Metering and energy management
- Electrical “green” initiatives
- Emergency back-up power and UPS equipment
- Co-generation and tri-generation advice
- Variable speed drives
- Electro-magnetic compatibility (EMC) compliance
- Power factor correction (PFC)
- Lightning and surge protection

Exclusions

- Emergency warning and communication systems
- Datacoms
- Fire alarms
- Electronic security and access control
- CCTV
- Audio visual systems

Electrical Design Guide

Overview

07.07. The Facilities and Services Division (F&S or the Division) is required to maintain an overview of the electrical services installed on all campuses, buildings, structures and facilities owned and managed by the ANU in the various states and localities of Australia.

07.08. Consultants, Designers or Project Managers who are engaged by the ANU to produce project documentation may use the ANU General Electrical Specification if appropriate or alternatively provide a project specific electrical specification incorporating all the ANU's requirements as identified in the CBRM.

Standards and Codes

07.09. For all new facilities, particular attention shall be paid to the design and selection of appropriate electrical plant, equipment and systems which shall be tested, commissioned, maintained and serviced in accordance with relevant Codes and Standards. Reference shall also be made to the latest issue of relevant Australian Standards, Codes of Practice, Local Authority regulations, Acts and the like. If there is no relevant Australian Standard then reference shall be made to ISO/BS/ANSI/ASTM standards.

07.010. For electrical services associated with buildings under refurbishment, the plant and equipment (where replaced) will be selected to meet the optimum design performance parameters. The Consultant will determine whether compliance with the National Construction Code (NCC), and specifically the energy efficiency requirements of Section J of the NCC, in full or part is required. The Codes and Standards to be followed will be as for plant in new buildings.

The Sites - Electrical Reticulation

07.011. Acton campus, Canberra ACT: Expansion of the Acton campus beyond its original site boundary has resulted in multiple electrical connection/disconnection points provided by the supply authority, Evoenergy.

07.012. A large portion of the Acton campus is serviced from a network of interconnected 11 kV ring mains and 11kV/400V/230V 50 Hz substations originating from two bulk supply substations and back-up connections located on the campus boundaries. There are approximately 50 sole-

use substations located on the campus. A single, high voltage monthly invoice is received by the ANU for all the energy consumed by these substations. The ANU Acton campus HV network is owned and maintained by the local supply authority, Evoenergy.

07.013. Most of the HV reticulation is by underground cable but there are remnants of supply authority HV aerials. Note that there is also a section of ANU privately-owned HV equipment (used in scientific experiments) located at the Research School of Physics .

07.014. ANU acquisitions such as the School of Music and the School of Art are not on the ANU HV grid and are supplied via district substations. Similarly more recent acquisitions such as Unilodge and Student Accommodation 4 (SA4) are supplied from district substations. These facilities receive individual billing from the Electricity Retailer.

07.015. ANU staff and contractors CANNOT access HV equipment and substations without prior approval from Evoenergy.

07.016. Small off-site facilities such as North Oval take power from the local aerial reticulation.

07.017. Paleomagnetic Laboratory, Black Mountain ACT: Low voltage aerials are provided by the supply authority to an ANU point of attachment pole and meter box located at the ANU's site boundary.

07.018. Mt Stromlo campus, Canberra ACT: The RSAA Mt Stromlo facility takes LV power from a number of district substations and receives multiple electricity consumption invoices from the Electricity Retailer. There are also some commercial/government facilities on the Mt Stromlo site not connected with the ANU that are also serviced by the local supply authority. All HV aerials and substations are owned and maintained by the supply authority.

07.019. Siding Spring Observatory (SSO), Coonabarabran NSW: The SSO facility takes power from two district substations and receives multiple electricity invoices from the Electricity Retailer. All HV aerials and substations on the SSO site are owned and maintained by the supply authority.

07.020. Other Sites: Refer to the Principal's Representative (the Principal or the Principal's Project Manager) for details

Building Controls and Monitoring

07.021. Refer to [Section.06 Building Management Systems](#).

Emergency Electrical Supplies and Uninterrupted Power Supplies

07.022. The ANU has a large number of emergency power generator plants and Uninterrupted Power Supply (UPS) systems across the various operations. Emergency power and UPS provisions shall be discussed with the Principal's Representative as early as practical in the planning stage.

Emergency Alarm and Communication Systems

07.023. [Refer to Section.08 Fire Protection Systems](#).

Loading

07.024. Any proposed alterations to the electrical loads on a site shall be discussed with the Principal's Representative at the earliest opportunity. The Division has information on site loads and has equipment to do load measurements. It is important that the local reticulation has evenly balanced phases.

Metering

07.025. As the ANU has a number of facilities located across various states, regional areas and local authorities, the metering requirements will need to be specifically tailored on a project by project basis. Accordingly, early discussion is necessary with the Principal's Representative to confirm project requirements.

07.026. The metering needs at the ANU will meet two basic requirements being:

- revenue collection; and
- energy management and energy monitoring.

Revenue Collection

07.027. Typically a meter is required at the head end of an electrical installation. This is traditionally the supply authority meter that must be installed in accordance with the local requirements. Revenue collection metering however, does vary across the ANU facilities.

Energy Management and Energy Monitoring

07.028. The ANU is committed to continuing improvements in energy efficiency and requires accurate energy consumption data to manage individual operations. The strategic direction is that sub meters shall be deployed. The minimum level of energy management metering required is as identified in the NCC. Where appropriate the ANU may wish to go beyond the NCC and this will be identified within the project brief.

07.029. The type of energy management metering required is detailed in [Section.06 Building Management Systems](#).

07.030. Electrical designers must make due allowance in their documentation for all the metering requirements on ANU projects. Particular emphasis shall be made for correct current transformer (CT) provisions, potential fuses, shorting out test blocks, safe access spatial allocation for the required metering equipment and meters, connection of the meters to the Energy Management Systems (EMS) where appropriate and testing and commissioning of the entire metering system.

Indoor Lighting

07.031. Indoor lighting shall be designed in accordance with the relevant sections of *AS 1680 Interior and workplace lighting (Lighting Code)*. Energy efficiency measures shall be in accordance with the NCC Section J.

07.032. Emergency evacuation lighting shall be provided in accordance with the requirements of *AS 2293 Emergency evacuation lighting for buildings*. Fixtures shall be the LED single point type. Refer to ANU General Electrical Specification for further details.

07.033. Luminaires considered in the design shall be energy efficient, robust in construction and be installed in locations that are easy to maintain without the need for sophisticated access equipment. All luminaires and internal components shall have approval for use in Australia. Where diffusers are used they shall be tight fitting and be appropriately IP rated to prevent the ingress of dust and insects.

07.034. The illumination levels as recommended in AS 1680 for various applications such as offices, educational, workshops and laboratories shall be adopted. Glare and veiling reflections where considered a problem shall be accommodated in the design.

07.035. Lighting designers are encouraged to include the use of LED type lighting in lieu of traditional forms of lamp technology. Proposals shall be submitted at the Preliminary Sketch Plan (PSP) stage.

07.036. DELETE THIS CLAUSE ENTIRELY. Lighting designers proposing luminaires fitted with linear or compact fluorescent lamps (CFL) shall consider single lamp technology with high efficiency internal reflectors. Inefficient incandescent or low-voltage dichroic lamps shall not be used.

07.037. The ANU has standardised on lamp colour temperature and unless otherwise indicated this shall be 4000 K with a colour rendering index (CRI) between Ra 80-90.

07.038. Energy management lighting control systems shall be considered for major and minor lighting installations such as:

- proximity/motion detectors in offices teamed with local switches;
- proximity/time controls for corridor, egress and entry paths;
- after hours controls;
- daylight harvesting;
- automatic dimming systems;
- individual control of lighting near perimeter windows;
- time switches; and
- proprietary lighting BMS.

07.039. Lighting controls shall be determined on a project-by-project basis after discussion with the Principal's Representative.

07.040. Lighting designs for lecture theatres, large conference rooms may require integration with audio visual systems. Refer to the Principal's Representative for details.

07.041. Lighting designers shall submit brochures of all proposed luminaires and lighting controls at the PSP or the Final Sketch Plan (FSP) stage.

Outdoor Lighting

07.042. Outdoor lighting is segregated into the following categories:

- footpath, cycleway lighting;

- road lighting;
- pedestrian crossings;
- car park lighting including disabled access;
- fixed lighting to buildings;
- architectural, feature, sports, signage, CCTV and landscape lighting;
- special application lighting for sensitive areas such as Observatories etc.; and
- public activity areas.

07.043. As the ANU has diverse applications for exterior lighting, early discussion with the Principal's Representative will provide further guidance to the designer on the best approach for a particular application.

07.044. Outdoor lighting where applicable shall comply with the various sections of *AS 1158 Lighting for roads and public spaces*. In addition the design guide principles as identified in *AS 4282 Control of the obtrusive effects of outdoor lighting* shall also be followed.

07.045. For sports lighting, the relevant sections of *AS 2560 Sports Lighting* are applicable.

07.046. Lighting designers should also be aware of the [National Capital Authority Outdoor Lighting Policy](#) where large areas of the ACT are now located in a designated area requiring the application of specific lighting design principles

07.047. Luminaires installed in external environments shall be sealed to prevent the entry of water, dust and insects and shall be rated at IP65. Lamps shall have a colour temperature of 4000 K. Colour rendering shall be CRI Ra 80-90. Luminaires shall be selected to minimise light pollution above the horizontal plane. Outdoor lighting shall be of the LED type.

07.048. External lighting shall in general be automatic in operation and be controlled by either a central photo-electrical cell or a Building Management System (BMS) if one is available. For most operations at the Acton campus, exterior lighting is controlled by a signal from the BMS linked to a photoelectric cell (PE Cell). Switchboards shall incorporate override switches so that external lighting can be tested during business hours.

07.049. Lighting columns where used shall be tapered steel with a hand hole at the base. There may be a requirement for columns and associated luminaires to be painted a specific colour. Columns shall be flange mounted with rag bolt footing assembly. Columns shall be engineer-designed for the particular soil, terrain and wind conditions. A Residual Current Device (RCD) breaker shall be installed in the hand hole at every column. Column heights and the general configuration of the column (i.e. outreach arms) shall be discussed with the Principal's Representative. All columns shall be fitted with a column number label obtained from the Principal's Representative. Some lighting columns may require to be multifunctional to accommodate other services such as WiFi and CCTV. Refer to the Principal's Representative for direction.

07.050. In some circumstances it may be appropriate to consider stand-alone solar powered lighting with back up batteries; however any proposals like this shall be discussed with the Principal's Representative.

Footpath and Cycleway Lighting

07.051. Footpath and cycleway lighting shall be designed to meet the P2 performance category as described in AS 1158.

07.052. Where footpath and cycleway lighting is required to be mounted on columns, column height shall generally be 5.0 m above ground.

Road Lighting

07.053. The ANU has numerous campuses and facilities with significant variations in road configuration and traffic density. Prior to commencing any design work, lighting designers shall contact the Principal's Representative to establish the design parameters for the particular road.

Pedestrian Crossings

07.054. Lighting for pedestrian crossing shall be designed to meet the requirement of AS 1158.

07.055. The lighting designer shall make a recommendation for the lighting category based on the operational specifics for the road.

Outdoor Car Park Lighting

07.056. Outdoor car park lighting shall be designed to meet the P11c performance category as described in AS 1158.

07.057. Parking spaces intended to be used by people with disabilities shall comply with P12.

07.058. Where car park lighting is required to be mounted on columns, column height and column configuration shall be discussed with the Principal's Representative. Generally luminaire heights for car park lighting should be in the order of 6.5 m

Fixed Outdoor Lighting to Buildings

07.059. The selection of external luminaires located on building facades should be under the control of the Consultant. The Consultant shall seek approval from the Principal's Representative and submit luminaire brochures for approval at an appropriate point such as the PSP or FSP stage. Luminaires shall be low maintenance, of robust construction, have IP ratings as previously identified and be installed in readily serviceable locations.

Architectural, Feature, Sports, Signage, CCTV, Public Space Lighting

07.060. These are all specialised areas and where required, further advice should be sought from the Principal's Representative prior to commencement of work. The use of low-height bollard luminaires and step lights is not supported due to maintenance issues. Similarly uplighters are not recommended as they may not conform with dark sky lighting principles. Refer to the Principal's Representative for further advice.

Special Applications - Observatories

07.061. The ANU maintains deep space observation facilities at Mt Stromlo, ACT and Coonabarabran, NSW. Outdoor lighting to these facilities will need special consideration. Lighting designers shall make reference to AS 4282.

Telephone and Data Communication Cabling

07.062. The ANU Information Technology Services (ITS) is responsible for all matters pertaining to telephone and data services at the ANU. The Principal's Representative is responsible for ANU ITS input for the Project.

07.063. Because of the commonality with electrical and datacom services, designers are required to liaise with the Principal's Representative in the planning and design of these services.

07.064. The ANU ITS [Cabling Specifications](#) should be access in all cases for guidance on the specification and installation requirements for data cabling.

Power Factor Correction

07.065. Where a new construction project is planned, Consultants will be required to include for adequate power factor equipment to ensure that the installation will operate at a lagging power factor not below 0.98. PFC equipment shall have high level communication capability to provide status output to the ANU BMS. Proposed power factor equipment shall be discussed with the Principal's Representative during the early design stage. Power factor associated with mechanical plant shall also be addressed.

Surge Protection

07.066. All new main switchboards or existing main switchboards subject to major changes shall be fitted with surge protection devices. Refer to ANU General Electrical Specification for further details.

Lightning Protection

07.067. Consultants shall seek confirmation from the Principal's Representative if their commission extends to providing lightning protection risk assessment advice and subsequent lightning protection design.

07.068. If it is deemed that lightning protection is required for the project, it shall be designed and installed in accordance with the requirements of *AS 1768 Lightning protection*.

Solar Voltaic Arrays

07.069. Consultants involved in the design and specification of solar voltaic arrays shall discuss proposals with the Principal's Representative at the early planning stage before proceeding with the design.

08 - Fire Protection Systems

Version	Date	Authors	Summary of Changes
2.0	28 February 2012	Mark Pritchard	
2.1	9 August 2012	Mark Pritchard	rewrite some sections
3.0	05 February 2016	Mark Pritchard	General Revision
4.0	27 March 2020	Adam Agius / Mark Pritchard	General Revision
4.1	08 October 2021	Mark Pritchard	General Revision

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Introduction

- 08.01** The Australian National University (ANU or the University) has set minimum requirements for essential fire safety measures for use in new and refurbished buildings at all Campus's. The Campus and Building Requirements Manual (the CBRM, Requirements or the Manual) may exceed the minimum requirements of the Australian Standards.
- 08.02** The Consultant shall refer to the relevant Australian Standard and the National Construction Code (NCC) and consult with local Fire and Rescue Authorities and the Principal's Representative (the Principal or the Principal's Project Manager) at the earliest possible stage in the design process. This will ensure that both local Fire and Rescue Authorities and the ANU Requirements are met and delays avoided at the building occupation stage.
- 08.03** The Consultant shall consider Safety in Design principles for maintenance of all essential fire safety measures, including the position of smoke detectors on ceilings.
- 08.04** The CBRM is intended to be read and distributed electronically. This does not preclude printing sections of the Requirements; however, the University takes no responsibility for the completeness and currency of printed/hard copy material distributed amongst the Consultant team. Notwithstanding any Consultant's particular discipline or area of responsibility, each Consultant and/or designer shall consider the document in its entirety.
- 08.05** The complete CBRM consists of the following Sections which may be referred to within this Section:

Campus and Building Requirements Manual	
Section 01	General Requirements
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Section 10	Mechanical Services
Section 11	Lifts, Cranes & Vertical Transportation Systems
Section 12	Security, CCTV & Access Control

Overview of Design Principles

Australian Standards and Statutory Requirements

08.06 All works shall comply with the relevant Australian Standards, National Construction Code (NCC) and Local Fire and Rescue Authorities policies. Where a standard or code referenced is superseded the new standard or code shall be adopted.

