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1 Introduction

1.1 Overview

The aim of this document is to provide a cabling infrastructure which has high reliability, is easy to maintain and can support the applications and services of today and the future.

The specification has been written to ensure that a cost-effective solution is provided without compromising any standards or safety issues, and that all single points of failure are designed out by means of route diversity and possible service duplication where appropriate.

This document describes the specification for the design of the network infrastructure including fibre and copper networks for voice, data and associated services within Central Queensland University’s (CQUni) network.

All cabling work supplied and installed shall be in-line with local, national and state standards, along with any additional requirements as stipulated by CQUni.

It is important to note that all network and communications rooms are for the sole occupancy of CQUni and their associated voice and data distribution equipment. It is not permissible for other parties to store or install equipment within these rooms without written consent from CQUni.

The product set has been standardised on CommScope. This product set has been selected for its high degree of reliability, quality and performance. By standardising on this product set a standard warranty for voice and data has been set for all buildings within the CQUni network. To this effect CommScope voice and data products must be selected.

All installation work must be covered by a 15-year system warranty. To ensure that this happens, only approved manufacturer Integrators shall be used.

1.2 Specification of Criteria

Two levels of criteria are specified, mandatory and highly desirable. The mandatory requirements are described by the word “must” and “shall”; whilst highly desirable are described by the words “should”, “may” or “desirable”. Mandatory requirements must be adhered to under all circumstances and may not be changed. Highly desirable requirements are the desired ways of design, implementation and documentation that may be changed depending on individual circumstances.

Where a product has been indicated the specified product shall be used, no substitution of product is permissible without the written approval of the CQUniversity Information Technology Project Manager.

All parties shall adhere to this specification document. Any deviation from this document can only be enacted upon receiving prior written approval from the CQUniversity Information Technology Project Manager.

1.3 Scope of Works

Central Queensland University provides tertiary educational services across a variety of Campuses from Cairns in the north to Melbourne in the south. CQUni has one of the largest and fastest growing footprints of any university in Australia.

This document provides minimum details on the scope and installation requirements across the network at all Campuses, Study Centres and Hubs owned and/or run by CQUni. It applies to all data and voice cabling, including that used for video and security.

Any Appendix details shall be adhered to.
2 Installer Requirements

2.1 Overview
All the work covered in this specification shall be implemented in strict compliance with the standards and codes issued or endorsed by the Australian Communications & Media Authority and the Standards Association of Australia.

2.2 Installer Requirements
All cabling works are to be performed under the Australian Communication & Media Authority (ACMA, formerly known as ACA) with the objective being to carry out general premises cabling as specified by the Structured Cabling System manufacturer.

2.3 Installer Licence
The communication cabling installation is to be carried out by a specialist Cabling Contractor licensed by the ACMA or registered with an authorised Cabling Registrar. The Cabling Contractor and nominated personnel must all hold current, relevant and necessary licences / Open Registration, along with appropriate endorsements and must present these prior to commencement of work. A copy of the Contractor’s license and Open Registration is to be made available to CQU on request.

2.4 Preferred Cabling Contractor
The cabling contractor will be chosen by competitive quotation. Tenderers are advised to submit all relevant details to CQU when responding to requests for quotes.

CQU Contact Details
CQU Data Centre Manager
Phone: (07) 4930 9777
Email: network@cqu.edu.au

2.5 Supplier Selection
The manufacturer’s components used on any CQU site shall be as follows:
Structured Cabling Components (Copper and Fibre Optic):

- CommScope (Krone)

2.6 Supplier Certification
The Contractors ACMA license / Open Registration must be endorsed to allow performance of the cabling products being installed (i.e. CommScope - ANIT Installer).

The Cabling Contractor (including 50% of employed staff) must be trained to the manufacturer’s requirements for installation of the cabling system.

The Cabling Contractor must provide documentation that their organisation is a current minimum 15 years Integrator upon request by CQU.

3 Cabling Systems

3.1 Overview
The topology of the cabling systems shall be set out and clearly defined in terms of design and product set. The Structured Cabling system is required to provide a flexible distribution architecture for both voice and data connectivity.
3.2 Cabling Practice

All cables shall be run and installed in a workmanlike manner in accordance with AS/NZS 3080 and AS/CA S009 Wiring Rules. The recommendations outlined within AS/NZS 3084 Pathways and Spaces should also be followed.

The Contractor shall plan the cabling system and routing to –

- ensure adequate segregation from hazardous services,
- ensure system integrity and performance,
- ensure that it does not inhibit maintenance or other access,
- ensure there is no conflict with the operation and maintenance of other systems.

The Contractor shall, in their tender submission, provide full details of the type of cables to be used including:

- the type of termination,
- colour scheme,
- identification method,
- method of installation and shielding (if required),
- limitations (if any)
- and any other relevant telecommunications information.

Unless otherwise stated, the contractor shall submit for approval to proceed (prior to commencement of installations) drawings showing the proposed wiring cable tray/catenary or conduit layout for the entire system with all necessary dimensions and support details clearly indicated.

All cable trays, catenaries and ductwork required to complete the installation will be the responsibility of the tenderer to supply and install. The installer is to liaise with end users and/or the main contractor when stripping out of existing floors/buildings commences, to evaluate if any existing cable tray or ducts can be re-used.

All necessary pathway penetrations and access between floors is the responsibility of the tenderer to provide and to ensure all penetrations and access holes at the completion of the installation, are fully sealed to local authority requirements and fire regulations by qualified personnel.

All work shall be installed and comply with the cabling manufacturer’s Installation Practices. These Practices are available upon request.

3.3 Conduit / Subduct Systems

3.3.1 General

The tenderer shall obtain all clearances in accordance with CQU Facilities and Maintenance before any work can proceed. The contractor shall follow the “Dial before you Dig” requirements at all times where applicable. All trenches and conduits shall comply with AS/CA S009 and AS/NZS 3084 for depth, location and usage.

All conduits will have a draw wire of 7/0.67 PVC SI Building wire installed. There must be no joins in this draw wire. Galvanised draw wire will not be permitted.

Before cable is installed and after installation, ensure that the conduit is thoroughly clean of any extraneous material such as cable scraps, dust, dirt, construction debris and moisture. Any cable that has been subjected to immersion in fluid that has not completely dried out within 24 hours of immersion starting, shall have the pathway dried and cleaned and the cable shall be completely replaced with new clean dry cable.

