UBC Technical Guidelines
UBC Vancouver and UBC Okanagan
November 2023 Revision

Section 27 40 00
Audio-Video Infrastructure
Page 1 of 11

1.0   GENERAL

1.1   Related UBC Guidelines

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

1.2   Description

.1   Audio-video infrastructure requirements for Sections 27 41 16 to 27 41 52.

2.0   DESIGN REQUIREMENTS

2.1   Consultant Coordination

.1   Coordination of architectural systems, audio-video power, data and pathways requirements is paramount for a successful implementation of all audio-video systems. It is the responsibility of the Consulting Engineer to ensure that all requirements have been capture in their Construction Documents.

.2   UBC IT Audio Visual shall be engaged by the project team to provide AV Infrastructure instructions, conceptual drawings or markups to be incorporated into the Consulting Engineer's Construction Documents, or in a case where an external AV system design consultant has been engaged this consultant shall provide same for review and approval by UBC IT Audio Visual. The instructions, conceptual drawings or markups provided by UBC IT Audio Visual shall not be issued to the Contractor performing the work in the Tender, or as a Site Instruction or Change Order. It is the responsibility of the Consulting Engineer to transfer the requirements to their documentation. This will ensure that the proper communication protocol is maintained throughout the project and that the requirements are fully coordinated with other disciplines.

.3   The Consulting Engineer shall provide UBC IT Audio Visual with Schematic Design, Design Development and Construction Documents for review and sign off at a minimum. Iterative reviews are required to ensure minimal impact prior to Tender. The Consulting Engineer shall provide electronic copies of the Drawings and Specifications for review.

.4   The Consulting Engineer shall use the UBC IT Audio Visual standard drawing symbols shown in AVSK-01.

.5   The Consulting Engineer shall provide the Issued for Construction Drawings and Specifications once issued to the Contractor.

.6   Shop Drawings, Site Instructions and Change Orders that affect audio-video systems shall be submitted to UBC IT Audio Visual for review.

.7   The Consulting Engineer shall inform UBC IT Audio Visual when audio-video power, data and pathways are ready for rough-in inspection, prior to boarding. UBC IT Audio Visual's site inspection will not remove the responsibility of the Consulting Engineer to ensure that the audio-video power, data and pathways conform to the Issued for Construction Documents requirements.

2.2   Basic Requirements

.1   Provide electrical power of the voltage, current and phase(s) required, from the main sources of supply to each audio-visual equipment load requiring supply of power. Typically a 120 VAC, 15A, single phase connection is required unless specified otherwise by UBC IT Audio Visual through design consultation.

.2   Provide an audio-visual raceway system consisting of outlet boxes, conduits, cable trays, pull boxes, sleeves and caps, and pull strings. *New conduit for cable runs are preferred for all new buildings. Free-air cabling is permitted for existing buildings where conduit is non-existent and/or inadequate for required AV cabling with permission from UBC IT Audio Visual.*

.3   Provide plywood backing behind finished wall surface for audio-visual equipment such as flat panel displays, projection screens and equipment racks.

.4   It is not permitted to install audio-visual equipment in an IT communications room, electrical room or mechanical room. Notwithstanding, at the UBC Okanagan campus, audio-visual equipment may be installed in an IT communications room with approval from both UBCO IT Audio Visual and UBCO IT Data & Infrastructure.

.5   It is not permitted to share conduit pathway with IT communications cabling with the exception of cable/basket tray that has barriers to separate IT and audio-visual cabling to ensure proper cable management for both disciplines. Notwithstanding, at the UBC Okanagan campus, IT and audio-visual cabling may share conduit and basket trays without barrier if they are the same type of cable (i.e. Category 6A) and is approved by both UBCO IT Audio Visual and UBCO IT Data & Infrastructure.

2.3   Performance Criteria

.1   Basket tray shall be sized for communications and audio-visual cable density plus 25% future expansion capacity:

.1   Continuous, rigid, welded steel wire mesh spaced 50mm x 100mm;
.2   Continuous T-weld on top rail of tray;
.3   And Finish: electroplated zinc coating.

.2   A zone conduit system shall be used in areas where basket tray is not feasible. Zone pull boxes c/w access hatches shall be spaced maximum 9 meters apart. All outlet box conduits shall homerun to the nearest zone pull box.

