



BID DOCUMENTS COVER SHEET

CONTRACT DOCUMENTS

FOR

**L-1161 CONFERENCE ROOM & COMMUNITY ROOM
AUDIO-VISUAL UPGRADES**

AT

Los Medanos College
2700 East Leland Road, Pittsburg, CA 94565

CONTRA COSTA COMMUNITY COLLEGE DISTRICT

Consists of the following:

VOLUME 1
SPECIFICATIONS

DSA Appl. #01-119293

Architect:

SMITH, FAUSE & McDONALD, INC.

San Francisco, CA 94103

Tel (415) 255-9140

February 19, 2021

SECTION 00007
SEALS PAGE AND DSA TESTS

ARCHITECT: TECTONICS
Andrew C. Chen
1500 Park Avenue, Suite 129
Emeryville, CA 94608
510.740.2400

STRUCTURAL ENGINEER: TECTONICS
Michael Ross
1500 Park Avenue, Suite 129
Emeryville, CA 94608
510.740.2400

LOW VOLTAGE ENGINEER: Smith, Fause, and McDonald, Inc.
Theodore S. Hartman
351 8th Street
San Francisco, CA 94103
415.255.9140

ELECTRICAL ENGINEER: A&S Engineers INC.
Robin Paul Roderick
111 Pine Street, Suite 1315
San Francisco, CA 94111
415.398.0400

Division of the State Architect
1515 Clay Street, Suite 1201
Oakland, CA 94612

END OF SECTION

DSA 103-19: LISTING OF STRUCTURAL TESTS & SPECIAL INSPECTIONS, 2019 CBC

Application Number: 01-119293	School Name: Los Medanos College	School District: Contra Costa Community College District
DSA File Number:	Increment Number:	Date Created: 2020-12-31 15:40:33

2019 CBC

IMPORTANT: This form is only a summary list of structural tests and some of the special inspections required for the project. Generally, the structural tests and special inspections noted on this form are those that will be performed by the Geotechnical Engineer of Record, Laboratory of Record, or Special Inspector. The actual complete test and inspection program must be performed as detailed on the DSA approved documents. The appendix at the bottom of this form identifies work NOT subject to DSA requirements for special inspection or structural testing. The project inspector is responsible for providing inspection of all facets of construction, including but not limited to, special inspections not listed on this form such as structural wood framing, high-load wood diaphragms, cold-formed steel framing, anchorage of non-structural components, etc., per Title 24, Part 2, Chapter 17A (2019 CBC).

****NOTE:** Undefined section and table references found in this document are from the CBC, or California Building Code.

KEY TO COLUMNS

1. TYPE	2. PERFORMED BY
Continuous – Indicates that a continuous special inspection is required	GE – Indicates that the special inspection shall be performed by a registered geotechnical engineer or his or her authorized representative.
Periodic – Indicates that a periodic special inspection is required	LOR – Indicates that the test or special inspection shall be performed by a testing laboratory accepted in the DSA Laboratory Evaluation and Acceptance (LEA) Program. See CAC Section 4-335.
Test – Indicates that a test is required	PI – Indicates that the special inspection may be performed by a project inspector when specifically approved by DSA.
	SI – Indicates that the special inspection shall be performed by an appropriately qualified/approved special inspector.

Appendix: Work Exempt from DSA Requirements for Structural Tests / Special Inspections

Application Number:
01-119293
DSA File Number:

School Name:
Los Medanos College
Increment Number:

School District:
Contra Costa Community College District
Date Created:
2020-12-31 15:40:33

Exempt items given in DSA IR A-22 or the 2019 CBC (including DSA amendments) and those items identified below with a check mark by the design professional are NOT subject to DSA requirements for the structural tests / special inspections noted. **Items marked as exempt shall be identified on the approved construction documents.** The project inspector shall verify all construction complies with the approved construction documents.

