Communications
Infrastructure
Standards & Specifications

Copper and Optical Fibre Cabling Specification

Revisioning

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INTRODUCTION

1.1 Purpose
This standard provides the minimum installation and operational requirements for Charles Darwin University cabling systems.

This standard applies to all CDU ITMS cabling (voice, data and audio-visual cabling), in horizontal cabling, backbone cabling, and inter-building cabling. The standard is to be applied to all copper and fibre optical cabling within all Charles Darwin University campuses and buildings, regardless of their intended use.

1.2 Scope
The principles of the standard must be applied when conducting cabling projects for:

- The construction of new buildings;
- Fit outs of existing buildings;
- Upgrades to existing cabling infrastructure;
- Implementation of cabling infrastructure to interconnect new or existing buildings.

1.3 Accountability and Management
Ensure effective and consistent management of cabling throughout all Charles Darwin University campuses and buildings.

Must ensure that:

- All cabling work conducted is consistent with regulatory and legislative obligations including relevant Australian Standards;
- All relevant stakeholders are consulted prior to commencing cabling projects;
- Comprehensive audits are conducted on completion of cabling projects;
- Only cabling systems offering appropriate warranties are used;
- Warranty documentation for cabling infrastructure is kept up to date and that copies are provided to CDU ITMS.

Any conflicting information should be clarified with CDU ITMS. Any conflicting information should be governed by reference to the following documents:

- Relevant Australian Standard;
- Relevant International Standards;
- This reticulation standard;
- Internal Instructions by CDU ITMS.

1.4 Requesting and Purchasing CDU ITMS Cabling Products and Services
Ensure requests and purchases comply with Australian and Charles Darwin University standards.

Must ensure that:

- Where cabling is purchased as part of a major building project contracts between Charles Darwin University and the contractor/vendor are formed in compliance with AS4000 or AS2124;
- This standard is referenced as requirements in tender and contract documentation;
- Tenders and contracts for CDU ITMS cabling are issued separately from any other electrical or building works;
- All CDU ITMS Installers must be registered by one of the Australian Communications and Media Authority (ACMA) approved registrars;
• All CDU ITMS installers have been inducted by Facilities and Asset Services (FAS).
• All CDU ITMS installers must be selected in consultation with CDU ITMS

1.5 Implementation

The University employs a Structured Cabling system which shall consist of a flexible cabling infrastructure to support computer, telephone, video and other IP based communications systems (e.g. Energy Wise, Security Video), independent of their manufacturer. The structured cabling infrastructure has at the workstation a telecommunications outlet that is wired to a central point using star topology providing flexibility for University personnel.

While the cabling infrastructure is primarily provided for the carriage of the CDU active network service, raw transmission media may be made available in very specific circumstances for non-Ethernet based applications such as security video.

The requirements of the structured cabling system described in this document, apply to all new cabling installations on all campuses of the Charles Darwin University. Where practicable these guidelines also apply to the refurbishment of existing installations or any Moves, Adds or Changes (MAC’s) to existing installations. All exceptions must be provided in writing and approved by CDU ITMS infrastructure representative.

Any and all approvals requested within this document are to be supplied in writing to a CDU ITMS infrastructure representative prior to any installation work commencing, any quotations for telecommunications MAC’s being provided, any design work requiring telecommunications services being finalised, and any specification and associated documentation involving telecommunications services submission of tender.

*The Structured Cabling Solution shall use shielded Category 6A components and Single Mode Optical Fibre (OS1) backbone and shall be capable of providing Class E_A operation using full duplex transmission.*

The solution should define the method(s) of flexible patching for the telecommunications services to enable simple MAC’s without frequent rewiring of locations.

All new installation work must comply with the standards and specifications outlined in this document, unless prior written approval from the CDU ITMS infrastructure representative.

All communications cabling works done on CDU sites shall be managed by the CDU ITMS infrastructure representative.

Any works which do not adhere to the guidelines contained in this document will be deemed noncompliant, and will be rectified by the contractor responsible for the works at the contractor’s expense.

This document will change to reflect current industry standards and CDU ITMS requirements, and as such will be subject to version changes as required.

It is the responsibility of the contractor to ensure that they have the latest version of the CDU ITMS cabling specification*.

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2 STANDARDS

2.1 Conformity to Relevant Standards

All Structured Cabling work shall be installed in strict compliance with the Charles Darwin University’s Communications Cabling Infrastructure specifications and to the latest standards listed below and the latest applicable TE Connectivity, Enterprise Networks warranty specification (available at www.adckrone.com.au). International standards shall be referred to where there is no applicable Australian Standard.

Charles Darwin University’s Communications Cabling Infrastructure specifications take precedence over such standards and the applicable ADC Krone specification. The relevant Australian Standards take precedence over any international standard unless otherwise specified in this document. All cabling and connection equipment and materials supplied shall be products that are approved by the manufacturer.

The latest versions of the following standards and specifications are to be complied with unless otherwise specified in this document. In all cases where there is a discrepancy or clarification is required between this document and the following standards and specifications, clarification and approval in writing by Charles Darwin University (CDU) representative shall be obtained prior to submission of tender. No variation will be allowed after tender submission.

**AS/CA S008**
Requirements for Authorised Cabling Products

**AS/CA S009**
Installation Requirements for Customer Cabling (Wiring Rules)

**AS/NZS 3000**
SAA Electrical Wiring Rules

**AS/NZS 3080**
Integrated Telecommunications Cabling for Commercial Premises

**AS/NZS 3084**
Commercial Building Standard for Telecommunications Pathways and Spaces

**AS/NZS 3085.1**
Administration of Communications Cabling Systems – Basic Requirements

**AS/NZS 4117**
Surge Protective Devices for Telecommunication Application

**AS/NZS ISO/IEC 15018**
Generic Cabling for Homes

**AS/NZS ISO/IEC 14763-3**
Implementation and operation of customer premises cabling Part 3: Testing of optical fibre cabling

**AS/NZS IEC 61935.1**
Testing of Balanced Communications Cabling In Accordance with ISO/IEC 11801 – Part 1
ISO/IEC 11801
Information Technology – Generic Cabling for Customer Premises

ISO/IEC 14763-2
Implementation and operation of customer premises cabling – Part 2: Planning and installation

2.2 Approved Manufacturer Certified Solutions & Products
TE Connectivity, Enterprise Networks Copper (e.g. Category 6a) and Optical Fibre Products and Solutions shall be used in all Charles Darwin University campuses. “Equivalent” products are not acceptable.

2.3 Cabling Standard - Structured Cabling System (SCS)
The Structured Cabling Solution shall be designed and installed to provide the telecommunications infrastructure (patch panels, frames, patch cords, cables, faceplates and outlets) necessary to build a uniform premises distribution system, which will function for a multimedia communications solution to support minimum 10000Mbps (10Gigabit Ethernet).

The solution shall be designed and installed to enable flexible point to point patching of the telecommunications services to allow for simple Moves, Adds & Changes, (MAC’s) without frequent rewiring of locations.

All of the products supplied into installations must be new and not reused products. All of the specified manufacturer’s products supplied shall be genuine.

The communications channel shall be capable of supporting the provision of power to the Data Terminal Equipment as specified in the latest IEEE 802.3at “Power over Ethernet” standard.

2.4 Installation Company Quality Assurance
The installation company shall have a quality system in place that conforms to the requirements set out in the Australian Standards - AS/NZS 9000 or the installation company shall provide details of progression towards accreditation to this standard.

The installation company shall install, terminate, test and commission the cabling infrastructure to the relevant Australian and or international Standard and the manufacturer’s standard unless approved in writing by an authorized CDU ITMS infrastructure representative.

2.5 Application Assurance and Warranty
All installations of Telecommunications infrastructure in new or existing Charles Darwin University premises require a minimum of a 15 year TE15 System Warranty, and shall be provided by the nominated manufacturer for warranty from the date of successful completion of testing and commissioning of the Structured Cabling System.

The application assurance shall cover the failure of the offered cabling system to operate the applications that the system was initially designed to support, namely those identified in the current (at the time of tendering) versions of the Cabling Performance Specifications (that is the AS/NZS 3080 or ISO/IEC 11801).
2.6 General Cabling Installation Standards and Workmanship

All cables shall be run and installed in a professional manner in accordance with AS/CA S009 Wiring Rules for safety and network integrity, AS/NZS 3080 for performance, and ISO/IEC 14763-2 for installation. The latest published TE Class E Installation Guidelines contains the appropriate and collective requirements of these standards and is therefore the mandated minimum requirements for cabling products, installation and compliance testing.