.3   Power connection shall be adjacent to audio-visual outlet box.

.4   Pathways shall avoid potential sources of electromagnetic interference by maintaining clearances of at least:

.1   305mm from fluorescent ballasts;
.2   305mm from electrical distribution conduit and cable less than 1kV;
.3   1000mm from electrical distribution conduit and cable more than 1kV;
.4   1220mm from motors and transformers;
.5   And 305mm from HVAC equipment, ducts and pipes.

UBC Technical Guidelines
UBC Vancouver and UBC Okanagan
November 2023 Revision

Section 27 40 00
Audio-Video Infrastructure
Page 3 of 11

.5   Audio-visual outlet boxes shall be masonry back box with minimum depth of 90mm. Outlet box shall be recessed if wall mounted below finished ceiling. All outlet boxes shall have cover plates installed and colour coordinated with other outlets and services.

.6   Floor boxes with audio-visual requirements shall be able to accept Extron AAP or MAAP plates. Floor box lid shall allow cable egress while in the closed position. Floor box shall be intended for AV cabling and termination use, and allow sufficient room for all required cabling without cable strain at the connectors.

.7   The bend radius shall be at least six (6) times the internal diameter for conduit that has an internal diameter of 50mm or less. The bend radius shall be at least ten (10) times the internal diameter for conduit that has an internal diameter more than 50mm.

.8   The maximum number of bends between cable pull boxes in a conduit run shall be two (2) 90 degree bends.

.9   Conduit runs shall have no continuous sections longer than 30m between pull boxes.

.10   If a conduit run requires a reverse bend between 100 degree and 180 degree then a pull box shall be inserted into the bend but shall not be used as the bend.

.11   Pull boxes shall be installed in fully accessible spaces.

.12   Support and secure all boxes independent of the conduit connected thereto.

.13   All conduit ends shall be protected by insulating bushings.

.14   Conduit stub and insulating bushing shall be as short as possible inside the outlet box to ensure that it does not obstruct installation of the audio-visual device. *Refer to AVSK-03 for AV outlet box detail.*

.15   All conduits shall be left with a nylon pull string installed.

.16   Plywood backing shall be a minimum of 20mm thick and spanned between a minimum of three (3) studs. The dimensions of the backing shall be sized appropriately for the equipment being installed.

.17   Each outlet box shall be clearly marked in back of box with an 'AV#' that corresponds to the riser diagram and floor plan.

.18   Audio-visual conduits and outlet boxes shall be colour coded with paint or similar. The colour shall be different from other systems including communications pathway.

2.4   General Device Power, Data and Pathway Requirements

.1   This section will aid Consultants and Contractors with general infrastructure requirements for each type of audio-visual device. Final infrastructure requirements shall be verified by UBC IT Audio Visual prior to finishing design or pricing scope of work.

.2   Ceiling Mount Projector

    .1   Provide ceiling mount double duplex receptacle, shared with respective electric screen 15A circuit.

    .2   Provide ceiling mount 2-gang projector outlet box.

UBC Technical Guidelines   **Section 27 40 00**
UBC Vancouver and UBC Okanagan   **Audio-Video Infrastructure**
November 2023 Revision   **Page 4 of 11**

        .3   Provide 41mm conduit from projector outlet box to audio-visual rack back box.

        .4   If the room does not have a rack, then conduit shall run to audio-visual input plate outlet box and provide ceiling mount data outlet box adjacent to projector outlet box.

.3   Wall Mount Flat Panel Display

        .1   Provide wall mount double duplex receptacle on dedicated 15A circuit.
        .2   Provide wall mount 2-gang display outlet box.
        .3   Provide 41mm conduit from display outlet box to audio-visual rack back box.
        .4   If the room does not have a rack, then conduit shall run to audio-visual input plate outlet box and provide wall mount data outlet box adjacent to display outlet box.
        .5   Provide plywood backing behind display.

.4   Wall Mount Digital Signage Flat Panel Display

        .1   Provide wall mount duplex receptacle.
        .2   Provide wall mount data outlet box adjacent to duplex receptacle.
        .3   Provide plywood backing behind display. Refer to AVSK-01 for typical flat panel display mounting detail.