Co-ordinate all conduit and subduct work with other services on site as necessary. Conduits and ducting protruding through a floor shall extend between 50 - 75 mm above estimated finished floor level to act as a bund against fluid spillages.

3.3.2 Indoor Conduit / Subduct

Restrict conduit lengths to no more than 30m of continuous pull inside a building between hauling points. Restrict any cable pull to no more than two (2) x 90-degree bends, in conduits or ducts.
All fibre optic cabling inside conduit systems shall be clearly labelled with warning tape, yellow and black in colour. The pathway system shall otherwise be installed in accordance with the manufacturer’s instructions.

3.3.3 Underground Conduit / Subduct

All conduits located in trenches shall be a minimum of 100mm diameter PVC, Class 12, white in colour. A detectable tape identifying that communications services are below shall be placed 150mm above the top of the conduits.

Any change of direction shall be done via cable pit. Any pits that are open at the time of the works shall have approved safety barriers surrounding them at all times. Any newly installed pits shall comply with AS/CA S009.

Any new pit installed in an existing and/or proposed garden bed shall have a communications locating marker installed.

3.3.4 Carrier Services

The contractor is to arrange for the installation of appropriate white UPVC conduit (with draw wire) - sized in accordance with AS/CA S009, to house the required carrier lead-in cabling and install it in a shared trench with the electrical lead-in. If the provision of a shared trench is not practicable, a separate trench shall be provided.

The contractor is to formally advise the nominated telephone sub-contractor (if applicable) on the completion of the lead in trench and conduit fit-out.

The contractor shall also ensure that cable is installed to the minimum depths and required separation from electrical and other services, as specified in AS/CA S009.

3.3.5 Pits

Pits shall be P6 unless otherwise specified.

3.4 Cabling System Structure

The cabling system can be considered as a series of clearly defined subsystems, each one interconnecting a specific piece of active equipment that may in some cases change the media type.

It can be seen that there are two main components to the cabling systems for any one end to end solution. The basic elements are as follows:

- Backbone Cabling (Copper and Fibre Optic)
- Horizontal Cabling (Copper Cabling)

The backbone cabling provides connectivity from the campus distributor (CD) to the building distributor (BD), and the building distributor to the floor distributor (FD)/communication room (CR), if applicable. The CD/BD shall house both lead in carrier cabling termination frames and associated active equipment.

The horizontal cabling is the cabling system that provides telecommunication services from CR to the user outlets (TOs).

3.5 Penetrations

Cables that penetrate fire barriers shall have the penetrations suitably sealed and fire-stopped by qualified operators as required by local building code regulations/laws.

All cable passing through floor or wall penetrations shall have the penetrations suitably sealed and fire-stopped by qualified operators as required by local building code regulations/laws.

3.6 Earthing

Tenderer shall supply and install a complete earthing system for the voice/data system to ACMA, AS/CA S009 and AS/NZS 3080 requirements.
All distribution frames, cable trays and catenary wires shall be connected to the building protective earth from the electrical distribution board on the floor where such is installed, as specified for each case in AS/CA S009 or local equivalent (whichever is superior / most stringent).

Sizing of earthing conductors shall conform to the standard specified in AS/CA S009 or local equivalent (whichever is superior / most stringent).

Cables with metallic sheaths will be earthed at one end only. This will then be tied to the building protective earth via green / yellow conductor as per AS/CA S009 or local equivalent (whichever is superior / most stringent).

No steel cabling enclosure medium will be installed without having continuity to a protective earth.

4 Fibre Optic Backbone

4.1 Overview

All data backbone services shall be single-mode fibre optic cabling.

Each CR shall be linked via fibre optic cabling.

The distances quoted in the table below are from the source equipment (i.e. switch) to the terminal equipment (i.e. PC). Allowances must therefore be made for vertical drops/rises as well as the horizontal runs.

<table>
<thead>
<tr>
<th>Technology</th>
<th>Distance for application (m)</th>
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<tr>
<td></td>
<td>1G Base T</td>
</tr>
<tr>
<td>OS2 Fibre</td>
<td>N/A</td>
</tr>
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</table>

Table 4.1 - Maximum distances

The distances for the fibre are the absolute maximum and do not take into consideration the number of splices and connectors used. A budget calculation must be done on any fibre channel before the exact distance is known.

4.2 Fibre Optic Backbone Cabling to the Building

An OS2 grade single mode (SM) fibre optic cable (underground nylon jacketed, gel filled, sacrificial sheath fibre cable) shall be run from the building distributor in each building back to the main campus communications room (CommScope part number 6462 4 448-24). Optic Fibre core count shall provide a minimum 50% spare capacity, with a minimum of a 24 cores.

There shall be two alternative fibre pathways to each new building, the routes of these shall be approved by the CQUniversity Information Technology Project Manager.

These fibre optic backbone cables are to terminate within each CR in the communications cabinet. Cabinet size and location is to be at the discretion of the CQUniversity Information Technology Project Manager. Fibre termination unit panels utilising SC/APC type connectors shall be used at both ends of the cabling.

All cabling (whether internal or external) shall be installed with “Warning – Fibre Optic Cable” detectable warning tape. Where fibre optic cabling is run internally, all cable shall be installed within flexible conduit and suitable warning tape to provide easy identification of this service.

4.3 Fibre Optic Backbone Cabling Within the Building

Internal installations require, as a minimum, 12 core single mode fibre optic cable. Fibre is to be run from the main communication room within the building to every floor distributor and/or communication room.

This cabling is also to be terminated using SC/APC connectors and suitable adapters at both ends.

The cable shall be labelled at each end with the name of the installer and the date of install.
4.4 Internal Fibre Cabling

All fibre optic cabling shall be run on communications trays and segregated from regular network cabling by way of separated bundling.

The multi-core optical fibre cable shall consist of SM fibre. Each fibre shall be tight buffered with colour-coded PVC (or LSZH) for easy identification of multi-core fibre optic cable. Cable shall be CommScope 6462 4 445-12YL (12 core).