The cabling system shall be planned and designed to ensure adequate segregation from electrical and hazardous services, ensuring system integrity and performance, ensuring that it does not present problems of current and future maintenance or access, and ensuring there is no conflict with the operation and maintenance of other systems. The installer shall seal all openings, either external or internal, made or provided through building walls, floors, ceilings or other fixtures after the cable has been reticulated to ensure the integrity of the barrier that has been penetrated. This includes but is not limited to the ingress of moisture, entry of rodents and other vermin and fire where applicable. All exposed cabling shall be mechanically protected to ensure protection from external forces.

The installation company shall be responsible for providing corrosion resistant products used in the installation of the structured cabling system and must ensure that any future corrosion of these products is limited. The installer is also responsible for the restoration of any damaged paintwork on equipment or accessories and this restoration must meet the original finish. If any damage occurs during the installation it must be reported to the CDU ITMS infrastructure representative immediately.

All Communications equipment installed within Charles Darwin University campuses shall be installed in such a way that it is aesthetically pleasing and is in conformity to the equipment surrounding it. All exposed materials shall be consistent and shall not conflict with the surrounding décor.

The contractor shall take responsibility for ensuring that after the work being carried out, the buildings / grounds / work areas are returned to its original state, as not to draw attention to the work that has been done i.e. installing the same duct work already existing in the area, painting, back filling, laying turf, etc.

The Contractor shall check the surface finishes and paintwork around the area of installation and touch-up or repair/replace all damaged parts after the installation of cabling and equipment.

The Contractor shall provide literature including data on maintenance and operation of all equipment installed. Relevant catalogues of all materials, instruments, equipment, and components, to be supplied shall be provided to a CDU ITMS infrastructure representative electronically.

All installed equipment and materials shall be permanently and legibly marked to indicate clearly the name of the manufacturers registered trademark.

Any existing data cabling affected by the relocation of the communication outlets is to be reinstated. All old cabling is to be totally removed by removing all cabling from the wall outlet to the network patch panel terminations in the cabinet/communications room.
Any cabling infrastructure found by the cabling contractor to be non-conforming to CDU’s guidelines, the manufactures guidelines, or Australian Standards, while doing work on the CDU physical layer network, shall be reported to CDU ITMS infrastructure representative for further investigation. A recommendation for rectification of the non-compliance should be included as part of the report.

2.7 Installation Staff Standards and Accreditation

The successful contractor shall supply a list of names of installation staff and a copy of their accreditation certificates from the specified manufacturer. This requirement does not apply to apprentices or trainees under the full-time supervision of an authorised installer of the specified manufacturer. A minimum of 50% of the installation staff on site at any time throughout the installation must be certified by the specified cabling manufacturer.

The contractor shall provide a list of their technical support staff listing their working experience in the relevant field.

The contractor shall state the nearest location of their principal support centre. This centre shall have permanently stationed support staff capable of providing technical support effectively and efficiently when requested by aCDU ITMS infrastructure representative.

Contractors are required to undertake Charles Darwin University site inductions for each site before commencing work on that site. Contractors working on CDU sites must attend CDU Workplace Health & safety induction, including asbestos training.

Contractors must adhere to facilities safety plan procedures and forward appropriate documentation as required under this.

Contractors on CDU sites must be uniformed, with company identification, clearly showing who they are and what company they are employed by.

Building and room access is to be provided by CDU Security.
3 GUIDELINES

3.1 Types of Use

The structured cabling system shall be capable of supporting current and future services that require 500 MHz or more signalling as specified by ISO/IEC 11801 Class E. These include but are not limited to the following services:

- IEEE 802.3 (Ethernet)
- IEEE 802.11 (Wireless LAN)
- Building Security and Access
- Analogue telephone
- Digital telephone
- Facsimile
- EFTPOS
- Building Management Systems
- Security Cameras
- Modems
- Digital and Analogue video
- Composite baseband video and audio
- Broadband Video
- RGB baseband video
- 3D Imaging
- Digital and Analogue Audio

3.2 Design Guidelines

The structured cabling system is designed to support a high speed, high availability and redundant network that allows for future growth and capacity increase.

All cabling infrastructure to be installed by Vendor certified ND&I installers, to the level as set out by this document. All cabling infrastructure is to be installed and tested to vendor certification.

Each building shall be provided with:

Lead in Cabling Infrastructure

- Optical Fibre services via diverse paths and building entry points
- Lead in Optical Fibre to be terminated as soon as practical after it enters a building on vendor certified Fibre Optic Break-Out Trays (FOBOT)
- Category 3 underground CPFUIT jelly filled telecommunications voice cable from site PABX or distributor node as specified by CDU ITMS infrastructure representative
- Voice cable lead in to be terminated on rack mounted 19” 15 way Krone frame, with provision of at least double capacity increase and accommodation of surge reduction devices on the frame
- Lead in Cabling Infrastructure shall be terminated in the Building Distributor (BD)

Telecommunications Rooms (TR)

- A minimum number of consolidated TR, the number of which to be governed by 90m maximum cable run length of horizontal F/UTP cable from the patch panel frame to the wall outlet
- If one TR is able to be provided then this will be the BD, MDF and TR for that building size of room to conform to Australian Standards AS/NZS 3084
- Racks to be at least 42 RU 800mm x 900mm with 900mm space at front, back and sides of racks or rack assembly as per Australian standards
Each rack to be supplied at minimum with 2 x 15A drop-down pendants for power, unless otherwise specified.

Power must be on its own dedicated circuit, and preferably each of the two from separate circuits.

All racks are to be lockable and fitted with the standard CDU ITMS communications rack key.

Overall capacity to allow for 30% growth of outlets in the rack /rack assembly.

Environmental such as power and air-conditioning to be sufficient to supply heat and power load.

Room to be permanently locked and keyed as per the standard CDU ITMS communications room keys.

Cable Risers and Pathways

- Cable risers and pathways to be independent from all other services.
- Main cable pathways shall be cable tray or steel wire basket form.
- Shall allow for 25% spare capacity for future growth.
- Shall be fire rated where the cabling traverses floors or fire rated building infrastructure as required by Building Code of Australia.
- Cable pathways above solid or feature ceilings to be cable tray or cage, with appropriate access panels to be installed for future access.

Horizontal Cabling and Data Outlets

- Horizontal cabling to be a shielded structured cabling system, at least Category 6A, with shielded RJ45 terminations at each end.
- Horizontal cabling to be no more than 90m from frame to wall outlet termination.
- Wall outlets at workstations are to be at least double outlets.
- Ceiling mounted outlets and in-ceiling data outlets for wireless access points are to be positioned as per CDU ITMS infrastructure representative direction and standards.
- Cat 6A cabling for wireless is to have a 3m service loop to allow for extending of position. Unless otherwise specified by CDU ITMS Wireless AP’s will have their runs terminated with a ceiling mounted or in-ceiling data outlet secured to a permanent structural member.

Labelling of cabling infrastructure

- Labelling as per CDU Cabling Specifications document section 7 of this document.

Test results, Documentation and Record Books

- Shall be provided to allow for the ongoing use and maintenance of the cabling infrastructure.
- Record books for voice and data services to be provisioned and updated in all TRs.
- Test results and as-built drawings for all cabling infrastructure to be provided on completion of works and be provided to the CDU ITMS infrastructure representative in the form as set out by the Cabling Specifications document, section 10 “Documentation” and in accordance with section.

Acceptance and handover

- It is a requirement that all works adhere to the above guidelines and to specifics outlined in the cabling specification document in order for acceptance, handover, and any associated payments for works to take place.
- Acceptance of TR to include the cleaning of the communications room floor, inside the cabinets and frames and wipe down of cabinets, racks and associated infrastructure, so as to prevent the ingress of building dust in active network equipment once installed.
4 TELECOMMUNICATIONS ROOMS (TR)

4.1 General

Telecommunications Room (TR) covers space dedicated to providing telecommunication and networking services inside buildings.

The TR is used to terminate the campus cabling, building backbone cabling, horizontal cabling, as well as house network equipment in order to allow data and voice services to be provided for the work area in a structured cabling system.

The TR may contain telecommunications equipment and other communications equipment such as CATV, IPTV, CCTV, Security, Fire Alarm, Lighting Control, Public Address and Audio.

The TR may also contain small UPS equipment, and other Building Automation Service (BAS) equipment. UPS equipment greater than 100 kVA should be located outside the Equipment Room.