.5   Recessed Electric Screen

        .1   Provide ceiling mount power connection c/w local disconnect switch on left-hand side of screen, shared with respective projector 15A circuit.
        .2   Provide ceiling mount single-gang electric screen outlet box mounted on left-hand side of electric screen.
        .3   Provide wall mount single-gang manual screen control outlet box mounted adjacent to local light switch.
        .4   Provide 21mm conduit from each outlet box to audio-visual rack back box.
        .5   If the room does not have a rack, then conduit shall run to the audio-visual control panel outlet box.

.6   Wall Mount Electric Screen

        .1   Provide ceiling mount duplex receptacle on left-hand side of screen, shared with respective projector 15A circuit.
        .2   Provide ceiling mount single-gang electric screen outlet box mounted on left-hand side of electric screen.
        .3   Provide wall mount single-gang manual screen control outlet box mounted adjacent to local light switch.
        .4   Provide 21mm conduit from each outlet box to audio-visual rack back box.
        .5   If the room does not have a rack, then conduit shall run to the audio-visual control panel outlet box.
        .6   Provide plywood backing at screen anchor points.

.7   Ceiling Mount HD Camera

        .1   Provide ceiling mount duplex receptacle.
        .2   Provide ceiling mount single-gang camera outlet box adjacent to power receptacle.
        .3   Provide 35mm conduit from camera outlet box to audio-visual rack back box.

.8   Wall Mount HD Camera

        .1   Provide wall mount duplex receptacle.

UBC Technical Guidelines
UBC Vancouver and UBC Okanagan
November 2023 Revision

Section 27 40 00
Audio-Video Infrastructure
Page 5 of 11

.2 Provide wall mount single-gang camera outlet box adjacent to power receptacle.
.3 Provide 35mm conduit from camera outlet box to audio-visual rack back box.

.9 Ceiling Mount Microphone

.1 Provide ceiling mount single-gang microphone outlet box above finished ceiling.
.2 Provide 27mm conduit from microphone outlet box to audio-visual rack back box.
.3 Multiple microphone outlet boxes can be daisy chained but conduit size may need to be increased to accommodate the additional cabling.

.10 Wall/Ceiling Mount Antenna

.1 Provide ceiling or wall mount single-gang antenna outlet box.
.2 Provide 27mm conduit from antenna outlet box to audio-visual rack back box.

.11 Wall/Ceiling Mount Room Support IP Camera

.1 Provide one (1) wall or ceiling mount duplex receptacle.
.2 Provide one (1) wall or ceiling mount data outlet box adjacent to power receptacle.

.12 Ceiling Mount Speaker

.1 Provide ceiling mount single-gang outlet box above finished ceiling.
.2 Provide 27mm conduit from speaker outlet box to audio-visual rack back box.
.3 If the room does not have a rack, then conduit shall run to an additional wall or ceiling mount 2-gang outlet box mounted adjacent to the local display device.
.4 Multiple speaker outlet boxes can be daisy chained but conduit size may need to be increased to accommodate the additional cabling.

.13 Wall Mount Speaker

.1 Provide wall mount single-gang speaker outlet box.
.2 Provide 21mm conduit from speaker outlet box to audio-visual rack back box.
.3 If the room does not have a rack, then conduit shall run to an additional wall or ceiling mount 2-gang outlet box mounted adjacent to the local display device.
.4 If required by system design, provide duplex receptacle adjacent to speaker outlet box (to support the use of active speakers).

.14 Wall Mount Button Control Panel

.1 Provide wall mount 3-gang outlet box.
.2 Provide 27mm conduit from control panel outlet box to audio-visual rack back box.
.3 If the room does not have a rack, then conduit shall run to local display device outlet box.

.15 Wall Mount Touch Control Panel

.1 Provide wall mount 2-gang outlet box.
.2 Provide 27mm conduit from control panel outlet box to audio-visual rack back box.
.3 If the room does not have a rack, then conduit shall run to local display device outlet box.

.16   Wall Mount Audio-Visual Input Plate

    .1   Provide wall mount multi-gang outlet box as defined by system requirements.

    .2   Provide 41mm conduit from input plate outlet box to audio-visual rack back box.

    .3   If the room does not have a rack, then conduit shall run to local display device outlet box.