The fibre cables shall meet the following transmission specifications:

<table>
<thead>
<tr>
<th>9/125 μm Fibre</th>
<th>OS2 Specification</th>
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</thead>
<tbody>
<tr>
<td>a) Max fibre attenuation:</td>
<td>0.4 dB/km at 139 nm</td>
</tr>
<tr>
<td></td>
<td>0.4 dB/km at 1373 nm</td>
</tr>
<tr>
<td></td>
<td>0.3 dB/km at 1550 nm</td>
</tr>
</tbody>
</table>
b) Sheath Colour: Yellow

c) Cabled cut off nm: <1170nm

4.5 External Fibre Cabling

Cabling to be run externally, either underground or outdoor, shall utilise outdoor rated loose tube cable. Any cable to be run underground shall pass the “water penetration test” as set out in AS/CA S008. Each loose tube is to be gel filled (thixotropic compound) surrounding a glass reinforced plastic (GRP) central strength member. Tubes are to be wrapped with water swell-able tape, sheathed with UV stabilised polyethylene (Black) with a nylon outer jacket (Blue), and a UV resistant thermoplastic sacrificial sheath (Black). Cable shall be CommScope 6462 4 44-24 (for 24 core).

The fibre cables shall meet the following transmission specification:

- 9/125 µm Fibre OS2 Specification
  a) Max fibre attenuation: 0.4 dB/km at 139 nm
     0.4 dB/km at 1373 nm
     0.3 dB/km at 1550 nm
  b) Sheath Colour: Yellow (indoor)/ Black (Sac Sheath)
  c) Cabled cut off nm: <1170nm

4.6 Fibre Termination

4.6.1 Fibre Termination Unit - TFP

The termination unit shall be KRONE TFP type and 19” rack mountable providing cross-connect and interconnect or splicing capabilities. TFP shall be

<table>
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<th>RTC1G-SCA-24-FS-A24-P24-Z-SM</th>
<th>RTCG 1RU STATIC SLIDING TRAY, 24 CORE OS2, SCA SIMPLEX, C/W PLATES-ADAPTORS-PIGTAILS-SPlice PROTECTORS &amp; TRAYS</th>
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The TFP 19” rack mount fibre termination unit shall consist of a frame mountable housing for terminating and/or splicing fibre optic cables and allow for organization of the fibre optic interconnects. The assembly shall have rear slots for cable entry, with grommet fibre retainers for holding buffered fibre in place and fibre storage guide for maintaining bend radius.

The 19” rack-mounting unit should provide 24 duplex ports in one rack unit (1RU) and can be either a fixed position unit, or have a slide or swing tray to improve access.

The required adaptor plates should be suitable for SC/APC duplex couplings (green in colour) and the adaptor plates should be installed to angle through adaptors to the left or to the right of the panel to improve patch cord management and prevent possible damage to the eyes from accidental exposure to active fibres.

4.6.2 Cabinets

Fibre optic cabling shall be terminated within the CR cabinet to a LKH patch panel. The final location of this cabinet to be provided by CQUinity Information Technology Project Manager.

4.6.3 Fibre Optic Patch Cords

The successful tenderer shall supply 50% of the fibre pair count with Fibre Patch Cords and:

- Lengths shall be at the following ratios - 30% at 1 metres; 40% at 2 metres; 30% at 5 metres
- Shall consist of one or two single, tight buffered, SM graded-index fibres with a 9-micron core and a 125-micron cladding.
- Shall be used for optical fibre cross connects and interconnects.
- Shall have the fibre cladding covered by aramid yarn and a protective outer jacket.
- Shall be factory terminated with SC/APC ceramic connectors at each end.
- Shall be Yellow in colour
They should also meet the following specifications:

- a) Minimum bend radius: 25 mm
- b) Operating temperature: -40 to +75°C
- c) Loss: ≤0.5 dB per mated connector
- d) Return Loss Maximum: -45dB
- e) Cable OD: 3mm
- f) Tip material: Ceramic

Patch Cords used for connection to active equipment shall have LC/APC connectors at the active connection end – SC/APC at the opposing end.

### 4.7 Powered Fibre

External devices that require POE network but are not in or attached to a building – eg security camera’s on poles, may be connected by powered fibre using POE extender technology. In all cases the design of these installs must be confirmed with CQUni’s Communications section of the Information and Technology Directorate. Where such services are deemed suitable, the following shall be used. Commscope POE extender PFU-P-B-O-001-02 for a 2 port device. PFC-S04O12-1000M (part number for 1000M length) Other lengths are available.

### 5 Voice Backbone

#### 5.1 Overview

All general telephones shall be VOIP type, administered by CQUni and run via the 4 pair balanced cable of the structured cabling system.

CQU no longer supports Voice grade cabling.

Any work pertaining to the connection or disconnection of voice services shall be co-ordinated and completed by CQUni’s Communications section of the Information and Technology Directorate.

(see also section 3.3.4 Carrier Services)

### 6 Horizontal Distribution

#### 6.1 Overview

The horizontal distribution listed is for the purposes of data and voice connectivity. Cabling shall extend from the CR and shall be terminated onto Category 6A outlets. Cables reticulating to the CR shall be terminated onto Category 6A Patch Panels.

All user outlets shall be fed from the nearest CR to ensure cabling lengths comply with AS/NZS 3080. Cable lengths of the permanent link must be less than 90 metres.

Cables reticulating to the CR shall be terminated onto 24 port Category 6A Patch Panels.

All connections that require connection to a switch must be terminated on a patch panel.

#### 6.2 Cable Capacity

Planning of cable capacity must be co-ordinated with all parties involved in the planning, design and implementation of the IT network. The capacity of cables must cater for requirements that will be implemented from day one and all known requirements that will follow in the future plus additional capacity for unknown future expansion.
Designs must take into account, and provide for, ease of future cabling works and repairs. It is critical that the horizontal distribution is designed correctly with consideration given to:

- Layouts
- Routing
- Ceiling void
- Access
- Cable management

### 6.3 Channel Design Rules

The maximum channel distances and connectors permissible for Category 6A are detailed in figure 6.3.1 below.

![Figure 6.3.1 Maximum Permanent Link Design](image)

The total length of the horizontal cable (solid conductor) must not exceed 90m and the total length of the patch cordage (stranded cable) must not exceed 10m. The total combined end-to-end length must not exceed 100m.

