

## ABBREVIATIONS

GC - General Contractor	ARCH - Architect
EC - Electrical Contractor	OSE - Owner Supplied Equipment
AVC - Audiovisual Contractor	AFF - Above Finished Floor

## AUDIOVISUAL REFERENCE NOTES

- All designs, plans and specifications generated by the architects, electrical engineers, acoustical consultants, or project planners, pertaining directly to the installation of the audiovisual systems should be forwarded to CMS for review. It is our intention to aid all involved in the project, by insuring a consensus and specific criteria are met for the proper installation of the audiovisual systems.
- These drawings are intended as design input only to the architect and the electrical engineer. They are intended only as a reference for field use.
- Where exact dimensions are not called for, the scale of this drawing is sufficiently accurate for determining location of equipment, junction boxes, outlet boxes, wire ways, panels, etc. Room dimensions on this drawing have been taken from preliminary architectural drawings.
- Exact locations of flush floor boxes and flush floor power receptacles shall be verified by the architect, once final furniture designs and locations have been determined.
- All power conduit, power wire ways, and power junction boxes are to be sized by the electrical engineer. Where these items have been sized on this drawing, the electrical engineer shall check sizing for compliance with applicable electrical codes.
- All junction boxes, conduit, wire ways, power, receptacles, floor boxes, are part of the base electrical contract. Please refer to drawing AV.101 and AV.102 for further detail.
- Conduit runs on this drawing show only interconnection between the termination points. The exact path of the conduit is to be determined by the electrical engineer. There shall be a minimum of one pull box for every 100 feet of straight empty conduit and a pull box for more than two 90 degree bends in a conduit run. All conduit shall be deburred, cleaned, capped, tagged and furnished with pull wires (by base electrical contractor).
- Power receptacles shown on the AV Electrical drawings are DEDICATED to specific audiovisual equipment. They should be standard commercial outlets (i.e., Hubbell 5252 or equivalent). Refer to CMS AV electrical drawings for quantities & locations. Additional utility power receptacles, to meet code or convenience requirements, are not shown.
- Power breaker panels are to be sized and specified by the electrical engineer. All circuits are to be protected 20 amp circuit breakers unless otherwise detailed. The circuit breaker panel should be accessible during conferences (i.e. not locked), and for maintenance access if required. All circuits must be CLEARLY labeled on breaker panel and electrical outlets within the room.
- Power circuits for the AV systems must be on the same phase, but NOT on the same phase as any compressors, motors or lighting dimming systems.
- All electrical equipment must be completely grounded to a true earth common ground or equivalent for proper operation.
- All rear projection booths are to be painted egg shell black. All rear projection booth finishes and hardware shall be non-reflective. Any windows must be blacked out 100%.
- All cable types and quantities shown are estimates only. Exact cable types and quantities shall be verified by the Audiovisual Contractor. The Audiovisual Contractor shall field issue an approved cable pull drawing at time of cable delivery to the job site.

## ROOM READINESS

This section provides a checklist for the condition of the AV conference rooms prior to delivery and installation of the Audiovisual systems. The Audiovisual systems are delivered after the rooms are "ready" to ensure a proper and secure installation of the Audiovisual equipment.

- All construction in the Conference Room complete, including:
  - the room free of debris and clean - by General Contractor.
  - all walls complete with any fabric wall coverings or paint - by General Contractor.
  - ceilings complete and closed - by General Contractor.
  - floor finishes / carpet installed - by General Contractor.
  - all doors installed - by General Contractor.
  - general and track lighting installed - by General Contractor.
- The projection / control room complete including:
  - room painted black - by General Contractor.
  - rear projection screens installed, front wall complete - by General Contractor and Audiovisual Contractor.
  - floor closed - by General Contractor.
  - all doors installed - by General Contractor.
  - general and track lighting installed - by General Contractor.
  - the room free of debris and clean - by General Contractor.
- All electrical work related to the AV system complete, including:
  - installation of all conduit, floor boxes, junction boxes wire ways, etc. - by General Contractor.
  - All AV related low voltage cables installed - by Audiovisual Contractor.
- All videoconference and other ceiling lighting installed - by Audiovisual Contractor.
- Lutron lighting systems installed, tested and operational - by others.
- Motorized window shades installed and operational - by General Contractor.
- All millwork items complete for housing the AV equipment - by General Contractor.
- All phone, data and LAN connections live - by General Contractor.
- The conference room table installed and complete - by General Contractor.
- All credenzas, cabinets & closets housing AV Equipment to have locking doors - by General Contractor.
- All AV Control Rooms, Equipment or Projection rooms to have security card readers as required - by General Contractor.
- Timeline