The layout of the equipment racks, voice frames and other equipment & services within the TR shall be approved in writing by a CDU ITMS infrastructure representative prior to installation. The design and layout of the cabling infrastructure terminated within the equipment racks shall also be approved in writing by a CDU ITMS infrastructure representative prior to installation. A TR would only hold the MDF if it was a BD.

Environment for the TR must be such that it ensures a dust free area that will allow any active equipment to operate within its optimal operating temperature.

Each TR shall be connected to the BD with a Fibre Cable/s to connect services to the University’s network. Each BD shall be connected to the University’s Campus Distribution Network. The size, Class and Quantity of the Fibre cable/s must be approved in writing by CDU ITMS infrastructure representative prior to installation or be supplied by the tenderer at the time of submission of tender.

Running fluid pipes and drains through TRs is not recommended. In cases where this is unavoidable, pipes carrying fluids through a TR must have a rigid barrier installed over it to prevent equipment damage, e.g. metal hat section, double conduit. Plans for these must have prior written approval from a CDU ITMS infrastructure representative before installation.

No high voltage electrical services to be present or traversing TR.

The telecommunication room shall be able to contain:

- Telecommunication equipment
- Horizontal and vertical cable terminations.
- Associated cross-connect cables.

A telecommunication room must be provided on each building level requiring data services.

- Additional rooms should be provided when the area to be served exceeds 2000m²
- An additional TR will also be required when the horizontal pathway distance to any work area exceeds 90m
- The telecommunication room shall be located as close as practicable to the centre of the area served.
- Horizontal pathways should terminate in the telecommunication room located on the same floor as the area being served.
- Concrete walls shall be treated to minimise dust. Finishes shall be light in colour to enhance room lighting.
• In multilevel buildings the risers shall be vertically aligned.
• Appropriate sleeves or slots to be provided between each riser in a multilevel building. The minimum requirement is 2 x 100 mm conduit.
• Where the sleeves or slots penetrate they shall be constructed to protrude at least 75mm to act as a bund. They shall not be left open except during cable installation and shall be properly fire-stopped as per Australian Standards.

4.2 Data Services

All fibre optic cables to be terminated on 24 or 48 port Fibre Optic Break-Out Trays (FOBOTs).

All Category 6A Shielded Horizontal Cable must be terminated on shielded 24 port Category 6A, 19” rack-mounted patch panels in the communications equipment racks. Each shielded patch panel shall be individually earthed to the earth point on the frame. Daisy-chain earthing of patch panels is prohibited.

TE Connectivity Patch cords shall be provided when patching of voice and or data circuits is required at the cross connections to facilitate MAC’s and maintain the vendor’s System Warranty.

Data patch cords will be TE Category 6A S/FTP. TE Connectivity Patch cord length shall be 2m for racks larger than 18RU and 1m for 18RU and smaller at the TR. TE Connectivity Patch cord length shall be 3m at the wallplate outlet end.

Enough quantities of patch cords will be supplied to allow patching of 50% of all building outlets with at least one outlet on each wallplate to be patched. This means each outlet requires at least two cables to be supplied – a patch end and a wallplate end.

4.3 Voice Service

Each TR shall be connected to the BD with a multi-pair voice cable to connect voice services to the University’s network. Each BD shall be connected to the University’s Campus Distribution Network. Voice patch cords will be TE Category 3 Modular Telephone Cords.

The size and quantity of the voice cable/s supplied to each TR shall be approved in writing by CDU ITMS infrastructure representative prior to submission of tender or be supplied by the tenderer at the time of quoting the installation.

For copper voice circuits, the tenderer shall supply TE KRONE HighBand 10 pair disconnect modules to terminate any backbone voice cables, incoming service provider cables or outgoing service provider cables to a PABX or PABX extension lines / cables.

The voice mounting system shall be TE KRONE profile or back mount frames to match the existing installation and must suit the HighBand 10 pair modules.

To ensure that University staff have the flexibility to patch voice services, all voice services must be presented at the patching field within the equipment racks on either 25 or 50 port TE Krone voice patch panels, A CDU ITMS infrastructure representative must approve the voice connections required at the patching field. The voice patch panels must have the ability to slide out at the front of the rack for easier termination or fault finding.

4.4 Room Size

The size, location and provisioning of services and facilities in the TR shall be in accordance with AS/NZS 3084. The location and number of TR rooms per building must be approved by a CDU ITMS infrastructure representative in writing. The TR must be of a size to allow the appropriate number of standard sized racks (see “racks” section of this document for size) with 900mm working area around all sides.
- Rooms should have a minimum standard ceiling height of 2.4 meters.
- Each telecommunication room shall have a minimum total door opening width of 1600 mm, a depth of no less than 2700 mm, and width of no less than 2600 mm.
4.5 Access

Access to the TR must be provided to ensure prevention of access by unauthorized personnel. Doors must be keyed to the standard CDU ITMS door key for existing installations. Shared access to TR must have prior written approval from aCDU ITMS infrastructure representative.

- For security reasons telecommunication rooms shall only be used for CDU ITMS approved services
- The floor level in the enclosure should be the same as the outer access area, so that equipment racks and equipment can be easily installed and maintained.
- Ease of access to the ceiling space above the enclosure(s) and uncluttered by other installations, including air conditioning and electrical installations
- Ceiling space to allow for access and installation, including future access and installation.
- The proposed telecommunication room must be fully accessible from common areas and internal to the Building.
- The enclosure should be fully secured by 2 full height doors and allow racks to pass through without dismantling, i.e. must have minimum clearance of 900 mm
- Doorway to TR must be in accordance with AS/NZS 3084
- TR Door should swing outwards.

4.6 Lighting

Intensity on the front and back of installed terminations should be 500lux at 1m above floor to meet AS/NZS 3084 requirements. The lights should be situated to minimise shadows on the patching and termination areas.

4.7 Air conditioning

A stand-alone air conditioning (A/C) system is to be provided in the Computer Room to ensure a suitable operating environment of 26 degrees Celsius for equipment in the room. This system is to be designed so that 24 hour, 7 day a week operation can be maintained. The A/C units are to be Refrigerated Air Cooled type design operation.

4.8 Racks

Racks shall be 42RU 800mm x 900mm, unless given prior written approval from a CDU ITMS infrastructure representative.

The internal layout of the Equipment racks and their position in the TR must be approved in writing by aCDU ITMS infrastructure representative. The equipment rack layout must be provided showing the location of the equipment racks and the equipment contained in them. Examples of standard rack layouts recommended by CDU can be found in Appendix A of this document.

The equipment racks supplied shall have 30% spare capacity after the installation of all equipment to allow for future growth unless approved in writing by CDU ITMS infrastructure representative prior to installation or specified by the contractor at the time of submission of tender.

All new installations shall use 42RU freestanding equipment racks. The minimum specifications for free standing equipment racks are:

- 19 inch mounting rails
- 800mm Wide
- 900mm Deep
- 42RU in Height
- Allow for 30% of spare capacity after the installation

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- Minimum of 1 x 5 way horizontal power rail
- Cable tray supplied down one side of the equipment rack. The width of the tray must support 200% of the installed horizontal and backbone cabling
- Vertical cable management to maintain Category 6A performance
- must be able to be secured and key lockable
- must have removable doors front and back
- must have removable panels on sides and roof
- should allow reasonable air flow front to back without compromising security (e.g. perforated doors front and rear)
- Horizontal and vertical cable management to maintain CAT 6A performance.

All free standing racks must be secured in the TR by a method approved in writing by a CDU ITMS infrastructure representative prior to installation or supplied by the contractor at the time of submission of tender. Mobile cabinets or racks are not acceptable for cabling System Warranty.

Wall mount equipment racks are not the University's preferred option for mounting infrastructure equipment. The use of wall mount cabinets within the University shall only be used with prior written approval by an aCDU ITMS infrastructure representative.

Contractors must ensure specifications for all proposed racks and communications cabinets have their manufacturer, model and the equipment which is to be supplied in them including layout and design approved in writing by a CDU ITMS infrastructure representative prior to installation or supplied by the tenderer at the time of submission of tender.

4.9 Earthing and Bonding

All equipment racks shall be effectively earthed to a Communications Earthing Terminal (CET) as per AS/CA S009 standard. At each and every TR, BD, TPF and FD location the tenderer shall supply a Communications Earthing Terminal System for connection to the building Protective Earthing System.

All shielded horizontal cables shall be earthed at one end only and this shall be the patch panel end. Shielded tie cables shall be earthed at one end only unless both ends are connected to the same CET in the room.

4.10 Power

- Each rack is to be supplied at minimum with 2 x 15A drop-down pendants for power, unless otherwise specified.
- Power must be on its own dedicated circuit, and preferably each of the two from separate circuits.

