



University of Otago

Building Technologies – Standards Suite

CHAPTER 7: AUDIO VISUAL (AV) CABLING STANDARD

DOCUMENT CONTROL

1) Document Identification

File Name	UoO_BTSS_CHAPTER 7 AUDIO VISUAL (AV) STANDARD
Version	VERSION 0.1
Document Owner	IT INFRASTRUCTURE TEAM

2) Preparation

Action	Name	Role / Function	Date
Prepared by:	Riaan Brits	Torque IP	2021-Sep-15
Reviewed by:		Torque IP	

3) Release

	Date Released	Change Notice	Remarks
0.1	15 September 2021	Document creation	For Review

4) Contribution (C) and Distribution (D) List

Name	C/D	Organisation	Title
Ryan Göllner	C	University of Otago	Team Leader
Ryan Walker	C	University of Otago	
Adrian Woodman	C	University of Otago	
Wallace Chase	D	University of Otago	
Rebecca Ottley	D	University of Otago	
Andrew Wardell	D	University of Otago	
Adrian Woodman	D	University of Otago	
Glynn Babington	D	University of Otago	
Brendon Walters	D	University of Otago	

BUILDING TECHNOLOGIES STANDARDS SUITE INDEX

This document is only one chapter of the University of Otago Building Technologies Standards Suite.

The Building Technologies Standards Suite consists of the following chapters (chapter highlighted refers this document):

Chapter 1	Introduction
Chapter 2	Cabling Infrastructure Pathways Standard
Chapter 3	IT Infrastructure – Generic Cabling Systems Standard
Chapter 4	IT Infrastructure – Passive Optical LAN Cabling Standard
Chapter 5	Electronic Safety and Security (ESS) Systems Standard
Chapter 6	Closed Circuit Television (CCTV) System Standard
Chapter 7	Audio Visual (AV) Cabling Standard

CONTENTS

1.	DOCUMENT PURPOSE	8
1.1.	Document sponsor	8
1.2.	Outcome statement.....	9
2.	USING THIS DOCUMENT	10
3.	REFERENCED DOCUMENTS	11
3.1.	New Zealand Standards	11
3.2.	Joint Australian/New Zealand Standards	11
3.3.	Australian Standards	12
3.4.	International Standards	12
3.5.	Other Publications	13
3.6.	Websites	13
3.7.	Latest Revisions.....	13
4.	DEFINITIONS AND ABBREVIATIONS	14
4.1.	Definitions	14
4.2.	Abbreviations	15
5.	GENERAL CONDITIONS	17
6.	PATHWAYS AND SPACES	18
7.	AV SYSTEM TYPES.....	19
8.	DESIGN CONSIDERATIONS.....	20
8.1.	Project programme.....	20
8.2.	AV Equipment provision	21
8.3.	Commissioning requirements.....	21
8.4.	Design by others	21
8.4.1.	Speaker placement	22

8.4.2.	Rack power and PDUs.....	22
9.	AV CABLING - OVERVIEW	23
9.1.	General.....	23
9.2.	Diagrammatic layouts	23
9.3.	Inspection.....	23
9.4.	AV cabling Infrastructure background.....	23
9.5.	Content distribution	24
9.6.	Associated Works by others	24
9.7.	Architectural	24
9.7.1.	Joinery Furniture.....	24
9.7.2.	Table Boxes	25
9.8.	Building services interfacing.....	25
10.	AV CABLING - INSTALLATION REQUIREMENTS	26
10.1.	Contractor Qualifications.....	26
10.2.	Precautions during Installation of Cables.....	26
10.3.	AV cabling shall NOT be:	26
10.4.	General AV cabling installation requirements	27
10.4.1.	AV Cables and terminations	27
10.5.	Separation from other services	28
10.6.	AV Outlets	28
10.6.1.	Table boxes	29
10.6.2.	Floor boxes.....	29
10.6.3.	Joinery.....	29
10.7.	Ceiling Cavities	30
10.8.	Generic Cabling.....	30
11.	AV RACKS	31
11.1.	Rack Sizing.....	31
11.2.	Rack Installation	31
11.2.1.	Floor Mounted Enclosed AV Racks.....	31
11.2.2.	Wall Mount AV Racks	32
11.2.3.	Joinery AV racks.....	33
11.3.	Cabinet Cable Entry	33
11.4.	Cable management.....	33
11.5.	Optical fibre patch panels.....	34

11.6.	Power Distribution Units	34
12.	ELECTRICAL.....	35
12.1.	Electrical installation.....	35
12.2.	Electrical segregation.....	35
12.3.	Rack Power.....	35
12.3.1.	Free Standing Rack requirements	35
12.3.2.	Wall Mounted Rack requirements	35
12.3.3.	Joinery AV Racks	35
12.4.	AV Equipment power.....	36
12.5.	Lighting requirements in AV spaces	36
12.5.1.	Placement	36
12.5.2.	Control	36
13.	EARTHING	37
14.	LABELLING	38
14.1.	AV Racks	38
14.2.	Patch Panels.....	38
14.3.	Cables.....	38
14.4.	Outlets.....	38
14.5.	Pathways	39
14.6.	Earth Points.....	39
15.	INSPECTION, TESTING AND CERTIFICATION.....	40
15.1.	Client inspections.....	40
15.2.	Manufacturer inspections	40
15.3.	Photo & Video Library.....	40
15.4.	Testing.....	40
15.4.1.	Twisted pair cabling.....	41
15.4.2.	Generic Cabling testing.....	41
16.	DOCUMENTATION	42
16.1.	General requirements	42
16.2.	Shop drawings.....	42
16.3.	Operation and Maintenance manual (O&M)	43

A	APPENDIX A – UOO WIRING STANDARDS EXAMPLES	45
A.1	Cable dressing & wire ends	45
A.2	Terminal termination.....	46
A.3	Cable ties installation.....	46
A.4	Cable shield covering	47
A.5	Cable looming	47
A.6	8P8C (RJ45) termination	47
B	APPENDIX B - WORK PRACTICES	48
B.1	General safe work practices and responsibilities.....	48
B.2	Work areas	48
C	AV PROVISION PROCESS CHECK-LIST	49

1. DOCUMENT PURPOSE

The University of Otago's AV Team is responsible for designing the AV systems to be installed on campus.

The purpose of this document is to:

- Make new projects / refurbishment projects aware of AV design responsibility and to consult the UoO AV Team early whenever AV design is required for any project.
- Comprehensively define all standards to be followed when undertaking AV Cabling installation work for the University of Otago (UoO).
- Note specific requirements and order of procedures to provide a fully installed AV system.
- Define approval requirements for AV design work by 3rd parties.

REFER TO SECTION 7 FOR AV SYSTEM TYPES – SHOULD ANY OF THESE BE REQUIRED ON A PROJECT, IT IS CRUCIAL FOR THE UOO AV TEAM TO BE CONSULTED AT THE EARLY PLANNING STAGE OF THE PROJECT (DURING CONCEPT AND SPATIAL DESIGN).