## NOTE

**IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO INCLUDE AUDIOVISUAL ROOM READY DATES IN THE CONSTRUCTION SCHEDULE AND COORDINATE / CONFIRM TIME FRAMES WITH CMS TO ENSURE SUFFICIENT TIME IS PROVIDED FOR AV INSTALLATION. 3-4 weeks (per room)**

**NOTE: EACH AUDIOVISUAL ROOM WITH INTEGRATED CONTROL SYSTEM MUST BE "ROOM READY" AT LEAST 3 WEEKS PRIOR TO EXPECTED SYSTEM OPERATION DATE**

## LIGHTING CRITERIA

### Audiovisual Facilities

- Lighting dimming systems are recommended for all Audiovisual Rooms.
- Light fixtures must be zoned and dimmable in order to provide suitable lighting scenes for typical conference, presentation, and projection modes.
- Fixtures in front of projection screens/displays must be on a separate zone. This will allow the lights nearest the projection screens to be turned off independently while having the remaining zones provide low level illumination during presentation modes.
- The dimming system should be a low voltage-type, providing control for all lighting zones. The system must allow for selecting a minimum of 4 preset scenes (General, Presentation, Video Conference, Off) from multiple locations.
- Control locations shall include: Scene selector wall plates at room entrance, a master preset panel (typically located near AV equipment cabinet or within a projection booth) and an interface to allow external-low voltage control from the AV system.
- The recommended dimming system is a LUTRON system. Depending on the AV system selected Crestron or AMX lighting systems may also be used.
- System loads and dimming equipment specification shall be specified by the electrical engineer and/or lighting consultant.
- An interface to connect the AV control system to the lighting control system must be specified with each conference room.
- The interface for AV must be installed at the AV rack location. Interface must be easily accessible.

### Videoconference Room Lighting

For lighting purposes, the "front wall" must parallel with the lighting and ceiling grid overhead. This will make it easier to design a proper lighting arrangement.

If the room is designed with fluorescent lighting, the temperature of the lamp used has a direct impact on the color of the light output (unobservable to the human eye, but evident on the video camera). Selection of the lamp type should be made with consideration to both the heat it may produce and the color temperature of the light output. A color temperature of 3200 to 3500 degrees Kelvin is preferred. Improper lighting can cause a color distortion in the picture, as seen on the display.

To eliminate shadows and dark areas, we need both reflective and directional lighting. Some portion of the light hitting the table top must be reflected up to illuminate the shaded or shadow areas of the participants. This is best expressed in the basic geometry equation, the angle of incidence equals the angle of reflection. In other words, some portion of the lighting should be angled in such a manner so as to reflect off the table surface and illuminate otherwise darker areas.

90 degree louvers are generally placed directly over the room participants, while the 45 degree louvers are placed slightly in front of the table and about 2 feet from the back wall. A general rule of thumb is 45 degree fixtures are placed about 2' (or one ceiling panel width) in front of the 90 degree fixture over the room participants. Since the height of the ceiling will have a great deal to do with where the light finally hits the table area, this is not a fool proof rule of thumb. However, for ceilings under 10' this is usually an adequate measure.

The reason for the front 45 degree louver is to create a reflective light off the table. The reason for the 45 degree louver on the back wall is to eliminate shadowing on the back wall that would be picked up by the camera. One of the benefits derived from light and shading differentials is our ability to perceive depths. If the background is very dark, the room participants tend to "flatten out" against the back wall on the distant end screen. With proper background lighting the room participants are outlined better, creating an appearance of depth. Background lighting also eliminates dimly lit areas at the top of the wall, to create a uniform backdrop for the camera.

Ideal lighting levels are:

Area	Foot-Candles	LUX
Horizontal on the table top	20 - 30	215 - 323
45 degrees at head height (seated)	20 - 30	215 - 323
Vertical at head height (seated)	20 - 30	215 - 323

## INTERIOR ROOM ENVIRONMENT

**Furniture:**  
Highly reflective surfaces in the room, such as chrome chairs, paintings with glass covers, etc. should be avoided. Harsh or severe colors, along with complex patterns on fabric should also be avoided.

**Tables:**  
Dark colored, high gloss tables should be avoided whenever possible as they create a glare problem for the cameras and do not effectively reflect light for shadowed areas. Glass tops can NOT be put on tables. For best results, a light colored table with a matte finish should be used; a light Oak is a good choice, i.e. Banister Oak. Table shape is also important. A slightly curved "C" shaped table, or a straight table is preferred. These offer the advantage of all meeting participants being about equal distance from the camera; thereby eliminating any field of focus problems. The disadvantage is that fewer people can be fit into the picture at one time. Another popular shape is the "V" shape. This allows more people to fit into the picture at one time but, because of the varying depth from the camera, can cause problems with the camera field of focus.