4.11 Patch Panels

New patch panels installed in Krone locations shall be a shielded 24 port patch panel (Krone 7022-1-155-24 – includes integrated cable management). Each installed patch panel should have a rear cable management bar which is attached to the back of the patch panel by screws example: Krone TPNP-NNC10-WM-BKT or Krone Mastermind Rear Cable manager p/n 6450-1-090-00.

4.12 Cable Management

Horizontal cable management in frames is to be CMA-00085 (1RU) CMA-00087 (2RU) Molex cable management.

Vertical cable management in frames is to be B&R ARPCMR3S or equivalent.
Fibre optic cable management is to be approved by a CDU ITMS infrastructure representative prior to installation.

Adequate vertical and horizontal cable management shall be provided to manage the quantity of patch cords being used within the communications rack. The style and layout of all cable management provided in the equipment racks shall be approved in writing by a CDU ITMS infrastructure representative. Examples of standard rack layouts used by Charles Darwin University can be found in Appendix A.

4.13 Cable Trays
Cable trays in TRs should be appropriate for the number of cables terminating in the communications room and allow for at least 30% growth. Where cables exit off cable tray or enter wall cavities the cables shall be protected with an approved ridge support maintaining the cable’s minimum bending radius for drops greater than 45°.

4.14 Building Distributor Telecommunications Room (BD)
The building distributor is a specialised TR and is used for terminating lead in paths for fibre and voice cabling (including the MDF). This room is normally on the ground floor, and fed externally from underground conduits which would ideally rise in this room.

The size, location and provisioning of services and facilities in the BD shall be in accordance with AS/NZS 3084.

The BD may contain telecommunications equipment and other communications equipment such as CATV, Public Address, CCTV, Security, Fire Alarm, Audio, and Building Automation Service (BAS) equipment as approved by a CDU ITMS infrastructure representative.

The BD can also be used as a TR and may also contain relevant equipment as necessary.

4.15 Data Centres
(Under Review)

4.16 Labelling
TR’s should be labelled as per the section on “Labelling and Numbering”.

4.17 Compliance Testing
TR compliance testing as per the section on “Compliance Testing”.

4.18 Documentation
TR documentation as per the section on “Documentation”.

**Please see next page for example**
TR room example:

**Please see next page for example**
Patch panel front cable management:

Patch panel rear cable management:

*All printed copies and duplicate soft copies are considered uncontrolled copies, and the original online version should be referred to as the latest.
5 CAMPUS BACKBONE CABLING SYSTEM

5.1 General

The campus backbone cabling system refers to cabling used to join Telecommunications Rooms (TRs). This encompasses connectivity between buildings as well as between TRs in the same building.

TE Enterprise Networks fibre products and solutions shall be used in all Charles Darwin University’s campuses to maintain the vendor’s TE15 System Warranty.

Backbone cabling shall be considered as any cabling that interconnects campus buildings. Backbone connections to the building distributor from the campus distributors shall be run in star topology and specifications, including path and capacity, shall be approved by a CDU ITMS infrastructure representative.

The current CDU standard for the campus backbone cabling infrastructure is to provide underground loose tube gel-filled tubes Optical Fibre services via diverse paths and building entry points. All outdoor conduits above ground shall be self-draining so that the indoor/outdoor OF cable does not lie in trapped or pooled water/liquid.

Outdoor Tight Buffered cable may be used for Indoor Riser applications.

- All backbone cabling for all data services shall be comprised of Single Mode Optic Fibre cabling
- Subject to application, cabling for Telephone services may either be multi-core copper cabling, or optical fibre cabling, as advised by a CDU ITMS infrastructure representative
- Communication pits should be established at locations no greater than 70 meters apart and at any point where there is a change in direction
- Wherever possible communications pits must be aligned so that they are easily located
- Communication pits should be located such that they remain permanently unobstructed (by landscaping, flowerbeds etc.)
- All backbone pathways shall be connected by at least 1 x 100mm dia. conduits

5.2 Underground Installations

Use Underground Loose Tube moisture blocked OF cable with gel-filled tubes for all underground applications. Moisture blocked Outdoor/Underground OF cable must pass the “Water Penetration Test” as referenced in AS/CA S008.

5.3 Outdoor Above Ground Installations

All outdoor above ground cabling must be mechanically protected. Use Outdoor Tight Buffered OF cable for all outdoors above ground applications. This cable has an UV-resistant sheath that can accept exposure to sunlight; however, this cable must be installed in weatherproof, UV-resistant conduit for protection against accidental mechanical damage.

CDU ITMS do not prefer this method. See “Pathways”.

5.4 Cabling Pathways

Standard pathways for outdoor cabling between buildings shall be via the University Pits and conduits system, unless otherwise authorized via written prior approval by a CDU ITMS infrastructure representative.
Any civil works associated with pits, conduits or pathways in general, done on CDU campus shall have approval from Facilities before the commence of works, and the grounds shall be reinstated to Facilities requirements.

All new cable installs within conduit system shall have a draw rope installed, regards of whether or not one is currently in place.

For all new conduits installed, conduit identification tape is to be installed 100mm above conduit. Copper Tracer wire or equivalent must also be installed, and may be included as part of the identification tape.

All pits shall be installed to Australian standards and shall be installed in such a way as to allow positive drainage.

All pits shall be large enough to accommodate a minimum of 2 x 100mm conduits (entering and exiting) however CDU ITMS shall have final say on the size of the pit to be installed.

All new pit installs shall have an internal pit cover installed so as to prevent rodents, insects and dirt ingress.

Every effort is to be made to ensure all pit joints are secured in such a way as to be kept off the bottom to avoid water immersion or moisture ingress, hung in an upright position.

5.5 Optical Fibre

Multi-core optical fibre cable shall consist of Category OS1 B1.3 optical fibre (also known as ITU specification G.652c or G.652d) single mode optical fibre and shall be colour coded for identification. “Multi-mode”, including OM1, OM2, OM3 and OM4 fibre is not to be used unless written authorisation is approved by a CDU ITMS infrastructure representative.

Optical fibre is specified as per current Australian and vendor standards for transmission and budget loss. Joints are to be fusion spliced. CDU does not accept puck and polish or mechanical splices.

5.6 Optical Fibre Terminations

Each TR may also house the rack mounted fibre termination trays for termination of fibre optic cables via a Fibre Optic Break Out Tray (FOBOT). The FOBOT shall provide cross-connect, interconnect or splicing capabilities.

The FOBOT shall consist of a frame mountable housing for terminating and or splicing fibre optic cables and allow for organisation of the fibre optic interconnects. The assembly shall have rear openings for cable entry, with posts to accept strain relief terminations and with fibre storage guide facilities for maintaining bend radius.

The FOBOT shall be 24 ports for one rack unit, 48 or 72 ports for up to three rack units and can be either a slide or swing tray to improve access.

The adaptor plates shall be suitable for LC duplex couplings, and the adaptor plates should be installed to angle the through adaptors to the left or to the right of the panel to improve the patch cord management and provide eye safety due to accidental exposure to active fibres.

Other couplings including SC and ST style couplings are not to be used unless prior written authorisation is given by aCDU ITMS infrastructure representative.

5.7 Voice Grade Cabling

Inter-building voice grade cabling is to be Category 3 underground CPFUIT jelly filled.
Each building is to be connected by at least 10 pair Category 3 underground CPFUIT jelly filled 0.64 gauges. For larger buildings, higher capacity cables will be installed to accommodate. The accepted types of Category 3 cabling are:

- 10 pair external grease or gel filled sac sheath 0.64 gauge
- 30 pair external grease or gel filled sac sheath 0.64 gauge
- 50 pair external grease or gel filled sac sheath 0.64 gauge

Any variation in this will not be used unless written authorisation is approved by a CDU ITMS infrastructure representative.

Voice cable lead in to be terminated on rack mounted 15 way frame, with provision of at least double capacity increase for both “A” and “B” side of frame.

The contractor shall make provision to supply TE KRONE over-voltage protection to all above ground and underground voice cables that are terminated on a Distribution frame. The provision for over-voltage protection includes installation of correct earthing at least 6 mm² to the mounting frames and racks.

5.8 **External Campus Cabling**

Charles Darwin University does not support the use of indoor cabling for external use or inter-building cabling. Indoor cabling used for outside the building situations requires the express written approval of the CDU ITMS infrastructure representative.

5.9 **Labelling**

Campus Backbone cabling should be labelled as per the section on “Labelling and Numbering”.