SOILS:	
<input type="checkbox"/>	1. Deep foundations acting as a cantilever footing designed based on minimum allowable pressures per CBC Table 1806A.2 and having no geotechnical report for the following cases: A) free standing sign or scoreboard, B) cell or antenna towers and poles less than 35'-0" tall (e.g., lighting poles, flag poles, poles supporting open mesh fences, etc.), C) single-story structure with dead load less than 5 psf (e.g., open fabric shade structure), or D) covered walkway structure with an apex height less than 10'-0" above adjacent grade.
<input type="checkbox"/>	2. Shallow foundations, etc. are exempt from special inspections and testing by a Geotechnical Engineer for the following cases: A) buildings without a geotechnical report and meeting the exception item #1 criteria in CBC Section 1803A.2 supported by native soil (any excavation depth) or fill soil (not exceeding 12" depth per CBC Section 1804A.6), B) soil scarification/recompaction not exceeding 12" depth, C) native or fill soil supporting exterior non-structural flatwork (e.g., sidewalks, site concrete ramps, site stairs, parking lots, driveways, etc.), D) unpaved landscaping and playground areas, or E) utility trench backfill.

CONCRETE/MASONRY:	
<input checked="" type="checkbox"/>	1. Post-installed anchors for the following: A) exempt non-structural components (e.g., mechanical, electrical, plumbing equipment - see item 7 for "Welding") given in CBC Section 1617A.1.18 (which replaces ASCE 7-16, Section 13.1.4) or B) interior nonstructural wall partitions meeting criteria listed in exempt item 3 for "Welding."
<input type="checkbox"/>	2. Concrete batch plant inspection is not required for items given in CBC Section 1705A.3.3.2 subject to the requirements and limitations in that section.

Appendix: Work Exempt from DSA Requirements for Structural Tests / Special Inspections

Application Number: 01-119293	School Name: Los Medanos College	School District: Contra Costa Community College District
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<input type="checkbox"/>	3. Non-bearing non-shear masonry walls may be exempt from certain DSA masonry testing and special inspection items as allowed per DSA IR 21-1.16. Refer to construction documents for specific exemptions accordingly for each applicable wall condition.
<input type="checkbox"/>	4. Epoxy shear dowels in site flatwork and/or other non-structural concrete.
<input type="checkbox"/>	5. Testing of reinforcing bars is not required for items given in CBC Section 1910A.2 subject to the requirements and limitations in that section.

	Welding:
<input type="checkbox"/>	1. Solid-clad and open-mesh gates with maximum leaf span or rolling section for rolling gates of 10' and apex height less than 8'-0" above lowest adjacent grade. When located above circulation or occupied space below, these gates are not located within 1.5x gate/fence height (max 8'-0") to the edge of floor or roof.
<input type="checkbox"/>	2. Handrails, guardrails, and modular or relocatable ramps associated with walking surfaces less than 30" above adjacent grade (excluding post base connections per the 'Exception' language in Section 1705A.2.1); fillet welds shall not be ground flush.
<input type="checkbox"/>	3. Non-structural interior cold-formed steel framing spanning less than 15'-0", such as in interior partitions, interior soffits, etc. supporting only self weight and light-weight finishes or adhered tile, masonry, stone, or terra cotta veneer no more than 5/8" thickness and apex less than 20'-0" in height and not over an exit way. Maximum tributary load to a member shall not exceed the equivalent of that occurring from a 10'x10' opening in a 15' tall wall for a header or king stud.
<input type="checkbox"/>	4. Manufactured support frames and curbs using hot rolled or cold-formed steel (i.e., light gauge) for mechanical, electrical, or plumbing equipment weighing less than 2000# (equipment only) (connections of such frames to superstructure elements using welding will require special inspection as noted in selected item(s) for Sections 19, 19.1 and/or 19.2 of listing above).
<input type="checkbox"/>	5. Manufactured components (e.g., Tolco, B-Line, Afcon, etc.) for mechanical, electrical, or plumbing hanger support and bracing (connections of such components to superstructure elements using welding will require special inspection as noted in selected item(s) for Sections 19, 19.1 and/or 19.2 of listing above).

Appendix: Work Exempt from DSA Requirements for Structural Tests / Special Inspections

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<input type="checkbox"/>	6. TV Brackets, projector mounts with a valid listing (see DSA IR A-5) and recreational equipment (e.g., playground structures, basketball backstops, etc.) (connections of such elements to superstructure elements using welding will require special inspection as noted in selected item(s) for section 19, 19.1 and/or 19.2 located in the Steel/Aluminum category).
<input type="checkbox"/>	7. Any support for exempt non-structural components given in CBC Section 1617A.1.18 (which replaces ASCE 7-16, Section 13.1.4) meeting the following: A) when supported on a floor/roof, <400# and resulting composite center of mass (including component's center of mass) $\leq 4'$ above supporting floor/roof, B) when hung from a wall or roof/floor, <20# for discrete units or <5 plf for distributed systems.