The University's AV Cabling shall support current and future active AV equipment deployed by the University's AV Services Group. Campus wide standardisation is important in meeting the scalability and serviceability requirements of the AV systems.

This document will be periodically updated, with copies and details of changes being issued to the holders of the document as listed in the document control register.

This document provides guidance on minimum technical standards in the following areas:

- a) Technical requirements for cabling systems
- b) Installation and testing
- c) Labelling, administration and documentation

1.1. Document sponsor

This document has been developed and is controlled by the University of Otago.

The contractor or designer shall adhere to the latest published edition of all standards and technical documents for all responses and construction work. Should a conflict exist between the standards or any scope of work, the contractor shall notify the Project Manager and University of Otago AV team of any conflict and seek clarification prior to continuation.

All queries, errors, omissions or suggestions related to this document are to be directed to:

The Head of the AV Team

University of Otago
LG01, Otago Business School
60 Clyde Street Ōtepoti
Dunedin
Email: ryan.gollner@otago.ac.nz

1.2. Outcome statement

By using this document and relative standards, contractors will meet the University of Otago's standards for the safety, installation and support of AV cabling systems and AV technology that the University manages and operates.

2. USING THIS DOCUMENT

This document is **CHAPTER 7: AV CABLING STANDARD** and forms part of a suite of documents under the University of Otago building technology standards.

This document shall be read in conjunction with the following chapters of the Building Technologies – Standards Suite:

- CHAPTER 1: INTRODUCTION TO BUILDING TECHNOLOGY STANDARDS
- CHAPTER 2: CABLING INFRASTRUCTURE PATHWAYS
- CHAPTER 3: IT INFRASTRUCTURE – GENERIC CABLING SYSTEMS STANDARD

3. REFERENCED DOCUMENTS

Reference is made in this document to the following:

3.1. New Zealand Standards

Standard number	Standard Description
NZS 3604	Timber framed buildings
NZS 4121	Design for Access and Mobility – Buildings and Associated Facilities
NZS 4219	Seismic performance of engineering systems
NZS 6801	Acoustics - Measurement of environmental sound
NZS 6802	Acoustics - Environmental noise

3.2. Joint Australian/New Zealand Standards

Standard number	Standard Description
AS/NZS 1367	Coaxial cable and optical fibre systems or the RF distribution of analogue and digital television and sound signals in single and multiple dwelling installations
AS/NZS 1680	Interior and workplace lighting
AS/NZS 2107	Acoustics – Recommended design sound levels and reverberation times for building interiors
AS/NZS 2967	Optical fibre communication cabling systems safety
AS/NZS 3000	Australian/New Zealand Wiring Rules. The cited version of AS/NZS 3000 as per the Electrical (Safety) Regulations 2010.
AS/NZS 4296	Cabling trunking systems
AS/NZS 61000.6.3	Electromagnetic compatibility (EMC) - Part 6.3: Generic standards - Emission standard for residential, commercial and light-industrial environments
AS/NZS ISO 717.1	Acoustics – Rating of sound insulation in buildings and of building elements-airborne sound insulation

3.3. Australian Standards

Standard number	Standard Description
AS ISO 140.4	Acoustics – Measurement of sound insulation in buildings and of building elements - Field measurements of airborne sound insulation between rooms

3.4. International Standards

Standard number	Standard Description
ANSI/InfoComm 10	Audiovisual Systems Performance Verification
ANSI-J-STD-710	Audio Video and Control Architectural Drawing Symbols Standard
AVIXA A102.01	Audio coverage uniformity in listener areas
AVIXA D401.01 (Previously ANSI/InfoComm 2M)	Standard Guide for Audiovisual Systems Design and Coordination Processes
AVIXA F501.01	Cable labelling for Audiovisual systems
AVIXA F502.01	Rack building for AV systems
AVIXA F502.02	Rack Design for Audiovisual (AV) Systems Standard
AVIXA S601.01 (Previously ANSI/InfoComm 4)	Energy Management for Audiovisual systems
AVIXA V201.01 (Previously ANSI/InfoComm 3M)	Image system contrast ratio
AVIXA V202.01	Display image size for 2D content in Audiovisual systems
IEC 61935.1	Specification for the testing of balanced and coaxial information technology cabling – Part 1: Installed balanced cabling as specified in ISO/IEC 11801 and related standards

3.5. Other Publications

Standard number	Standard Description
AETM	Audio Visual Design Guidelines – Tertiary Teaching Spaces
AVIXA RP-38-17	Recommended practices for lighting performance for small to medium VC Rooms
AVIXA RP-C303.01	Recommended practices for security in networked AV systems
New Zealand Building Code	Compliance document for New Zealand Building Code – Clause C Protection from Fire (including amendments 2 and 3) Compliance document for New Zealand Building Code – Clause E2 External Moisture (including all amendments) Compliance document for New Zealand Building Code – Clause G9 Electricity (including amendment 6)
Otago University Campus Passive Fire Guide	Volume 1 – General Volume 2 – Product Selection Volume 3 – Basic Solutions
Otago University Acoustic Guidelines for Higher Education	

3.6. Websites

<http://www.legislation.govt.nz/>
<http://www.otago.ac.nz>
<http://www.telepermit.co.nz/PtcSpecs.html>

3.7. Latest Revisions

The users of this document shall ensure that their copies of the above -mentioned New Zealand Standards and the New Zealand Building Code are the latest revisions. Amendments to referenced New Zealand and Joint Australian/New Zealand Standards can be found on <http://www.standards.co.nz>.

4. DEFINITIONS AND ABBREVIATIONS

For the purposes of this document the following definitions and abbreviations shall apply.

4.1. Definitions

Term	Definition
Application Specific Cabling	System manufacturers design
As-built	Final set of drawings produced at the completion of a construction project, including all changes made to the original construction drawings
Builder works completion	All work to be completed prior to occupation of end user(s), and all subsequent standards to be met
Category 6A (Cat 6A)	A definition of cabling components which provide a permanent link that, when tested, meet AS 11801.1 Class EA performance
Contractor	Where the term "Contractor" is used within this document it shall be interpreted as the "Audio Visual Contractor".
Designer	A person who plans the look, or workings, or both, of something prior to it being made, by preparing drawings or plans
Generic cabling system	Structured telecommunications cabling system, capable of supporting a wide range of standardised applications. Standards based design
Installer	A person that places or fixes equipment or machinery in position ready for use. The party(s) responsible for the supply, installation, testing and warranty of cabling systems
Integrator	A person that places or fixes active IT equipment e.g. network switching, Wireless Access Points, servers, desktop computers etc. in position and configures, programs them ready for use. The party(s) responsible for the supply, installation, testing and warranty of active equipment systems
Manufacturer	A person or company that makes cabling goods for sale

Term	Definition
Suitably qualified person	A person with the professional qualifications and experience in the Audio Visual industry to undertake the design and supervision of the works