### 6.4 Cable Management

Cable management is split between continuous (tray) and non-continuous pathways. This is primarily to cater for the differing requirements for capacity and future expansion requirements.

### 6.5 Cable Trays

Trays or baskets must be either an overhead in-ceiling mounted solution or an under-floor mounted solution, depending on the overall building design and construction. Cable trays or baskets must be installed to provide routes from the communications room to the building distributor.

Cable runs holding more than 10 cables must use a tray or basket only while smaller cable runs (less than 10 cables) may utilise catenary wires.

There shall be separate trays for power and telecommunication services. Where the trays cross they must be bridged and cross at 90°. Horizontal, building backbone cables must be dressed to enter either the top or the bottom of the designated structured wiring cabinets.

There shall be separate trays for power and telecommunication services. Where the trays cross they must be bridged and cross at 90°. Horizontal, building backbone cables must be dressed to enter either the top or the bottom of the designated structured wiring cabinets.

Cable tray sizing shall conform to AS/NZS 3084, and CommScope Installation Specifications. No “whale bone” type trays will be accepted. Any pathway shall not exceed 50% capacity. Clause 4.9 provides further detail.
Cable entry/exit shall be via a system to ensure the bend radius of the cable is maintained (e.g. waterfall or similar). Cables passing through cavity wall spaces shall be protected via flexible conduit at all times.

6.6 Skirting Duct / Service Columns
Where appropriate, skirting duct shall be used for the reticulation of power and communications services to the final outlet location. Cable pathways must be designed to ensure cabling should not run any further than 5 metres within enclosed skirting duct work.

Skirting duct shall be a minimum of 50mm in depth, comprising of 3 channel construction to ensure adequate separation between power and communications services. All outlets mounted to skirting duct shall use the manufacturer’s approved outlet mounting kits.

Changes of direction within the skirting duct shall require the use of suitable bend radius protection of the communications cabling. No sharp edges shall be evident. All outlets should be mounted directly to the skirting duct. The channel system shall use angled faceplates to provide adequate bend radius protection of the communications cable.

Service columns to supply skirting duct and/or workstations shall provide adequate separation of the power and communications services. Cabling through service columns shall not exceed the maximum allowable fill rate. Bend radius protection of the cabling entering and leaving the service column must be provided for.

Side entry outlets will be used to cater for cat6a and shall be:

- AMP-Twist XG STP Side Entry RJ45 SL Alloy Q12

Exact skirting/service column type/model must be approved by CQUniversity Information Technology Project Manager with consultation from Information Technology Director, before any on site work begins.

6.7 Media Selection
The category and type of copper cable to be installed shall be:

- CommScope Category 6A F/UTP (Part #: 1859218-2)

The type of horizontal cables used shall be 4-pair 100Ω Category 6A high performance, shielded twisted pair (F/UTP) cable for all Category 6A applications.

The diameters of the insulated wires shall be different between the pairs to achieve the necessary NEXT and delay skew performance. The 4-pair F/UTP cable shall be run using a star topology format from the cross connect at the floor distributor (CR) on each floor to every individual telecommunications outlet.

The 4-pair UTP cable must meet AS/NZS 3080 Category 6A requirements. It must be proven to ensure connectivity for any application up to and including 10 Gbps from the BD/floor distributor (CR) wiring closet to the telecommunications outlet at the work area.

Any variation to the above cable grade requires approval from the CQUniversity Information Technology Project Manager.

Final outlet locations and quantities shall be confirmed by the CQUniversity Information Technology Project Manager.

6.8 Telecommunication Outlet (TO)
All telecommunications outlets supplied by the tenderer shall be Category 6A RJ45 outlet type, accepting standard phone and data modular plugs.

The category and type of copper connector to be installed shall be:

- CommScope Category 6A (Part #: 1711716-1)

Should have the ability to accept a dust cap to prevent dust and dirt getting into the socket. The TO shall be multi-application supportive and shall be able to be reconfigured to different applications when required.
Each outlet shall have an automatic wire cutting feature for termination, and provide 360-degree shield protection.

The TO shall meet or exceed AS/NZS 3080 Category 6A component requirements. The modular jack offered shall conform to AS/NZS 3080 T568A wiring scheme.

6.9 Outlet Presentation

All wall faceplates shall be able to accommodate two Category 6A FTP RJ45 outlets via direct connection or via a bezel system. Only two gang faceplates are to be used, except for wall hung phone, wireless access points and CCTV, where single gang plates will be required. In computer labs, two gang outlets may be used for two computers that are side by side. Each faceplate shall have the option for the faceplate to be mounted vertically or horizontally.

Faceplates shall be electric white in colour with identification windows and match the power GPOs to ensure the aesthetics of the site are maintained.

6.10 User Type Outlet Quantities

Each user type will demand different requirements from the structured wiring infrastructure. The main user types and associated technologies have been defined below as the minimum requirements for outlet concentrations. See table 6.10.1 below.

<table>
<thead>
<tr>
<th>User Type</th>
<th>Number of channels per outlet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Data and Voice</td>
</tr>
<tr>
<td>General office outlet, workstation user or generic work space</td>
<td>2 per user</td>
</tr>
<tr>
<td>Student Lab Computers</td>
<td>1 per computer</td>
</tr>
<tr>
<td>Printer</td>
<td>2</td>
</tr>
<tr>
<td>Emergency Lighting</td>
<td>2 per main panel</td>
</tr>
<tr>
<td>Fire Alarm</td>
<td>2 per panel</td>
</tr>
<tr>
<td>IP CCTV</td>
<td>1 per unit</td>
</tr>
<tr>
<td>Wireless AP</td>
<td>1 per unit</td>
</tr>
</tbody>
</table>

Table 6.10.1 Outlet densities per user

6.11 Patch Panels

Patch Panels should be used at the CD/ BD and CR locations as approved by CQU. The category and type of copper connector panel to be installed shall be:

- CommScope Category 6A Universal Connectivity Platform, flush (Part # 1-1671594-1) with SL Quick-Fit plates (Part # 2111093-1)

The Tenderer shall supply 24 port Category 6A Patch Panels with identical performance to that listed in Clause 6.8 (TO’s).

The patch panel shall be available in 24 port configurations in one rack unit height and shall fit into a 19" rack.