DSA 103-19: LISTING OF STRUCTURAL TESTS & SPECIAL INSPECTIONS(SIGNATURE), 2019 CBC

Application Number:

01-119293

DSA File Number:

School Name:

Los Medanos College

Increment Number:

School District:

Contra Costa Community College District

Date Created:

2020-12-31 15:40:33

Name of Architect or Engineer in general responsible charge:

Name of Structural Engineer (When structural design has been delegated):

MICHAEL ROSS, SE 4485

Signature of Architect or Structural Engineer:



Date:

12/3120

Note: To facilitate DSA electronic mark-ups and identification stamp application, DSA recommends against using secured electronic or digital signatures.

DSA STAMP

DSA 103-19: LIST OF REQUIRED VERIFIED REPORTS, CBC 2019

Application Number:

01-119293

DSA File Number:

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Contra Costa Community College District

Date Created:

2020-12-31 15:40:33

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DIVISION 01 – GENERAL REQUIREMENTS

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END OF SECTION

Campus Overview

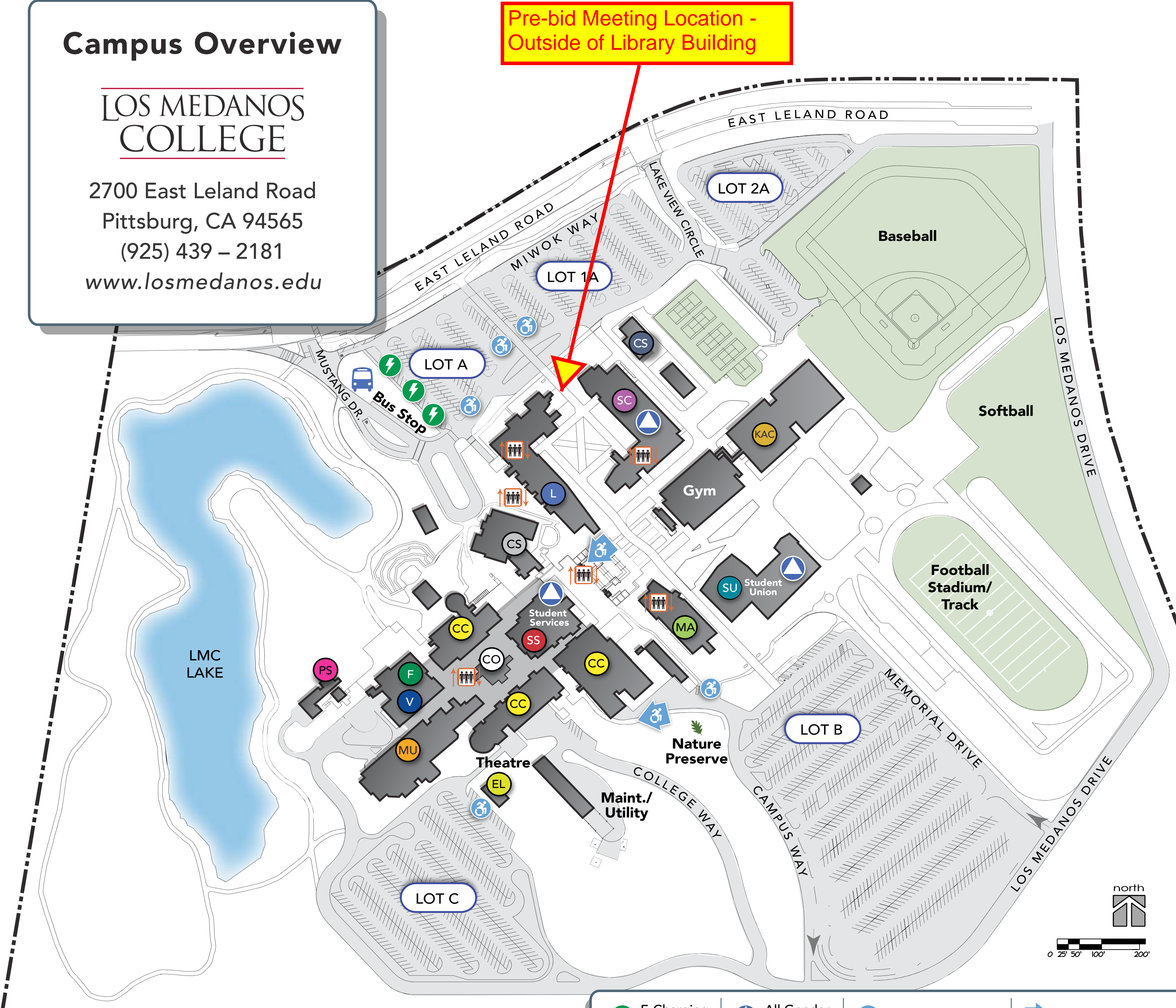
LOS MEDANOS COLLEGE

2700 East Leland Road
 Pittsburg, CA 94565
 (925) 439 – 2181
www.losmedanos.edu

Pre-bid Meeting Location -
 Outside of Library Building

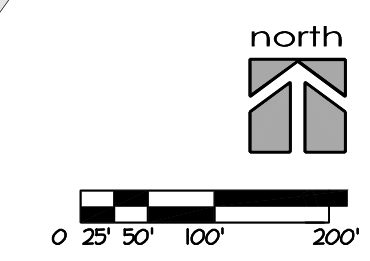
Building Legend

- CC College Complex
- CO CORE
 - Business Services
 - Center for Academic Support
 - Equity & Inclusion
- CS Child Study Center
- CS Campus Safety
 - Police Services
- EL ETEC Lab
- F Cafeteria
- KAC Kinesiology & Athletics Complex
- L Library
 - Community Room
- MA Math
- MU Music
 - Recital Hall
- PS Classrooms
- SC Science
 - MESA Center
- SS Student Services
 - Admissions/Cashier
 - Assessment Services
 - Counseling Services
