

1.0 **GENERAL**

1.1 **Related UBC Guidelines**

- .1 [UBC Learning Space Design Guidelines](#)

1.2 **Coordination Requirements**

- .1 Audio-Video system design shall be coordinated with Architectural, Structural, Interior Design, Electrical and Mechanical to provide a safe and functional operation.

1.3 **Description**

- .1 General requirements for Sections 27 41 16 to 27 41 52.

2.0 **MATERIALS AND DESIGN REQUIREMENTS**

2.1 **General**

- .1 With few exceptions, all Audio Visual systems installed on UBC campuses are owned and supported by the UBC IT Audio Visual team (UBC Vancouver) or the IT, Media, and Classroom Services teams (UBC Okanagan).
- .2 Any significant design and implementation decisions relating to AV systems at UBC Campuses requires approval from relevant AV support team.
- .3 Any and all proposed changes to these Guidelines/Specifications shall be subject to approval in writing from UBC IT Audio Visual representative prior to implementation.
- .4 UBC IT Audio Visual will be engaged by the project team to develop the approach to AV system design for all new projects. In many cases, UBC IT Audio Visual will play the role of the AV consultant within the project, and provide the AV designs and coordination directly. In cases where capacity, expertise or other considerations warrant the engagement of external AV design consultants, this decision shall be made in collaboration with UBC IT Audio Visual. Any external AV design consultants engaged by the project shall be a consultant in good standing with a proven history of recent, relevant, and comparable experience in AV design within a higher education context. Avixa CTS and Crestron CTI-CSD shall be considered minimum certifications for potential AV system designers, with other certifications such as Avixa CTS-D and P.Eng considered favorably. UBC IT Audio Visual will be engaged in the selection process for any and all proposed AV system design consultants, and will have the opportunity to formally review and provide feedback on their credentials, experience, and proposed services.
- .5 UBC IT Audio Visual will review and approve AV tender packages inclusive of final specifications provided by any external AV design consultant prior to release to the market. The project team will allow a minimum of two weeks for this review, and will notify UBC IT Audio Visual of the requested review period at least four weeks in advance.
- .6 A copy of any and all AV Tender responses will be provided to UBC IT Audio Visual for review and feedback, with a minimum of 1 week review period. UBC IT Audio Visual should be notified of requested review period no later than the date of tender issue.

- .7 Provide only new equipment and material approved for the installation and suitable for continuous operation. Where the guidelines do not describe a required item, furnish equipment or material consistent with the quality of other specified products, and best suited to the purpose required. Submit these products for review by UBC IT Audio Visual.
- .8 The terms “Approved Products” and “Approved Manufacturers” indicate that products/manufacturers described are the UBC standard, and any alternate products must be reviewed and approved in writing by UBC IT Audio Visual.
- .9 The terms “Typical Products” and “Typical Manufacturers” indicate that the products/manufacturers described are commonly used at UBC, but are not necessarily an enforced standard. Alternate products may be used, provide they are of equal or greater quality and approved by UBC IT Audio Visual.
- .10 User accessible rack mount equipment will be fitted with security covers and tamper proof rack screws to prevent tampering

2.2 Contractor Qualifications

- .1 This section describes minimum and preferred qualifications, experience, and credentials for any AV contractor bidding on and being awarded UBC AV integration opportunities.
- .2 Please note that UBC IT Audio Visual maintains a list of pre-qualified integrators who have already demonstrated their ability to meet the below criteria through a competitive process, and require no further project qualification. The current list of pre-approved AV contractors can be found at the following location: <https://finance.ubc.ca/procure-pay/list-suppliers/categories-and-suppliers/it-hardware-software-and-services/audio-visual>
- .3 Prior to award of any AV systems integration opportunities at UBC to any parties not already on the pre-qualified list, UBC IT Audio Visual will have the opportunity to review documentation and supporting evidence of their ability to satisfy the below qualification criteria.
- .4 CTS certification from Avixa and/or PMP certification from the Project Management Institute is strongly favored for the role of Project Manager.
- .5 Avixa CTS certification is strongly favored for on-site technicians
- .6 Avixa CTS-I or CTS-D is strongly favored for engineer and lead technician roles
- .7 The person(s) in the role of Lead Programmer MUST be Crestron Certified and Crestron Digital Media Certified (DMC-E), Crestron NVX certified and Biamp Tesira certified.
- .8 For AV contractors not on the pre-qualified list, at a minimum the below evidence of qualifications shall be submitted to UBC IT Audio Visual for review and approval prior to award.
 - .1 Submit with proposals resumes/work profiles for at a minimum the positions of Account Manager, Project Manager, Lead Programmer, and Lead Site Technician. Include relevant work history details, past project experience, certifications/education, and any other qualifications relevant to this scope of work.
 - .2 Provide a minimum of three (3) to a maximum of five (5) client references for projects of similar size, scope, and complexity completed within the last 3 years.