    .4   Refer to AVSK-02 for AV input plate *J*-hook installation detail.

    .5   *J-Hook shall be installed with two (2) toggler bolts and (2) 3/16" flat head screw to secure to dry wall.*

    .6   *J-Hook shall be installed at 25-3/4" AFF.*

.17   Table Mount Audio-Visual Devices

    .1   Provide floor box c/w with double duplex receptacle and 41mm conduit from floor box to audio-visual rack back box.

    .2   If the room does not have a rack, then conduit shall run to local display device outlet box.

.18   Audio-Visual Equipment Rack (each)

    .1   Provide wall mount double duplex receptacle on dedicated *20*A circuit.

    .2   Provide wall mount data outlet box adjacent to power receptacle.

    .3   Provide wall mount 300mm x 300mm rack back box.

    .4   If the rack is wall mounted, provide plywood backing.

.19   Fixed Instructor Lectern

    .1   Provide four (4) double duplex receptacles on single 15A circuit.

    .2   Provide data outlet box adjacent to each rack power receptacle.

    .3   Provide data outlet box adjacent to power receptacle in trough.

    .4   All conduits for power, communications and audio-visual shall stub up below lectern trough. Stubs shall never be installed underneath lectern rack bay locations.

.20   Mobile Instructor Lectern

    .1   Provide wall mount duplex receptacle on dedicated 15A circuit.

    .2   Provide wall mount data outlet box adjacent to duplex receptacle.

    .3   Provide wall mount 3-gang furniture whip outlet box mounted adjacent to duplex receptacle.

    .4   Provide 41mm conduit from outlet box to audio-visual rack back box

.21   Lighting Integration

    .1   Provide 2-gang outlet box adjacent to the local low-voltage lighting controller.

    .2   Provide 27mm conduit from lighting integration point outlet box to audio-visual rack back box.

.22   Electric Window Blind Integration

    .1   Provide 2-gang outlet box adjacent to the blind controller.

    .2   Provide 27mm conduit from blind integration point outlet box to audio-visual rack back box.

    .3   Blind shall have a LAN or RS-232 port for control by a 3rd party controller.

2.5   Typical Room Power, Data and Pathway Requirements

.1   This section will aid Consultants and Contractors with infrastructure requirements for typical audio-video systems. UBC IT Audio Visual shall be consulted to confirm which system type applies to the given project rooms. UBC IT Audio Visual shall verify final infrastructure requirements prior to finishing design or pricing scope of work.

.2   Typical Rooms:

.1   Bring-Your-Own-Device (BYOD) Projector System

.1   **Description:** This system has a single projector and screen and allows for connection of a personal device such as laptop or tablet. Wall mounted speakers flanking the screen drive program audio.

.2   Refer to AVSK-08 for typical BYOD projector system riser diagram.

.2   Bring-Your-Own-Device (BYOD) Flat Panel Display (FPD) System

.1   **Description:** This system has a single flat panel display and allows for connection of a personal device such as laptop or tablet. A sound bar mounted below the display drives program audio.

.2   Refer to AVSK-09 for typical BYOD FPD system riser diagram.

.3   Single Screen Video Conferencing (VC) System

.1   **Description:** This system has a single flat panel display, camera and microphone to allow live, real-time two-way communication between two or more geographically separated parties using a hardware-based endpoint. Presentation material can be transmitted from any personal device such as a laptop or tablet. Program audio is typically driven from the all-in-one camera, sound bar and microphone.

.2   Refer to AVSK-10 for typical single screen VC system riser diagram.

.4   Dual Screen Video Conferencing (VC) System

.1   **Description:** This system has two flat panel displays, a camera and microphones to allow live, real-time two-way communication between two or more geographically separated parties using a hardware-based endpoint. Presentation material can be transmitted from any personal device such as a laptop or tablet. Program audio is typically driven from the all-in-one camera, sound bar and microphone.

.2   Consult with UBC IT Audio Visual for system riser diagram.

.5   Web Conferencing System

.1   **Description:** This system has a single flat panel display, web camera and microphone to allow live, real-time two-way communication between two or more geographically separated parties using a PC running web conferencing software. Presentation material can be loaded to the PC to transmit. Program audio is typically driven from the all-in-one camera, sound bar and microphone.