Definition of Essential Fire Safety Measures

08.07 Design and installation of essential fire safety measures shall include all subjects / aspects pertaining, but not restricted to the following:

- automatic fire detection and alarm systems;
- automatic fire sprinkler systems;
- access panels, doors and hoppers to fire resisting shafts;
- automatic fail safe devices;
- Emergency Warning and Intercommunication Systems (EWIS);
- smoke and heat alarm systems;
- emergency evacuation plans;
- Emergency and exit lighting (refer to [Section.07 Electrical Services](#));
- fire doors;
- smoke doors;
- fire hose reel systems;
- fire hydrant systems;
- fire seals protecting openings in fire resisting component;
- fire shutters;
- gaseous fire suppression systems;
- mechanical air handling system shutdown;
- portable fire extinguishers and fire blankets;
- pressurising systems;
- fire dampers;
- smoke and heat vents;
- smoke dampers;
- standby power systems;
- required power operated exit doors;
- wall wetting sprinkler and drencher systems; and
- warning and operational signs.

08.08 The classification of a building will determine the essential fire safety measures. The proposed essential fire safety measures shall be submitted to the Principal's Representative by the Consultant team during initial design development, for review and comment.

08.09 Several buildings at the ANU contain increased risks for health and safety hazards in excess of those normally found in typical Class 9b buildings. The essential fire safety measures may need to be increased in these buildings.

08.010 The Requirements be in addition to, but not in substitution of legislation.

Specific Design Requirements

Fire Monitoring Provider

08.011 The ANU uses an external service provider to monitor fire systems in its buildings. The Principal's Representative will arrange the application process for the facility to be connected to the service provider.

Tender Packages for Fire Systems

08.012 All fire system packages must be separately tendered and not be incorporated into another trade package. For example, a dry fire system must not form part of an electrical tender package.

Major Refurbishments

08.013 Major refurbishments of buildings will be required to meet the most recent CBRM at time of design. Advice on the scope and inclusions for systems in major refurbishment projects can be sought from the Associate Director, Infrastructure and Planning with input from the Technical team.

08.014 When replacing Conventional FIP's with new Fusion AU5000 addressable systems a LVM-100 short circuit isolator must be installed and configured to allow fully addressable functionality.

Block Plans

08.015 FIP block plans shall indicate all detectors in the building

08.016 Block plans shall be installed in aluminium frames for easy replacement.

08.017 A DWG of the block plan shall be provide in the WAE package

08.018 Block plans shall be submitted to the Principal's Representative to review prior to final installation.

Fire Systems Interface Matrix

08.019 A Fire systems interface matrix shall be prepared and installed as part of the deliverables. The ANU reserves the right to undertake witness testing to ensure its consistency with actual operation.

Evacuation Diagrams

08.020 The ANU's service provider shall be engaged to design, supply and install evacuation diagrams

08.021 The responsibility and cost of updating the diagrams will remain with the Project.

08.022 New evacuation diagrams shall be installed as part of any refurbishment project for existing buildings.

08.023 The evacuation diagrams shall be installed in an A3 brushed aluminium frame and installed in accordance with *AS 3745 Planning for emergencies in facilities*.

08.024 A master PDF Evacuation Diagram per level shall be forwarded to Facilities and Services for review before production and Installation. CAD and PDF copies of all Evacuation Diagrams shall be supplied as part of WAE documentation.

Fire Protection and Fire Protection Systems

Standardised Equipment

08.025 The ANU has standardised the type/brand of equipment. Any equivalent technologies must be submitted as an alternative solution in the tender.

Analogue/Addressable Fire Panel	:	Fusion Advanced AU5000 complete with BACnet card
Detectors	:	Fusion Advanced Smoke, Thermal or Multi criteria
Aspirated Detectors	:	Xtralis VESDA
Warning System EWS	:	Simplex T-Gen 50
Warning System EWIS	:	Fusion Advanced VIGIL 2 EWIS
Sprinkler Systems	:	Any SSL approved

Sprinkler (Wet) Systems

08.026 For sprinkler systems, the Consultant shall prepare plans, specifications and tender documents for the installation of the system as part of the design and documentation procedure.

08.027 Plans and specifications shall conform to the ANZ/ISO Standards for Automatic Sprinkler Installations, supplemented by the [Additional Requirements](#) outlined in this section.

08.028 The wet system shall meet the requirements of the Australian Standards and comply with the requirements of the NCC and the Chief Officer, local Fire and Rescue Authority.

08.029 Additional Requirements

1. The ANU has a preference for automatic sprinkler systems in all new general type buildings greater than two storeys high. If for any reason a dispensation from this rule is sought, the application must go to the Associate Director, Infrastructure and Planning, Facilities and Services.
2. The ANU has a preference for quick response heads.

3. Drainpipes shall not terminate in blind spaces under the building. Drains will be sized to accommodate a discharge rate of 2000 L per minute (200 – 250 mm diameter would be considered minimum).
4. The minimum classification of sprinkler systems on the ANU Campus shall be Ordinary Hazard 1. Extra light hazard systems shall not be accepted.
5. All sprinkler systems shall be fitted with an automatic electric jacking pump with run hour meter to enable the sprinkler system to be restored to normal operating pressures after maintenance procedures.
6. Local Fire and Rescue Authorities requires that all sprinkler systems be separately monitored and that all flow switches are represented at the Fire Indicator Panel (FIP).
7. Devices such as retard chambers will not be accepted on the ANU's fire sprinkler systems.
8. Pre-action systems in conjunction with VESDA systems shall be installed in any super computer hall, server room or the like.

Dry Fire Alarm Systems

08.030 For dry fire alarm systems, the Consultant shall prepare plans, specifications and tender documents for the installation of the alarm system as part of the design and documentation procedure.

08.031 Plans and specifications shall conform to *AS 1670 Automatic fire detection and alarm systems - System design, installation, and commissioning*.

08.032 The dry system shall meet the requirements of the Australian Standards and comply with the requirements of the Chief Officer, local Fire and Rescue Authority.

08.033 The Consultant shall arrange for the successful tenderer to submit full detail drawings of the installation (layout), type of detectors and FIP type to the Principal's Representative before any work is commenced.

08.034 The drawings shall show the following information:

- circuit grouping;
- detector grouping and position;
- route of cabling and conduit runs concealed from view; and
- cabling and location of any other ancillary equipment associated with the contract.

08.035 Additional Requirements

1. For fire detection systems, the specification for the automatic fire alarm system shall include all wiring in the installation as part of the contract and such wiring shall be carried out in accordance with *AS 3000 Electrical Installations*.
2. All detectors shall be identified on the layout plans by circuit and detector numerals. Example: 8/12 indicates No. 8 circuit, No. 12 detector.
3. A systems interface matrix shall be supplied and installed near the FIP.
4. VESDA systems shall be considered in all major communication rooms.

Fire Detection Alarm System

- 08.036** The ANU has a preference for automatic fire detection systems in all buildings. If for any reason a dispensation from this rule is sought, the application must go to the Associate Director, Infrastructure and Planning, Facilities and Services.
- 08.037** Fire detection systems in accommodation building may have a programmed delay of 2 minutes on the smoke detector before generating a general fire alarm. The smoke detector shall be fitted with a sounder base and raise a local alarm to warn the occupant and allow them to clear any smoke / particles to prevent a false alarm. Any smoke detector in a common space or thermal detector shall raise a general fire alarm immediately.
- 08.038** The fire detection alarm system shall automatically indicate an alarm to the local fire authority upon detection of a fire by a thermal or smoke detector or any other fire detection device or manually operated alarm via the ANU's fire monitoring service provider.

Very Early Smoke Detection Apparatus (VESDA): Aspirated Smoke Detection System

- 08.039** The use of a Very Early Smoke Detection Apparatus (VESDA) system should be considered in all high risk or high insurance areas of the ANU.
- 08.040** VESDA systems shall work independently; they shall be connected to the FIP and only Fire 1 and Fire 2 conditions shall activate the FIP.
- 08.041** An isolated VESDA system shall display a fault on the FIP. A fault on the VESDA shall also activate a fault on the FIP.
- 08.042** The VESDA shall have a mimic panel installed and the controller is to be located remotely from the VESDA.

Detectors

- 08.043** All detectors containing end of line resistors shall be clearly marked on their bases and on the as installed drawings.
- 08.044** All ceiling mounted detectors shall be symmetrically located with respect to luminaires, air registers and other ceiling mounted items.
- 08.045** If cabling for fire systems is external on the building, it must run in Galvanised Steel Screw conduit, boxes and connections to prevent damage from hail.

Fire Hydrants, Hydraulic Hose Reels and Fire Extinguishers

- 08.046** The size and length of hoses shall be determined by the Chief Officer, local Fire and Rescue Authority.
- 08.047** The quantity and location of hydrants, hose reels and fire extinguishers shall be determined by the relevant standards and hazards in the facility.
- 08.048** Fire extinguishers shall comply with the relevant Australian Standards.

- 08.049** Installation of hose reels shall be included in the fire services contract and not form part of the general building works.
- 08.050** Fire blankets and a small DCP AB(E) extinguisher shall be installed in food cooking and reheat areas such as kitchenettes.
- 08.051** Commercial kitchens shall have a wet chemical fire extinguishing system installed to reduce risk of fat fires spreading, this will be interlocked with a gas shutoff system.

Evacuation Systems: Emergency Warning System (EWS) and Emergency Warning and Intercommunication System

- 08.052** The ANU has a preference for programming EWIS for a one out all out evacuation process. EWIS can be programmed for alert then evacuate but the delay from alert to evacuation shall be 5 minutes.
- 08.053** Where required, the contractor shall ensure that the location of Warden Intercom points are such that they can be operated without interference from noise from the system speakers or air handling system.
- 08.054** Emergency Warning System (EWS) and EWIS evacuation systems shall be installed in all buildings that are greater than two stories high. All evacuation systems installed shall comply with AS 1670 and NCC requirements.
- 08.055** When possible, PA and EWS (including Grade 1, 2 and 3 systems) will share cabling. The cable must be suitable for the installation to comply with AS1670-2018.
- 08.056** Fire and PA zones must be suitably designed to comply with AS1670-2018 and also offer the required PA zoning.
- 08.057** Loudspeakers (across both PA and EWS) must comply with AS7240.24, ISO7240.24 or EN.24.
- 08.058** Loudspeakers must be equal to AS7240.24 / EN.24 compliant speakers and horns such the DNH range of speakers below:

Loud Speaker	Horn
CAP-15-54 (T)	DP-10-54 (T)
CAS-15-54 (T)	DPD-10-54 (T)
P-3X2P-54(T)	DSP-15-54 T
SAFE-561-54(T)	HP-10-54 T
VES-561-54(T)	MH-30-54 T
SAFE-10P-54(T)	

- 08.059** A BVRDTSM Baldwin Boxall Touch screen Microphone to suit Vigil2 shall be installed in the reception desk of a building so that staff can utilise the PA system.

Fire Indicator Panel (FIP)

- 08.060** The panel shall incorporate all Alarm Zone Facilities (AZF's), Ancillary Control Facilities (ACF's), Master Alarm Facilities (MAF's), indicators and isolators grouped in a neat logical order.
- 08.061** The Fire Indicator Box shall also contain all necessary test facilities, batteries and battery charger and battery voltmeter and all associated wiring and accessories.
- 08.062** The Fire Indicator Box shall be a recessed wall mounted enclosure.
- 08.063** The ampere hour capacity shall be sized to allow for additional items such as buzzers, bells and relays as required by this specification. Batteries shall comply with the current version of *AS 60598 Luminaires - General requirements and tests*.
- 08.064** The battery charger shall be a fully automatic constant potential type employing all solid-state components, and shall be capable of recharging a fully discharged bank of batteries to 80% of their capacity within 24 hours.

Required Exit/Egress Doors

- 08.065** All exit doors shall be fitted with an approved latching device that must be capable of opening from inside with normal door lever action and without recourse to a key. Should dead-locking devices be used, the dead-lock must cancel out under normal door lever action.

Access Control Door Integration

- 08.066** The access control door system is to be tripped to release all doors on any fire alarm condition. This is achieved by connecting the fire trip circuit to the output circuit on the FIP.

Fire Doors

- 08.067** All fire doors and door hardware shall meet the requirements of the NCC and Australian Standards.
- 08.068** Sliding type fire doors shall not be installed, except in special cases and then only by approval of the Chief Officer, local Fire and Rescue Authority.

Smoke Doors

- 08.069** Corridor smoke doors shall be double acting with a 180° swinging movement. The doors shall be effectively sealed against fire and smoke for reasonable periods of time. The closing mechanism shall ensure that the door returns to the sealed position as required.

Electromagnetic Door Holders

- 08.070 All smoke and fire doors shall be fitted with magnetic door holders operating in conjunction with the fire protection or detection system, whichever is the case and shall operate on 24 V DC.

Automatic sliding or swing doors in paths of egress

- 08.071 Automatic sliding and swing doors shall be tripped and drive open on any fire alarm condition. This is achieved by connecting the fire trip circuit to the output circuit on the FIP.

Emergency and Exit Lighting

- 08.072 Emergency lighting shall be installed in accordance with current version of AS 2293 *Emergency escape lighting and exit signs for buildings - System design, installation and operation* and AS 3000. Refer to [Section.07 Electrical Services](#).
- 08.073 The emergency and exit light fittings shall have a built in self-testing system incorporated in each fitting. Centralised monitoring systems are not recommended.
- 08.074 Emergency light test switches shall be provided at each DB.

Labelling & Cable Markers

- 08.075 All wiring to detectors, door holders, door locks, strobe lights, bells, sirens, mimic panels etc. shall be clearly marked.
- 08.076 Circuits to detectors shall be numbered sequentially circuit 1 - cable 1, circuit 2 - cable 2 etc.
- 08.077 All switches and isolators shall be clearly labelled. The Fire Indicator Box shall have a label fixed to the front of the panel stating the following:
- Fire Brigade installation number (AFA number);
 - Source of 240V power supply (distribution board and circuit number); and
 - Labels shall be of red background with white engraved letters.

Other requirements

- 08.078 Deep fat fryers shall have over temperature cut-off switches installed to shut down the fryer if a maximum temperature is reached.

09 – Hydraulic Systems

Version	Date	Authors	Summary of Changes
1.1	15 August 2011	Andy Smith/ Jeff Albrecht	Generally revised.
1.2	31 September 2011	Andy Smith	Generally revised.
1.3	5 January 2012	Andy Smith	Generally revised.
1.4	27 February 2012	Andy Smith/ Solomon Elijah	Section and Clause numbering changed. Clauses 12.7, 12.10, 12.12 & 12.17 and.
1.5	12 July 2012	Andy Smith	Minor additions to Sections 12.2, 12.3, 12.4, 12.5 & 12.26.3
2.0	05 February 2016	Andy Smith	General Revision
2.1	02 May 2017	Andy Smith	Amendments to Section 12.26
2.2	13 August 2021	Andy Smith	General Revision

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Introduction

09.01 The Australian National University (ANU or the University) is responsible for the in-ground services infrastructure on various ANU campuses. These services are quite old in certain areas. Consultants shall assess the need to fully evaluate the impact any proposed new development may have on the existing hydraulics and irrigation infrastructure.

09.02 In evaluating the capacity and condition of in-ground services Consultants shall provide for ANU review in-principal concepts and designs at an early stage. The Principal's Representative (the Principal or the Principal's Project Manager) will provide overview of the designs and proposals to ensure that they incorporate the provisions of the Campus Building and Requirements Manual (CBRM, the Manual or the Requirements) into their design philosophy.