- .3 Certificate or letter from control system manufacturer stating official stocking dealer status.
- .4 Certificate or letter from audio processor manufacturer stating official stocking dealer status.
- .5 Comprehensive list of all product brands and lines stocked and available through the dealer, including projectors, flat panel displays, video switching equipment, video conference solutions, technical furniture and racking equipment, and audio reinforcement equipment.
- .6 Provide a comprehensive overview of project quality controls and process.
- .9 Provide examples of AV project documentation, including at least one example of each of the following: Audio system schematic, video system schematic, control system schematic, equipment list, IP log, simplified user manual.

2.3 Energy Efficiency

- .1 The University of British Columbia pursues energy efficiency in audio and video equipment where ever possible. Audio and video products that offer the performance described in these technical guidelines with greater energy efficiency will be of interest, and should be submitted to UBC IT Audio Visual for technical review.
- .2 AV systems should incorporate energy conservation measures so that the display equipment in the systems are not left in an operational state when the rooms are unoccupied. An end of day shutdown shall be implemented in the AV system code to ensure equipment is not unnecessarily running after business hours.
- .3 Provide Energy Star compliant equipment were available, and where the Energy Star power management feature does not compromise the function of the AV systems.
- .4 LEED Gold, when applied to a project, will require the AV systems operation to be included in Whole Building Energy Usage Data gathering.

2.4 Shop Drawings

- .1 Submit prints of the following drawings for review by the Owner, or their designated Consultant before proceeding with the work:
 - .1 Manufacturer's specification cuts and quantity schedule for all items furnished under the contract.
 - .2 Detailed schematic diagram showing all specified components including manufacturers, model numbers, signal types, wiring types, rack elevations, and connector panel drawings.
 - .3 Cable logs showing destinations at both ends and cable identifiers.
 - .4 IP Network design and list of equipment requiring IP address on UBC LAN.
 - .5 Drawings for all custom fabricated equipment indicating dimensions, hardware, labelling and finish.

- .6 Suspension details for all suspended equipment, with relevant engineering stamps.
 - .7 Details for all mounting and equipment integration that interfaces with base building structures, as requested by the consultant team.
 - .8 Manufacturer's catalogue/specification cut-sheets indicating the part number, accessories and options pertinent to the project.
 - .9 Where UBC IT Audio Visual is not programming, example programming files including GUI samples, verbiage and program flow/function map. All requested programming revisions prior to final approval of the programming example files will be considered the responsibility of the winning bidder, and must be undertaken at no additional cost.
- .2 Coordinate documents of related divisions when joint submissions are required.

2.5 Project Record Drawing Requirements

- .1 Instruct the Contractor to mark in red ink on one set of white prints any changes, additions, and omissions not contained in the original documents, and any other pertinent information affecting future work. Maintain the record set on site at all times.
- .2 Within 30 days of Substantial Performance, the contractor to submit a clean set of marked up As-Built prints. Instruct them to certify with signature and turn them over to the Owner, or their designated Consultant, one (1) set of white prints so revised. Instruct the contractor to include in each operating and maintenance manual one set of white prints so revised.