**Coloring:**  
For room interiors, very bright or very dark colors should be avoided. Also, patterned wall paper, fabric or drapes in front of the camera should not be used. For best results the color should be a light blue (crystal blue), a medium gray, or a dark wheat color. These colors aren't mandatory, nor will the room be unusable if they aren't selected. However, empirical data has shown these colors to provide the best background for the camera, and enhances the probability of a successful video conferencing environment.

**Floors:**  
All floor surfaces in the conference room should be carpeted, preferably with an anti-static type of carpeting. Since the carpet is rarely seen on camera, prohibitions about colors, and patterns are much less critical for the carpets. The main function of the carpet is to provide a sound absorption material to prevent echo from bouncing around the room, or noise intrusion from the floor below. Where available, a thick, plush carpet is preferred.

**Exterior Windows:**  
All exterior windows must be covered with blackout type shades, blinds or drapes. These shades should have an electrical interface for the AV system to connect to so they can be controlled from the AV touch panel.

**Interior Glass Partitions:**  
Interior glass partitions will cause additional unwanted glare in the room, especially an exterior perimeter room which has exterior windows. In all cases all glass partitions must be covered (from the inside) with blackout type shades, blinds or drapes.

## ROOM ACOUSTICS

Of all the problems associated with audio and videoconferencing, audio quality usually causes the most problems, and is the hardest to correct. Room acoustics are impacted by several factors: room size, ceiling height, wall/ceiling/floor material, table placement, external noise factors, microphone types, the number of people in the room, etc. Ideally, all walls and ceiling should have acoustical panels; having a noise coefficient (NRC) of 9 or better. The reality is, most rooms will have walls that are made of panel, plasterboard, or concrete, with windows, doors, and white boards; all having hard surfaces. The impact of these hard surfaces will be felt, not in the local room, but at the remote site during a conference call. These hard walls act as reflectors for the room sound, or the voice coming from the remote site via the speaker. This noise hits the walls, and is directed back into the microphones at the table, just as a ping pong ball thrown against a hard surface. The results are that the remote site hears the noise, or worse, their own voice coming back at them. The effect is similar to a bad echo canceller on a voice line, which is extremely disconcerting to the remote site.

The best solution is to create an environment where the incoming audio level can be turned up to where all local room participants can hear the distant end without straining. Also, the system should be capable of reproducing audio at the remote site where you can speak at a normal or low level without the remote site having problems hearing you. To do this we have to adjust speaker and microphone levels higher, while simultaneously reducing the reverberation or echo from feeding back into the microphone.

Acoustical treatment to the walls, ceiling and floor will prevent reverberation and ambient noise from intruding into the conference. This is where sound absorption, or acoustical panels are used. Acoustical panels come in varying levels of effectiveness and while .9NRC is desired, a .6NRC is acceptable.

There are also several other products, not specifically designed for sound absorption, that will also perform the function adequately. Although not recommended as the only solution, one solution that many customers choose is drapes. Drapes or curtains are normally less expensive than panels, require less modification to a room, and can be moved aside during non-video conferencing conditions. Standard acoustical ceiling tile should be used in the conference room; however Owens Corning Softek Acoustical Ceiling Panels, or their equivalent, will provide greater reverberation control and are suggested. Another option to consider is building walls up past the false ceiling to the true slab above as this will help eliminate any noise that travels in ceiling plenum area.

Air conditioning is frequently a large contributor to excessive ambient level noise. This can be alleviated through the use of air flow diffuser (100CFM) or adding acoustical baffles inside the ducts, if the noise is coming from the AC motor.

## ACOUSTICAL CRITERIA

The AV rooms must be designed for the following Noise Criteria (NC) ratings:

ROOMS	NC RATING
ALL AUDIOVISUAL CONFERENCE ROOMS AS PER AV KEY PLANS	NC - 30

## ROOM ACOUSTICS (CONTINUED)

One of the most common concerns with demising wall constructions involve the resulting acoustical privacy between the two spaces.

In addition to the noise criteria ratings listed below the conference rooms should also be designed to meet the following speech privacy potentials.

Speech privacy between two spaces is a function of two factors: the background noise level in the receiving space (expressed as noise criterion, NC) and the acoustic separation of the total construction between the spaces (expressed as Sound Transmission Class, STC). The combination of these two ratings (STC + NC) has been shown to correlate well with the degree of speech privacy

$$STC + NC = SPP$$

## SPEECH PRIVACY POTENTIAL (SPP)

The AV rooms must be designed for at least the following minimum speech privacy (SPP) ratings:

ROOMS	SPP RATING
ALL AUDIOVISUAL CONFERENCE ROOMS AS PER AV KEY PLANS	SPP - 80

## REVERBERATION TIME (RT60)

Reverberation Time (RT60) is the time required for reflections from a direct sound (pink noise signal) to decay by 60dB SPL. For good speech intelligibility in audio and videoconference environments, a RT60 of 0.5 seconds (500ms) in the 100-5000Hz octave bands is recommended.