09.03 The scope of hydraulic services shall comprise:

- incoming water supply and tapings (Refer to [Section.08 Fire Protection Systems](#));
- domestic cold-water supply reticulation.
- domestic hot water supply reticulation.
- flusher service reticulation or cistern toilets.
- sanitary plumbing, drainage, and fixtures.
- storm water drainage.
- natural gas supply and reticulation systems.
- laboratory systems and safety equipment.
- roof and rainwater systems.
- rainwater storage systems.
- trade waste drainage systems; and
- pumps and control equipment.

09.04 The CBRM is intended to be read and distributed electronically. This does not preclude printing sections of the Requirements; however, the University takes no responsibility for the completeness and currency of printed/hard copy material distributed amongst the Consultant team. Notwithstanding any Consultant's particular discipline or area of responsibility, each Consultant and/or designer shall consider the document in its entirety.

09.05 The complete CBRM consists of the following Sections which may be referred to within this Section:

Campus & Building Requirements Manual	
Section 01	General Requirements
Section 02	Architectural Requirements
Section 03	Roads, Car Parking & Civil Works
Section 04	Soft Landscaping

Section 05	Roofing, Roof Fabric & Roof Safety
Section 06	Building Management Systems
Section 07	Electrical Services
Section 08	Fire Protection Systems
Section 09	Hydraulic Systems
Section 10	Mechanical Services
Section 11	Lifts, Cranes & Vertical Transportation Systems
Section 12	Security, CCTV & Access Control

Authorities Requirements

09.06 All current standards will be mandatory and complied with, except where a higher standard is outlined in the CBRM.

09.07 In the ACT the relevant authorities shall include:

- Icon Water
- Icon Water has contracted Jemena Asset Management for the supply of natural gas to the ACT. Jemena has requirements, some of which are outlined in this Section, which need to be complied with.
- Australian Capital Territory Planning and Land Authority (ACTPLA).
- ACT Fire and Rescue; and
- ACT Government, Territory and Municipal Services (TAMS), specifically the [TAMS Design Standards for Urban Infrastructure: Storm water](#).

09.08 For other States the relevant authorities shall include:

- the water supply authority in that State; and
- standards and regulations in force of that State, as pertinent to the regulatory body/council under whose jurisdiction the work is to comply with.

Specific Design Requirements

09.09 Sanitary plumbing, drainage and fixtures shall be subject to the following:

- no toilets or waste facilities shall be provided below the level of the main sewer lines.
- selection of fixtures and fittings including devices designed to limit water usage should be cognizant of availability and continuity of spare parts supply.
- on refurbishment and replacement toilet pans are to be 6/3 flushing type.
- no waterless type urinals to be used.
- tap-sets installed at basins in common areas are to include hands-free operation Thornthwaite Presto sensor taps, Rada sensor systems, Galvin – Flowmatic Electronic tapware, Enmatic touch type preferred or equal equivalent).
- under bench/sink boiling and chilled water unit are preferred (Zip or equal equivalent) for kitchen installations.
- all materials shall be approved by the Watermark certification trademark.

- all sanitary fittings and fixture will be WELS compliant.
- the Consultant will supply details for all/any sanitary fittings and fixtures selected to the Principal’s Representative for review.
- all wet areas must have a floor waste.
- each toilet on the ground floor must have an Inspection Opening (IO) access to the sewer system; and
- drainage systems from toilets on the lowest floor of a building must be accessible via brass IOs.

Water Supply and Reticulation Systems

09.010 All spurs off campus mains for water and natural gas supply to buildings shall be fitted with isolating valves.

09.011 On all services supplied by a ring main or the Icon Water service, the main shall be capable of being isolated on either side of the tee-off position.

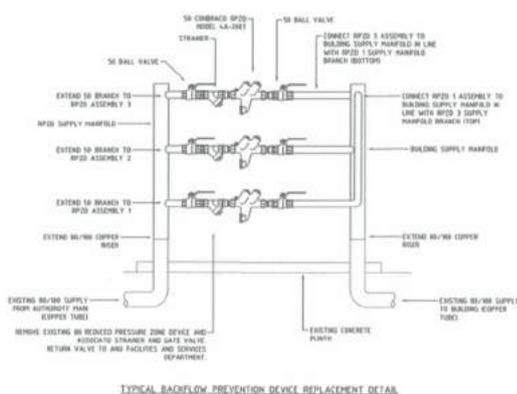
Supply and Install a WaterGroup SIM water logger to all Icon Water meter and connect to the ANU data system

09.012 Stop cocks in hot and cold-water lines and natural gas services shall be easily accessible and clearly marked. Separate stopcocks are required for each floor and for each laboratory on each floor of a building. These stopcocks shall be located within a lockable AISI grade 304 stainless steel cabinet at 2.0 m from the finished floor level.

09.013 A designated cold water stop cock is required in all plant areas for the purposes of mechanical equipment servicing and cleaning.

09.014 Backflow prevention devices must have by-pass valves installed on water services of 40 mm and higher size (Conbraco valves are preferred or equal equivalent).

09.015 Backflow devices on building supply (Containment protection) over 50mm must be installed in a multi parallel installation



09.016 Where an irrigation system is not installed, stopcocks or quick coupling devices shall be provided on the perimeter of the building for hard time irrigation and cleaning purposes. These shall be spaced at no more than 20.0 m apart.

09.017 All sanitary fittings such as cisterns, hand basins and sinks shall be fitted with isolating valves to the hot and cold-water supply respectively.

09.018 All water services below the ground must be of a product that can be located. No trace wires shall be used, for example copper and Ductile Iron Concrete Lined (DACL). The only exception being irrigation pipework that is downstream of the master valve on irrigation systems.

09.019 Potable water services having pipe sizes of 25 mm and larger, must be of copper Type B as classified within *AS 1432 Copper tubes for plumbing, gas fitting and drainage applications*.

09.020 Identification labels shall be secured to all pipe work. Signage shall be supplied and installed as per the requirements of *AS 1345 Identification of the contents of pipes, conduits, and ducts* exception for exposed vent pipe work above the finished roof level.

09.021 Fire hydrant systems where located above the ground shall be constructed with heavy duty mild steel piping jointed by approved patented rolled grooved pipe and fittings; equal to all respects to Victaulic systems.

09.022 Fire hydrant systems below the ground must be of approved copper pipe and fittings.

09.023 Provide filtration to the incoming water supply and any automatic back wash system using a filter with minimum mesh size of 5 microns.

09.024 As a general requirement, externally provide quick coupler valves installed at 20.0 m spacings throughout garden beds supplying potable water, which may be used for plant establishment.

Domestic Hot Water Systems

09.025 Domestic hot water services shall be selected to ensure that the balance between energy source, location and long-term running costs is properly evaluated. To ensure that the most efficient operation of the hot water is achieved, the unit standing heat losses through long flow and return pipework shall be avoided. Solar, high efficiency heat pump, solar type systems shall be selected in preference to electric only units. Life cycle costing shall be provided so that all options are evaluated.

09.026 Domestic scale hot water units are typically installed in most buildings to supply hot water to bathrooms and kitchens. They can range from small under-bench units, through to large (>300 L) storage tanks or high-volume instantaneous heaters. To ensure that the most energy (and greenhouse) efficient systems are installed the following will apply:

- solar hot water systems.
- heat pump systems; or
- if none of the above are applicable, gas fired instantaneous hot water.

- Exposed pipework must have a metal sheathing over the installation where it is exposed to sunlight, bird, or vermin attack.

09.027 Sheath shall be 0.5 mm thick zincalume. Spring over the insulation in one piece with at least 30 mm lap; the whole tightly clamped in position and fastened with either approved self-tapping screws; zinc plated, or snap head type rivets spaced not greater than 150 mm centres. Raw metal must be painted. The longitudinal joints shall be approximately 4 o'clock position with the top lap outermost to prevent water penetration.

09.028 Hot water circulating pumps are to be Grundfos UPS20-60B (or equal equivalent) and are to have a dual system running in parallel with all installations.

Sanitary Drainage System

- Major sewer bends or junctions to include a manhole installed outside the building footprint.
- all manhole lids must finish 150 mm above the finished ground level in landscaped areas.
- all sewer branches entering the building footprint will have Inspection riser and will terminate at finished ground level.
- toilet drainage must exit the building independent of the wastewater system.
- all traps and floor wastes are to be self-cleaning" S and P" type only.
- High Density Polyethylene (HDPE) pipe work is to be used on all trade waste and specialised drainage systems; and
- all in-ground sewer drainage shall be of a minimum nominal diameter size of 100 mm.

Natural Gas Service

Natural Gas Distribution Networks:

09.029 Natural gas is available on the Acton, Fenner Hall, Mount Stromlo and NARU Campuses and is distributed as follows:

Acton Campus:	Polyethylene/nylon mains deliver gas at 210 kPa to each meter set from the natural gas network. It is then required to be reduced after each meter set to pressures that are one of the following: 2.75 kPa, 5.0 kPa, 35 kPa or 100 kPa.
Fenner Hall:	The steel mains deliver gas at 1,050 kPa pressure up to the secondary meter set. Thereafter the pressure is to be reduced to 100 kPa.
Mt Stromlo:	Polyethylene/Nylon mains deliver gas at 210 kPa to each meter set and that pressure is to be reduced after each meter set to either 2.75 kPa, 5.0 kPa 35 kPa or 100 kPa.
NARU Campus:	

Note: Siding Spring Observatory & Kioloa Campuses do not have natural gas available, but bottled gas in the form of LPG is available.

09.030 All work carried out to install or repair any of ANU's natural gas system must be done in accordance with *AS 5601 Gas Installations*, any other applicable Australian Standard, all Jemena requirements, and the Gas Supply (Safety and Network Management) Regulation 2008.

09.031 ANU requires gas meters be fitted with pulse outputs. Pulse outputs are required for connection to the ANU Building Management System (BMS). The requirement is to measure gas usage in m³. A suitable intrinsically safe barrier is to be specified for installation at the pulse output. Any equipment supplied and installed is to meet the requirements of Jemena.

09.032 Natural gas meter enclosure shall be installed to prevent unauthorised access or damage to the meter/regulator set. Figure.1 indicates a standard ANU enclosure. No other equipment such as water meters, irrigation control boxes and electrical items shall be placed within this compound.

09.033 Such enclosure or protection must:

- have enough clearance to allow changing and servicing of the meter set.
- locked with a Jemena/AGL gas padlock.
- be powder coated a yellow biscuit colour.
- clearance from the ground to the bottom of the structure is to be 100 – 250 mm.
- the floor of the meter set / regulator set must be constructed of concrete and be level; and
- appropriate permanent safety barriers such as Armco railing and bollards must be installed between a gas/regulator/structure set and any adjacent vehicular traffic path.



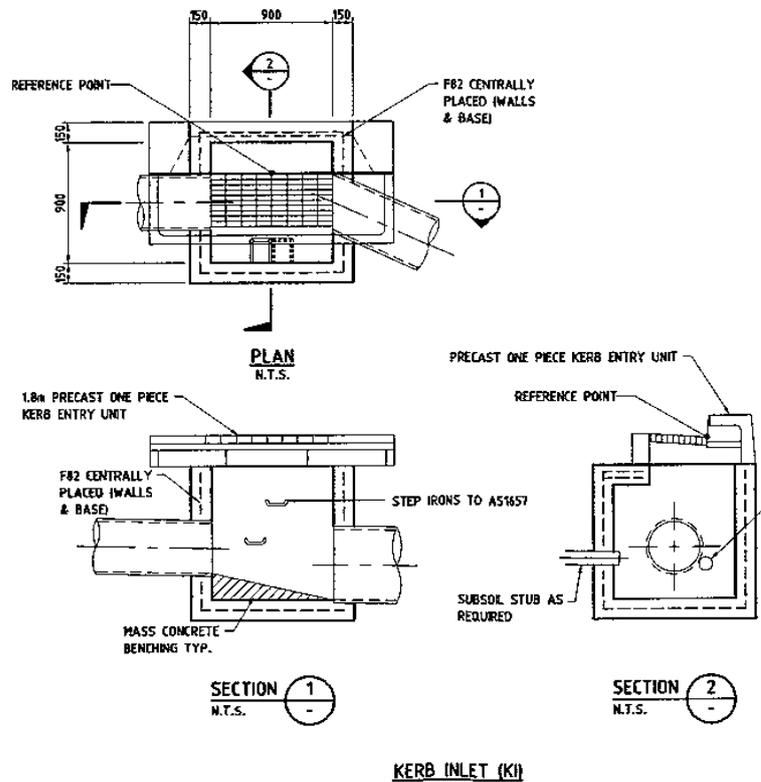
Figure.1: Typical ANU gas meter enclosure

Storm Water Reticulation

09.034 Consultants shall ensure the entire storm water reticulation system complies with the following requirements:

1. Storm water drainage systems shall be subject to the following:
 - the system shall be designed in accordance with the CSIRO recommendation for 1:100-year return rainfall intensity, storm duration 5 minutes, rainfall intensity 200 mm/hour with drainage gravitating to appropriate storm water drains. Consultants shall provide the Principal's Representative with calculations demonstrating the adequacy (or otherwise) of the existing drainage system relating to its capacity to cope with the proposed new storm water load.
 - all manhole lids must finish 150 mm above the finished ground level in landscaped areas.
 - all sumps and inspection pits shall have a silt chamber below the lowest invert level.
 - shoes of downpipes shall not be mortared in place but shall discharge into a separate trap with grating. The trap will be designed to minimise splashing at the downpipe discharge point.
 - rainwater heads shall be readily accessible and shall have adequate overflow capacity; Overflow from rain head must be lower than the gutter.
 - no internal box gutters shall be used, and the external box gutters must be 50 mm lower on the external than the internal edge of the gutter.
 - gutters shall be designed to minimise the build-up of leaf litter and debris.
 - siphonic systems must not be used where there is leaf litter and debris from trees as this will affect the system; and
 - gutters are to be designed so that flashing/gutters are higher internally than externally and eliminates water entering the building.
2. The condition and position of existing storm water mains to which a new building is to be connected, will be checked to ensure that they can be serviced and easily accessed for maintenance, the sizing is correct and true and in the correct location.
3. All grated drains in pedestrian areas that collect surface water must be a type that has a locking system, and the grate has a heel guard finish. Hangan kid safe (or equal equivalent) are the preferred type, cast iron or stainless steel (heel guard type).
4. Gutters and downpipes discharge into a sump at the ground level to be a physical break with the storm water system or blockage caused by vegetable detritus and hail. Down pipe to finish 100 mm above the grate to allow cleaning and leaves to be removed. Gutters are to be designed so that flashing/gutters are higher internally than externally and eliminates water entering the building.

5. All storm water kerb side sumps (Side Entry Pit or SEP) are to be 1.8 m precast one-piece kerb entry units, Type QS and R side entry pits, depth to base of sump must not exceed 1.8 m from top of kerb, F82 steel in the centre and base of the sump with subsoil PVC stubs minimum 300 mm. Refer typical Drawing 09.1 and Figure.2.



Drawing 09.1

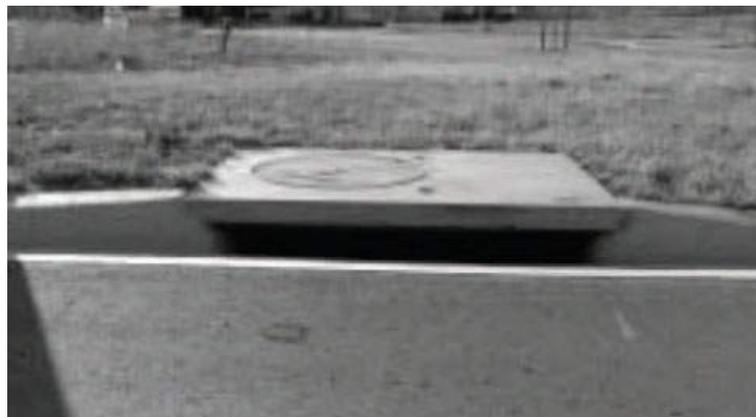


Figure.2

6. All storm water pipework 150 mm and above must have a manhole, grated sump or kerb type sump installed at the change of direction and or junctions. No bend construction or bandage joint will be accepted.