2.6 AV Operation and Maintenance Manuals

- .1 Provide an electronic copy of the manual, formatted as follows:
 - .1 List of equipment provided in each room, with recorded serial numbers (including any AV equipment supplied by UBC or other trades. UBC IT Audio Visual will provide an itemized inventory to the Audio-Visual Contractor).
 - .2 Simplified Operating Instructions
 - .3 As-Built and Reviewed Shop Drawings
 - .4 Performance Measurements
 - .5 Service and Adjustment Instructions
 - .6 Provide list of Rooms, IP addresses used, and CCT port connection numbers and locations for equipment connected to any VLAN.
 - .7 Identify power source locations of any devices powered via remote power supplies.
 - .8 Return all product remote controls, rack keys, cables, and any other miscellaneous accessories not permanently installed on site to UBC IT Audio Visual. Loose items left on site will be considered lost, and subject to replacement at integrator's expense.
 - .9 Digital copies of all product configuration software, and configuration files, along with compiled and uncompiled Crestron code and VTP files.

- .10 Provide a schedule of terminations, cross-referenced to test results.

2.7 Audio Visual Cabling and Connectors

- .1 Duplex Multimode Fiber Optic 50/125 Cables
 - .1 For all 8 Gbps duplex multimode fiber optics connections, provide 50 micron core, 125 micron cladding multimode duplex fiber optics cable with an overall diameter of 3mm. the cable jacket shall be PVC in orange colour. Insertion loss shall be smaller than 0.5dB and have a ferrule end face radius of less than 30mm. operating temperature shall be 02 to plus 70 degrees.
 - .2 Typical products are:
 - .1 Corning Premium
 - .2 Crestron DM fiber
 - .3 Extron OM4 MM P
- .2 Duplex Multimode duplex Fiber Optics Patch Cables
 - .1 For all 8 Gbps duplex multimode fiber optics connections provide 50 micron core, 125 micron cladding multimode duplex fiber optics cable with an overall diameter of 3mm. Insertion loss shall be smaller than 0.5dB and have a ferrule end face radius of less than 30mm. operating temperature shall be 02 to plus 70 degrees. The patch cable shall be equipped with 2 multimode LC connectors at each end. The patch cables shall be in the following overall length: 1m, 2m, 3m, 5m or 10m.
 - .2 Typical products are:
 - .1 Corning Premium
 - .2 Crestron DM fiber
 - .3 Extron 2LC OM4 MM P
- .3 Fiber Optics Connector Modules
 - .1 Systems using fiber optic cables must have the fiber trunks be terminated in fiber optic patch bays or modular connector termination boxes in the AV racks and in the lectern.
 - .2 Extenders, transmitters, receivers and switchers will be connected to the patch bays or termination boxes using pre-fabricated fiber-optic patch cables.
 - .3 Typical: Corning Pretium Plug & Play Classic CCH-CP24-D3 series.
- .4 CAT6 Shielded Twisted Pair Video Cable
 - .1 Must be certified to minimum CAT6 specifications, 250 MHz bandwidth
 - .2 Must include end to end foil shield with 100% coverage
 - .3 Must include 4 pairs of 23 or 24 AWG solid copper conductors
 - .4 Maximum overall cable diameter is 0.260"
 - .5 Jacket colour:
 - .1 **White** for HDBaseT link;
 - .2 **Purple** for Video-over-IP network.