4.2. Abbreviations

Abbreviation	Definition
8P8C	8pin 8-connector
AV	Audio Visual
DC	Direct Current
DVI-D	Digital Visual Interface - Digital
EASE	Enhanced Acoustic Simulator for Engineers
EDID	Extended Display Identification Data
GCS	Generic Cabling System
HDMI	High Definition Multi-media Interface
HVAC	Heating Ventilation and Air Conditioning
IP	Internet Protocol
IT	Information Technology
LAN	Local Area Network
LC	Lucent Connector
mm	millimetre
MACs	Moves, Adds and Changes
NZ	New Zealand
O&M	Operating and Maintenance
OSH	Operational Safety & Health
OFCS	Optical Fibre Communications Systems

Abbreviation	Definition
ohm	Cable Resistance
PC	Personal Computer
PDU	Power Distribution Unit
RCA	Radio Corporation of America
RU	Rack Unit
TP	Twisted Pair
UoO	University of Otago
USB	Universal Serial Bus
UV	Ultra Violet
v	Volt
VGA	Video Graphics Array

5. GENERAL CONDITIONS

The contractor shall refer to the **UoO BTSS CHAPTER 1: INTRODUCTION TO BUILDING TECHNOLOGY STANDARDS** for all general conditions required by the University when installing AV Cabling infrastructure and systems.

6. PATHWAYS AND SPACES

The contractor shall refer to the **UoO BTSS CHAPTER 2: CABLING INFRASTRUCTURE PATHWAYS** for all general conditions required by the University when installing any cabling under this standard.

7. AV SYSTEM TYPES

The following are typical AV System Types that are present on the University of Otago's campus.

Type	Enclosed Volume	Description	Primary application
Type 1	$\pm 85\text{m}^3$	Small meeting, or huddle rooms	Small group meetings, and audio or video conferencing
Type 2	$\pm 85\text{m}^3$ to $\pm 425\text{m}^3$	Large conference rooms	Large group meetings, and audio or video conferencing
Type 3	$\pm 425\text{m}^3$ to $\pm 1415\text{m}^3$	Lecture hall or small entertainment venue	Large classroom, with audio or video conferencing, and/or a live multi-purpose / entertainment venue
Type 4	$\pm 1415\text{m}^3$ to $\pm 3540\text{m}^3$	Large lecture halls, gymnasias, or multi-purpose venues	Large classrooms, and medium size entertainment and/or sporting venues
Type 5	Greater than 3540m^3	Performing arts centers, concert halls, or large, indoor sporting venues	Live, amplified music concerts; live theatrical productions and indoor sporting events.

8. DESIGN CONSIDERATIONS

A complete AV system installation will **typically** be designed, procured and installed by multiple parties as follows:

AV System provision phase	Responsible party
AV System design (including defining system components, connection details, schematics, layout drawings, cable schedules and specification)	UoO AV Team
AV infrastructure cabling (in-wall/in-ceiling cabling – as per UoO's design)	AV Contractor
AV equipment installation (including final patch lead installation & system programming)	UoO AV Team and/or AV Contractor
Testing	UoO AV Team and AV Contractor
Commissioning	UoO AV Team and AV Contractor
Training	UoO AV Team

8.1. Project programme

It is crucial for the UoO AV Team to be included in the design and construction programmes due to their involvement as per above.

The following key set points in the programme will be critical to ensure a timely outcome:

- a) UoO AV Team involvement & endorsement is required in each of the following stages:
 - i) Concept
 - ii) Preliminary
 - iii) Developed
 - iv) Detailed
 - v) Installation
 - vi) Commissioning / Handover

- b) The areas of concern that UoO AV Team will require approval and input on is:
- i) Budget (to be based on pedagogical needs)
 - ii) Power: outlet location(s), type, general needs
 - iii) Data: bandwidth, outlet location(s), numbers, PoE requirements
 - iv) AV Specific Generic Cabling
 - v) Acoustics (Architectural and Surface)
 - vi) Spatial requirements:
 - In-Room tech
 - Rack Space and requirements
 - vii) FF&E: teaching-related furniture
 - viii) Lighting & Blinds: location, control integration

8.2. AV Equipment provision

Before the UoO AV Team can install any equipment into a room, the following conditions will have to be met by the builder, and endorsed by UoO AV Team:

- a) Construction must be at handover stage
- b) Builder works must be complete, clean, and safe
- c) The room must be able to be secured and fully functional

8.3. Commissioning requirements

Before an AV System can be commissioned, the following conditions will have to be met by the builder:

- a) Commissioning by UoO AV Team begins only after all conditions in 8.1b are approved
 - i) UoO AV Team commissioning timeline considered static, and tethered to the above
 - ii) Should above conditions not be met, compromises to UoO AV Team product delivery adjusted at team discretion, and only with mutual approval.

8.4. Design by others

Where a project requests AV design to be carried out by a 3rd party design consultant or the contractor, the design of, and proposals for, all work to be undertaken by the AV Contractor **shall be submitted for approval** by the UoO AV Team prior to procurement of equipment and commencement of installation works.

The Contractor's personnel undertaking the AV installation shall be trained by the manufacturer, or its representatives, in the installation of the AV system and components being installed. The Contractor shall be accredited by the manufacturer of the Audio Visual systems components and meet the manufacturer's requirements for the provision of the system performance guarantee or warranty.

8.4.1. Speaker placement

Speaker placement shall be determined through acoustic EASE modelling.

The AV designer/contractor shall provide drawings indicating speaker placements as per the acoustic modelling. The drawings shall indicate all other ceiling services proving coordination of placement:

- in accordance with the system manufacturer's recommendations and installation guidelines
- with other services in the ceiling

8.4.2. Rack power and PDUs

AV rack power supply and PDU requirements shall be submitted for approval by the UoO AV Team prior to final procurement and installation.

9. AV CABLING - OVERVIEW

9.1. General

The works covered by this standard, unless specifically excluded, comprises the manufacture, supply, delivery, storage, positioning, erection, fixing, connection, testing, commissioning and services during defect liability period of all AV cabling associated with the audio visual services installations, as per the specified designs done by the UoO AV Team.

Unless otherwise indicated, the Audio Visual (AV) Contractor shall be deemed to have included for all works necessary, a safe and fully functioning installation.

The AV Contractor shall take note and make due allowance for works associated with this project. The requirement for fully **co-ordinated** drawings is essential and no first fix works shall be undertaken without prior approval from the UoO AV Team.

9.2. Diagrammatic layouts

Generally, layouts on the drawings are indicative, except where dimensions are provided. Before commencing work inspect the site and obtain measurements and other necessary information.

9.3. Inspection

During the tender period and in the course of the works, the contractor shall become fully informed of the contract work by inspection of the site and/or by other means considered necessary. Ceiling/floor tiles will be removed for verification of ceiling/floor space available for installation of light fittings, cable trays etc. Unforeseen difficulties due to neglect of this precaution shall in no way relieve the responsibility for the full proper execution of the works. No claim for additional work arising from neglect of a thorough inspection will be approved.