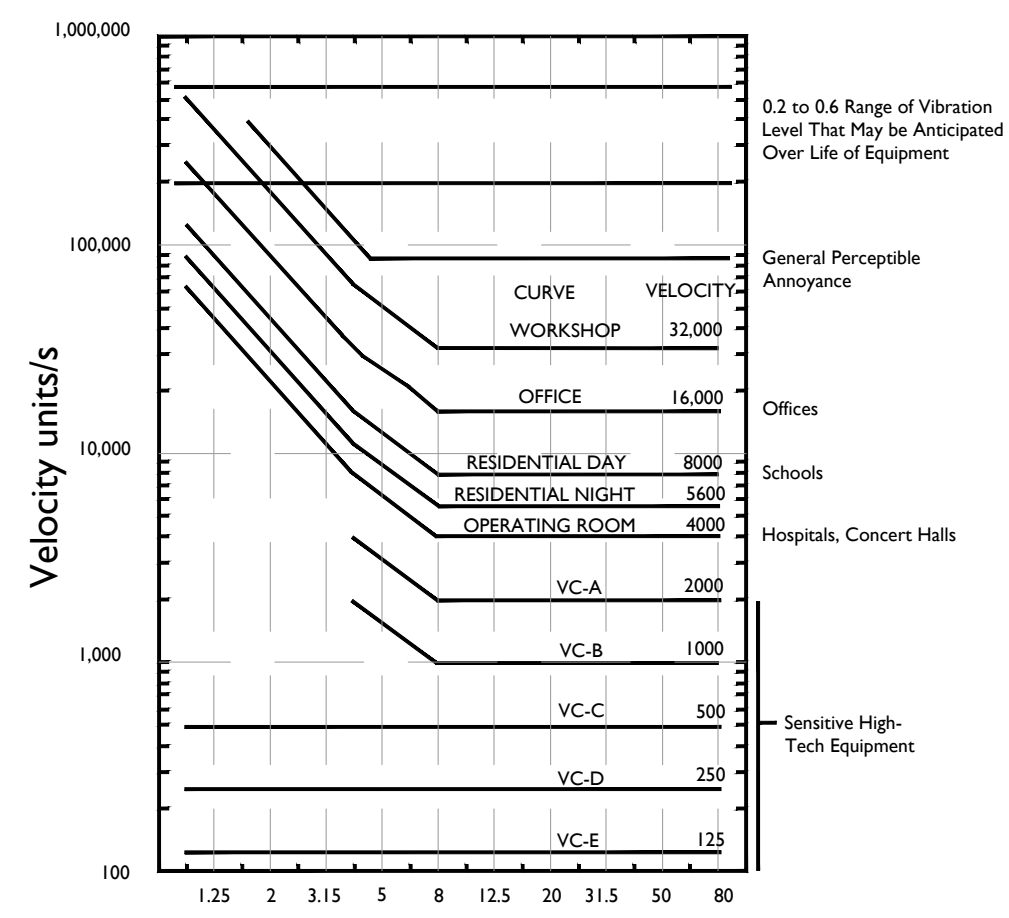
Untreated rooms have a variety of reverberation times depending on the size and shape along with the absorptive qualities of the surfaces in the room. Generally, it is expected that audio and videoconference environments will require additional absorptive materials on the walls, ceilings, floors and/or other acoustically reflective surfaces in order to achieve an appropriate RT60.

The acoustic absorption should, to the extent possible, be distributed on the walls in addition to the ceiling to avoid/minimize flutter echo effects in all directions. Distribute the absorption elements about the walls, avoid absorption clusters. Carpet on the floor is also strongly recommended.

## VIBRATION

Vibration isolation of the environment in which the AV equipment is to be installed is of particular concern, especially at locations where video cameras, projectors, rear projection systems are to be installed.

Below is a chart which outlines the recommended guidelines for vibration as per ASHRAE (American Society of Heating, Refrigeration and Air-conditioning Engineers). A study by an accredited acoustical engineer shall be conducted to certify the space is with these working conditions.



One-Third Octave Band Center Frequency, Hz

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△ Date	Description
11/21/2017	REVIEW & COORDINATION
11/28/2017	REVIEW & COORDINATION
12/05/2017	REVIEW & COORDINATION
12/14/2017	CD

Seal / Signature

**NOT FOR CONSTRUCTION**

Project Name  
Unum Workplace Transformation- Phase 2 & 3  
Project Number  
59.6481.003  
Description  
AUDIOVISUAL NOTES

Scale  
1/8" = 1'-0"

AV.102.00