UBC Technical Guidelines
UBC Vancouver and UBC Okanagan
November 2023 Revision

Section 27 40 00
Audio-Video Infrastructure
Page 8 of 11

.2   Consult with UBC IT Audio Visual for system riser diagram.

.6   <u>Single Screen Projector System</u>

    .1   **Description:** This system has a single projector and screen and allows for connection of a personal device such as laptop or tablet, or presentation from a built-in PC or document camera. Wall mounted speakers flanking the screen drive program audio.

    .2   Consult with UBC IT Audio Visual for system riser diagram.

.7   <u>Dual Screen Projector System</u>

    .1   **Description:** This system has two projectors and screens and allows for presentation from two sources concurrently. Connections can be made from a personal device such as laptop or tablet, or built-in PC or document camera. A lectern provides a work surface and a location to house the audio-video equipment. Wall mounted speakers flanking the screens drive program audio.

    .2   Consult with UBC IT Audio Visual for system riser diagram.

.8   <u>Lecture Theatre System</u>

    .1   **Description:** This system has two projectors installed in a projection booth that allow presentation from two sources concurrently on two screens at the front of room. Connections can be made from a personal device such as laptop or tablet, or built-in PC or document camera. A lectern provides a work surface and a location to house audio-video equipment. The projection booth will house audio-video equipment that is not required at the lectern. Wall mounted line array speakers flanking the screens drive program audio and ceiling mounted speakers drive microphone audio.

    .2   Consult with UBC IT Audio Visual for system riser diagram.

.9   <u>Collaboration Lab System</u>

    .1   **Description:** This system has a flat panel display for the instructor and at each student pod allowing presentation from any single display to all the other displays. The instructor has connections for a personal device such as laptop or tablet, or built-in PC or document camera. Each student pod has connections for a personal device such as laptop or tablet. A lectern provides a work surface and a location to house audio-video equipment. An audio-video equipment closet will house equipment that is not required at the lectern. Ceiling mounted speakers will drive program and microphone audio.

    .2   Consult with UBC IT Audio Visual for system riser diagram.

    .3   Collaboration Lab systems require an audio-video equipment closet to house at minimum one (1) back-end audio-video equipment rack. The closet shall provide acoustic isolation from the lab and adequate ventilation or cooling for the heat generated by the audio-video equipment. Dimensions, power, data and HVAC requirements shall be verified by UBC IT Audio Visual.

.10   <u>Digital Signage System</u>

.1   **Description:** This system has a flat panel display with digital signage player PC mounted behind the display.

.2   Consult with UBC IT Audio Visual for system riser diagram.

2.6   Projection Booth Infrastructure Requirements

.1   Projection booths are required in lecture theatres to house projectors and back-end audio-video equipment racks.

.2   Projection booths require coordination with architecture, electrical and mechanical to ensure the booth location, dimensions, power, data and HVAC support the needs of the audio-video system.

.3   Refer to AVSK-11 for an example layout of a typical projection booth with three (3) projectors (left, right and centre), and two (2) audio-video equipment racks.

.4   Architectural Requirements

.1   The projection booth shall be sized at a minimum for two (2) projectors and one (1) full height swing-out audio-video equipment rack. Additional equipment racks and projectors may be required for the audio-video system. Quantities shall be confirmed by UBC IT Audio Visual.

.2   The projection booth shall be located such that all projectors are aligned centred to their corresponding projection screen at the front of room. The projection screens can be angled to reduce the width of the projection booth. Angled screen must adhere to the horizontal viewing angle defined in the UBC Learning Space Design Guidelines.

.3   The audio-video equipment racks shall have a minimum clearance of 1500mm in front, 1000mm on one side, and 150mm on the other side.

.4   The projectors shall have a minimum clearance of 500mm on the back, and both sides from walls or any other audio-video components.

.5   The projection booth shall have a minimum depth of 2900mm. Final depth of room shall be confirm by UBC IT Audio Visual to suit the needs of the audio-video system requirements.

.6   The projection booth shall be accessible from the entry vestibule or foyer outside the lecture theatre for support staff to be able to access the booth without disrupting a session.

.7   The projection booth shall be designed to provide the required structural support for the projectors and should include any required vibration isolation measures to prevent the projectors from shaking. In addition to vibration caused by HVAC, movements in the building such as doors opening and closing shall not cause the projectors to shake. Refer to AVSK-12 for example projector mounting structure.