5.10 **Compliance Testing**

Campus Backbone compliance testing as per the section on “Compliance Testing”.

5.11 **Documentation**

Campus Backbone cabling documentation as per the section on “Documentation”.

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6 BUILDING BACKBONE CABLELING SYSTEM

6.1 General

Within a building all of the backbone cables shall be run in a star topology, terminated in the BD at one end, and in a Telecommunications Room TR at the other end.

Krone products and solutions shall be used for backbone cabling solutions in all Charles Darwin University’s campuses.

The backbone system shall include UTP category 3 copper for voice services and single mode fibre optic cable for high-speed data networking in the intra-building wiring. There may be a requirement of Category 6A F/UTP cables for links between TR’s and BD’s.

Tie cables between FD and TRs may be required for connection of additional service. Any backbone services that are not for voice communication shall be a minimum of a Category 6A F/UTP cable, if the cable runs are less than 90 m long.

The multi-core optical fibre cable shall consist of single mode fibre, colour coded for identification.

All Optical fibre types, class, size and quantity used in all University building backbone cabling installations shall be approved in writing by CDU ITMS infrastructure representative prior to installation or be supplied by the contractor at the time of submission of tender.

Specification of optical fibre as per current Australian and vendor standards for transmission and budget loss.

All through connectors on FOBOTS shall use LC duplex with LC connectors. Multi-mode fibre, including OM1, OM2, OM3 and OM4 are not to be used unless written authorisation is approved by a CDU ITMS infrastructure representative.

Seek the guidance and approval from a C CDU ITMS infrastructure representative for the layout of the backbone infrastructure required. The quantity, class and size of voice and fibre backbone cables shall be approved in writing by CDU ITMS infrastructure representative prior to submission of tender or be supplied by the tenderer at the time of quoting the installation. Full details of the type of cables to be used including the type of termination, identification method, method of installation and limitations (if any) shall be provided in writing to a CDU ITMS infrastructure representative.

Fibre Optic cable shall be Tight Buffered cable for all internal Horizontal and Riser applications, except in wet internal locations. Outdoor Tight Buffered cable may be used for Indoor Riser applications.

6.2 Voice Grade Cabling

As per vendor specifications and standard category 3 voice cable, terminated at each end on Krone certified termination equipment.

Voice cable is to be terminated on rack mounted 15 way frame, with provision of at least double capacity increase for both “A” and “B” side of frame.

The cross connection system for voice backbone cables coming from the BD shall be an industry standard test point frame using 10 pair disconnect modules and profile mounting frames.

6.3 Cabling Pathways

Building backbone cabling system and associated pathways must have adequate segregation from electrical and hazardous services, ensuring system integrity and
performance, ensuring that it does not present problems of maintenance or access, and ensuring there is no conflict with the operation and maintenance of other systems.

All indoor conduits shall be installed in such a way that the indoor/outdoor OF cable does not lie in trapped or pooled water/fluid.

All newly installed Metallic pathways shall be earthed to the building and or the electrical protective earth system where applicable.

6.4 Labelling

Building Backbone cabling should be labelled as per the section on “Labelling and Numbering”.

6.5 Compliance Testing

Building Backbone compliance testing as per the section on “Compliance Testing”.

6.6 Documentation

Building Backbone cabling documentation as per the section on “Documentation”.

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7  HORIZONTAL CABLING

7.1  General

Krone products and solutions shall be used for horizontal cabling solutions in all Charles Darwin University’s campuses.

The horizontal cable installed shall be a minimum of a Category 6A F/UTP horizontal 4 pair solid-conductor cable, grey in colour, used to connect each telecommunication outlet (TO) to the TR.

The 4-pair F/UTP cable must exceed AS/NZS 3080 Category 6A requirements. It must be tested to Class EA to ensure performance for any application up to and including 10,000 Mbps (10GBE) from the TR to the telecommunications outlet (TO) at the work area.

The 4-pair F/UTP cable shall be run using a star topology from the TR to every individual telecommunication outlet. For information on the approved materials that can be used for the cable pathways please refer to AS3084.

All cables shall be run and installed in a professional manner in accordance with AS/CA S009 Wiring Rules for safety and network integrity, and AS/NZS 3080 for performance and to comply with sites designated manufactures warranty.

All parts shall comply with Australian standards, communications manual module 1 Australian regulatory arrangements, and also meet vendor’s product certification.

Each cable from the cross-connect at the TR to the telecommunication outlet (TO) shall be continuous without any joints or splices. Use of consolidation points (CP) or (MUTO) are not to be used.

The length of each fixed horizontal cable from the TR to the telecommunication outlet (TO) shall not exceed 86 metres based on a 30°C ambient cabling pathway temperature.

The cabling system shall be planned and designed to ensure adequate segregation from electrical and hazardous services, ensuring system integrity and performance, ensuring that it does not present problems of current and future maintenance or access, and ensuring there is no conflict with the operation and maintenance of other systems.

Full details of the type of cables to be used including the type of termination, identification method, method of installation and limitations (if any) shall be provided in writing to a CDU ITMS infrastructure representative.

Termination of cables in the TR shall be on racks or assemblies to suit the selected modules and or patch panels.

To comply with the identification requirements of AS/CA S009, cable shall not be painted. Occasional overspray from Acrylic water-based painting can be acceptable provided the overspray coverage does not exceed 1m length on the cables.

Copper installs and infrastructure shall meet the sites designated Manufacturer’s warranty.

Cat 6A F/UTP cabling for wireless is to have a 3m service loop to allow for extending of position, unless otherwise specified by CDU.

Cables that penetrate fire barriers, inter-floor, building entries shall have the penetrations suitably fire-stopped by qualified operators as required by local building code regulations/laws and Charles Darwin University Facilities Management requirement.

7.2  Cabling Pathways
All cable pathway designs for refurbishments and new buildings shall be approved by a CDU ITMS infrastructure representative before installation.

All cable pathway designs for refurbishments and new buildings shall incorporate ease of access for the laying of future cables.

Cable pathways for horizontal cabling shall be cable cage or tray for main cable routes.

All metal pathways shall be bonded to the building earth system thereby providing a bonding conductor facility to minimise the effects of noise coupling.

All new cable infrastructure solutions shall be submitted to CDU prior to installation to verify appropriate type is being used for.

Cable pathways above fixed, feature or hard ceilings shall be cable tray or cage, with access hatches in ceiling every 3 meters and at each change of direction for future maintenance and access to the cable path.

Adding cables to existing catenaries should not exceed the maximum number of cables recommended by the vendor.

If by adding cables to existing catenaries the total number of cables in that catenary exceeds 80% of the maximum number of cables recommended by the vendor, a cable tray or cage should then be considered.

The installer shall seal all openings, either external or internal, made or provided through building walls, floors, ceilings or other fixtures after the cable has been reticulated to ensure the integrity of the barrier that has been penetrated. This includes but is not limited to the ingress of moisture, entry of rodents and other vermin and fire where applicable.

Where cables exit off cable tray or enter wall cavities it shall be protected with a ridge barrier and the bend radius to be within vendor’s specification.

**7.3 Cable terminations - Cross-Connect System**

The cross-connection system for all horizontal cabling within the University’s TR’s shall be a standard modular patch panel design, except for essential services.

For all horizontal cables connecting to telecommunications outlets, the modular outlet patch panel shall be a 24 port Category 6A.

For all horizontal voice cables connecting from the FD or TPF to the patching rack within the TR, excepting essential services, the modular outlet patch panel shall be either a 25 port or 50 port patch panel.

Rear cable management approved by a certified manufacturer shall be supplied on all patch panels. This rear cable management will be affixed to the back of the patch panel using the manufacturer’s certified solution. “Zip-ties” and other ad-hoc items are not to be used.

The cross connection system for essential services from the TPF to the patching environment should be via a Krone disconnect direct punch-down module.

**7.4 Work Area**

Contractors shall supply and install the wiring or interconnections that connect active terminal devices to the telecommunication outlets. This includes patch cords, telecommunications outlets (TO), connectors, faceplates, as well as the work area patch cords (terminal fly leads) needed to make connections.

For outdoor use, all equipment must be rated to the appropriate weatherproof rating.
7.4.1 Telecommunication Outlets (TO)
All copper telecommunication outlets and modules supplied by the contractor shall be modular 8-position / 8-contact outlets, accepting standard modular RJ45 plugs, and meet vendor specification to enable vendor certification. Outlets shall not be earthed at the work area end.