- .6 Must be available in both plenum and non-plenum rated versions
- .7 Typical manufacturers are:
 - .1 Belden
 - .2 Crestron
- .5 Video RJ45 Connector
 - .1 The data connector shall meet or exceed all requirements of TIA/EIA-568-B.1 & B.2 & B.2-1 for Category 6 shielded.
 - .2 The connector shall have the following features:
 - .1 8P/8W modular female connectors at both ends of video cabling.
 - .2 T568A wiring.
 - .3 Snap-in type at both ends.
 - .4 Connector colour:
 - .1 White for HDBaseT link;
 - .2 Purple for Video-over-IP network.
 - .3 Product manufacturer shall be Leviton, Belden or Approved Alternative.
- .6 Video RJ45 Patch Panel
 - .1 The patch panel shall be rack mounted with standard 19" rack compatibility. Placement of the patch panels to be approved from Drawings submitted to the Consultant by the Contractor. Layout will be expected to optimize rack space and proximity to active components.
 - .2 The patch panel port quantity shall match corresponding network switch port count.
 - .3 The patch panel shall have the following features:
 - .1 Category 6, shielded twisted pair, STP
 - .2 Colour: black
 - .3 T568A wiring
 - .4 14-gauge steel
 - .5 Terminates 26-22 gauge solid conductors
 - .4 Product manufacturer shall be Leviton, Belden or Approved Alternative.
- .7 HDMI Cables
 - .1 Must be minimum HDMI 2.0 certified
 - .2 Must support minimum data transfer rate of 10.2 Gbps, and minimum 48 bit colour depth
 - .3 Cables shorter than 15' in length must support a minimum resolution of 2160p/4K UHD at 30hz
 - .4 Cables greater in length than 15' must support a minimum resolution of 1080p/Full HD at 60 hz

- .5 Must support a minimum of 8 high bandwidth, uncompressed multichannel audio streams
 - .6 Must include high quality, gold plated connectors
 - .7 Must be highly flexible. Overly rigid, thick, or otherwise difficult to manage cable types will be rejected.
 - .8 Where cable runs are longer than those attainable with standard HDMI cabling, appropriate transmitter/receiver extender sets, HD-BaseT extenders, or signal boosters should be specified.
 - .9 Cables should include factory manufactured ends. Modular cables (Rapid Run, etc.) will be rejected.
 - .10 Typical manufacturers:
 - .1 Kramer
 - .2 Crestron
 - .3 Extron
- .8 Data Cabling
- .1 The data cabling shall meet or exceed all requirements of TIA/EIA-568-B.2 for Category 5e cabling and components.
 - .2 The cabling shall have the following features:
 - .1 Category 5e unshielded twisted pair, UTP
 - .2 Four pair, 22 AWG to 24 AWG, 100 ohm, solid copper.
 - .3 FT6 rated
 - .4 Jacket colour:
 - .1 Green for AVB network;
 - .2 Green for Dante network;
 - .3 Black for Control network;
 - .4 Red for UBC IT AV trunk;
 - .3 Product manufacturer shall be Leviton, Belden or Approved Alternative.
- .9 Data Connector
- .1 The data connector shall meet or exceed all requirements of TIA/EIA-568-B.1 & B.2 & B.2-1 for Category 5e.
 - .2 The connector shall have the following features:
 - .1 8P/8W modular female connectors at both ends of data cabling.
 - .2 T568A wiring.
 - .3 Snap-in type at both ends.
 - .4 Connector colour:
 - .1 Green for AVB network;
 - .2 Green for Dante network;
 - .3 Black for Control network;
 - .4 Red for UBC IT AV trunk;
 - .3 Product manufacturer shall be Leviton, Belden or Approved Alternative.

- .10 Data Patch Panel
 - .1 The patch panel shall be rack mounted with standard 19" rack compatibility. Placement of the patch panels to be approved from Drawings submitted to the Consultant by the Contractor. Layout will be expected to optimize rack space and proximity to active components.
 - .2 The patch panel port quantity shall match corresponding network switch port count.
 - .3 The patch panel shall have the following features:
 - .1 Category 5e, unshielded twisted pair, UTP
 - .2 Colour: black
 - .3 T568A wiring
 - .4 14-gauge steel
 - .5 Terminates 26-22 gauge solid conductors
 - .6 Product manufacturer shall be Leviton, Belden or Approved Alternative.

3.0 EXECUTION

3.1 Installation

- .1 Secure all equipment, except portable equipment, in place with a safety factor of at least five (calculate mounting based on object weight x 5). Adequately ventilate all equipment for worst case power dissipation. No item of equipment shall produce residual noise in excess of NC-30 when measured from the centre of the enclosing room.
- .2 Install all equipment in such a manner as to present no safety hazard to operating personnel.