6.12 Patch Cords

The successful tenderer will be responsible to supply the sufficient number of Category 6A F/UTP patch leads required to ‘flood patch’ the rack switches (i.e. every outlet is to be connected to a switch port) and supply sufficient patch leads for all new desk device connections. At the rack, these leads will be 20, 25 or 30cm in
length. (see 6.18 for rack patching details). For desk devices, this should be at a ratio of 30% at 1 metres, 50% at 2 metres and 20% at 3 metres.

The required numbers of leads and lengths for rack patching will need to be calculated based on the rack layout design. The final rack layout design must be approved by the CQUniversity Information Technology Project Manager prior to installation of any patch panels or live equipment.

The patch cords shall have built in exclusion features to prevent accidental polarity reversals and split pairs. It shall have a latching mechanism to prevent accidental dislodging of the plug from the termination module or modular Patch Panel.

All copper patch cords shall comply with Category 6A applications requirement. The category and type of copper connector to be installed shall be CommScope Category 6A (Part #: 1711816-X where X equals length) and green or grey in colour. For the short leads used in the rack, other brands will be accepted, provided they meet the Catagory 6a standard. This length generally needs to be custom made. The University can recommend suppliers if required.

### 6.13 Wireless LAN (WAP)

Where possible, TOs for WAPs shall be hidden inside the ceiling. There is a separate standard document for Wireless installation. Please refer to this standard for more details.

- CQUniversity Wireless Installation Technology Standard

### 6.14 Surface Mount Outlets

Cabling mounted on a surface shall use surface mount outlets designed to carry the outlet and maintain the bend radius of the cable. A two port surface outlet box shall be the maximum number of outlets unless otherwise approved by the CQUniversity Information Technology Project Manager. The copper connector surface mount to be installed shall be:

- CommScope 2 port Surface Module (Part #: 193366-3)

### 6.15 Labelling

All Patch Panels and TO’s shall utilize label holders for clear identification along with coloured label inserts to clearly identify services i.e. Active Equipment, horizontal cabling etc. Proper labelling and numbering shall also be provided on all outlets.

All cable labels are to be of clear wrap around self-adhesive type and each cable is to be labelled at each end 100 - 150mm from the termination point.

Outlets shall be clearly labelled on the exterior of the wall plate utilising a lettering method to the approval by CQU. A white label with black lettering is to be firmly fixed and secured to the outlet frame/cover in a prominent position.

The frame labels shall be supplied in black on white and fitted by the cabling contractor.

All cabinets and approved connection frames are to be labelled as agreed with CQU, and complete records are to be provided showing all connections.

The labelling shall be:

<table>
<thead>
<tr>
<th>Floor / Room . Outlet</th>
</tr>
</thead>
<tbody>
<tr>
<td>e.g. G/1.08 = ground floor, room 1, outlet number 8 in that room</td>
</tr>
</tbody>
</table>

**NB: Outlets are numbered from 1 within each room.**

These numbers must be entered in the Communications Room (CR) record book in the same way outlets are numbered. Both data and voice shall be labelled in the same manner.

**Failure to correctly label ports will result in relabelling being required at the contractors cost. If in doubt,**
ask CQU to clarify.

Backbone cabling shall have both ‘to’ and ‘from’ listed on the labelling to provide maximum amount of detail.

Voice frames – shall be labelled by vertical and pair number. All detail should be entered in the Communications Room record book.

Voice Frame Label Example: 

A = Vertical A
001 = Cable appearance on Frame

6.16 Security / Access Control

Access control cabling shall be via a single telecommunications outlet to comply with this document. Consultation with the access control manufacturer should be sought to confirm any other additional cabling/ installation requirements.

Details on the access control system shall be available from the CQU Project Director.

6.17 Joiners, Media Converters etc.

The use of joiners, media converters, repeaters, hubs, splitters and other similar devices is strictly prohibited.

6.18 Rack Layout

Patch panels shall be installed as per the below layouts. When designing the overall rack layout, the number of switch ports should be sufficient to allow patches of ALL data outlets on the floor the rack resides in.

An additional amount of spare capacity (extra, un-patched switch ports) should also be included within the network design. Generally, this will be 15% additional switch capacity above the total data point count on the floor. A concession may be approved by the CQU University Information Technology Project Manager to reduce this percentage, if the total port count (including spare capacity) will require an additional switch to be installed just to maintain the percentage spare.

Connecting the patch panel and the switch, the patch leads will be 20, 25 or 30cm. Flood patching will achieve a result similar to the photograph figure 6.1.8.1. To achieve this result, a 24 port patch panel is located above and below each switch. The switch will have 48 ports. Short patch leads connect the ports above the switch to the top row of switch ports and connects the ports below the switch to the bottom row of switch ports.

Figure 6.1.8.1 – Example Patching of rack
See below Figures (6.18.2, 6.18.3 and 6.1.8.4) for a typical cabinet layout. Exact layout to be provided by CQUiversity Information Technology Project Manager. Explicit layout for single building sites must be sought from CQUi.
Figure 6.18.2 – Cabinet Layout – single rack room.
Figure 6.18.3 – Cabinet Layout – main communications room – large building

Figure 6.18.3 – Example Cabinet Layout – server room – full site
7 Communication Room

7.1 Overview

CQU has specific design requirements and methodologies that shall be adhered to for all new and refurbished Communications Rooms and associated spaces across all campuses of CQU.

This document provides minimum standards for a general communications room without servers. A larger communications room will be required to cater for servers and other equipment at a standalone site. Room and Rack Layouts will need to be approved by CQU before construction. This document was drafted with reference to AS2834 Computer accommodation, 1995. CQU standards are supplemental to Australian Standards and manufacture requirements or methodologies. Where CQU have not made comment then the design and methodologies of the associated Australian Standards or products manufacture methodologies apply.

A communications room consolidates all connectivity from the enterprise network and building control systems and distributes it to pre-determined areas of the enterprise. It is the “horizontal” convergence point between the building’s network backbone, workstations and conference rooms. Each building is to have a designated ‘Main Communications’ room on the ground floor level.

Communication Rooms shall be centrally located and adjacent to risers within the building to ensure maximum cables lengths of 90 metres are not exceeded at the furthest point. If the building is multi-level each floor shall have a Communication Room, and Communication Rooms shall be vertically aligned and connected with propriety cable trays.