9.4. AV cabling Infrastructure background

The Audio Visual (AV) cabling system plays a critical role in AV systems, providing the physical link between source and sink device and field devices. Audio, video, data and control signals are transmitted over this infrastructure linking devices within a room.

Cabling systems range in size from small and simple, linking just a couple of devices, to large and complex, linking several AV devices.

To facilitate the day-to-day operations, the cabling system shall enable the University to make additions, moves and changes, wherever and whenever necessary. Where required, a Generic Cabling System (GCS) shall be provided to achieve this, to be flexible and provide the capability to carry a wide variety of applications.

9.5. Content distribution

The AV system design shall be based on digital signal distribution (eg HDMI) and may be over Twisted Pair (TP) copper cabling or AV-over-IP, rather than analogue signals (eg VGA, Composite, Component) over coaxial and/or proprietary cabling, for extended cable lengths.

Twisted Pair will be used for extended audio and video signal cabling lengths to cater for future flexibility in upgrading the Audio Visual systems.

All AV systems will include Extended Display Identification Data (EDID) management and inbuilt video scaling to minimise incompatibilities between external sources such as laptops and the display devices. The UoO AV Team must be consulted on EDID specifics.

9.6. Associated Works by others

The contractor must provide all components and accessories required to provide completed cabling systems with the exception of items presented in the following list:

Item	Supplier / Installer
General power	Electrical contractor
Generic Cabling System (data outlets)	GCS contractor
Cable tray and in slab conduits	Electrical contractor
Floor boxes (excluding AV outlets and plates)	Electrical contractor
LAN interfacing	UoO IT
Joinery, lecterns, credenzas and desks	Architectural fitout contractor
Table box (excluding AV outlets and plates)	Architectural fitout contractor
Resident PCs and peripherals	UoO IT

The AV contractor is responsible for coordinating their works with all other contractors as set out above.

9.7. Architectural

9.7.1. Joinery Furniture

Typically all AV equipment will be installed either in

- Joinery units provided by the builder (under the architectural package)
- Cupboard or Under-bench mounted AV racks

- Comms cabinets

The joinery units will be provided with suitable pathways for ventilation.

9.7.2. Table Boxes

Table boxes will be provided as part of the architectural package.

9.8. Building services interfacing

The UoO AV Team endorsement shall be necessary in all AV spaces for the following building services:

- Room Lighting (e.g. type, placement, interfacing with AV systems, etc)
- HVAC (e.g. placement/location, noise)
- Blinds (e.g. type, interfacing with AV systems, etc)

10. AV CABLING - INSTALLATION REQUIREMENTS

10.1. Contractor Qualifications

Only contractors who have the following shall install AV cabling infrastructure:

- a) Staff trained and certified in the design and installation of the manufacturer's cabling system where applicable
- b) Staff who are qualified in the generic design, project management, installation and testing of endorsed equipment and cabling.
- c) The contracting company shall have been in business in NZ for at least a minimum of five (5) calendar years.

10.2. Precautions during Installation of Cables

- a) Precautions shall be observed to eliminate cable stress caused by tension in suspended cable runs and tightly strapped bundles.
- b) Care shall be taken not to damage cables by excessive pulling or bending of cables.
- c) Cable bundles shall not rub on or be unduly compressed against or by any cable tray, building or enclosure penetrations, equipment racking, or other cable support.
- d) Grommets or similar forms of protection shall be provided where cables traverse sharp edges.
- e) The weight of vertically installed cabling shall be adequately supported.
- f) Cables shall be securely fixed to cable trays and catenary wires using Velcro or manufacturer recommended cable ties only.
- g) Cables fixed to catenary wires or above-cable trays shall be supported at regular intervals.
- h) Cables that are supported by below-cable trays shall be tied at intervals not exceeding 1200mm.
- i) At no point shall the cabling rest on the false ceiling, light fittings, or any other services.
- j) Cables shall be neatly grouped together, based on their destination and bound at regular intervals.
- k) In areas where future access will be difficult to achieve, cabling shall be installed in conduit for future flexibility.
- l) Where cabling is run in cavity walls, surface mounted ducting and similar enclosures, cables shall be installed in areas free from protrusion of screws and similar fasteners.
- m) Care shall be taken to avoid tight twisting of the cable, tearing of the outer jacket, cutting or wearing through due to abrasion of the cable.

10.3. AV cabling shall NOT be:

- a) Anchored to the false ceiling supports (the calculated maximum loading of these supports does not consider the additional weight of cabling).

- b) Creased / kinked at any point (even temporarily when being drawn from the manufacturer's cable dispenser / container).
- c) Secured with nylon cable ties, pin clips, nails, screws or similar.

10.4. General AV cabling installation requirements

The contractor is responsible for providing and installing all required AV cabling, other than general network category cabling supplied and installed by the GCS contractor.

The colour of all exposed cabling and plugs (eg speaker cables or equipment cables) shall match room colours for each location (wall, ceiling, equipment and the like).

No installed cable shall be exposed to general view within AV rooms.

10.4.1. AV Cables and terminations

The following AV cabling specifications shall be complied with as a minimum, with all proposed designs subject to UoO AV Team approval:

Category	Type	Description
Audio cables	Line Level Audio	<ul style="list-style-type: none"> Connectors: Dual RCA/3.5mm stereo mini-jack (computer audio out) Outlets: Female. RCA left and right RCA outlets shall be coloured white and red respectively.
	Balanced Audio	<ul style="list-style-type: none"> Connectors: XLR Outlet: Female
	Speaker cable	<ul style="list-style-type: none"> Connectors: Screw terminals and lugs Individual cables shall be star wired from the audio visual cabinet to each speaker location. The cable shall be installed in line with manufacturer specifications ensuring that minimum cable bend radius is maintained.
Video cables	HDMI Video	<ul style="list-style-type: none"> Outlets: HDMI Type A Female Bandwidth: 48Gbps Specification: HDMI 2.1
Control cables	EIA RS-232	<ul style="list-style-type: none"> Connectors: D-sub 9-pin to RS-232C Outlets: Female
	Voltage-free contact	<ul style="list-style-type: none"> Connectors: Screw terminals and lugs
	Ethernet	<ul style="list-style-type: none"> As per Chapter 3: IT Infrastructure – Generic Cabling Systems Standard.

Category	Type	Description
Communications cables	USB data	<ul style="list-style-type: none"> Connectors: For computer provide USB type A male connectors (both ends). For Smartboards provide USB type A at one end, USB type to suit Smartboard connector at other end.
AV signals over Twisted Pair cable	AV	<ul style="list-style-type: none"> Twisted pair category style cabling shall be provided as recommended by the equipment supplier. Should no recommendation be available by the equipment supplier, the follow shall be provided: <ul style="list-style-type: none"> Cable: Category 6_A (F/STP) (as per AS/NZS 11801.1). Connectors: 8P8C (RJ45) shielded jacks and plugs (as per AS/NZS 11801.1)

10.5. Separation from other services

Separation between parallel runs of AV and power cables:

- A minimum separation of 300mm or that specified by the manufacturer (whichever is greater) shall be maintained at all times between AV cable and low voltage (230v/400v) power cables. In situations where this distance cannot be achieved, the cabling manufacturer shall be consulted to ensure respective minimum segregations requirements are not compromised.
- Cable trays and ducts used for AV cabling shall not be shared with low voltage (230v/400v) power cables.
- Separation between AV cable and fluorescent light fixtures shall not be less than 300mm.