Associated asset and infrastructure requirements

In-ground asset covers, void access and safety lids

09.035 Pits housing in-ground assets; sewer pumps, stormwater infrastructure and the like; shall be designed with user access and safety in mind. Accessible sub-surface pits will have an integrated pit lid and safety enclosure installed meeting the following minimum requirements:

- McBerns (or equal equivalent) as indicated in Figure.3.
- aluminium lid parts and folding componentry.
- flush finished to the finished surface level with no slip or trip hazards.
- vehicular trafficable lightweight lid/s.
- integrated hinged safety grates acting as void protection when in position;
- a sealed lock devise with an ANU standard lock installed;
- gas sampling port on the lid for confined space monitoring; and
- adjacent to pit/void, cast in recessed davit post sleeve for confined space entry/retrieval.



Figure.3

Metering

09.036 All incoming cold water and natural gas services shall be metered and all meters must connect to the ANU BMS, refer to [Section.06 Building Management Systems](#).

09.037 Commercial metering must be placed in a securer location outside the tenanted space, where multiple tenancies are located close, a designated metering room is to be installed.

09.038 All major uses and users of water must be individually metered. Major meters are to be in an uses are minimally:

- evaporative heat rejection systems.
- irrigation Systems.
- rainwater Supply; and

- recycled grey water.

09.039 Paint finishes on water meter lids as follows:

- potable water meter lid: 2-pack blue; or
- non-potable water meter lids: 2-pack lilac.

09.040 All lids are to be complete and fixed with stainless steel screws having hexagonal type heads.

Cisterns and Flushing Valves

09.041 The use of exposed half flush cisterns is preferred in buildings solely occupied by ANU staff, or a mixture of staff and research personnel. Recessed (or in-wall) cisterns shall be used wherever these are primarily used by undergraduates and/or the public.

09.042 All toilet flushing should be supplied via a header tank such that recycled water can be supplied to the header tank. Flushing valves are preferred where toilets are subject to peak usage, e.g. toilets adjacent to a lecture theatre or a large teaching laboratory.

09.043 Where possible these systems are to be fed from a non-potable water supply or storage tank from recycled water or rainwater.

09.044 If flushing valves are installed, consideration shall be given to providing ease of access for maintenance purposes and sound attenuation.

Neutralising Chambers and Trade Waste

09.045 Consultants shall be required to ascertain the type, quantities, and concentration and dilution levels of chemicals that are likely to be discharged into the sanitary drainage system. Users have an obligation to provide accurate information to assist Consultants in determining the need for a neutralising chamber. The local water supply and drainage authority shall also be consulted regarding their requirements. If a neutralising chamber is required, it shall be located to provide easy vehicular access were pumping out or cleaning procedures are necessary.

09.046 Generally, neutralising chambers shall not be located within plant rooms. Preferred chambers are concrete or PanelTrim (or equal equivalent lightweight) chambers.

09.047 Associated dosing tanks shall be located where maintenance staff can gain access independently of any laboratory or office area.

09.048 All dosing equipment and control systems should be external to the pit itself and located within a weatherproof enclosure. This enclosure shall be suitably bunded and a floor waste that drains into the pit provided. All enclosures should have a standard water supply with tap and

appropriate electrical supply. The enclosure must have a minimum floor space of 5.0 x 4.0 m with a minimum ceiling height of 2.5 m.

- 09.049** Supply portable spill response kit for a chemical type of accident in the space provided.
- 09.050** Install an MSDS storage centre made from a durable outdoor grade material with a self-closing lid.
- 09.051** Supply and install all signage to ANU Work Health and Safety (WHS) requirements.
- 09.052** A cold-water supply and general-purpose outlet shall be provided for mixing purposes.
- 09.053** Ventilation of the neutralising chambers shall in accordance with *AS 1668 The use of ventilation and air-conditioning in buildings*.
- 09.054** Ventilation of the Trade waste plant room needs to comply with AS 1668.
- 09.055** All pH controller/monitor/alarm are to be located outside the neutralising chamber.
- 09.056** Solenoid diaphragm pumps (SERA type ANU standard) are to be used and chemical storage is to be banded.
- 09.057** A primary circulation pump drawing from the inlet side of the treatment pit.
- 09.058** Air blower and sparge is to be installed in the inlet treatment chamber(Model HP-120 ANU standard)
- 09.059** Secondary circulation pump draws a sample from the outlet side of the treatment pit are to be ANU standard system Model complete LCA-TWTS-1(Diaphragm pumps), refer to Figure 04.
- 09.060** PH sensor mounted in the suction line will operate an alarm if sample readings are outside the required parameters. The sample is returned to the inlet side of the treatment pit. This process creates a re-circulation of the treatment pit and helps maintain correct pH levels in times of minimal
- 09.061** PH Controller is to be a LIQUITRONICS MCD-301 Series Dual Controller (ANU Standard system).
- 09.062** A safety eye wash/shower station is to be installed within 20.0 m and requires the Principal's Representative be consulted to review any proposed installation.
- 09.063** All new work will need the approval from the Icon Water trade waste section

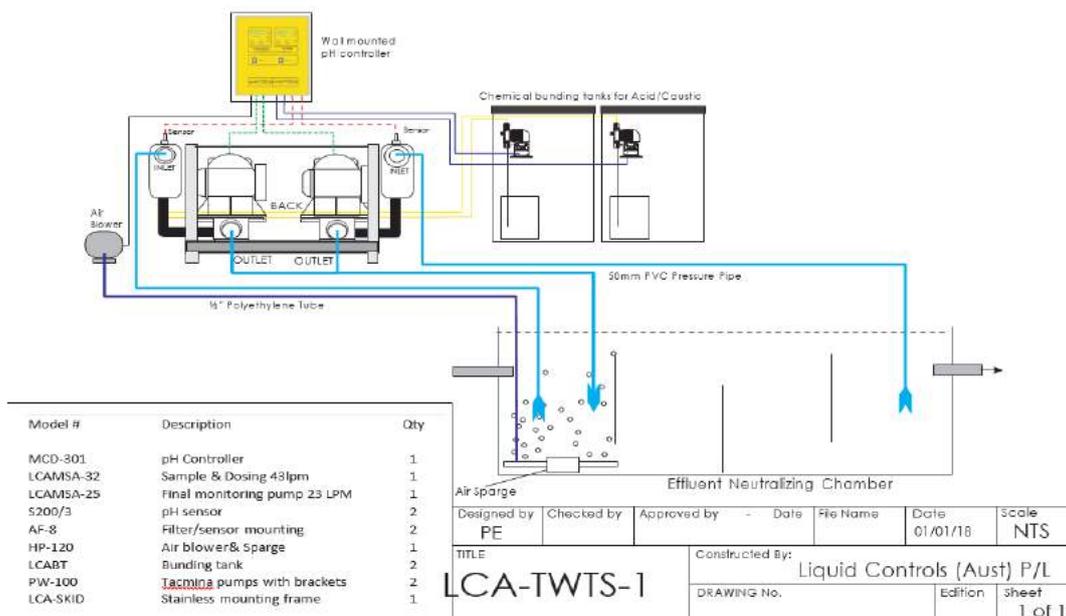


Figure.04: Indicative ANU standard dosing system

Sump Pumps and Alarms

09.064 Duplicate pumps shall be provided in storm water and sewer pits. Each pit shall be controlled by a common control panel with automatic run/standby/alternating facilities together with multi-mode level sensing probes, which shall sense:

- high level alarm;
- pump 1 start;
- pump 2 start; and
- pumps 1 and 2 stop.
- Manual operation on pump 1 & 2.

09.065 The control panel shall include terminals to provide remote control indication to the ANU’s BMS for pump operation and high-level alarm. A local audible and visual alarm shall also be included in the control panel for high level condition.

09.066 Pump motors shall be installed to permit disconnection by simple plug withdrawal. Power outlets shall be located a minimum of 600 mm above finished floor level.

09.067 Pumps shall be labelled. Labels shall include pump number, circuit number and switchboard location, all in accordance with labelling of equipment.

09.068 Pump and control switches shall be installed to allow easy access for inspection and testing procedures.

09.069 Where duty and standby pumps are installed, each pump shall be provided with a duty hour run meter.

09.070 Check valves and isolating valves shall be installed as appropriate.

09.071 Sumps and submersible pumps shall be designed to facilitate easy pump removal by the provision of:

- adequate lighting above the sump; and
- lifting eye above the sump.

09.072 Submersible pumps and all fittings required for installation shall be specified as being completely corrosion resistant.

09.073 Non-submersible pump motors shall be located a minimum of 600 mm above floor level.

09.074 Internal and external ground water systems shall be kept separate. The ANU prefers external sumps and pumps (if required) for ground water disposal and internal sumps for basements, lift wells and the like.

Identification of in-ground services

09.075 All in-ground services are to be identified by installing continuous warning tape in the ground 100 mm directly above the service. Provide a means of tracing non-metallic in-ground services, such as by using tracer wire which is easily identifiable.

Irrigation

09.076 Refer to [Section.04 Soft Landscape](#) for irrigation system requirements.

Rain Water Harvesting

09.077 Rainwater collection is to be installed on all major projects and used within and around the building to replace use of potable water. Rainwater collection tanks to be appropriately sized such that a minimum of 2 months of average annual rainfall on the building can be captured and stored.

09.078 Captured rainwater is to be provided, in order of preference to:

- toilet flushing.
- process cooling or heat rejection systems; then
- irrigation.

Signage

09.079 Green coloured identification tape marked “CAUTION RAINWATER LINE BURIED BELOW” should be used to identify in-ground storm water pipes to the tank and in-ground water supply pipes from the tank. Identification tape is to be laid above the pipes and within the trench. Identification markings should comply with AS 1345. The tape shall be placed longitudinally along the pipe so that the marking is visible from all viewing directions.

09.080 All external hose taps that are supplied with rainwater are to be identified with a metallic safety sign (100 x 75 mm) labelled “RAINWATER” which shall be securely fixed above the rainwater hose tap outlet. The words and symbol are to be black in writing on a yellow background. The hose tap shall be fitted with a hose connection vacuum breaker or backstop valve. Signs shall comply with *AS 1319 Safety signs for the occupational environment*.



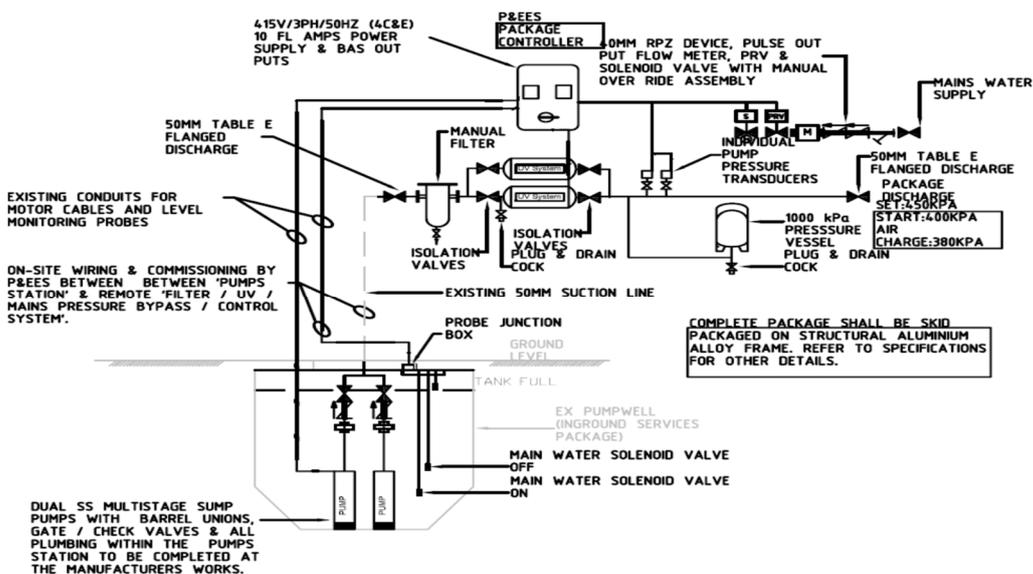
Pipe Markers

09.081 Pipework less than 40 mm in diameter shall have a continuous green pipe marker band/tape around the circumference of the pipe with the word “RAINWATER”. Identification markings should comply with AS 1345. The tape shall be placed longitudinally along the pipe so that the marking is visible from all viewing directions.

Pumps

09.082 All rainwater tank pumps must be installed so noise levels do not create a nuisance to occupants and/or any neighbouring properties.

09.083 The plumbing system is to be designed to ensure that the maximum static pressure at any outlet does not exceed 500 kPa and the minimum pressure at the most disadvantaged outlet or fixture is not less than 50 kPa at the minimum flow rate required, refer to *AS 3500 Plumbing and Drainage*.



Typical below ground installation and filter/Pump package.

Safety Shower and Eyewash Facilities

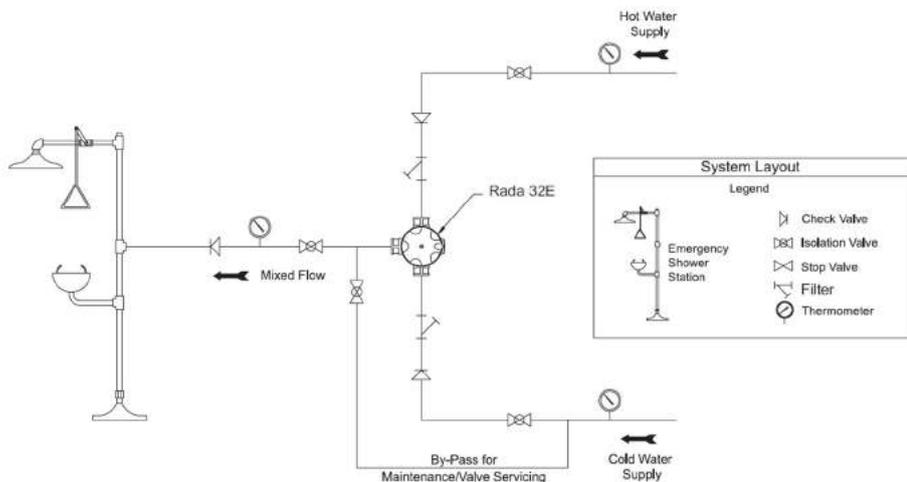
09.084 Any unusual situations associated with safety showers and eye wash stations, or their installation shall be discussed with the Principal’s Representative.

09.085 At least one safety shower and eyewash or eye/face wash facility shall be installed, in each laboratory where hazardous substances are used, and shall be specified by the user group. In addition, hand-held drench hoses may be installed as specified by the user.

09.086 GEMS FS200 Flow Switch (set point 7.5 LPM) connected to the buildings BMS/Alarm system.

09.087 Signage shall be highly visible in compliance with AS 1319 and visible throughout the area serviced by the shower/eye wash.

All safety showers are to be fitted with RADA 32E or Broen temperature control devise No. 17460.009 and it must be installed as per manufacture recommendations / as per drawings below.



09.088 The ANU design requirement is for a travel distance not exceeding 15.0 m (corresponding to approximately 10 seconds walking travel time) to such devices from any point in the laboratory is considered good practice. Shorter travel distances may be appropriate for high-risk applications. The equipment must be installed on the same level as the hazard, accessing the equipment should not require going up or down stairs or ramps. The path of travel from the hazard to the equipment should be free of obstructions and as straight as possible. Distances more than 15.0 m (between the hazard and safety shower/eye wash) shall be reviewed by the WHS Branch.