7.4.2 Faceplates
The faceplates offered shall have the following for Cat 6A:

- A minimum of 2 outlets.
- Options for vertical style or horizontal mounting style.
- 2 or 4 port angled faceplates on perimeter trunking or surface skirting ducts.
- A clear fixed label for application of circuit identification.
- Newly installed faceplates are to be Clipsal 2000 ID series flush mount electric white.
- Must match the existing faceplates for Moves, Adds and Changes.
- Newly installed faceplates for staff or student workspaces are to be mounted above desk height. This includes, but is not limited to: Printers, PC’s and Desk Phones.
- Connections for specialist equipment and specialist purposes may be mounted in other orientations/locations e.g.: building management systems, security cameras, and floor boxes in meeting rooms.
- Where network outlets are fixed to furniture or partitions, all aspects of this document still apply, specifically end to end testing, labelling and cable management. It is not acceptable to have wall mounted faceplates and run a network flylead to integrated outlets at the workspace.

7.5 Patch Cords
7.5.1 S/FTP Patch Cords
For OH&S reasons it is critical to ensure that appropriate cable management is in place for all S/FTP patch cords running from faceplates to workspaces.

All Cat 6A S/FTP patch cords shall be factory terminated 4-pair S/FTP. The Cat 6A S/FTP work area patch cords shall be factory terminated, by the same manufacturer type as the installed horizontal cabling and must follow the colour coding below.

Cat 6A S/FTP cord length shall be 2m for racks larger than 18RU and 1m for 18RU and smaller at the TR. Cat 6A S/FTP cord length shall be 3m at the wallplate outlet end.

<table>
<thead>
<tr>
<th>Data Centre</th>
<th>Communication Room</th>
<th>Work Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crossover = Red</td>
<td>Crossover = Red</td>
<td>Crossover = Red</td>
</tr>
<tr>
<td>Analogue/ISDN = Grey</td>
<td>Analogue/ISDN = Grey</td>
<td>Analogue/ISDN = Grey</td>
</tr>
<tr>
<td>Server Nic 1 = Blue</td>
<td>Wall Plate = Blue</td>
<td>Wall Plate = Blue</td>
</tr>
<tr>
<td>Server Nic 2 = White</td>
<td>Wireless AP = Purple</td>
<td>Wireless AP = Purple</td>
</tr>
<tr>
<td>Server KVM = Yellow</td>
<td>Bridge AP = Pink</td>
<td>Bridge AP = Pink</td>
</tr>
<tr>
<td>Server ILO = Green</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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7.5.2 Fibre Patch Cords
The Fibre Patch Cords shall:

- Consist of Category OS1 B1.3 optical fibre (also known as ITU specification G.652c or G.652d) to suit the installed OS1 fibre optic cabling
- Be 2m in length
- Be used for optical fibre cross-connects and interconnects
- Have the fibre cladding covered by Kevlar fibres and a protective outer jacket
- Be factory terminated with LC duplex ceramic connectors at each end,
- Meet the vendor specification

7.6 Labelling
Horizontal cabling should be labelled as per the section on “Labelling and Numbering”.

7.7 Compliance Testing
Horizontal cabling compliance testing as per the section on “Compliance Testing”.

7.8 Documentation
Horizontal cabling documentation as per the section on “Documentation”.

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8 LABELLING AND NUMBERING

Each piece of equipment, patch panel and outgoing cable from the patch panels shall be labelled. Corresponding labelling and numbering shall also be provided on the telecommunication outlets.

To comply with the identification requirements of AS/CA S009, cable shall not be painted. Occasional overspray from Acrylic water-based painting can be acceptable provided the overspray coverage does not exceed 1m length on the cables.

All labels or labelling systems used are to be clearly visible and legible and are not to be handwritten. All labelling shall comply with AS 3085.1 (latest edition).

8.1 Backbone Cabling Labelling

All fibre optic cables shall be labelled in every telecommunications riser, pit entry, exit of any conduit and shall be labelled within 1m of entry to the FOBOT.

All labelling exposed to the environment shall be of self-laminating adhesive and durable enough to withstand water and UV.

Any exposed or above ground conduits that have copper or Fibre optic telecommunications cable inside must have a firmly affixed label on the outside of the conduit at 3 metre intervals to enable University staff to easily identify the type of cable/s which are inside. The label on the conduit must match the cable that is inside the conduit reflecting the standard labelling method outlined in this document.

All pits shall have brass labels installed on the outside to identify the pit number and extra labels shall be installed to indicate the direction of the conduits exiting and entering the pit.

All cabling installed with the communications pits shall have at least two ID labels on them, identifying:

- The cable belongs to CDU
- The “a” end, and the “b” end (i.e. both termination points of the fibre)
- Date of installation (for any fibre optics type and core count are to be included)

Examples of ID labels include:
- “CDU / cor12c2 / cbl5c1 / SM-24”
- “CDU / cbl5c1 / cgn2c1 / MM-OM2-24”
- “CDU / pac1 / pcc1 / MM-OM1-48”

The following label “CDU / cor12c2 / cbl5c1 / SM-24” refers to Charles Darwin University / Casuarina Campus Orange 12 Comms Room 2 / Casuarina Campus Blue 5 Comms Room 1 / Single Mode 24 core.

Strict adherence to this format is required for the installation to be deemed complaint and accepted.

8.2 Equipment Racks

Equipment racks/cabinets shall be labelled with the communications room and the sequential rack number. Examples include:

- “Comms2 Rack1”
- “Comms3 Rack2”
- “Comms1 Rack3”

8.3 In-Rack Labelling
Labels shall be laser printed and be of at least 11pt font.

Patch Panels and FOBOTs shall be labelled horizontally and sequentially from left to right, working down the rack.

FOBOTs shall have the cable ID as specified in “Backbone Cabling Labelling”.

Hand written and “permanent ink” markers are not permanent and shall not be permitted even in the interim.

8.4 Horizontal cabling labelling

All cable labels should be of clear wrap around self-adhesive type fixed onto each cable. Each copper cable is to be labelled at each end 100 - 150mm from the termination point. Lettering on the label is to be machine typed.

Horizontal cabling shall be labelled at both ends of the cable with self-laminating adhesive labels identifying communications outlet.

Hand written and “permanent ink” markers are not permanent and shall not be permitted even in the interim.

8.5 Telecommunications Outlet Labelling

Telecommunication face plates are to be Clipsal C2034HI with engraved insert in top right corner. Other face plates may be used with prior approval from a CDU ITMS infrastructure representative.

The labels on the Communications outlets and patch panels shall be laser printed and be of at least a 16pt font width of label on outlet.

Each faceplate has a unique reference number. All ports on that faceplate are labelled sequentially, starting at 1. Both of these form the unique identifier for each outlet. For example, in the picture below; the top left outlet below is referenced as “c2-003-1”. The outlet on the bottom left is “c2-003-2” and the bottom right is “c2-003-3”.

Each faceplate has a label and each outlet on that faceplate has its own label, starting from 1 and incrementing. Outlet labelling and numbering in a new building or refurbishment shall be numerical and sequential, following a walk-through of the room, area and floor.

Outlets labels installed in ceiling spaces, typically for wireless access point installations, shall be labelled on the T rail, to identify that there is an outlet in the ceiling for wireless.

Wireless AP’s will also be labelled with AP Identification and Outlet Identification.

Strict adherence to this format is required for the installation to be deemed compliant and accepted.

**Please see next page for example**
Wall plate example:

![Wall plate example](image1)

Wireless AP example (note outlet label on t-bar next to AP):

![Wireless AP example](image2)
In ceiling AP wallplate example:

Rack Horizontal cabling example:

**Please see next page for example**
Fibre optic cabling labelling example:

FOBOT labelling example:
9 COMPLIANCE TESTING

9.1 General

All cables will be tested prior to acceptance. Testing equipment used must be calibrated and operated according to manufacturer instructions.

9.2 Optical Fibre Link Testing

Testing of fibre optic cabling shall be Bi-directional testing showing loss budget, length, fibre type, using Light Source and Power Meter.

9.2.1 Test Requirements

All optical fibre links must be tested for:
- Continuity and Maintenance of Polarity
- Length
- Propagation Delay
- Optical Attenuation of Link, 2 x wavelengths, 2 x direction

Conduct the tests in accordance with TE' “Performance Testing of Optical Fibre Links Using ISO/IEC 14763-3 for Compliance to ISO/IEC 11801”, using either LSPM equipment.

Where LSPM results exceed the Power Loss Budget, the link shall be investigated with an OTDR to determine the location of the faulty component.