10.6. AV Outlets

The contractor shall provide and install the complete AV outlet assembly of the same style and orientation as the electrical outlets wherever possible. Alternatives to be confirmed with UoO AV Team and Architect prior to procurement and installation.

Refer to the architectural drawings for exact outlet positions and set out dimensions. AV outlets in back to back wall penetrations shall be offset horizontally by minimum 300mm.

10.6.1. Table boxes

Table boxes shall only be used in fixed, stationary tables.

The AV contractor shall provide AV outlets and plates for connectivity inside the table box.

Where active transmitters are to be mounted under the table top for connectivity to a table box, provide fly leads between a passive face plate located in the table box and the transmitter located under the table. The preferred method of installation is non destruction adhesives that allow for future removal and replacement as required (eg industrial strength Velcro). Mechanical mounting to the table shall only be allowed where confirmed in writing as acceptable by the UoO AV Team. Where confirmation has not been sought on the preferred mounting, the contractor shall be liable for any damage caused by the mounting method.

Provide UoO AV Team approved cable management to achieve a clean and tidy finish.

AV contractor to coordinate all interfacing onsite with the joinery contractor.

10.6.2. Floor boxes

Floor boxes and associated conduits will be provided as part of the electrical package. The AV contractor shall provide UoO AV Team approved outlets and plates for connectivity inside floor boxes as required.

Coordinate all interfacing onsite with the electrical package.

Floor box faceplates to match floor finish colour.

10.6.3. Joinery

The AV contractor shall provide AV outlets and plates for connectivity inside joinery units. Exact outlet locations and pathways shall be coordinated with the Architect and approved by the UoO AV Team prior to termination and fit off.

UoO AV Team to coordinate with architect to ensure joinery is fit for purpose in teaching spaces.

10.7. Ceiling Cavities

AV outlets may be required to be installed in ceiling cavities.

- a) Mounting plates and enclosures shall be approved by the architect and UoO AV Team prior to installation.
- b) The AV contractor shall detail a proposed fixing arrangement bracket for the vertical, ceiling mounting of these outlets as part of their tender response, subject to Project Manager and/or UoO AV Team approval.
- c) Where outlets are positioned above the ceiling, visible printed, and permanent labels shall be fitted to the ceiling.

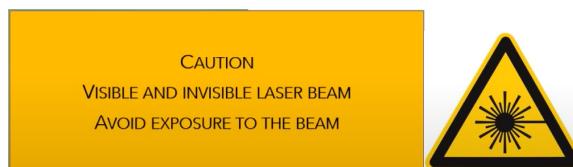
10.8. Generic Cabling

Where a Generic Cabling System (GCS) has been provided specific to the AV installation, the Generic Cabling System shall conform to the requirements as laid out in University of Otago Building Technologies – Standards Suite, **CHAPTER 3: IT INFRASTRUCTURE - GENERIC CABLING SYSTEM STANDARD**

11. AV RACKS

Equipment racks will be suitable for 19" standard rack mounted equipment.

- a) All free standing racks, wall mount racks and joinery racks supplied by the AV contractors shall be approved by the UoO AV Team prior to procurements and installation.
- b) The AV contractor shall supply and install all required fixings to mount AV racks
- c) If and where required, racks shall be seismically braced (Ref NZS 4104)
- d) Metal surfaces of the cabinet and accessories shall be powder coated to protect against corrosion. Zinc plating shall not be accepted unless also powder coated.
- e) Un-used rack positions (rack units) shall be provided with blank panels to seal off the front of the cabinet
- f) Provide cabling lacing bars for vertical and horizontal looms for all patch panels and AV equipment as required
- g) Provide fan tray with filters as required for cooling
- h) Source AV equipment requiring user access shall be housed separate from the racks or a separately lockable section of a common rack to ensure non-source equipment is not accessible to non-technical personnel
- i) Racks shall be bonded to the protective earth system using a minimum 2.5mm green/yellow conductor
- j) Enclosures and racks shall not be placed next to windows or areas subject to direct sunlight (UV). In situations where this is unavoidable, the window shall be UV tinted, covered, or blanked off
- k) All cabinets and racks containing fibre optic cabling terminations shall have the following Laser Safety warning signs fitted to the front of the cabinet or rack:



11.1. Rack Sizing

Final rack size shall be determined based on final selection of AV equipment and joinery.

11.2. Rack Installation

11.2.1. Floor Mounted Enclosed AV Racks

The racks shall have the following as minimum requirements:

- a) Final RU shall be specified by UoO AV Team
- b) Minimum 800mm wide, to provide space for vertical cable management

- c) Cabinets shall be at least 150mm deeper than the deepest equipment expected to be mounted within the cabinet for safe access to power cables etc.
- d) Perforated doors
- e) RU labelling – front and rear
- f) A facility for levelling adjustment
- g) Lockable front and rear bi-folding perforated doors
- h) Lockable, removable, accessible perforated side panels
 - i) One side of the cabinet (or bay of cabinets) may be positioned against the wall with the side panel removed. The other side shall have a clearance space of at least 600mm from the wall.
- i) Two internal vertical cable trays i.e. one on each side of the frame
- j) Welded earth bonding studs and earth connecting leads to achieve earthing/bonding standards for all frame parts i.e. doors, panels etc.
- k) Factory manufactured cabling access components allowing entry of cabling from the top, rear and sides of the cabinet.
- l) Should cable entry be required through floor penetrations, racks shall be installed on a factory manufactured plinth to facilitate cable entry from below.
- m) Cabinet(s) shall be installed in a dedicated, environmentally controlled AV equipment room.

11.2.2. Wall Mount AV Racks

Wall mounted enclosures shall be located to avoid injury and follow relevant Standards and OSH requirements.

Top of the enclosure shall be no higher than two thousand (2000) mm AFFL and the bottom of the enclosure a minimum of five hundred (500) mm AFFL. If this requirement is unable to be met, then written approval from the University for an alternative installation shall be obtained prior to installation.