09.089 Standard product list for the ANU is Enware, Broen items or equal equivalent.

09.090 Consultants must consider where wastewater will go. In particular, care must be taken that wastewater does not create a hazard.

09.091 Connect any drain piping from the emergency equipment or floor drain to the building’s acid waste disposal system or to a neutralizing tank.

09.092 Where possible all safety showers must have a floor waste and the water must flow into the trade waste drainage system.

Maintenance and Service

09.093 Consultants are to ensure that the specification will include provision for the hydraulics and services contractors to coordinate and discuss project details and specific requirements with the Principal’s Representative.

Standard Sanitary Fittings and Fixtures

09.094 The following sanitary fittings (or equal equivalent) are to be used. Alternatives can be offered with full documentation and technical details to be provided to the Principal's Representative for review.

09.095 Vanity Basins - White Only

Wall Mounted Basins

- Duravit D Code 550mm Wall Basin
- Caroma Caravelle

Semi Recess Basin

- Duravit D Code 550mm Wall Basin
- Caroma Caravelle 550

Under Counter Basin

- Duravit D Code 560x400mm Under Counter Basin
- Caroma Caravelle

Insert Recess Basin

- Duravit D Code Vanity Basin 545mm
- Caroma Caravelle

Disable Basin (AS1428.1)

- Duravit D Code 550 & Shroud
- Integra 500 wall basin One Tap Hole

09.096 Toilet Suites – White Only

- Duravit Darling New Wall Faced Pan & Seat
- Leda Wall Faced Invisi 11 Suite
- Duravit Darling New Wall Faced Suite
- Leda Wall Faced Pan
- Enware Toilet Infill's (AS1428.1 disable)
- Care 800 Invisi 2 Suite – Care Button & Back Rest

09.097 Toilet Pans –White Only

- Duravit Darling New Wall Hung Pan & Seat
- Walvit Wall Hung Pan & D760 Bracket
- Duravit Darling New Wall Faced Pan & Seat
- Caroma Leda
- Caroma Flex Wall Faced Back Inlet Pan
- Caroma Caravelle
- Caroma Trident

09.098 Toilet Seats – White Only

- Duravit Darling New Seat
- Caravelle or Caravelle Care Seat
- Colani Care Seat
- Caravelle Care Seat (Blue Seat)
- Avolon Soft Close Seat
- Metro Toilet Seat
- Caravelle Care Seat

09.099 Squat Toilets

- Caroma Caravelle squat Invisi 11 Toilet suites
- Alternatives need approval

09.0100 Urinals

- No waterless products.
- Cube Invisi Series 2 Urinal (1.8lt Flush)
- Cube 0.8lt Electronic Urinal (0.8lt Flush)
- Duravit D Code Urinal with
- Zip 41091 Flushmaster Solo WS005 Ceiling Sensor, Solenoid Kit & Battery
- Zip 99024 Flushmaster Direct Injection Air Break Kit 25mm
- Rada Mono 122 wall urinal flushing system (1 stall) – Part No. 850911
- Rada Mono 125 ceiling urinal flushing system (1 stall) – Part No. 850931
- Rada Mono 126 ceiling urinal flushing system (2 stalls) – Part No. 850941 automatic electronic flush.
- passive infra-red sensor.
- adjustable time selector for flush delay and cistern fill cycles.
- power source 240V mains.

09.0101 Showers

- Liano Rail Shower
- Liano Shower
- Rada VR 105 vandal resistant shower head 8.5L/min
- Rada VR 106 vandal resistant shower head 5L/min
- Rada VR2 vandal resistant shower head
- Rada SF1 10 or SF1 20 Hand held shower and rail with hose slide and rail
- Mira 360 showerhead with hose and rail
- Hansgrohe Croma 100 Multi Hand Shower with Porter E shower Holder with Integrated Hose Connection
- Hansgrohe Crometta 100 Shower on Rail
- Hansgrohe 100 Multi Overhead Shower

09.0102 Tap Sets

- Retro or Liano Range

- Manor House or Eltoro Range
- Linkware Kirra Beach or Elle Lever Ranges
- Enware School Pattern
- Linkware Noosa or Design Ranges
- **Timed flow taps option**
 - Option 1
 - Presto timed flow taps
 - Option 2
 - Presto 2000 basin mounted timed flow tap – Part No. P20024
 - Presto 2010 wall mounted timed flow tap – Part No. P20118
 - Presto 605 basin mounted timed flow tap (cold) – Part No. P64608
 - Presto 605 basin mounted timed flow tap (warm) – Part No. P64626
 - Presto 705 basin mounted timed flow lever tap – Part No. P64654

09.0103 **Mixing Taps**

- Enware Vega Range
- RBA Range RBA4L50-7070 + RBA5935-1900
- Caroma Nordic Range
- Presto 2020, 3000 or 7000 range of basin mounted timed flow mixer tap

09.0104 **Electronic Tapware**

- Enware – Enmatic 1000 series basin Tap
- Enware Enmatic 2000 Series Basin Tap with Anti-Vandal Proof
- Dyson Airblade Tap AB09 Short, AB10 Long & AB11 Wall
- Presto Volta sensor tap – Battery
- Presto Volta sensor tap – Mains
- Presto Volta sensor tap - Lever Mixer Battery
- Presto Volta sensor tap - Lever Mixer Mains
- Hansgrohe Focus Electronic Basin Mixer
- Rada PULSE sensor systems
- Rada 215 and 320 sensor systems

09.0105 **Thermostatic Mixing Valves**

- Enware – Aqua blend Series.
- Broen – Stabitherm Series.
- Rada - thermostatic mixing valves

09.0106 **Laboratory Safety Equipment**

- Enware.
- Broen.
- RBA.
- Thornthwaite B-Safety equipment
- Safety Showers temperature control devices to be used only Rada 32E and Broen NO. 17460.009

09.0107 Boiling/Chilled Water Units- Must be air cooled only and must provide a commercial warranty period of 5 years from commissioning

- Zip products.
- Rheem products.
- Billi product

09.0108 Floor wastes

- Stainless steel proprietary items.
- Minimum 100 mm diameter inlet with screw in gratings.
- Floor wastes complete with puddle flanges shall be epoxy grouted into the penetration.

10 – Mechanical Services

Version	Date	Authors	Summary of Changes
1.1	19 October 2010	Solomon Elijah	
1.2	08 February 2012	Solomon Elijah	Document completely revised
1.3	06 December 2012	Solomon Elijah	Referenced 19.29 to section 06
1.4	18 January 2013	Solomon Elijah	Modified Clauses 19.5.1.1, 19.5.2, 19.5.6.1, 19.7.2 & 19.28
2.0	02 March 2016	Kanhasamy Mohan	General Revision

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Introduction

10.1. The Australian National University's (the ANU or the University) is committed to energy efficient design and low long-term maintenance costs associated with mechanical (and other) services and systems within buildings and on the sites of ANU campuses.

10.2. These Requirements need to be referred to before commencement of design of any mechanical service or system. For refurbishment of existing buildings where infrastructure limitations, such as available power supply, preclude provision of air-conditioning throughout, priority shall be given to provision of air-conditioning to essential areas where a controlled environment is critical to the functions performed. Examples of such areas include PC-2 laboratories, computer areas, animal houses and clean rooms.

10.3. The Campus and Buildings Requirements Manual (the CBRM, the Requirements or the Manual) documents the minimum design and construction requirements for new, refurbishment or repurposed building works, landscapes and engineering/infrastructure projects on buildings, facilities and campuses of the ANU. The Requirements are prepared for the direction of a Consultant, Designer or Project Manager in the preparation of project specific documentation and in the delivery of project works.

10.4. This section of the CBRM outlines the ANU minimum requirements for air-conditioning and ventilation systems and services.

10.5. Notwithstanding any Consultant's particular discipline or area of responsibility, each Consultant and/or designer shall consider the document in its entirety. The complete CBRM consists of the following Sections which may be referred to within this Section:

Campus and Building Requirements Manual	
Section 01	General Requirements
Section 02	Architectural Requirements
Section 03	Roads, Car Parking & Civil Works
Section 04	Soft Landscaping
Section 05	Roofing, Roof Fabric & Roof Safety
Section 06	Building Management Systems
Section 07	Electrical Services
Section 08	Fire Protection Systems
Section 09	Hydraulic Systems
Section 10	Mechanical Services
Section 11	Lifts, Cranes & Vertical Transportation Systems
Section 12	Security, CCTV & Access Control

10.6. Sensible and appropriate levels of technology and design should be applied to obtain the correct level of quality and reduce energy wastage and carbon dioxide emissions arising from the building operation without reducing the functional standards necessary.

10.7. Mechanical services and systems shall be comprised of systems and equipment that have been tried and tested.

10.8. Mechanical services and systems will need to be adaptable and flexible due to the changing needs of the ANU. Systems are to be designed and zoned to accommodate the building design, proposed and future users.

10.9. In as much as the design can be developed to be efficient, the future operation and management of the building and its systems will have a huge bearing on energy consumption. To this end the designers shall liaise closely with the Principal's Representative to ensure all design features are clearly articulated and understood and systems properly handed over for successful operation of the systems.

10.10. The quality aspects of the services proposed will be provided to the Principal's Representative for review at all project stages.

10.11. A peer review of the designs, at various stages, may be arranged at the discretion of the Principal's Representative.

10.12. Specifications provided by the designer must be tailored to suit the specific project requirements and must not include generic or non-applicable material.

Design Requirements

10.13. In designing and specifying a system due regard shall be given to the following criteria:

- Size or capacity of the system including peak and minimum loads;
- Performance requirements;
- Energy utilisation through seasonal cycles;
- Noise considerations;
- Location and space considerations;
- Owning and operating costs;
- Reliability;
- Ease of maintenance;
- Capability of future expansion;
- Separation of process and comfort cooling systems to ensure reliability; and
- Project specific energy targets.

10.14. Systems designed and specified must be suited to the purpose for which they are designed and installed, must be technically sound and must meet the current requirements of the National Construction Code (NCC) and any other applicable Standards, Regulations or Acts in force at the time.

Environmentally Sustainable Design

Passive Design Considerations

10.15. The Project Team shall give consideration to the benefits derived from incorporation of passive design measures from the earliest stages of the design process.

10.16. The mechanical services designer, in conjunction with the Project Team, will propose, analyse, develop and implement passive design measures to reduce thermal plant sizing and maximise energy efficiency of the building.

10.17. Passive design measures to be considered include but are not limited to the following:

- Building orientation and floor plate configuration;
- High performance glazing and facade design;
- External shading elements; and
- Natural ventilation (where appropriate).

System Selection

10.18. The mechanical services designer shall undertake analysis of various system types during the concept design phase to identify appropriate energy efficient system selections and secondary energy efficiency measures to be incorporated into the mechanical services design.

10.19. System design should consider and utilise, for maximum efficiency and enhanced user comfort, features of the prevailing climate. For Canberra this includes a high diurnal range, a low wet-bulb temperature, low average wind speed and low average ran days.

10.20. System design measures to be considered include but are not limited to the following:

- Outdoor air economy cycle on air handling plant;
- Mixed mode active/passive systems;
- Utilise free cooling where suitable;
- Chilled and heated water temperature reset;
- Heat recovery and thermal storage systems; and
- Use of Variable Speed Drives (VSDs) on system components with variable demands.

10.21. A value engineering analysis shall be undertaken during the concept design phase to assess appropriateness of the potential system types and energy efficient design measures to validate the final systems selections. A cost benefit analysis shall be prepared where payback periods of 5, 10, 15 and 20 years shall be presented to the ANU for consideration. The requirements for preparation of a cost benefit analysis shall be confirmed with the Principals Representative.

10.22. The value engineering analysis, including detailed life cycle costing, shall incorporate as a minimum the following elements:

- Capital expenditure;
- Recurrent maintenance and repair costs;
- Payback periods;
- Replacement at end of economic life; and
- Energy usage costs.

10.23. The value engineering analysis shall be based on the building's operating schedule and take into consideration areas and systems with extended hours of operation (i.e. the economic service life of equipment serving a 24 hour facility will be significantly shorter than for a typical weekday office type application).

10.24. Life cycle costing shall be determined over a 30 year period for major projects and account for cost of equipment replacement which may be required during the life of the building.

Existing Installations

10.25. In areas where an existing installation is in place, consideration should first be made to the possibility of extending the system to take in the proposed additional load. The proliferation of diverse self-contained systems in the same location is to be avoided.

Hours of Operation

Hours of operation of air-conditioning systems are to suit the application and user requirements. For comfort air-conditioning of small spaces, the preference is for operation via BMS time-schedules with over-ride push-button functionality set initially for two hours. A number of research laboratories, libraries, computer facilities and other areas may require 24 hour operation. Detailed requirements for the operation of air-conditioned spaces must be clarified with the Principal's Representative at an early design stage.

Mechanical Systems Design Parameters

Outdoor Design Conditions

Summer

10.26. Design ambient conditions for selection of air-conditioning equipment, chillers, cold room, constant temperature room and freezer room equipment and the like shall be as follows:

ANU campuses	Summer Design, 8-10 hrs/day	Summer Design, 24hrs/day	Average Daily Range, °K	Average Yearly Range, °K	Elevation, meters above MSL	Latitude, South
ACT-Acton, Fenner Hall, Spring Valley Farm	36.2°C DB/ 20.8°C WB	37.1°C DB/ 21.4°C WB	15.0	33.5	565	35°27'
ACT-Mt Stromlo	36.5°C DB/ 19.5°C WB	37.5°C DB/ 20.0°C WB	15.0	33.5	742	35°19'
NSW-Kioloa	28.5°C DB/ 17.0°C WB	29.0°C DB/ 17.5°C WB	10.0	26.0	12	35°32.7'
NSW-Coonabarabran, SSO	36.3°C DB/ 22.3°C WB	39.2°C DB/ 24.7°C WB	18.0	34.5	1,164	31°16.5'
NT-NARU	34.5°C DB/ 27.7°C WB	35.0°C DB/ 28.0°C WB	7.0	16.0	30	12°28'

Notes to Table:

- Dry Bulb Temperature (DB), Wet Bulb Temperature (WB), Relative Humidity (RH), Mean Sea Level (MSL).
- Siding Spring Observatory (SSO), North Australian Research Unit (NARU).
- Comfort applications for all ACT campuses & SSO site: Air cooled condensing unit/air cooled chiller to be selected for 37°C DB 'air-on' condition.
- Critical/process applications for all ACT & SSO campuses: Air cooled condensing unit/air cooled chiller to be selected for 40°C DB 'air-on' condition.
- For all cold rooms and freezer rooms the condenser 'air-on' condition to be used for sizing and selection of air-cooled condensing units is 43°C DB.
- For evaporative coolers/cooling towers, where permitted, the design WB shall be 22°C for critical applications, otherwise 21°C WB shall be used.

Winter

10.27. Design ambient conditions for selection of heating equipment, heating boilers, constant temperature room equipment and the like shall be as follows:

ANU campuses	Winter Design, 8-10 hrs/day	Winter Design, 24 hrs/day
ACT-Acton, Fenner Hall, Spring Valley Farm	-2.5°C DB, 80% RH	-4.5°C DB, 80% RH
ACT-Mt Stromlo	-3.0°C DB, 80% RH	-5.0°C DB, 80% RH
NSW-Kioloa	5.0°C DB, 80% RH	3.0°C DB, 80% RH
NSW-Coonabarabran, SSO	-3.5°C DB, 80% RH	-5.0°C DB, 80% RH
NT-NARU	18.0°C DB, 85% RH	17.0°C DB, 85% RH

Notes to Table:

- Library applications: Use -3.0°C DB, 80% RH for heat loss estimating and -3.0°C DB 'air-on' condition for air cooled condensing unit/reverse cycle chiller selection.
- Comfort applications for all ACT campuses & SSO site: Air cooled condensing unit/reverse cycle chiller to be selected for -2.5°C DB 'air-on' condition.
- Critical/process applications for all ACT campuses & SSO site: Air cooled condensing unit/reverse cycle chiller to be selected for -5°C DB 'air-on' condition.