9.2.2 Compliance Criteria

The compliance criteria shall be a PASS for all of the tests listed under Test Requirements. The Optical Attenuation of the Link shall not exceed the Power Loss Budget calculated in accordance with the losses set out in AS/NZS 3080 and ISO/IEC 14763-3 for the optical fibre components that make up the Link. For a TE15 System Warranty, the optical fibre installation must pass the requirements and test methods set out in the document “Performance Testing of Optical Fibre Links Using ISO/IEC 14763-3 for Compliance to ISO/IEC 11801”.

9.2.3 Reference Setting (Zeroing) Methods for LSPM Testers on MMF and SMF

The 1- Reference Cord Method of Reference Setting as per Cl 9.1.2 of ISO/IEC 14763-3 Ed2 is the preferred method as it produces the least unacceptable Gain results. Modern up to date testers allow for the input adaptor knobs to be switched to suit the different fibre connectors under test (e.g. SC or LC)

The “3-Reference Cord Method of Reference Setting” as per Cl 9.1.1 of ISO/IEC 14763-3 Ed2 may be used where the connectors on the older LSPM tester are different from the connectors on the Link to be tested (E.g. SC on Tester and LC on Link). However, this method will produce some unacceptable Gain results that may be expensive to fix.

The 2-Jumper method of reference setting is not accepted in ISO/IEC 14763-3 and SHALL NOT be used.

9.2.4 Use of Mandrels (for 1 & 3-Test Cord Methods)

For MMOF, the LSPM Tester should meet the Encircled Flux requirement in the launch cord. This was achieved by using a correctly sized and securely held Mandrel Wrap on the Launch Cord for mode stripping during Reference Setting and Testing. An Encircled Flux launch cord will also meet the Encircled Flux requirement for MMOF.
9.2.5 Reference Cords & Field Calibration Cords (for 3 & 1-Test Cord Methods)

Launch and Tail Reference Cords for MMOF & SMOF LSPM testing shall be 1m to 5m each and have a Reference Connector at one end.

Field Calibration Cord shall not exceed 2m in length and have Reference Connectors at both ends. Reference Connectors shall be the same type of connectors as the cabling to be tested.

Reference Connectors have the following loss values when 2 reference connectors are connected in a reference adaptor.

<table>
<thead>
<tr>
<th>Fibre</th>
<th>Attenuation</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMF</td>
<td>≤0.10 dB</td>
</tr>
<tr>
<td>SMF</td>
<td>≤ 0.20 dB</td>
</tr>
</tbody>
</table>

9.2.6 Test Cord Qualification

For both MMF and SMF test cords, after the Reference Setting has been done, the test cord connectors shall be tested to ensure the loss is less than the values in 9.2.5. This shall be done 3 or 4 times per day and the results saved as REF 1, Ref 2 etc. and presented with the cable test results with the warranty application.

9.3 F/UTP Class E_A Performance Testing on Category 6_A Installations

Permanent link performance is the preferred acceptance criteria for all F/UTP installations.

Horizontal cabling testing should be done once the cable is in its final installed position. It should not be done, for example, before the faceplate is mounted on the wall or before the patch panel is mounted in the rack.

The installer must individually test 100% of the F/UTP cables after installation of the cables to determine compliance to certified manufacturer performance requirements.

All test results, shall be kept by the installer and supplied to the CDU ITMS infrastructure representative prior to acceptance of the site. Charles Darwin University and TE only accept PASS. Charles Darwin University does not accept cable runs with test results indicating a FAIL, any failed cable results shall be rectified prior to sign off by a CDU ITMS infrastructure representative.

A certain percentage of the outlets may be chosen at random for the final acceptance testing by a representative of CDU or, in their absence, by the cable manufacturer. The design data and the full results of all compliance tests performed by the installer are to be fully documented and submitted to a CDU ITMS infrastructure representative to hold for the period of the warranty.

Permanent Links shall meet the appropriate minimum requirements of:

- AS/NZS 3080 for Class E_A (using Category 6_A components), or
- ISO 11801 for Class E_A (using Category 6_A components).

The Structured Cabling System shall be tested by the installer for compliance to the requirements specified by the certified manufacturers Class E_A performance standard using Level 3 testers or higher in accordance with AS/NZS IEC 61935.1 – Testing, using a Fluke tester in accordance with AS/NZ IEC 61935.1.
The results must include 100% of total installation and provide full electronic data files in tester format for each cable run indicating the name of the person doing the testing, date, building, cable identification, and to certified manufacturers testing class $E_A$ requirements. PDF test results are not acceptable for warranty analysis.

Star passes shall not be accepted unless approved by the warranty provider and CDU ITMS infrastructure representative.

**9.4 Voice Cable Testing**

For testing of voice tie Krone disconnect end to end, use a test wizard.

**9.5 Documentation**

See section on “Documentation” for documentation of test results.
10 DOCUMENTATION

10.1 TR Documentation

Documentation must meet Australian and Vendor standards.

Record books shall be provided.

Laminated floor layout of as-built shall be provided in each communications room.

TR Record Books should include information showing inter-floor fibre and communications building backbone cabling.

10.2 Backbone cabling documentation

All external work will have as-built documentation supplied electronically and inspected by CDU ITMS infrastructure representative before sign off of the job is complete.

10.3 Work Area

Documentation of work area outlet position and numbering is to be provided “as built”.

This should be provided electronically.

10.4 Test Result Documentation

A copy of the full “Plot Data Enabled” test results for each copper cable run and each core of each optical fibre cable run shall be supplied to CDU ITMS in an electronic format. Results should be in a recognised test vendor’s application format, such as from Fluke LinkWare.
11 CUSTOMER ACCEPTANCE

11.1 General

Customer acceptance includes, but is not limited to:

- Cabling infrastructure installed to vendor specifications for the System Warranty
- Cabling infrastructure tested to and pass vendor certification as set out in “compliance testing” section of this document
- Test results provided to CDU as set out in “compliance testing” and “documentation” sections of this document
- As-built diagrams provided as set out in the “documentation” section of this document
- All defects corrected to the satisfaction of client and CDU ITMS infrastructure representative.

At the conclusion of the installation, the CDU ITMS infrastructure representative will require two weeks’ notice for a preliminary walkthrough with the installation contractor to perform checks for installation quality, accurate performance of the work, and to verify engineering diagrams. Any required modifications to the documentation or installation shall be accomplished within a 2 week period.

A minimum of two inspections to be organised with the installation contractor and CDU ITMS infrastructure representative. The first after the completion of roughing in the cabling infrastructure (Prior to ceiling tiles or plasterboard being installed, the second after the termination of the patch panels and TO’s).

"Customer Acceptance" shall consist of a final walkthrough with the installation contractor. The walk through shall be scheduled within 3 weeks of the completion of the installation in order to turn the project and documentation over to the end-user.

"Customer Acceptance" does not release the installation contractor from repairing any cabling errors or improperly labelled circuits, caused by the installation contractors that may be discovered at a later date.

"Customer Acceptance" of TR to include the cleaning of the communications room floor and wipe down of cabinets, racks and associated infrastructure, so as to prevent the ingress of building dust in active network equipment once installed.

Failure to meet customer acceptance may result in delay or withhold of payment of works.
12 APPENDIX A. Example Comms Rack Layouts

12.1 Standard Building Distribution/Telecommunications Room

A Building Distribution/Telecommunications Room Rack will normally be 42 RU, 800x900 and may contain:

- TE FOBOTs for lead in fibre and inter-floor fibre at the top of the rack
- Copper cabling panel below FOBOTs with a reasonable gap
- Voice patch panel below Copper patch panel with a reasonable gap
- Regular horizontal cable management for fibre, voice and S/FTP patch leads
- Vertical cable management
- Network switch(es) underneath all patch panels, with a reasonable gap
- Krone 15 way recessed frame in the bottom 3rd of the rack
- A 1.5 - 3kVAUPS at the bottom of the rack
- PDU mounted to back uprights facing forward and connected to rack UPS
12.2 Large Building Distribution/Telecommunications Room

A Building Distribution/Telecommunications Room Rack will normally be 42 RU, 800x900 and may contain:

Rack 1:
- TE FOBOTs for lead in fibre and inter-floor fibre at the top of the rack
- Network switch(es) below FOBOTs with a reasonable gap
- Voice patch panel below Network Switch(es) with a reasonable gap
- Krone 15 way recessed frame in the bottom 3rd of the rack
- Regular horizontal cable management for fibre and S/FTP patch leads
- Vertical cable management
- A 3-6kVA UPS at the bottom of the rack
- PDU mounted to back uprights facing forward and connected to rack UPS

Rack 2:
- Copper cabling at the top of the rack
- Regular horizontal cable management/UTP patch leads
- Vertical cable management

*All printed copies and duplicate soft copies are considered uncontrolled copies, and the original online version should be referred to as the latest.*
13 APPENDIX B. Example Telecommunications Rooms Layouts

13.1 “Single 800x900 Rack” Layout
13.2 “Dual 800x900 Rack” Layout

Double Equipment Rack
Communications Room

Minimum Room Size
2.7m x 3.4m

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14 APPENDIX C. Video Conference and Meeting Rooms

14.1 General
For all video conference and meeting rooms the following should be considered:

- Controlled Room Acoustics
- Controlled Room Lighting
- Controlled room Environmentals (Air/con, mains noise etc.)
- External noise penetration into the room
- Internal noise out of room (disturbing nearby classrooms/offices).