In addition, the wall mounted cabinets shall have the following minimum specifications:

- a) Vented top, bottom and side panels to allow airflow
- b) Top of rack cabling access and accessories
- c) Cabinets shall have no sharp edges or protrusions that could cause injury to persons or damage to cables
- d) Welded earth bonding studs and earth connecting leads to achieve the earthing/bonding of all cabinet parts i.e. doors, panels etc.
- e) Reversible hinged back mount
- f) The cabinet shall not be situated behind a door, at floor level, or in direct sunlight (where direct sunlight shines directly into front of unit glass panel)
- g) The cabinet shall be fitted to allow the door to fully open without hindrance. Clearance shall also allow for the full swing of the unit hinged on the back plane with unrestricted access to the cabling bundles and the rear of the unit

- h) Be fully lockable
- i) The cabinet should be located in a dedicated AV equipment room. Where this is not possible and the AV cabinet is located inside the teaching space, noise pollution shall be minimised through UoO AV Team-approved cabinet construction.

11.2.3. Joinery AV racks

Provide castors to racks to allow for easy removal of the rack for servicing. Racks shall be able to swivel on their base once removed from the joinery unit.

Coordinate with the joinery/credenza supplier to ensure that necessary cut-outs for outlets, cabling and ventilation are provided.

- a) All penetrations through joinery/credenzas shall be fitted with escutcheons. Provide ventilation fans where required for joinery/credenzas. Ventilation fans shall be low-noise fans.
- b) Noise pollution shall be minimised through appropriate UoO AV Team-approved cabinet construction.
- c) Provide sufficient slack in cabling such that the rack can be wheeled out for maintenance without the need for disconnecting patch leads

The AV contractor shall provide proposed coordinated joinery/credenza layouts to the UoO AV Team for approval prior to procurement and installation.

11.3. Cabinet Cable Entry

Cabling entering a cabinet shall conform to the following:

- a) Cabling entering from the floor or ceiling space to enclosures shall be supported by a vertical cable support system
- b) The vertical cable support system shall extend from the floor/ceiling cable pathway to the enclosure.

11.4. Cable management

Racks shall be supplied with cable management panels to facilitate the support and organisation of cables and patch cords.

Rear cable support systems shall be installed to offer strain relief for cables entering the rear of the rack and patch panels, as well as control of bend radius as per previously referenced specifications.

11.5. Optical fibre patch panels

Optical fibre patch panels shall be combination type 1RU 12 or 24 port fitted with duplex LC couplers and cover plate. Patch panels shall be equipped with cable management facilities including splice trays.

All fibres installed shall be terminated within this enclosure using manufacturer-approved fusion splice pigtailed with LC connectors to maintain warranty.

Hardware shall minimise potential eye hazards from optical sources.

All spare adaptors shall either be shuttered or have dust caps fitted to prevent dust or debris contamination.

11.6. Power Distribution Units

Power Distribution Units (PDUs) shall be provided for AV racks. The units shall be controllable via the AV control system (where provided) and provide the following features:

- Remote power cycling of frozen equipment
- Remote Power down of AV systems for scheduled outages

EXACT PDU REQUIREMENTS SHALL BE PROVIDED BY THE UOO AV TEAM DURING THE DESIGN PHASES.

12. ELECTRICAL

12.1. Electrical installation

The installation of all electrical products and equipment shall be installed in accordance with manufacturer's instructions, Electricity Safety Regulations and applicable standards by a registered electrician.

12.2. Electrical segregation

Cable pathways and cables shall be installed to always achieve a minimum 50mm safety separation between AV cabling, fire alarm cabling and low voltage services as defined within AS/NZS 3000. Where this distance cannot be achieved, a durable insulated barrier shall be provided to achieve physical separation.

Where specific UoO and/or manufacturer requirements exceed the minimum 50mm separation, the greater of the distances shall be observed.

12.3. Rack Power

All circuits & sockets to be clearly labelled with DB / Circuit visible while equipment is still connected.

12.3.1. Free Standing Rack requirements

Each free-standing rack shall have 1 x 15A GPO installed, supplied by a single dedicated circuit. The circuit shall be on the same phase as all the AV equipment in the applicable room and connecting to the cabinet.

- a) The power outlet shall be located on the wall inside the enclosure.
- b) The GPO shall be mounted 300mm AFFL.

12.3.2. Wall Mounted Rack requirements

Each wall mounted Rack shall have 1 x 10A GPO installed, supplied by a single dedicated circuit. The circuit shall be on the same phase as all the AV equipment in the applicable room and connecting to the cabinet.

- a) The power outlet shall be located on the wall inside the enclosure.
- b) The GPO shall be mounted 250-300mm above the base of the cabinet.

12.3.3. Joinery AV Racks

Each joinery Rack shall have 1 x 10A GPO installed, supplied by a single dedicated circuit. The circuit shall be on the same phase as all the AV equipment in the applicable room and connecting to the cabinet.

The power outlet shall be located inside the joinery unit. Coordinate exact location with the UoO AV Team, architect and joinery contractor.

12.4. AV Equipment power

The power supply for AV System components within a room shall be fed from circuits on the same phase. All circuits for AV system components are not to be shared with general power/ other circuits.

12.5. Lighting requirements in AV spaces

In AV spaces, all lighting must be designed and conform to:

- AETM Design guidelines for Tertiary Teaching Spaces
- AS/NZS 1680.2.2 – Interior and workplace lighting – Specific applications – Office and screen based tasks
- AS/NZS 1680.2.3 – Interior and workplace lighting – Specific applications – Educational and training facilities

12.5.1. Placement

The placement of light fittings shall not interfere with ceiling mounted (or cavity) Audio Visual equipment and/or outlets. Final lighting placement in AV spaces to be approved by UoO AV Team.

12.5.2. Control

Lighting in AV spaces to be UoO AV Team-approved in terms of control placement, and control circuits, and colour control.

13. EARTHING

All equipment racks and cabinets, cable trays, and metal duct systems shall be earthed in accordance with AS/NZS 3000 to the building protective earth system.

Earth wires shall be used for the general earthing of metal structures (AV racks, catenary, cable tray, frames, and so on).

Connection to catenaries shall be by way of a brass or copper line tap.

Connections to cable tray or metal structures shall be via a suitably sized terminal lug, and serrated star washer, ensuring that any paint is scraped back to bare metal.

The University has a preference when installing earth wires for grounding or bonding, that a single wire be terminated into each earth bar connection point for ease of long-term maintenance. However should a free-standing rack be filled with shielded patch panel's this may not be practical to keep it just one wire per connection point, so the contractor shall install no more than 3 earth wires into any one (1) earth bar connection point.

Solder shall not be used as the primary connection method for earth connections.

Each rack shall be directly earthed to the local earth bar.

AV Contractor to install UoO AV Team-approved Anti-static floor surfaces near all AV racks/lecterns.

14. LABELLING

All components of the AV installation shall be labelled. Helenski is the UoO AV Team standard labelling font.

Labels shall be of a font, size, colour and contrast to be readily legible and have a useful life equal to or greater than that of the component being labelled.

Machine printing or engraving labels shall be provided as per below.

Examples of labelling may be requested by the UoO AV Team if required.

14.1. AV Racks

Distributors shall be labelled top and bottom, front and back.