Indoor Space Design Conditions

Summer

10.28. Unless stated otherwise, room design conditions for assessment of cooling loads shall be based on the following:

Comfort applications	
Offices, Libraries, Study Rooms, Laboratories* and the like	24°C DB +/- 2°C DB; 50% RH
Auditoriums, Conference Rooms, Exercise Rooms and the like	22°C DB +/- 2°C DB; 55% RH
Machinery Workshops	26°C DB; 40% RH
Critical/process applications	As determined in consultation with the user and recorded in the user brief
Passive/Naturally ventilated areas	As determined in consultation with the user and recorded in the user brief

Notes to Table:

- *Some laboratories may require narrower temperature tolerances.
- For facilities such as laboratories which must be cooled and heated on a 24/7 basis, the temperature set point may be different to that during normal working hours.

Winter

10.29. Unless stated otherwise room design conditions for assessment of heating loads shall be based on the following:

Comfort applications	
Offices, Laboratories and the like	21°C DB +/- 2°C DB
Auditoriums, Conference Rooms, Exercise Rooms and the like	21°C DB +/- 2°C DB
Workshops	20°C DB
Entry air-locks, foyers, break-out spaces, circulation spaces (including waiting areas that are part of such spaces), break-out rooms and the like	21°C DB +/- 3°C DB
Shower rooms, Change/Locker rooms, Cleaners Rooms and the like – source of heated make-up air from circulation space.	21°C +/- 3°C DB
Toilets	Unconditioned
Large store rooms for distributing items of equipment that are likely to be occupied for 30min or more	21°C +/- 3°C DB
Critical/process applications	As determined in consultation with the user and recorded in the user brief
Passive/Naturally ventilated areas	As determined in consultation with the user and recorded in the user brief

Occupancy and Ventilation Rates

10.30. For animal facilities, the following are the minimum outdoor air ventilation requirements:

#Laboratory animals (rats, mice, etc.)	15 room volumes/hr
Laboratory animals in IVC enclosures	+15 room volumes/hr to the room in which the IVC cages are housed
*Birds	8 room volumes/hr
Insects, Lizards, other *animals	8 room volumes/hr

Notes to Table:

- +The actual outdoor air change for each IVC enclosure will probably exceed 100 cage volumes/hr.
- #These are for some older facilities where laboratory animals are housed in cages.
- *These apply to those birds and animals where behavioural studies are being carried out.

10.31. While the maintenance of negative air pressure with respect to the surrounding areas is the norm for the purpose of odour control, in animal facilities, there are applications where positive pressure is required to be maintained with respect to the surrounding areas. Therefore the user will require to be consulted in each case and the design parameter indicated in the Final Sketch Plan (FSP) Report.

Mechanical Services for Laboratories and Critical Applications

Laboratory Design

10.32. Design of air-conditioning and ventilation systems to laboratory areas is to take into consideration the impact of localised effluent removal systems at the source of contaminant generation and the resulting reduction of outside air flow rates required, rather than be based on generic air change rates.

Critical Areas

10.33. Critical areas, including laboratories where applicable, shall be supplied with essential services including power, chilled water, condenser water, humidification, heating, ventilation and controls. The systems shall be designed so the appropriate load shedding occurs.

10.34. Single point of failure analysis is to be completed for critical areas with agreement of solutions with the Principal's Representative.

Cleanrooms

10.35. The Principal's Representative shall liaise with users in determining the production requirements of the cleanroom to ensure the design process is followed to be able to achieve sign off and shall include design, installation and commissioning qualification processes.

10.36. Cleanroom redundancy details shall be referred to the Principal's Representative for review.

Specific Equipment Requirements

Chillers

10.37. Chillers and chilled water systems shall be analysed during the design phase to determine the most suitable type of system for the installation. A cost benefit analysis is required comparing, at a minimum, the following factors:

- Air-cooled vs water cooled systems;
- Multiple chillers vs single chiller;
- Fixed speed Primary only vs Primary/secondary; and
- Chiller installation configuration and staging. Equal sized, low load chillers, Series pipework, Parallel pipework, Series-Counterflow pipework etc.

10.38. Given the low proportion of time that the chiller will run at full load in Canberra, the analysis must be weighted toward low load efficiency and minimum turndown capability. The analysis and recommendations shall be provided to the Principals Representative for review.

10.39. Chillers serving process cooling other constant load applications year round must be fitted with a free cooling mode of operation that can run simultaneously with mechanical cooling.

10.40. All chillers should be optioned with CHW temperature reset functionality, and demand limit capacity control.

10.41. ANU Facilities and Services shall be able to monitor the chiller operating parameters directly via the chiller native BACnet HLI controls.

10.42. All chillers must feature variable speed compressors. Any chiller operating in a standalone configuration must feature twin independent refrigerant circuits and compressors.

10.43. For the purpose of commonality, the ANU prefers Carrier, Trane, York or Daikin (or equal equivalent) central chilling equipment. These brands are preferred in terms of the ready availability of technical support and moderate cost of spare parts; although other brands will be given due consideration. Written applications with supporting documentation shall be submitted to the Principals Representative for approval to use alternative brands of plant.

Heating Hot Water Generators (Boilers)

10.44. Heating water generators shall be factory assembled units, complete with burner, combustion chamber, refractories, heat exchanger/s, flue connection, piping and valves, instrumentation, control system and control panel, safety and heating water generator protection devices and auxiliary equipment as necessary for the satisfactory operation of the heating water generators.

10.45. Condensing heating water generators may be offered subject to review and approval of the Principals Representative, based on HHW system operating temperatures and materials used in the

generators and flues construction. Part load performance characteristics shall be submitted to the Principals Representative for review.

10.46. For the purpose of commonality, the ANU prefers Hunt (or equal equivalent) central heating plant for heating capacities in excess of 300kW output and Raypak (or equal equivalent) central heating plant for heating capacities up to and including 300kPa. These brands are preferred in terms of the ready availability of technical support and moderate cost of spare parts; although other brands will be given due consideration. Written applications with supporting documentation shall be submitted to the Principals Representative for approval to use alternate brands of plant.

Pumps

10.47. Pumps shall be selected to achieve the lowest practical power absorbed at the specific operating conditions. Pumps shall be selected with 20% spare capacity in airflow.

10.48. Pumps shall be of vertical in-line centrifugal type for smaller systems or back pull out centrifugal type for larger pumping systems. Pumpsets shall be complete with mechanical seal. All pumpsets shall be mounted on concrete plinths and have sufficient space for service, maintenance and installation of connected pipework and fittings. All pumpsets should be installed with flexible connections, strainers and test points on the inlet and outlet pipework

10.49. All pumpsets should be provided with variable speed drive (VSD) motors. Pumpsets with motors of 0.37 kW and above power rating shall be suitable for three phase power supply.

10.50. Empirically derived pump curves shall be supplied with each fan in technical submittals and provided in Operating & Maintenance Manuals.

Fans

10.51. Fans shall be selected to achieve the lowest practical power absorbed at the specific operating Conditions. Fans shall be selected with 20% spare capacity in airflow.

10.52. All motors shall be either induction (3 phase over 0.37kW) or EC type with suitable enclosures.

10.53. Empirically derived fan curves shall be supplied with each fan in technical submittals and provided in Operating & Maintenance Manuals.

Ductwork and Pipework Reticulation

10.54. In the design of air and water distribution systems, due regard shall be given to first cost and operating cost and where necessary effective attenuation must be provided to achieve the required noise levels.

10.55. Duct and pipework runs within the building are to be preferably run in risers or ceiling spaces for minimum aesthetic impact and must be adequately supported.

10.56. Main risers (air and water) must be sized to handle an increase of 20% in air/water quantity, and fans and motors must be selected with this in mind.

10.57. Pipework reticulation must feature isolating valves on all branches. Pipework to include strainers and binder points across all installed equipment, coils, and valves. Blend valves to be installed at the highest point in all pipework circuits.

Air Handling / Fan Coil Unit

10.58. Large built up central air handling units (AHUs) are to be avoided. Packaged type AHUs are preferred. Air handling units shall incorporate heating coils and the use of terminal re-heat shall be avoided for the purpose of energy conservation unless dictated by the application.

10.59. Packaged AHUs should be readily disassembled to enable ready removal of fans, coils, trays and filter frames.

10.60. Consideration of demand based outside air rates should be given to all AHUs/FCUs with dedicated outside air systems. AHUs/FCUs shall be able to run a full outside air economy cycle on demand. Pre-cooling of the outside air using an air-to-air or air-to-water heat exchanger system shall be considered and evaluated for each system.

10.61. The outside air / return plenums shall be provided as part of all main air handling unit.

Cooling Towers

10.62. Where cooling towers are used, strict adherence to *AS/NZS 3666:2011 Air-handling and water systems of buildings* shall be followed.

10.63. Careful consideration must be given to the siting of cooling towers with respect to adjacent exhaust system discharge points and adjacent ventilation openings and acoustic constraints.

10.64. A minimum 100 mm diameter drainpipe connection shall be installed for quick draining. Ladders, handrails and maintenance access platforms for cleaning and servicing of components on the top of the tower must be provided. Ladder, handrails, platforms and kick plates shall comply with the requirements of statutory authorities.

10.65. Platforms shall be provided around the entire top of each tower. The access arrangement shall be documented by the designer and not designed by the supplier of the cooling tower. Submit details of stair and platform arrangement to the Principals Representative for review. Access ladders and restricted platforms will not be accepted.

10.66. Side stream filtration shall be incorporated into the condenser water systems sized to suit the application. Provide basin sweeping piping with inductor nozzles to effectively prevent sediment from collecting in the cold water basin, with pipe for connection to the side-stream filtration system.

10.67. Where cooling towers are appropriate for heat rejection of specialist laboratory cooling water systems, closed circuit cooling towers are to be considered.

10.68. Water treatment shall be provided by the incumbent water treatment specialist of ANU (Hydro Industries Pty Ltd).

Storage Tanks

10.69. All storage tanks shall feature the following fittings and features as a minimum:

- A bolted and flanged gasketed manhole of at least 450 mm clear internal diameter;
- Flanged pipe nozzles; suitably sized for the maximum flow rate;
- A half coupling at the bottom of the lower dished end for draining purposes;
- A half coupling for air venting and a safety valve near the highest point of the top dished end;
- A half coupling for vacuum break purposes at the highest point of the top dished end;
- A half coupling connection near the highest point for a temperature gauge; and
- Two or more lifting lugs of Carbon Steel to *AS 1548:2008 Fine grained, weldable steel plates for pressure equipment*; with 60 mm diameter holes.

10.70. Ensure that the storage tanks are provided with water distribution headers and/or baffles in capacities larger than 2000 L water volume storage capacity. At least two strategically located manholes shall be provided for tanks of 10,000 L or more in capacity. Tanks shall be etch-primed and painted; suitable for application of thermal insulation on site.

10.71. For chilled/process cooling water tanks the chilled water leaving the chiller/process cooler shall be brought into the tank at high level and the leaving water drawn at low level. For heating water tanks the heating water from the heating appliance shall be brought into the tank at low level and the leaving water drawn off at high level.

Expansion Vessels for Water Reticulation Systems

10.72. Sealed expansion vessels shall be used to provide make-up water to all chilled, heating and process water recirculation systems. These shall be located so as to provide make-up on the low pressure side of a recirculating water system. For heating water systems these should provide make-up water to the return line, upstream of the boiler inlet port. Such vessels shall be sized to take up the contraction/expansion volume of the system.

Water Treatment Systems

10.73. Chemical dosing systems shall be provided for all heating and cooling recirculating water or glycol systems. These shall consist of vertical cylindrical dosing pots fabricated of AISI 304 stainless steel. Vessels shall be complete with the following:

- Charging funnel for introducing chemicals;
- Air venting port with pipe having a reverse 'U' bend;
- Inlet and outlet pipe connections in the same vertical plane;
- Drain port at lowest level;
- Minimum of three legs, each with feet for fixing to the floor slab of the plant room; and
- Isolating valves for the tail pipe of the funnel, each inlet and outlet pipe connection and drain connection.

10.74. Consideration should be given to engaging the company currently contracted to the ANU (Hydro Industries Pty Ltd) for the treatment of existing cooling towers (against legionella), condenser water, heating water, PCW and chilled water systems, as well as to conduct the required servicing during the defects liability period.

10.75. Water treatment chemical composition should be compatible with all materials installed within the CHW/HHW system, with particular emphasis on the materials used within the heating hot water generator's heat exchanger.

Packaged DX Air Conditioning Systems

10.76. DX systems should not be installed if central CHW/HHW plant can be utilised. The lower efficiencies of DX air equipment can be accepted based on a usage profile and size of the application being unique, the energy consumption costs, the building aesthetics, the available space for equipment installation. If a DX system is to be installed in lieu of a central CHW/HHW system, then written approval must be received from the Principals Representative.

10.77. The DX plant and equipment shall be provided on a separate electrical control panel. All control and indication points shall be available via a native Bacnet HLI.

Steam Boilers and Steam & Condensate Reticulation Systems

10.78. On the Acton campus the need for steam boilers is generally associated with research activities which are generally critical as far as building operation is considered. Boiler selection shall be based on assessment of the peak load that the facility is likely to cater to, with adequate allowance for future additions. Steam demand charts shall be included in the FSP Report. This should show the steam demand plotted during a day's duty cycle of the boiler. A list of steam consuming equipment stating dry steam usage (Kg/hr) at start-up and during normal operation as well as pressure required at the inlet to the equipment (kPa) should also be included.

10.79. If users of the facility assign a 'critical' rating for steam boiler operation to ensure business continuity, it is recommended that a dual natural gas fired boiler system be sized and selected. Selection of boilers shall be based on the maximum steam demand. The extra allowance on capacity shall be as follows:

- Boilers that operate during normal working hours: 20%
- Boilers that operate on a 24/7 year round basis: 10%

10.80. Each boiler shall be sized to take 100% of the maximum steam demand (including allowance for future loads).

10.81. In sizing the boiler, it may be noted that normal steam consumption of equipment operating simultaneously shall be used rather than summation of the maximum steam consumption figures; unless otherwise dictated by equipment operation.

10.82. Generally an unattended, vertical, tubeless, packaged Hunt Alfarel steam boiler (or equal equivalent) shall be selected for steam output capacities <500 kW (798.5 Kg/hr of dry saturated steam from and at 100°C). For steam output capacities >500 kW an unattended, natural gas fired, packaged water tube boiler of Forbes-Bryant (or equal equivalent) shall be selected.

10.83. Vertical tubeless boilers shall be fully automatic, packaged entities that are designed and manufactured to recognised, and in compliance with, standards as well as statutory authorities requirements.

10.84. Horizontal, water tube boilers shall be fully automatic, packaged entities that are designed and manufactured to recognised, and in compliance with, standards as well as statutory authorities requirements.

10.85. Boilers shall generally be installed on concrete slabs within plant rooms that are located at the highest level of the facility. A suitable metal roof shall preferably be provided for the boiler room. If this is not feasible, and boiler plant rooms are at lower or intermediate levels, a natural gas monitoring system with alarms shall be installed in that plant room.

Equipment Identification

10.86. All items of equipment must be suitably identified with Traffolyte labels of an approved size and type. Identification markings should comply with *AS 1345 Identification of the contents of pipes, conduits and ducts*. All thermometers, pressure gauge tappings, remote sensing points and the like, must be similarly labelled to indicate their function.

Colour Schedule for Plant and Equipment

10.87. All plant and equipment in plantrooms, services risers and whenever exposed to view must be painted.

10.88. Where colours are not specified for particular items of plant, the Principal's Representative shall be consulted before colours are nominated.