Communications Rooms contain critical equipment and require clean, dry, environmentally controlled and secure rooms. Shared accommodation with plant rooms, lift motor rooms, air handling rooms, cleaner’s rooms or similar shall not be considered. Communications rooms must be directly accessible via a corridor and not located inside store rooms or other spaces.

All Communication Rooms should not contain, or have passing through them, other building services e.g. electrical services, water, sewer etc. to exclude the possibility of accidental damage and to prevent the need for trade access.

Access will be restricted to authorised CQU Information technology personnel only.

7.2 Minimum Dimensions

Adequate floor area is essential for Communications Rooms; the minimum required dimensions are 3 metres by 4 metres to achieve a 12 square metre room. Other dimensions will be considered by the IT Project Manager in order to achieve the required 12 square metres if they do not compromise accessibility to the equipment for installation and maintenance.

Each communication room shall conform to the minimum requirements as specified in AS/CA 5009. Passive Cabinets shall provide minimum of 900mm clearance at the front and rear, with an additional 100mm added to this figure if active components are present within the cabinet.

Sample layouts for rooms that contain 1, 2 or 3 racks are below. The designated “main” communications room for a building will contain a minimum of 2 racks. Other rooms will contain as many racks as are required for the patch panels with at least 6RU free for spare.
Figure 7.2.1 - Communications Room Layout (1 Rack)
Figure 7.2.2 - Communications Room Layout (2 Racks)
Figure 7.2.3 - Communications Room Layout (3 Racks)
7.3 Doors
All communications rooms are to be provided with a door that has as a minimum clear opening of 900 mm and opens outwards. All communication rooms doors are to have, as a minimum, 2 metres clearance in front to ensure adequate clearance for the manoeuvring of communication racks.

7.4 Door Locks
If an electronic swipe card or proximity card security system is installed on the site, card access must be installed on all Communication room doors. A unique By-Lock cylinder override shall also be fitted in line with CQUUniversity By-Lock profile. Each site has a specific key for Communication Rooms which must be used. On a new site, a specific lock shall be provided for all Communication Rooms. The IT Project Manager shall be supplied with Keys for this lock on final commissioning.

7.5 Ceilings
All Communication Rooms are to be provided with a demountable ceiling (removable tiles) at a height generally of the surrounding rooms or at 2.8m. No continuous plaster board sheeting is to be used.

7.6 Flooring and Walls
All Communication Rooms shall have a flat level floor; uneven and sloping surfaces will not be accepted; this is essential for a safe working environment. All Communication Rooms shall be provided with anti-static vinyl floor covering. Concrete floors that are level polished and sealed are also acceptable. Carpet is not to be used due to static build up which can damage the equipment.

All communication room walls shall be painted / polished sealed.

7.7 Cooling - Ventilation
The CR room shall be fed by a dedicated HVAC system that is design to provide the correct operational environment for all active equipment to be installed. To allow a safety margin of cooling it should be designed to accommodate the requirements of flood wiring with all ports active. As a minimum, there must be a single AC unit rated to a minimum of 750W output of cooling per cabinet.

Each HVAC unit shall be fed from via a separate mains cable to the circuit board. Each HVAC unit within the same data room must not share the same circuit breaker with any other HVAC unit. Consideration must be taken for future power requirements of any new equipment.

The HVAC shall be provided and operational on a 24hr 365 days a year basis.

The temperature and humidity shall be controlled to provide continuous operating ranges of 18° C (64° F) to 23° C (73° F) with 45% to 55% relative humidity. Humidification and dehumidification equipment may be required, depending upon local environmental conditions.

Location of the HVAC inlets (head units) should not obstruct or be located directly above the IT equipment racks.

Airflow from HVAC should be from the front to the back of rack and not from the side.

7.8 Fire Services
All Communication Rooms shall be fitted with fire and smoke detectors but must not be fitted with sprinklers unless required by BCA for fire regulations. One fire extinguisher of the “High Voltage” foam type shall be supplied per room. Dry chemical or CO₂ extinguishers are NOT to be supplied.

7.9 Power

7.9.1 Rack Power

The power requirements for each cabinet must be calculated from the maximum amount of equipment that can be fitted. In standard Communications Rooms where there is no UPS, a single 20A captive socket shall
provide a feed to each active cabinet and their rating shall be based on the calculated power rating for each cabinet.

The captive sockets shall be ceiling mounted and hung by chains within close proximity to top of the racks.

The power should be fed from a local distribution board, which in turn is fed from the main distribution board. Each outlet shall be labelled with Distribution Board and Circuit number using a plastic label with black lettering on a white background.

7.9.2 UPS power distribution

In server rooms and standard communications rooms where a UPS is installed, an additional captive socket shall be installed above each rack to connect to the UPS. The UPS must also have its own captive socket to connect to mains power. It will be on a separate circuit. The rating on this circuit will depend on the size of the UPS.

7.9.3 PDUs in Racks

PDUs must be APC brand PDUs with built in network management. There shall be one PDU for each captive socket. In racks without a UPS feed that is one PDU per rack. In racks with a UPS feed, there shall be two PDU per rack. PDU model to be used is APC 8858 EU3 with power cable suitable to connect to the captive socket as specified in 7.9.

7.9.4 Other GPOs in room

At least 1 double GPO should be provided on the wall.

7.10 Uninterruptible Power Supply (UPS)

The communications rooms shall be fitted with surge protection. Where the main communications room is the main communications room for the site or will house servers, it shall also have a managed UPS with a minimum one-hour rating for that rooms expected load. When a UPS is installed in the cabinet, the surge filter protection device will be fitted between the captive outlet and the UPS and the UPS will then connect to the cabinet’s PDU(s);

Each UPS shall be fitted with a network management card.

7.11 Environmental Monitoring

Where a main communications room contains servers, the PDUs shall include environmental monitoring that is compatible with APC’s StruxureWare.

7.12 Internal Cable Tray

Either an overhead ceiling mounted tray/basket, or under-floor mounted basket solution may be used to carry cables within the CRs, depending on the overall building construction.