- AV Racks shall be fitted with labels of 40mm high white lettering on a black background showing the distributor identification

14.2. Patch Panels

Patch Panels shall be labelled to correspond to the labelling of their respective AV Outlet.

Labels at fibre patch panels shall identify individual fibres in an optical fibre cable.

- Patch panel labels shall be machine printed labels with black text (minimum text size of 6 mm) on a white background.

14.3. Cables

All AV cables shall be labelled with heat shrink or cable-wrap type labels, fixed 50mm from both ends of every cable run.

Patch cables or cables of shorter lengths (5m and below) may be labelled with a single label fixed in the middle of the cable.

14.4. Outlets

AV Outlets shall be labelled with the outlet number (which corresponds to its appearance at the rack) and those additional identifiers which may be necessary to uniquely identify the outlet at the respective premises.

Outlets mounted within the ceiling space shall be labelled on the outlet faceplate and on the underside of the ceiling grid below the AV Outlet.

AV Outlet labels shall be:

- Permanent marker pen on the outlet to match the cover plate engraved label

- Machine printed labels on the cover plate with black text (minimum text size of 6mm) on a white background for standard outlets
- Machine printed labels with black text (minimum text size of (6mm) on a white background for labels on the underside of the ceiling grid

14.5. Pathways

Every conduit and cable tray shall be clearly labelled at both ends and within 50mm of every wall penetration, designating the floor room by number which includes the sequential numbering of the AV service type originating at that room.

Draw boxes shall be labelled on the exposed exterior.

- Pathways shall be labelled with machine printed or wrap labels with black text (minimum text size of 6mm) on a white background.

14.6. Earth Points

Each connection point shall be labelled as AV and shall reference the distribution board number it connects to.

15. INSPECTION, TESTING AND CERTIFICATION

15.1. Client inspections

The UoO AV Team may make periodic inspections of the installation in progress.

Upon completion of the project, the UoO AV Team shall perform a final inspection of the installed cabling/system. The final inspection and UoO AV Team approval is a necessary step for validation of the cabling/system being installed as defined in the design.

15.2. Manufacturer inspections

System manufacturer must undertake site inspections to qualify the installed cabling system for a manufacturer's warranty where required. Manufacturer inspections must be considered part of the cabling contractor's project scope incurring no additional costs to the University. These inspections must be arranged by the AV contractor, notifying the UoO AV Team of inspection dates and times.

Evidence is to be provided for all manufacturer inspections in the form of a declaration of conformance confirming compliance with respective manufacturer cabling/system requirements.

15.3. Photo & Video Library

The contractor shall keep a photo & video library of all cable installations, taken just before walls are due for lining. The photo and video Library shall be made available to the UoO AV Team for their records when doing future MACs. Photo quality shall be 12MP minimum, Video quality shall be 1080p minimum, full colour, landscape.

15.4. Testing

Test records for all cable links installed under a project must be provided. Testing must be done by test equipment that is accepted and approved by the manufacturer.

The following tests must be conducted before installation of any AV cabling:

- Cable integrity
- Continuity and phasing of multicore cable conductors and screens
- Isolation of cable screens from building earth
- Insulation resistance between screen and earth, and cores and screen
- Induced hum, and noise for audio cables and terminations using a standard microphone
- PAT Tested to AS/NZS3670 as required

15.4.1. Twisted pair cabling

All cables and termination hardware must be 100% tested for defects after installation and to verify cable performance under installed conditions.

- The tester must be factory calibrated within the previous 12 months
- The latest firmware must be loaded prior to testing
- The tester must be in good working order, including test heads, leads, adaptors, etc.
- Marginal pass (*PASS) indication must be active
 - Marginal pass results are not acceptable and must be rectified
- Fail and marginal fail (*FAIL) results must be rectified
- DC unbalanced testing must be undertaken
- The cable must pass HDBaseT testing

15.4.2. Generic Cabling testing

Where a Generic Cabling System (GCS) has been provided specific to the AV installation, the Generic Cabling System shall be tested in accordance with the requirements as laid out in University of Otago Building Technologies – Standards Suite, **CHAPTER 3: IT INFRASTRUCTURE - GENERIC CABLING SYSTEM STANDARD**

16. DOCUMENTATION

Documentation is of great importance for ongoing reference, maintenance and future MACs. The contractor shall provide the following documentation at a minimum. Additional documentation may be requested on a project-by-project basis.

16.1. General requirements

- Submissions will be reviewed by the UoO AV Team and will give written approval before site works may commence.
- It may be required to provide practical submissions for review, including data sheets and specifications.
- Submission timeframes must adhere to UoO AV Team timeline to avoid delays to the project programme.
- Submit samples when requested.
- All provided documentation must be in New Zealand English.
- Final documentation must be submitted within 15 working days of site handover.

16.2. Shop drawings

Shop drawings must be provided for approval prior to commencement of any site works. As a minimum the shop drawings must include:

- Cabling type, manufacturer and warranty details (if applicable)
- Rack layout drawings (if applicable)
- Floor layout drawings indicating AV rack and outlet locations
- Floor layout drawings indicating proposed cable pathways including cable tray, conduit and catenaries
- Details on all interfaces with other services
- Label schedules

Shop drawings must be submitted in soft copy in the native drawing package format used by the project (i.e. DWG or RVT). In addition, a PDF copy will also be provided for cross reference.

16.3. Operation and Maintenance manual (O&M)

An O&M manual must be compiled on completion of the installation and submitted as a part of the complete as-installed system. Failure to do so shall result in final payment being withheld.

The compilation of the manual must be undertaken by a suitably qualified person, capable of detailing the overall systems architecture, operation and any other required information to provide the University the ability to understand and operate the installed solution. All material supporting the installed solution must be written in a manner that allows the University non-technical personnel to understand and use it.

Information irrelevant to the specific installation must not be included within the O&M manual.

The O&M manual must be provided in the following format:

Section 1	Cover	The cover must contain the Project name, project location, manual name, volume number, date of issue and contract number.
Section 2	Table of Contents	Title to match cover, include index of all volumes in the first volume if applicable.
Section 3	Contact details	Company name, address, contact person, phone number, email address of: <ul style="list-style-type: none">• Principal• Consultant• Main Contractor• Sub-contractor(s)
Section 4	Bill of Materials (BoM)	A schedule listing all the cabling and materials that were used for the installation and must include as a minimum: <ul style="list-style-type: none">• Item of material• Supplier/manufacture• Model number• Serial number• Photo• All contact details of supplier/manufacture
Section 5	Test & Commissioning	A compilation of all the testing and commissioning records <ul style="list-style-type: none">• Contractor testing records (pre-commissioning)• Test results must be provided in the native tester format and in PDF format• Contractor commissioning records• Manufacturer inspection reports and sign-off documents• AV cabling test results

Section 6	Warranties	Manufacturer warranties – original documents.
Section 7	As-built drawings	<ul style="list-style-type: none"> • Cover page – title to match cover • Legend & notes • Full schematic diagrams of the installed solution, showing the interconnectivity and labelling • Layout drawing detailing as-installed cable pathways, primary and secondary pathways (cable tray, conduit & catenaries) and labelling <ul style="list-style-type: none"> ○ Where pathways transverse through ceilings, walls and floors, note on the drawing the penetration location and fire stop number when penetrating fire walls • Rack layout drawings (if applicable)

A Appendix A – UoO Wiring standards examples

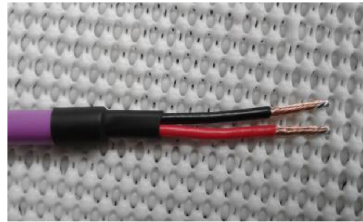
The following are general examples of the level of workmanship that shall be expected from the AV contractors.