10.89. All pipework, valves and fittings must be colour banded. Pipework identification must be achieved throughout using Safetyman pipe markers and labels to indicate content and flow.

Labelling and Bar Coding of Equipment

10.90. All equipment, plant, switch rooms and controls shall be identified using engraved Traffolyte labels fixed in a suitable manner using adhesive, rivets or screws.

10.91. Labels shall consist of black engraved letters/numerals on a white background identifying function, number and, where appropriate, circuit number.

10.92. All electrical equipment, motors and the like shall be fitted with rating plates fixed to ensure easy identification.

10.93. All pipes and conduits shall be labelled with adhesive labels showing type of service, direction of flows, etc.

10.94. Name plates shall be provided to all mechanical services plant and equipment in plant rooms/enclosures/elsewhere. Labels shall be engraved Traffolyte fixed in an approved manner. Temperature, relative humidity and pressure sensors/controllers, CO₂ sensors, gauges, temperature and remote sensing points, etc; and control valves shall be similarly labelled to indicate their function. A valve schedule shall be provided in each plant room indicating valve number and function. Labelling of control valves, balancing valves, etc. shall be by means of stamped brass tags identifying valve function, size and number tied to each valve by wire or chain.

10.95. Labels in the form of name plates shall be provided to all equipment, plant and apparatus in plant rooms and in the field labels shall be engraved Traffolyte fixed in an approved manner. Sensors for temperature and relative humidity, pressure, CO₂, thermometers, pressure gauge tappings, remote sensing points and valves shall be similarly labelled to indicate their function. A valve schedule shall be provided in each plant room indicating valve number and function.

11 – Lifts, Cranes and Vertical Transport Placeholder

12 – Security, CCTV and Access Control

Version	Date	Authors	Summary of Changes
1.01	4 April 2012	Alex Chryss	
1.02	15 January 2013	Ben Crossling	Changed references to Project Lead
2.0	26 October 2015	Ross McLoughlin	General Revision

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Security Systems General

12.01 The Campus and Buildings Requirements Manual (the CBRM, the Requirements or the Manual) documents the minimum design and construction requirements for new, refurbishment or repurposed building works, landscapes and engineering/infrastructure projects on buildings, facilities and campuses of the Australian National University (the ANU or the University). The Requirements are prepared for the direction of a Consultant, Designer or Project Manager in the preparation of project specific documentation and in the delivery of project works.

12.02 Notwithstanding any Consultant's particular discipline or area of responsibility, each Consultant and/or designer shall consider the document in its entirety. The complete CBRM consists of the following Sections which may be referred to within this Section:

Campus and Building Requirements Manual	
Section 01	General Requirements
Section 02	Architectural Requirements
Section 03	Roads, Car Parking & Civil Works
Section 04	Soft Landscaping
Section 05	Roofing, Roof Fabric & Roof Safety
Section 06	Building Management Systems
Section 07	Electrical Services
Section 08	Fire Protection Systems
Section 09	Hydraulic Systems
Section 10	Mechanical Services
Section 11	Lifts, Cranes & Vertical Transportation Systems
Section 12	Security, CCTV & Access Control

Principles of Security Levels

12.03 The appropriate level of security shall be established during the design phase of the project.

12.04 The degree of damage, which could be caused to the ANU through personal injury; loss of or damage to property (including intellectual property); or interruption of a critical service determines the basis for the level of security for buildings, or areas within buildings.

12.05 The ANU has a [policy](#) on site security that is predicated upon electronic access control for all perimeter doors on campus. Through a process of risk assessments during design and throughout the life of the building additional security requirements may be identified to attain the appropriate level of security risk management.

12.06 All perimeter doors shall be electronically secured and monitored to ANU specifications (available separately) with backup manual locking to protect against long term power outages. Internal doors maybe locked electronically or using a keying system appropriate for the area. Electronic security devices shall be used internally when risk assessments indicate a higher level of security is required. The type and location of any electronic security device shall be subject to discussion with the Principal's Representative (the Principal or the Principal's Project Manager) during the early design stage.

Application to Building Design

12.07 Design principles having security implications include the following:

- electronic access control systems;
- passenger lift control functions;
- design of the building façade;
- design of accessible low level windows;
- design of internal areas to ensure that high security functions are grouped together;
- external lighting; and
- profile of usage e.g. afterhours access, types of research and teaching, security risks for visitors, students or staff members emanating from the activities within the building.

Crime Prevention through Environmental Design (CPTED) Principles

12.08 CPTED is to be incorporated into the design of new buildings (and major refurbishments) in accordance with the policy: http://policies.anu.edu.au/policies/security_buildings_and_site/policy

12.09 Where major building renovations or changes to building usage are intended, a security design consistent with the ANU's principles shall be provided.

12.010 Where applicable, refer to the Principal's Representative for a security risk assessment and [Section.07 Electrical Services](#) for guidance on luminaires and [Section.08 Fire Protection Systems](#).

Peripheral Security

12.011 External lighting shall be provided to all buildings to ensure that:

- the main external entrance is well lit; and
- all perimeter doors and other ground floor points of access are properly illuminated.

12.012 Security lighting from the building shall extend to adjacent car parks and associated illuminated pedestrian path.

12.013 The building façade shall be designed to minimise recesses, alcoves, columns and the like that may be a security hazard.

12.014 Plant room access shall be isolated from the main building security perimeter to ensure that service personnel need not enter secured areas to access the plant room.

12.015 Main entry doors shall be the principle access for all people entering or leaving the building.

12.016 Standard doors located on the building's façade shall be fitted with magnetic locking devices wherever possible. Where reed switches are used, they should detect door open/closed status. Where double doors are installed, the inactive leaf shall be secured with a lockable panic bolt, keyed to the building's master key system. A suitable door-closing mechanism shall be installed on each active door leaf.

12.017 Electromechanical doors shall be fitted with the appropriate actuator linked to the electronic access control system.

12.018 Door actuators shall have the following features:

- Automatic door controllers are required to be serviced by the ANU service provider and are required to have universal service access.
- battery back-up for a minimum of 8 hours in the event of mains power failure. In the event of a power failure, the battery back-up system should keep the doors locked and secure unless there is a fire alarm;
- the ability to physically monitor doors when open and closed;
- contain a separate electric lock for positive locking;
- the ability to monitor the status of the electric lock;
- Automatic safety reversing of doors;
- self-checking safety Photoelectric Beams (P.E. Beams); and
- afterhours access via an electronic control system and manual override.

12.019 Emergency exit doors shall have the following features:

- no external door furniture;
- all door furniture shall allow for single handed operation;
- doors shall be hung to open out with triple hinges of a secure design and construction;
- door closing mechanism to ANU specification; and
- doors shall be of solid core construction (fire rated as necessary).

12.020 External doors shall be secured by an electronic lock linked to the fire alarm and/or the ANU central monitoring station.

12.021 Where keyed locks are accepted by the ANU, reed switches shall be installed to monitor door open/closed status.

12.022 Electronic access systems shall meet the ANU specifications and integrate into existing monitoring arrangements, be fully monitored and programmable to lock/open doors as required by a user defined schedule. Magnetic card swipe readers shall allow access/egress outside normal business hours. All fire exit doors (access controlled) shall have connections between the fire and Cardax system as appropriate to ensure compliance with fire trip requirements.

Internal Security

12.023 The level of security required by the ANU and the building user through a risk assessment process shall determine the level of security systems used within buildings.

12.024 Generally, areas shall be zoned according to their security requirements with high security areas grouped together. The principles outlined in test required shall be utilised when establishing the security requirements for access to each zone within a building.

12.025 Internal exit doors shall be keyed to the building's master key and lock system.

12.026 Additional security devices may be required within specific areas and may include the following:

- electric door strikes;
- key override switches;
- emergency release latches;
- request-to-exit push buttons;
- duress alarm buttons;
- break glass units;
- passive infra-red detectors;
- communications systems; and
- Closed circuit television (CCTV).

Closed Circuit Television Systems General

12.028 The ANU will review and ensure compatibility of any proposed and designed CCTV system based upon the IP CCTV System detailed below. The system shall be a Geutebruck (or equal equivalent capable of system continuity and consistency) fully IP CCTV System, installed by a certified Geutebruck installer.

12.029 Provide an IP based CCTV surveillance system to permit overall visual surveillance by ANU Security of public and secure areas. The system will comprise of network switches, backbone cabling, IP CCTV Cameras, server and monitor and all required brackets and housings in order to ensure system is operational. All cameras shall be powered using power over Ethernet (PoE) in network switches.

12.030 Design all interface equipment and any necessary lightning protection and other items to make the system completely operational.

12.031 Provide a complete and separate Local Area Network (LAN) backbone to facilitate the transferring and communication of all video and data between equipment. Liaise with the Principal's Representative on system design and setup including the installation of relevant client software. All elements within the CCTV system are to support IPv6.

12.032 All CCTV control, monitoring and recording equipment shall be housed within the Equipment Racks in the ANU building IT Server Room (or ANU Security Control Room rack, as appropriate). Equipment racks are to be included in system design.

12.033 All necessary system design, programming (i.e. videotext, point descriptors, display maps, alarm message text) is to be included.

Cameras

12.034 Camera images are to provide clean, roll-free switching and image stability. All cameras shall be fully compatible and integrated with the Geutebruck software, in appropriate domes or external grade housings as locations dictate. Cameras shall be provided with Activity Detection and Video Motion Detection inside the camera.

Lenses

12.035 All lenses used are to be constructed of colour corrected glass optics and have steel body construction. To accommodate any changes in lighting, all lenses are to be identical in make and model and be Direct Coupled (DC) Auto Iris types. Lenses are to be of reputable manufacture that has been operating in the optics industry for over the past ten years. Acceptable types include Pentax, Computar, Fujinon, Navitar and Panasonic. Final selection of focal length will be made on site by the Consultant system designer.

Camera Housings

12.036 All Camera housings are to conform to the following:

- minimum internal dimensions to accommodate the camera and lens;
- fit with tamper locks to prevent unauthorised access;
- fit with tamper switch to be monitored by security system;

- completely sealed to protect against environmental damage and condensation;
- any dome housing utilising tint is not to reduce light input by more than 1 F stop;
- all external housings are to be mounted at a minimum of 3.0 m off ground level. Any housing below this height must be a high security type; and
- all internal cameras are to be mounted at a minimum of 2.2 m off ground level.

12.037 Camera mounting is to conform to the following:

- all cabling to the camera is to be concealed within the mounting bracket;
- utilise any accessories e.g. ceiling/wall/pole mount brackets, as required by the situation;
- all cameras mounted on brackets are to provide manual adjustment of position of +30° to -90° tilt and 360° pan;
- be firmly locked into the desired position and be rigidly supported to prevent any vibrations and movement; and
- the housings tendered are to be demonstrated to the Consultant system designer prior to install for evaluation.

Internal Dome Housing

12.038 All cameras to be mounted internally are to be placed in a housing conforming to the following as a minimum:

Internal Dome Housing	
Style	Flush/recess mount dome housing
Construction	1.2 mm extruded aluminium, mild steel camera bracket
Lens	3 mm optically clear acrylic dome with no distortion in any section
Black inner liner	Tinted dome option
Finish	Polyester powder coated, colour to suit environment
Rating	IP55, IK06
Mounting	Upper section flange mounted to fixed ceiling or tiles
Camera Access	3 x spring clips to remove lower dome hemisphere
Cable Entry	1 x 20 mm poly(vinyl chloride) (PVC) gland on top rear
Internal Dimensions (WxHxD)	To accommodate proposed camera and lens combination

External Dome Housing

12.039 All fixed cameras to be mounted externally on a penetrable ceiling or eave and are to be placed in a weather proofed housing and fitted with heaters as appropriate for Canberra climate as detailed. Housing to further conform to the following:

External Dome Housing	
Style	Flush/recess mounted dome housing
Construction	1.6 mm extruded aluminium, mild steel camera bracket
Lens	3 mm MR10 GE Lexan (Polycarbonate) optically clear polycarbonate dome with no distortion in any section. Black inner liner Tinted dome option
Finish	Polyester powder coated, colour to suit environment
Rating	IP66, IK10
Mounting	Flush – upper section flange mounted to fixed ceiling Surface – housing to be secured to surface
Camera Access	4 x M6 Stainless steel security screw to remove lower dome hemisphere
Cable Entry	1 x 20 mm PVC gland on top rear
Thermostatic Heater	Controlled Factory Option. 7 W nominal (Canberra – minus 5°C operability)
Thermostatic Controlled Fan	Factory Option. 7 W nominal
Internal Dimensions (WxHxD)	To accommodate proposed camera and lens combination

External Tubular Housing

12.040 All cameras to be mounted externally on a wall or a non-penetrable ceiling and are to be placed in a housing conforming to the following:

External Tubular Housing	
Style	Tubular housing mounted on adjustable manual pan/tilt bracket. Mounted on suitable wall bracket
Construction	1.6 mm extruded aluminium
Lens	6 mm MR10 GE Lexan (Polycarbonate)
Finish	Polyester powder coated, colour to suit environment

Rating	IP66, IK10
Mounting	Upper section flange mounted to fixed ceiling or tiles
Camera Access	4 x M6 Stainless steel security screws, flip top construction
Cable Entry	2 x 20 mm PVC cable compression glands
Sunshield	Adjustable along length of body
Thermostatic Heater	Controlled Factory Option. 7 W nominal
Thermostatic Controlled Fan	Factory Option. 7 W nominal
Internal Dimensions (WxHxD)	To accommodate proposed camera and lens combination
Weight	Approximately 4 kg

Power Supplies

Power over Ethernet

12.041 Where possible, all cameras are to be powered from the same point (circuit) in order to maintain synchronization and avoid ground loops. All cameras are to utilise the IEEE802.3af PoE standard for the supply of power. Further, support for IEEE802.3at is preferable.

12.042 PoE is to be supplied from associated network hardware such as switches.

Server and Network Video Recorder

12.043 The complete CCTV system comprises a complete CCTV management server and software package that will allow the operator full control of the various components within. The entire system is to be controlled via a Graphic User Interface (GUI) front end. The system will encompass a server and client machines for each operator as needed. The system will be a Geutebruck GeViScope-IP/SE and be provided with the following:

- the GUI will provide a dynamic interface allowing real-time updating of indicators such as all text, position of cameras and alarm statuses via multi coloured icons;
- the GUI must allow for the display of multiple cameras from multiple sources on the one screen. Cameras are to be listed in a tree format to the side of the viewing area. Multiple screen layouts are to be provided. Populated layouts are to be able to be saved retaining server and camera number and position for each spot;
- the GUI must be provided with MultiMap with as many individually designable maps for intuitive operation of the entire system as desired;
- display live camera images by the clicking of an icon on the map screen;
- incorporate programmable 'macros'. Each macro is to have a minimum of five steps;
- the GUI will use password protection to allow login and logout. The user management system will allow for multiple permission levels so as to restrict functionality from certain users. An event log will allow all actions on the server to be recorded. This

- must be retained for a minimum 31 days on a separate physical backup location identified by the ANU;
- it shall be possible to display the video images in any combination on the overview monitor (e.g. 25, 16, 8, 4 way split, one quad and graphic display per screen, multi-images per screen, or any other combination). The content and orientation of the information shown on these screens shall be flexible allowing for live video, data, maps and other forms of visual cues to be displayed in a variety of formats. As a minimum, up to 16 separate live (real time) images at 4CIF each, shall be displayed per overview monitor;
- all recorders, switchers, control systems and other primary equipment shall be time synchronised to maintain time continuity across all components;
- all equipment (where practical) shall be assembled off site and fully tested prior to installation and operation;
- provide full 32bit SDK for high level integration;
- video motion detection shall be provided on the camera rather than on the server. When in dormant state, a camera's image shall be recorded at five frames per second at 4CIF. When movement is detected, the camera's full frame rate at 4CIF shall be recorded;
- the system shall be provided with a minimum 4 TB activated database size. Footage shall be stored on the server until either dumped to the ANU campus wide archive storage. Recorded footage can be overwritten with new footage once the local storage is full;
- the system shall be integrated into the ANU campus wide archive storage and configured to dump it's footage on a 24 hour cycle; and
- the system shall be provided with a suitable monitor, keyboard and mouse.