3.2 Mounting, Rigging and Seismic Restraint

- .1 All overhead mounting or rigging installations of video projectors and flat panel display equipment must have received the approval of a Professional Engineer registered in British Columbia, at the shop drawing stage prior to installation.
- .2 Rigid and fixed mounting systems (brackets, tube and clamp, frames etc.) used for any piece of suspended equipment must have a safety cable attached between the suspended device and the superstructure used to support the mounting system. The size and construction of the safety cable, and attachment points must be suitable to support the weight of the equipment being restrained.
- .3 Flexible rigging systems (chain and aircraft cable) must be installed by a Certified Rigger. Flexible mounting systems must have suitable seismic restraint sway bracing provided. Seismic restraint systems must be approved by a Professional Engineer registered in British Columbia.
- .4 All free standing equipment racks, trolley or caster equipped racks intended for permanent locations, free standing or platform mounted loudspeakers, video projectors, and other equipment with significant mass and freedom of movement must be equipped with a seismic restraint system that can be disconnected for servicing the equipment.

3.3 Wiring

- .1 Neatly arrange cables with Velcro cable wraps. Avoid tight bundling, and twist cable bundles into a spiral configuration before installing cable ties. Allow a minimum of a 1 metre spiral bound slack service loop when entering racks or panels. Exercise care to avoid damage to wiring or equipment.
- .2 Make all signal connections within systems with rosin-core solder or approved mechanical connectors. Untidy or cold solder joints will be rejected. Use proper crimping tools for mechanical connectors.
- .3 Do not splice cables except with permission of the Owner, or their designated Consultant
- .4 All RJ-45 connections shall be terminated in accordance with this TIA/EIA-568B standard.
- .5 Refer to AVSK-05, AVSK-06 and AVSK-07 for AV wiring details.
- .6 For AV equipment racks with more than three (3) wall wart power supplies of the same voltage, provide DC power distribution system. Distribution system shall include a DIN rail power supply and DIN rail termination block. Refer to AVSK-04 for DC power distribution detail. DC power supply shall have the following features:
 - .1 DIN rail mountable
 - .2 Isolation class II
 - .3 Input voltage: 120 VAC
 - .4 Output voltage: as required by AV equipment
 - .5 Protections: short circuit, overload, over voltage and over temperature
 - .6 Cooling: free-air convection

3.4 Grounding and Shielding

- .1 Isolate all racks containing sound system equipment from the building and electrical grounds. Bond adjacent equipment racks with #6 AWG insulated ground cable.
- .2 Conduit and tray systems containing audio, video and control wiring will be permanently connected to the electrical ground.
- .3 Do the utmost to prevent ground loops of any type, including use of ground isolators when necessary.
- .4 Isolate the shields of all shielded cables from both the conduit system and any other shielded cables.
- .5 Provide continuous shield from source to input point, with shields lifted at the source and grounded at the input point.

3.5 Marking

- .1 Mark all wiring with PVC or neoprene slip-on sleeves, or with tape type markers with a clear heat shrink boot, indicating approved circuit number. All labels must be machine printed. Hand written labels will be rejected.
- .2 Mark all remote or outboard power supplies with permanent labels to indicate which devices they power, and mark all power cables at the U-GND connector where plugged in to the

power outlets to indicate which devices they power.

- .3 Log IP address and other relevant network info of all network enabled devices, and include IP table of all system IP info with as-built documentation.
- .4 Record circuit numbers and wire destinations on as-built drawings and schedules. List spare circuits.

3.6 Nameplates

- .1 Dymo labels are not acceptable. Decal type labels (Brother P-touch) are not acceptable in high traffic or high wear applications. All nameplates shall be printed on a black background, with white text.
- .2 Identify all racks and panels as specifically noted on the drawings.
- .3 Submit all nomenclature to the Owner, or their designated Consultant for approval prior to installation.
- .4 All blank rack panels shall be solid black, and include no logos or company advertising. Integrator(s) may not install custom logos, decals, stickers, or electronic images on any equipment, and will remove any such items at their own expense

3.7 Finishes

- .1 Finish all components exposed to the public with colours and finishes approved by the Owner, or their designated Consultant.