The examples are self-explanatory, but comments have been provided for further clarity.

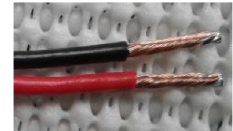
A.1 Cable dressing & wire ends



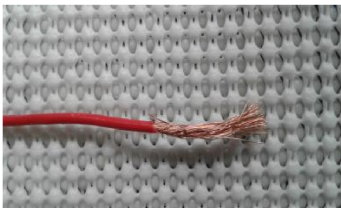
NOT ACCEPTABLE



ACCEPTABLE



ends of wire
tinned to stop
fraying



NOT ACCEPTABLE



ACCEPTABLE



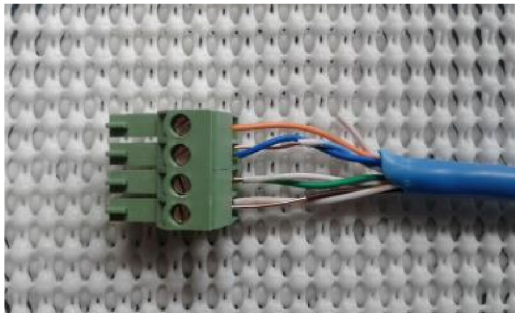
bare wire ends should be
terminated with the correct
size ferrule.



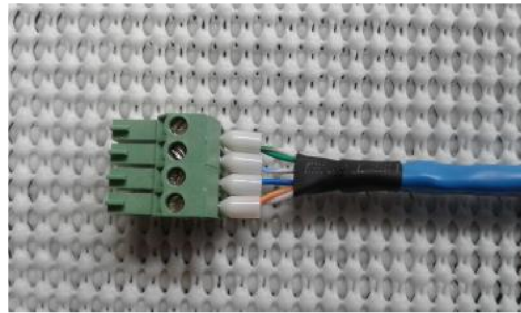
NOT ACCEPTABLE

the conductor should
protrude the ferrule then be
cut off at an angle which
crimps the end

A.2 Terminal termination



NOT ACCEPTABLE



ACCEPTABLE



NOT ACCEPTABLE



ACCEPTABLE



NOT ACCEPTABLE



ACCEPTABLE



ends of wire
tinned to stop
fraying

A.3 Cable ties installation



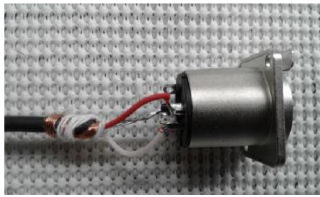
NOT ACCEPTABLE



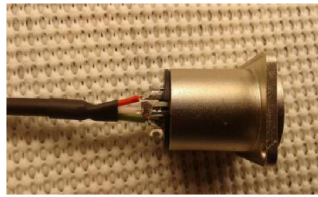
ACCEPTABLE

cable tie should be cut flush
with a pair of sharp side
cutters

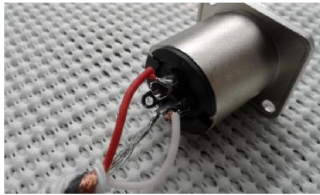
A.4 Cable shield covering



NOT ACCEPTABLE



shield covered with silicon
tubing.
heat shrink



ACCEPTABLE

A.5 Cable looming



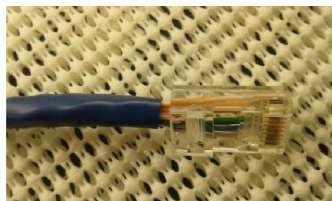
NOT ACCEPTABLE



ACCEPTABLE

when using pre-made cables
the surplus should be coiled
in a tidy and even way

A.6 8P8C (RJ45) termination



NOT ACCEPTABLE



ACCEPTABLE

strain relief should clamp
onto outer jacket

B Appendix B - Work Practices

B.1 General safe work practices and responsibilities

The contractor shall ensure that all persons working on any University facility that is under their control are protected from risk created by residual materials and workmanship associated with any construction works, including ensuring all areas are cleaned after fibre optic work to ensure no sharps or splinters of fibre remain, and the removal of all sharp and hazardous edges from fittings.

B.2 Work areas

Work areas for terminating copper and fibre optic cables, and splicing optical fibre cables shall:

- a) Have adequate lighting and ventilation.
- b) Be kept free of debris and other contaminants.
- c) Ensure optical fibre off-cuts are removed from site and disposed of in an appropriate manner.
- d) Ensure sharps and syringes used as part of optical fibre cabling are disposed of in an appropriate sharps container and removed from site.
- e) Ensure a medical waste or clinical waste container will meet the requirements of a sharps container.
- f) Sharps containers shall not be disposed of via domestic and standard industrial collection services.
- g) Sharps containers shall be disposed of off-site separately from other site waste.
- h) Chemical waste shall be removed from site and disposed of in an appropriate manner.
- i) Washing of hands both before entering and after leaving the work area shall be required for all persons working on the site.
- j) Food or beverages shall not be consumed or brought into the work area.

C AV provision process check-list

The following checklist can be used by all parties to keep track of coordination and approval processes.

Item	Description	Complete	Incomplete	Notes
DESIGN				
1	The UoO AV Team have been consulted on the new project and AV requirements			
2	The architect consulted the UoO AV Team on: <ul style="list-style-type: none"> - spatial requirements - acoustics - ambient lighting controls - joinery units containing AV equipment 			
3	The Communications design has been coordinated with the AV design			
4	Electrical design has been coordinated with the AV design			
5	Lighting design has been coordinated with the AV design			
INSTALLATION				
1	All cables have been installed as per the design			
2	All cables are adequately supported and secured			
3	All cable terminations are made securely and meet the UoO standards			
4	AV cabinets have been correctly installed			
5	Pull out cabinets have sufficient cable slack to freely pull out and swivel			
6	Patch panels have been correctly terminated and mounted			
7	AV Cabinets have been labelled			
8	Cables have been correctly labelled			
9	Outlets have been correctly labelled			
10	Patch panels have been correctly labelled			
11	Appropriate cable separation has been followed between dis-similar services			
12	All cable test results have been submitted			
13	As-built drawings and OM manual have been submitted			

EQUIPMENT

1	Verify that the area is clean and dust-free and suitable for equipment installation			
2	Can the room be secured			