Monitors

12.044 Provide a 19" (48 cm) TFT display with 1 x DVI-D and 1 x VGA input for use in combination with Geutebruck video surveillance systems. The operator monitor is to comply with the following minimum:

Monitors	
Size	19" active matrix TFT LCD
Display Colours	Over 16 Million colours.
Resolution	1280 x 1024 @ 60 Hz.
Pitch	0.26 mm dot pitch or better.
Brightness	300 cd/m white luminance- typical
Contrast Ratio	800:1 contrast ratio- typical
Response Time	5 ms or less

Viewing Angle	176/170 viewing angle (H/V) minimum
Video Input	VGA - 15pin D-sub. and DVI-D
Case	Black Plastic
Stand	Detachable, Adjustable
Power Consumption	37 W (<2 W in power save mode)

Networking Equipment

12.045 It is the Consultant's responsibility to ensure that the network infrastructure is designed and installed correctly to allow for the IP traffic expected by their solution. The network is to be designed to allow for the simultaneous recording and viewing of all documented cameras (at 25 frames per second at 4CIF) from the main server.

12.046 A separate LAN is to be created for the interconnection of all IP based CCTV system components. As a guide, the private architecture will entail:

- all cameras and encoders are to be connected via TCP/IP to an edge network switch with POE (IEEE 802.3af supply to each port);
- all edge switches will be connected to the core switch(s) by optical fibre cabling;
- the management PC, Network attached storage, client machines, printers and all other peripherals are to be directly connected to the switch(s) via a Gigabit connection;
- the system shall be capable of performing at full capacity across multiple nodes and switches within the network;
- a single port is to be connected to the ANU's WAN for integration into the Campus Security Network. To be either Cisco or HP; Conform to C-Tick, CE Mark, FCC Part 15 Class A;
- provide LEDs for speed, link, PoE and activity on each port. Support switch latency of < 20µs for 64byte frame;
- be rack mountable;
- edge switches to be Layer 2 management and located in the Communications Room closest to the camera location. Each Communications Room shall be provided with provided with four spare switch ports for future cameras;
- core switch to be Layer 3 management and located in the ground floor main Communications Room; and
- be provided with a minimum five year warranty.

Access Control General

12.047 The ANU access control system is based upon the Cardax (Gallagher) access control system. The proximity readers utilise Mifare Plus (128 bit AES encryption).

12.048 The ANU requires compliance with *AS 14443 Identification cards – Contactless integrated circuit(s) cards – Proximity Cards* on this component with important additional requirements.

12.049 The access control system will also need to comply with any specific project requirements issued by the ANU in addition to the CBRM, relevant Australian Standards and codes as applicable. Consultants are required to refer to [Section.07 Electrical Systems](#) of the CBRM and the ANU Information Technology Services (ITS) [Cabling Specification](#).

12.050 Consultants are also advised to ascertain from the Principal's Representative the level of interfacing between the Cardax system and other security and building systems at the time of project design. Consultants are also to apply the principles of the ANU [Security: Buildings and Site policy](#).

Requirement

12.051 Access card specifications will need to comply with AS 14443 for proximity cards used with the Cardax or equal equivalent system.

12.052 The ANU has specified a minimum requirement of 128 bit AES encryption for the proximity card system chosen Cardax Mifare Plus (X configuration).

Replacement of Existing Hardware Where Required

12.053 Clear descriptions of how the work would be accomplished within buildings with areas of possible concern clearly explained in a series of compliance statements.

Functional Overview - Electronic Access Control System - Campus Wide System

12.054 The system shall provide a means to control access through nominated doors having electric locking door status monitoring and access control readers. Access rights associated with a presented access card shall be checked for validity based on card, access area, access time and any other access management function defined in this specification; as stored in intelligent field controllers. Access shall be granted or denied, dependent on the access privilege. Access rights shall be programmed in a variety of ways to allow flexibility.

12.055 The system shall provide access control in elevators as identified in schedules enabling the access of each cardholder to have access to any combination of floors over specified time periods. The interface to the elevator manufacturer's equipment shall be by either low level interface (relay outputs) or preferably by a high level (data) interface.

12.056 The system shall monitor the condition of inputs. The system shall be able to be programmed to apply a variety of conditions to the way in which these inputs are monitored and shall enunciate the condition of such inputs in accordance with such programming.

12.057 The system shall provide a fully functional intruder alarm system including entry and exit delays where intruder detection sensors are connected to system inputs. The intruder alarm systems component shall be fully integrated with the access control aspects of the system. It shall be possible to set (secure) or unset (unsecure) areas from any access control reader associated with an area, or via Remote Arming Terminals (RAT's) or as required from defined central control locations.

12.058 Intercom functionality shall be integrated with a card reader, enabling a card reader user to talk to an operator as and when required, and an operator to talk directly to the card reader user. All intercom communications shall utilise the common Integrated Security system network and communications cabling infrastructure; and be fully integrated with the access control system.

12.059 The system shall provide an integrated software facility for the design and production of photo ID cards.

12.060 The system shall be 'OPC Alarms and Events' enabled using Microsoft COM and DCOM enabling integration of event data with other third party OPC enabled automation and business systems.

12.061 The system shall allow data exchange with other applications using XML protocols for schedule changes, and card record changes. The system shall be capable of carrying out the data exchange on a batch or real time processing basis.

12.062 The system server shall be Microsoft Windows (enterprise edition) compatible. If an alternative operating system is designed, full details must be supplied on how the alternative meets the ANU criteria.

12.063 All system communications must be totally integrated with either existing or new firewalled LAN/WAN networks using the ANU IP numbering scheme.

12.064 Connection to Intelligent Field Controllers (IFCs) shall be achieved using Ethernet cabling supporting 10baseT and TCP/IP protocols. The network connection must be on-board the IFC. Interface transceiver units (10BaseT to RS485, RS232 and the like) are not acceptable.

12.065 Remote IFCs not permanently connected to the network can be connected via a PSTN service, using TCP/IP protocols.

12.066 Connection from the remote IFC to the server shall be either via dialup to an Internet Service Provider (ISP) using encrypted TCP/IP; and then via an approved firewall through into the IT environment or via dialup directly to a remote arming station (RAS) connection to the Server

12.067 All system software upgrades shall be downloadable through the network to the IFC.

12.068 All data communication internal to the system on the TCP/IP network between IFC's and between IFC's and the Server shall be encrypted using symmetrical session keys and an industry-standard encryption algorithm to a minimum of 40 Bits (Secure Socket Layer). Session keys shall be changed on a regular basis at intervals no longer than 24 hours.

12.069 The system shall report all events to the operator(s) as configured and shall produce and maintain a log of all system events, alarms and operator actions.

12.070 The system shall provide a means for an operator to extract information relative to the event log and system configuration and produce this information in the form of printed reports, screen displays or ASCII files.

12.071 The system shall provide for a Windows based User Interface with Site Plans and interactive icons representing the location and real-time status of access control, and alarm monitoring equipment.

12.072 The system must provide emergency evacuation reporting.

12.073 All equipment shall have the following approvals:

- FCC Part 15;
- CE approval BS EN 50130; and
- CE approval BS EN 55022.

12.074 Encoders and readers shall also meet:

- CE ETS 300 683 Short Range Devices; and/or
- C-Tick RFS29.

12.075 The system software shall be written in a fully structured, fully validated and commercially available language that provides a strictly controlled development environment.

12.076 Comprehensive backup and archiving facilities shall be incorporated as an integral part of the system software.

12.077 The system shall include system division suitable for multi-tenanted buildings. Operators shall only be able to access those parts of the system which fall within their division and operator privileges.

12.078 IFCs must support peer to peer communications for input and output communications between IFC's. Systems that require the main server for communications between panels are unacceptable.

Readers

12.079 All readers installed on campus in new installations are required to be Cardax (or equal equivalent) Mifare Plus (X configuration) proximity readers, charcoal grey in colour or to match existing installation.

Lock Types

12.080 The locking devices controlled by these systems shall be either the Magna lock type or the Padde ES2000 type. Some variations may be encountered, such as automatic doors, all documentation is to be provided to the Principal's Representative for review prior to final specification.

12.081 Padde EML6 for single leaf doors. Incorporating bond sense, LED on lock and 1500 LBS holding force.

12.082 Padde EML10 for double leaf doors. Incorporating bond sense, LED on lock and 1500 LBS holding force.

Locking Style

12.083 All locks shall be the fail to safe type (power on to lock).

12.084 All Magna lock types shall be fitted with tamper proof screws if on the non-secure side and to include appropriate mounting equipment for inward and outward swing doors.

12.085 All Electric strikes shall be fitted with a diode across the coil to reduce "Back EMF". Strikes shall also have high strength striker cover plates securely mounted to protect the tongue and lock mechanism from being forced or manipulated.

12.086 Magna lock types (unless otherwise approved) shall always be installed on the secure side of a door.

12.087 An additional manual lock set will be provided (where none pre-exists) to ensure that the door can be secured should the access or power system fail (cylinder and key format to be specified by the ANU).

Break Glass Units

12.088 All electric locks installed must have a Green break glass unit mounted adjacent to the door at 900-1200 mm above finished floor level. Fracturing/breaking the glass or plastic must initiate a direct break in lock power to allow free egress and produce an individual alarm on the Command Centre e.g. Glass broken.

12.089 The break glass (Green) shall be key resettable dual pole units utilising clear plastic inserts.

12.090 The initiation of free egress via communication input is not permitted.

Reed Switches

- Sentrol type flush type;
- 19 or 25 mm; and
- Only be surface mount where flush mount is not suitable.

Power Supplies

12.091 Low voltage power supplies shall be self-contained and installed within the secure equipment cabinets. The power supplies shall be a switch mode with a minimum capacity of 2 A and shall have stand by batteries capable of sustaining continuous operation for at least eight hours in the event of a mains supply failure. Power supplies to incorporate mains fail and battery low indications.

12.092 All power supplies will be Austel Approved 240 V/12 V DC.

12.093 All power supplies must have their mains and battery condition monitored and shall activate an alarm on the Cardax or equal equivalent System if a problem occurs for example loss of mains (240 V) and/or low battery alarm.

12.094 All power supplies installed shall not have more than 65% current drain.

12.095 For additions to existing systems current draw shall not exceed 80% before new additional power supplies should be allowed for.

12.096 The ANU prefers the use of linear power supplies to reduce any possible interfaces to the facilities electronic equipment used in high technology buildings.

12.097 The minimum specifications as above shall be utilised when supplying linear units.

12.098 Details must be provided in the material list of the capacity and type of each power supply included to meet the tender requirement.

12.099 Power supplies shall be scaled up in output capacity so as to have the ability to recharge the connected battery/s from a fully discharged condition without tripping or failing.

Batteries

12.0100 EDAM BA006 (or equal equivalent) minimum 12 V 7 A per hour capacity (sealed unit).

12.0101 Be monitored by the power supply for low battery alarm.

12.0102 Battery capacity scaling shall be considered in lieu of multiple minimum sized units.

Equipment Cabinets

12.0103 Rittel or equal equivalent (samples may be requested).

12.0104 All equipment cabinets are to be tamper monitored to both the door and to the rear-mounting surface.

12.0105 All wiring inside the enclosure shall conform to Australian Standards and [Section.07 Electrical Systems](#).

Time Controlled Access Doors (TCR)

12.0106 All doors installed without readers will comply with [Section.02 Architectural Requirements](#).

12.0107 Each TCR will have the reader cable installed and located above the door for future reader connection.

12.0108 Hardware allocation should allow for the future connection of the reader to the system.

Request to Exit Button

12.0109 Any exit buttons specified will meet the *AS 1428 Design for Access and Mobility* suite of standards for location and operation.

12.0110 The request to exist button shall be an approved button assembly equal equivalent to the EX16 specification.

Security Alarms

12.0111 Within the ANU Campus there were two options for installing alarms systems, the first is to utilise the Gallagher access control system and the second is the stand alone alarm system. The ANU will, where possible replace existing stand-alone security/intruder detection panels

with an integrated access control and intruder alarm system. For all new systems an integrated access control and intruder alarm system is to be designed.

12.0112 For alarm system indication there are a minimum of two approved means:

- a) RAT indication or equivalent
- b) Red indicator located above the reader

Cardax System or Equivalent Intruder System

12.0113 Connection to a relay interface output board with security devices such as detectors or reed switches. These devices will be set up with an alarm zone that can be controlled by a reader and/or a RAT and/or a Schedule (timeframe).

12.0114 The ANU will assess the capability of the intruder component system in relation to alarm management and the functionality for remote arming and disarming

Security Panel Option

12.0115 The ANU reserves the right for site installations with specific needs to retain the separate panel installation in such sites on campus the equipment shall:

- be RAT, C&K Sierra Type or approved alternative;
- supply a normal contact that can interface into the Cardax or equal equivalent;
- have only one detection device per zone (unless otherwise briefed and advised by the ANU); and
- not have its installers combination code changed from factory default.

Glass Break Detectors

12.0116 Dual flex/audio detection separate microphone.

12.0117 Minimum 7.6 m detection range.

Detectors

12.0118 Dual Technology PIR and Microwave.

12.0119 Selectable pulse count and walk test facility.

Duress Buttons

12.0120 DURE001 PAB 11-117 Holds Up with Centre Push (or equal equivalent); they must lock on and be able to be reset manually through use of a key.

Conduits

12.0121 Internal

- a) Shall be rigid LD-UPVC of minimum 25 mm diameter.
- b) All fittings, draw boxes, bends and couplings are to be purpose made.
- c) Shall be joined using an approved solvent cement.
- d) Shall be secured using metal saddles spaced at 600 mm (maximum) centres and within 150 mm of all fittings.

- e) Shall be installed so that cables can be drawn in at draw boxes only. Inspection elbows shall not be classified as draw points.
- f) Shall be filled with cables to not more than 60% of its capacity.
Cable Duct
 - a) Shall be fitted with removable covers.
 - b) Shall be fitted with the manufacturer's standard bends, elbows, couplings and reducers.
 - c) Shall be manufactured from extruded PVC when exposed. When concealed cavities and ceiling spaces maybe metal.
 - d) Shall be filled with cables to not more than 60% of its capacity.
 - e) Shall not be used on external building installations

12.0122 External

- a) All conduits installed externally of a building shall be steel conduit (plated or painted depending on environment) to prevent tampering.
- b) Where possible, all visible conduit and duct routes shall be identified on contractual documentation.

12.0123 Fixings

- a) Shall comprise corrosive resistant metal thread screws or bolts into expanding type masonry anchors for fixing to concrete or masonry.
- b) Shall comprise tapered woodscrews for fixing to timber (full thread).
- c) Shall comprise metal expanding anchors for fixings to gyprock.
- d) All fixings to be corrosive resistant.

External Reader Fixing and Installation Rating

12.0124 All card reader installations on buildings and facilities (including under awnings, verandas, porticos and under crofts) shall meet or exceed an IP65 rating.

Network and 240 V Construction and Responsibility

12.0125 The ANU builds and supports its campus IT Network and electrical reticulation in buildings.

12.0126 The access control system currently operates in a virtual private network with an ANU controlled IP range. The network resides behind an ANU administered firewall. Power over Ethernet is available in some part of the network.

12.0127 Cabling and Ethernet wall plug installation is managed by Network Services within ANU ITS.

12.0128 Network cabling shall comply with the ANU ITS [Cabling Specification](#). Note that Ethernet cables shall comply with CAT6 specifications.