There shall be separate trays for power and telecommunication services. Where the trays cross, they must be bridged and cross with 900mm separation. Horizontal, building backbone cables must be dressed to enter either the top or the bottom of the designated structured wiring cabinets.

Cable entries and exits shall be via a system that ensures the bend radius of all cables is maintained (e.g. waterfall or similar).

7.13 Ceiling Void

Planning of overhead cable trays must be co-ordinated between all parties involved in the planning, design and implementation of the building works.

Lighting must not be impeded by tray work


7.14 Fire Stopping

Any doors into CR’s that require venting must have vented grills with inbuilt intumescent fire stopping materials.

Any cabling or associated pathway associated with telecommunications services penetrating fire related elements of the building shall be fire stopped to comply with the BCA and Australian Standards.

7.15 Communication Rack / Cabinet

The tenderer shall use 19” wide, 42 RU high cabinets for cable termination panels and for all equipment mounting. Lockable cabinets with mesh doors, front and rear, must be used. The racks must be charcoal grey in colour. All frames, racks and cabinets shall be mechanically fixed to the floor to prevent movement to themselves and the cables. Doors shall be mesh not glass.

Side/Vertical cable management on the 19” racks shall be by suitable rubber access entry/exit containers complete with bend radius protection to comply with ISO/IEC 11801:2002 Table 25 to ensure mechanical protection and performance is maintained.

Acceptable models are

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>APC Netshelter SX42U AR3140 Rack</td>
<td>42U x Width 750mm x Depth 1070mm - Integrated High Density Cable Management</td>
</tr>
<tr>
<td>MFB S2005 42RU Rack</td>
<td>Height 1886mm x Width 800mm x Depth 1000mm - Vertical cable management duct</td>
</tr>
</tbody>
</table>

Horizontal cable and patch cord management between patch panels or equipment on the 19” racks shall be 1 RU cable managers spaced every 2 patch panels as a minimum.

Non Standard Rack Sizes

Where the structured cabling system at the site in question has less than 24 outlets, a smaller sized cabinet may be considered. The smaller sized cabinet shall be no smaller than 18 RU high – 800mm x 800mm. Smaller sized cabinets shall be floor mounted, dependent on the mounting structural integrity. Approval to use, and exact mounting specifications, will be provided by CQUniversity Information Technology Project Manager.

7.16 Cleaning

The Contractor, once all work and installation in any CR Room is completed, shall clean all dust, dirt, debris and other foreign material that is either on the cabinet, patch panels, cable or floor. When Final handover of the CR Room is undertaken and the completion of work, an inspection shall take place to ensure that the room is found clean and in an “as new” condition.

8 Testing

8.1 General

Testing of all installed services shall conform to the cabling manufacturer’s Installation Specifications and all local regulations. Where there is conflict between any of these requirements, the more stringent shall be utilised.
8.2 Copper – Category 6A F/UTP System Performance

Channel performance is the preferred acceptance criteria for all installations if possible. All permanent links are to be installed and all end user patch cords, equipment cords and work area cords are to be in place, and left in the position where they were tested.

Where this is not practical, the Permanent Link performance will be the acceptance criteria for the installation. A certain percentage of the outlets may be chosen at random for the final acceptance testing by the end user or in his absence, by the manufacturer. The design data and the full results of all acceptance tests performed by the installer are to be fully documented and submitted to the end-user to hold for the period of the warranty.

The results must include 100% of total installation and provide full electronic data files for each cable run indicating the name of the person doing the testing, date, building, cable identification, cable length, insertion loss, NEXT, PSNEXT, ACR, PSACR, propagation delay, delay skew, ELFEXT, PSELFEXT, and Return Loss.

All copper cabling shall be tested in accordance with AS/NZS IEC 61935.1. Summary files in electronic format are not acceptable. All test results must be provided in native format.

8.2.1 Channel Performance

Channels shall meet the minimum requirements of;
- AS/NZS 3080 for Class E₄ (using Cat6A F/UTP components), or
- ISO/IEC 11801 Ed 2 for Class E₄ (using Cat6A F/UTP components).

8.2.2 Permanent Link Performance

Permanent Links shall meet the minimum requirements of;
- AS/NZS 3080 for Class E₄ (using Cat6A F/UTP components), or
- ISO/IEC 11801 Ed 2 for Class E₄ (using Cat6A F/UTP components).

8.3 Fibre Optic – System Performance

Channel performance shall not be accepted criteria for any fibre optic installations. All permanent links are to be installed and tested at the completion of the installation.

8.3.1 OS2 Links

100% of the single-mode optical fibre links must be tested for attenuation (power loss);
1. In both directions, and
2. At both frequencies, SMOF (1310 nm & 1550nm),

Conduct the tests in accordance with the manufacturers OF Testing Guidelines (e.g. use mode of stripping) and ISO/IEC 14763-3 using, as a minimum, LSPM and OTDR equipment if links are longer than 300 metres. If conflict exists, correct testing with LSPM shall be taken as correct.

Ensure Reference Grade leads have been used and qualification of these has been saved as part of fibre optic test results.

Summary files in electronic format are not acceptable. All test results must be provided in native format.

8.4 Customer Acceptance

At the conclusion of the installation, a preliminary walkthrough with the CQUi representative and installation contractor will be performed to check for installation quality, accurate performance of the work, and to verify engineering diagrams. Builder / Tenderer to notify CQUi when the walk through is ready and verify with CQUi in writing.

Any modifications to the documentation or the installation that may be required shall be accomplished within a 2-week period. "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. Please note that "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.

The cabling contractor shall warrant all cabling installation works for a period of no less than 12 months.

## 9 Documentation

### 9.1 Overview

The contractor shall provide complete documentation covering the installation and maintenance of the Structured Cabling System. Including “as built” drawings, showing all main cable runs, cable trays and catenaries, consolidation points, multi-use terminal outlets and telecommunications outlets: complete with outlet numbering.

#### 9.1.1 Quantity

The Tenderer shall provide three complete sets of documentation. As built drawings shall be provided within 14 days of completion of the project to the project manager and/or the client showing all main cable runs, locations, identifications and destinations.

#### 9.1.2 Printing and Binding of Documentation

The Tenderer shall provide all documentation in suitably labelled, A4 sized binders. All binding shall be of a high quality to provide for a long and durable service.