For rooms that focus around a central table:

- Network and power outlets will be installed under the table in a “Floor Box”.
- The Floor Box will have a minimum of 4 network outlets and 4 GPO.
- This should be able to be expanded to 8 network outlets and 8 GPO.
- Minimum of 40mm conduit running to Floor Boxes.
- Floor Boxes need to provide bend radius control for all network cabling.
- Pull string to be installed in all conduits for adding additional cabling.

14.2 Special Considerations for Video Conference Rooms
It is understood that room design is complicated. Room design needs to be signed off by CDU ITMS who will usually, at their discretion, engage a third party to review all aspects of the proposed design.

Video conference rooms will be built taking into consideration:

- Lighting – 300-400 lux in the vertical plane
- Acoustics (Reverberation time) 150-700mS. The actual recommendation is very dependent on the room size, and it is recommended that an acoustic engineer with knowledge in Video Conferencing usage be engaged for specific design.
- Acoustics – Mechanical Services noise, NC30

Large Video Conferencing rooms:

- This equipment should be housed in a dedicated rack.
- This rack should be appropriately ventilated, noise controlled and located away from but from the video conferencing space.
- Any rack must be accessible from the video conference space and externally. It doesn’t have a door connecting the two, but does need to be in close proximity.
- Dedicated cabling running from the lectern to the video conference rack will be terminated into standard patch panel and cable minders.
- Only needed equipment will be housed in the lectern, all other major equipment will be housed in video conference rack.
- A min of 12 TIE cabling will be run from the Video conference rack to the closest TR.
15 GLOSSARY

The following is a Glossary of terms and acronyms utilised in this document:

**Application:** A system, with its associated transmission method which is supported by telecommunications cabling.

**Balanced cable:** A cable consisting of one or more metallic symmetrical cable elements (twisted pairs or quads).

**Building backbone cable:** A cable that connects the building distributor to a floor distributor. Building backbone cables may also connect floor distributors in the same building.

**Building Distributor (BD):** A distributor in which the building backbone cable(s) terminate(s) and at where connections to the campus backbone cable(s) may be made.

**Building Entrance Facility:** A facility that provides all necessary mechanical and Electrical services, that complies with all relevant regulations, for the entry of Telecommunications cables into a building.

**Cable:** An assembly of one or more cable units of the same type and category in an overall sheath. It may include an overall shield.

**Cable element:** The smallest construction unit (for example pair, quad, or single fibre) in a cable. A cable element may have a shield.

**Cable Tray:** A ladder, trough, spline, solid bottom or channel raceway system intended for the support of telecommunications cable and other cables that are permitted to exist in that pathway.

**Cable unit:** A single assembly of one or more cable elements of the same type of category. The cable unit may have a shield. NOTE - A binder group is an example of a cable unit.

**Cabling:** A system of telecommunications cables, cords, and connecting hardware that can support the connection of information technology equipment.

**Campus backbone cable:** A cable that connects the campus distributor to the building distributor(s). Campus backbone cables may also connect building distributors directly.

**Campus distributor (CD):** The distributor from which the campus backbone cabling emanates.

**Catenary wire:** A catenary is a length of wire suspended between two points, such as eyebolts, on which cables or looms are attached at suitable intervals. Typically, there is an eyebolt at either end with the catenary wire attached directly to one end and a turnbuckle to the other end. This system shall also be supported for its entire length at intervals no longer than three (3) metres.

**Channel:** The end-to-end transmission path connecting any two pieces of application specific equipment. Equipment and work area cables are included in the channel.

**Consolidation point:** A location for interconnection between horizontal cables that extend from building pathways and horizontal cables that extends into work area
pathways. Any consolidation points shall only be installed with approval of University Networks CCPMs.

**Cross-connect:** A facility enabling the termination of cable elements and their connection, primarily by means of patch cords or jumpers.

**Distributor:** The term used for the functions of a collection of components (such as, patch panels, patch cords) used to connect cables.

**Equipment cable:** Cable connecting equipment to a distributor (FD or CD).

**Equipment room:** A room dedicated to housing distributors and application specific equipment.

**Floor distributor (FD):** The distributor is used to connect between the horizontal cable and other cabling subsystems or equipment. (See telecommunications closet). The FD also connects to the BD/CD.

**FOBOT:** Fibre Optic Break Out Tray. A tray used to contain and distribute the terminated fibres.

**Fusion Splice:** The means by which Optical Fibre Cable shall be joined and terminated to Optical Fibre Pig-Tails.

**F/UTP Foil over unshielded twisted pair cable:** An electrically conducting cable comprising one or more pairs of UTP with a foil shield over all pairs.

**S/FTP Foil over shielded twisted pair cable:** An electrically conducting cable comprising one or more pairs of STP with a foil shield over all pairs.

**Horizontal cable:** A cable connecting the floor distributor to the telecommunications outlet(s).

**Interconnect:** A location at which equipment cables are terminated and connected to the cabling subsystems without using a patch cord or jumper.

**Interface:** A point at which connections are made to the generic cabling.

**Jumper:** A cable unit or cable element without connectors, used to make a connection on a cross-connect.

**Krone HighBand 25:** A cross-connect designed to accommodate the use of patch cords or jumper wire. It facilitates administration for moves and changes.

**Optical fibre cable (or optical cable):** A cable comprising one or more optical fibre cable elements.

**Optical fibre duplex coupler:** A mechanical device designed to align and join two duplex connectors.

**Optical fibre duplex connectors:** A mechanical termination device designed to transfer optical power between two pairs of optical fibres.

**Optical Fibre Pig-Tails:** The termination device at the end of each optical fibre cable. This is a factory terminated connector and shall be fusion spliced onto the installed optical fibre cable.

**Patch By Exception:** This is ADC Krone’s HighBand 25 solution, consisting of HighBand25 disconnection modules, leads, mounting and management hardware.
**Patch cord**: Flexible cable unit or element with connector(s), used to establish connections on a patch panel.

**Patch panel**: A cross-connect designed to accommodate the use of patch cords. It facilitates administration for moves and changes.

**PDU**: Power Distribution Unit for supplying power to all network rack mounted equipment normally connected to Rack UPS.

**Riser**: A common space allocated between floors of multi level buildings for the reticulation of services. In this manual it is for the reticulation of Communications cabling.

**Riser Cable**: see Building backbone cable.

**RJ-45**: An 8 pin modular plug/socket for copper cables suitable for patching by Non licensed personnel.

**SC Connector**: An optical fibre modular plug / socket suitable for patching by licensed personnel. The shape of this connector has a rectangular shroud.

**Site**: A premises containing one or more buildings

**Splice**: Joining of conductors and fibres, generally from separate sheaths.

**Structured Cabling**: A cable system connecting the campus distributor through to the telecommunications outlet(s).

**TE**: TE Connectivity, Enterprise Networks Australia, including KRONE and AMP brands.

**Telecommunications Closet**: An enclosed space for housing telecommunications equipment, cable terminations, and cross-connect cabling. The telecommunications closet is a recognized cross-connect point between the backbone and horizontal cabling subsystems.

**Telecommunications Outlet (TO)**: A fixed connecting device where the horizontal cable terminates. The telecommunications outlet provides the interface to the work area cabling.

**Telecommunications Reference Conductor (TRC)**: A telecommunications earth bonded to the main building earth at one point only.

**Twisted pair**: A cable element that consists of two insulated conductors twisted together in a regular fashion to form a balanced transmission line.

**UTP Unshielded twisted pair cable**: An electrically conducting cable comprising one or more pairs none of which are shielded and no overall shield.

**CDU ITMS**: Section within the University that is responsible for the design, deployment and maintenance of the communications network for the Charles Darwin University.

**Work area cable**: A cable connecting the telecommunications outlet to the terminal equipment, for example a typical office.