.8   The projection booth shall have a window spanning the full width of all projectors in the booth. The window shall be designed for projection allowing optimal transmission of light, contrast and colour. The window shall be clear, colourless glass with a 2-

sided, multi-layer broadband anti-reflective coating. Transmission rate shall be 95% or better. The window shall be installed on 2 degree angle to minimize ghosting.

  .1   Typical product is Abrisa Technologies CPG series.

.5   Electrical Requirements

  .1   Provide one (1) wall mounted double duplex receptacle on dedicated 20A circuit for each audio-video equipment rack.

  .2   Provide one (1) ceiling mounted duplex receptacle on dedicated 20A circuit for each projector.

  .3   Provide one (1) wall mounted data outlet with two (2) data drops for each audio-video equipment rack.

  .4   Provide surface mounted light fixtures in the projection booth. The location of the fixtures shall not affect the location of the racks and projectors as well as the swing of the racks.

  .5   Provide minimum 150mm wide basket tray around the perimeter of the projection booth to support the audio-video cabling to the equipment racks and projectors.

  .6   Provide adequate wall space, unimpeded from audio-video equipment rack location and swing, for lighting controller panel and electrical panel board as required.

  .7   For UBCO provide the following additional data drops:

    .1   One (1) ceiling mounted data outlet with one (1) data drop for each projector.
    .2   Four (4) data drops in addition to those required above for each audio-video equipment.

.6   Mechanical Requirements

  .1   Ventilation or cooling shall be provided in the projection booth to manage the heat gain produced by the audio-video equipment and projectors without adversely affecting the functionality of the audio-video system through factors such as condensation and vibration.

  .2   The projection booth shall be kept at a temperature range between 21 and 24 degrees Celsius with a relative humidity level between 30 and 50 percent.

  .3   The total amount of heat gain in the projection booth shall be calculated by allowing 4000 BTU/h per projector and 4000 BTU/h per audio-video equipment rack.

2.7   Stage Lighting

.1   Stage lighting shall be provided by the audio-visual contractor unless indicated otherwise by UBC IT Audio Visual.

.2   Stage lighting installation methods include flexible truss mount, flexible pole mount or fixed surface mount.

.3   The stage lighting installation requires the following infrastructure:

UBC Technical Guidelines
UBC Vancouver and UBC Okanagan
November 2023 Revision

Section 27 40 00
Audio-Video Infrastructure
Page 11 of 11

.1   Pathway from stage light fixtures to audio-visual equipment rack for DMX control cable

.2   One (1) 20A receptacle on dedicated circuit for every nine (9) fixtures

.3   Pathway from chain hoists to wall mounted connection point for remote plug station if applicable

.4   One (1) 20A receptacle on dedicated circuit for each pair of chain hoists if applicable

.4   Refer to Section 27 41 16.15 for Stage Lighting requirements.

3.0   EXECUTION

3.1   Electric Screen Mounting

.1   Electric screen shall be mounted at a height such that the bottom edge of the image is at 1220mm for applications where the viewers are typically seated. The screen may need to be higher if the viewers are standing or the room geometry requires adjustments.

.2   The following table provides a guide for electric screen case mounting height by typical screen size. The exact mounting height shall be confirmed onsite prior to installation and shall account for non-standard black drop height as indicated in the design.

Image Size			Case Size		Bottom of Image Height Above Finished Floor	Black Drop	Top of Case Height Above Finished Floor
Height	Width	Diagonal	Height	Width			
50"	80"	94"	6"	92"	48"	2"	106"
57.5"	92"	109"	6"	104"	48"	2"	113.5"
60"	96"	113"	6"	108"	48"	2"	116"
65"	104"	123"	6"	116"	48"	2"	121"
69"	110"	130"	6"	122"	48"	2"	125"
72.5"	116"	137"	6"	128"	48"	2"	128.5"
87"	139"	164"	6"	152"	48"	2"	143"
100"	160"	189"	9"	173.5"	48"	2"	159"
110"	176"	208"	9"	189.5"	48"	2"	169"
117.5"	188"	222"	9"	201.5"	48"	2"	176.5"

END OF SECTION