#### 9.1.3 Document and Drawing Sizes

All documentation shall be typed on either single or double-sided A4 pages. Drawings shall, where practicable, be on A3 sized paper. Electronic versions of drawings shall be supplied to CQUni as an AutoCAD drawing.

#### 9.1.4 Contents

The Installation/Systems manual shall cover the following areas:

a) A detailed overview of the building cabling system  
b) Full description of the specific installation  
c) Full schematics showing the overall layout of the installation  
d) Floor layout drawings showing the location and designation of each outlet, location of cable trays and ducts and location of all connection frames.

### 9.2 Warranty

The contractor shall provide a CommScope 15-year passive product warranty from the date of successful commissioning and, backed up by the Manufacturer’s Category 6A Certification, will form part of the Warranty.

The Manufacturer’s Warranty Registration form and test results shall be submitted for approval. This shall be appraised and approved after the manufacturer has carried out their site audit(s).

The warranty documentation shall be contained within the Maintenance Manuals. Included in this documentation shall be the Manufacturer 15-year Warranty Certificate.

If required, Calibration certificates for the test equipment used to test the site shall be forwarded to CQUni.

## 10 Standards

### 10.1 Standards

All stated standards must be adhered to, but not limited to, where applicable. In the case of conflict between standards the most onerous standard must be adhered to for the individual section under discussion.
### 10.1.1 Australian Standards

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS/CA S008</td>
<td>Requirements for Customer Cabling Products</td>
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<tr>
<td>AS/CA S009</td>
<td>Installation Requirements for Customer Cabling (Wiring Rules)</td>
</tr>
<tr>
<td>AS/NZS 3000</td>
<td>SAA Electrical Wiring Rules</td>
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<tr>
<td>AS/NZS 3080</td>
<td>Telecommunications Installations – Generic Cabling for Commercial Buildings</td>
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<td>AS/NZS 3084</td>
<td>Telecommunications Installations – Telecommunications Pathways and Spaces for Commercial Buildings</td>
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<td>AS/NZS 3085.1</td>
<td>Telecommunications Installations – Administration of Communications Cabling Systems – Basic Requirements</td>
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<td>AS/NZS 3087</td>
<td>Telecommunications Installations – Testing of Balance Communications Cabling</td>
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<td>AS/NZS 4117</td>
<td>Surge Protective Devices for Telecommunications Cabling</td>
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<tr>
<td>AS/NZS IEC 61935.1</td>
<td>Testing of Balanced Pair Cabling – Site Certification</td>
</tr>
</tbody>
</table>

### 10.1.2 ISO/IEC

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO/IEC 11801:2002</td>
<td>Information Technology – Generic Cabling for Customer Premises. (Inc Amd. 2.2)</td>
</tr>
</tbody>
</table>
11 Appendix A - Definition of Terms

11.1 Overview
To provide detailed information regarding the definitions of terms that is pertinent to this standard.

11.2 Definition of Terms

11.2.1 Building
A roofed structure enclosed by walls on all sides, used for the express purpose of housing telecommunications related equipment for the transmission and reception of data, voice, video etc, signals and any related processing of the signal content.

11.2.2 Backbone Cable
A cable that connects any combination of carrier and network devices for the transmission of multiplexed signals.

11.2.3 Channel
ISO/IEC 11801 defines a channel as “The end to end transmission path connecting any two pieces of application specific equipment. Equipment and work area cords are included in the channel, but not the connecting hardware into the application specific equipment.”

11.2.4 Communications Room (CR)
A room within the building that houses all the core telecommunications transmission and processing equipment.

11.2.5 Consolidation Point
ISO/IEC 11801 defines a consolidation point as “A connection point in the horizontal cabling subsystem between a floor distributor and a telecommunication outlet.”

11.2.6 CP Cable
ISO/IEC 11801 defines a CP cable as “A cable connecting the consolidation point to the telecommunications outlet(s).”

11.2.7 CP Link
ISO/IEC 11801 defines a CP link as “The part of the permanent link between the floor distributor and the consolidation point, including the connecting hardware at each end.”

11.2.8 Cross Connect
ISO/IEC 11801 defines a cross connect as “An apparatus enabling the termination of cable elements and their cross-connection, primarily by means of patch cords or jumpers. Incoming and outgoing cables are terminated at fixed points.”

11.2.9 Data Room
Generic term used to describe entrance, equipment and main communication rooms.

11.2.10 Entrance Room
A room within the building that caters for the entry of cables into the building.

11.2.11 Floor Distributor (TR)
A room within the building that houses all cabling termination frames and PABX equipment. The Floor Distributor shall not contain communications equipment such as CATV, Public Address, and Security or Fire Alarm systems. An CR may also be referred to as the ‘Local Communication Cabinet’ or ‘Communications Room (CR)’.
11.2.12 HighBand
A KRONE horizontal cable distribution frame.

11.2.13 Pit
A box, joint box, manhole or cable chamber.

11.2.14 Pit Cover
A covering lid used to seal a pit.

11.2.15 Solution
An end to end network of active and interconnecting passive devices that are required to transmit and process a stream(s) of client or application specific data.

11.2.16 Telecommunications
A branch of technology concerned with the transmission, emission and reception of signals, that is, information of any nature by cable, radio, optical or other electromagnetic systems. Telecommunications covers all forms of information whether voice, video, data etc.

11.3 Abbreviations

<table>
<thead>
<tr>
<th>a.c.</th>
<th>Alternating current</th>
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<tbody>
<tr>
<td>BD</td>
<td>Building distributor</td>
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<tr>
<td>CR</td>
<td>Communication Room</td>
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<tr>
<td>CP</td>
<td>Consolidation point</td>
</tr>
<tr>
<td>d.c.</td>
<td>Direct current</td>
</tr>
<tr>
<td>ER</td>
<td>Equipment room</td>
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<tr>
<td>FD</td>
<td>Floor distributor</td>
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<tr>
<td>ISO</td>
<td>International Standards Organisation</td>
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<tr>
<td>LAN</td>
<td>Local area network</td>
</tr>
<tr>
<td>TE</td>
<td>Terminal equipment</td>
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<tr>
<td>TO</td>
<td>Telecommunications outlet</td>
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<tr>
<td>POE</td>
<td>Power over Ethernet</td>
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