3.8 Lamacoid Labelling

- .1 Engraved lamacoid labels shall be used to identify audio visual equipment accessible to end-users for the purpose of training and supporting.
- .2 Numbering scheme shall start with '1' at stage left (from the point of view of the presenter facing the audience) and ascend in order by increments of one until stage right is reached.
- .3 Each lamacoid number shall correspond to its respective control tab on the touch panel GUI.
- .4 In spaces where there is a single, central projector in addition to dual content projectors, the central projector shall be assigned the last number in the sequence.

3.9 Testing Copper Category Cable Installation

- .1 All copper Category cables shall be tested in conformance with the current ANSI/TIA/EIA-568-C Standard. Testing shall be accomplished [certified tester](#) with appropriate permanent link adapters. Testing shall be performed for at least the minimum copper Category type including, but not limited to the following:
 - .1 HDBaseT, F/UTP Category 6
 - .2 AVoIP, UTP Category 5e
 - .3 Control, UTP Category 5e
 - .4 Dante, UTP Category 5e
- .2 All links must attain a "PASS" certification as required by the standards defined above,

- unless otherwise released from this requirement by the UBC IT Audio Visual representative.
- .3 All copper Category cable links shall be tested for permanent link performance and the following parameters:
 - .1 Length;
 - .2 Wire Map;
 - .3 Insertion Loss;
 - .4 Near-End Crosstalk (NEXT) Loss;
 - .5 Attenuation to Crosstalk Ratio, Far-end (ACR-F);
 - .6 Propagation delay and delay skew;
 - .7 Return Loss;
 - .8 Power Sum Near-End Crosstalk (PSNEXT);
 - .9 Power Sum Attenuation to Crosstalk Ratio, Far-end (PSACR-F).
 - .4 Trained technicians who have successfully attended an appropriate training program and have obtained a certificate, as proof thereof shall execute the tests.
 - .5 The testing equipment shall be within the calibration period recommended by the equipment manufacturer in order to achieve the vendor-specified measurement accuracy.
 - .6 All shielded Category cable test results must show continuity of shield from end-to-end.
 - .7 Random testing of copper Category cables shall be done by UBC IT Audio Visual representative. Where any portion of the end-to-end system does not meet the specifications, the Contractor shall correct the deviation and repeat all applicable testing at no additional cost.
 - .8 Supply a complete set of electronic test results for all copper Category cable tests performed in PDF format with the Operation and Maintenance Manuals.
 - .9 Supply test results for all copper Category cable tests performed for each space as it is handover to the AV Programmer.

3.10 Testing Fibre Optic Cabling Installation

- .1 Measure, verify, and document proper operation of the fibre optic based video system performance in accordance to the TIA/EIA-568-B.3 standards:
 - .1 Test and document end-to-end attenuation for each simplex and duplex multimode fibre optics link to determine optical power loss between each cable termination point.
 - .2 Measure and document fibre optics cable systems insertion loss for each connectorized cable link, using a stabilized optical source and an optical power meter to compare the difference in optical power levels in dBm, by measuring how much light is put into the near end and how much light is exiting the far end. Use factory approved 50/125 core test jumpers only. Perform this procedure in accordance to the TIA/EIA OFSTP-14A multi-mode fibre testing specifications.
 - .3 To prevent high order modes from invalidating the power loss testing they must be attenuated during the referencing step to obtain a valid measure of the optical power travelling along the fibre core using the mandrel wrapping method. Use a mandrel diameter of 22mm for the multimode 3.0mm jacketed 50/125 core fibre optics cabling system.

- .4 For all fibre optics cable runs longer than 100m (300feet) conduct and document a signature trace using an optical time domain reflectometer (OTDR) to locate fibre events and measure losses attributable to cable, connectors & splicing.
- .5 For all Crestron Digital Media systems, provide a complete Digital Media test report
- .2 Forward to the Owner, or their designated Consultant a complete report detailing test results obtained above, accompanied by a letter certifying that all video components meet manufacturer's specifications and that the system is complete and ready for inspection.

*****END OF SECTION*****