 - DSPS
 - EOPS, CARE, CalWORKs
 - Financial Aid/Scholarships
 - Information/Welcome Center
 - LMC Foundation
 - Office of Instruction
 - President's Office
 - Transfer & Career Services
- SU Student Union
 - Bookstore
 - Conference Center
 - Food Pantry
 - Honors Program
 - International Students Program
 - Latinx Empowerment Center
 - Reflection Room
 - Student Life
 - Student Lounge
 - Unity Center
 - Umoja Scholars Program
- V Veterans Resource Center



Smoking restricted to parking lot areas.

E-Charging Stations	All Gender Restrooms	Accessible Parking	Accessible Entrance	Bus Stop	Elevator
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**SECTION 00100
NOTICE INVITING BIDS
(INFORMAL BIDS)**

**L-1161 CONFERENCE ROOM & COMMUNITY ROOM
AUDIO-VISUAL UPGRADES**

LOS MEDANOS COLLEGE
2700 E Leland Rd.
Pittsburg, CA 94565

SCOPE OF WORK: The scope of work includes, but not limited to the construction of Audio-Visual systems for the Community Room L-113, two small adjacent conference rooms L-108 & L-109, and Conference Rooms 409 and 420.

IMPORTANT INFORMATION:

- **Pre-Bid Meeting & Job Walk:** **Monday, March 1, 2021, 2:00 PM**
Non-Mandatory
- Location:** (see Campus Map) Los Medanos College Library Building
2700 E Leland Rd.
Pittsburg, CA 94565

PLEASE NOTE: A Site Visit will be held immediately following the Pre-Bid meeting. Please sign in on the attendance Log. Attendees are required to wear face masks, as required by CCC Health Services.

- **Cost Estimate (Range):** \$200,000 to \$240,000
- **CA License Required:** **C -7 Low Voltage Systems or B-General Building Contractor**
- **Last Date / Time for Bidder’s Requests for Information:** **Wednesday, March 3, 2021, prior to 5:00 PM**
- **BID OPENING DATE/TIME:** **Wednesday, March 17, 2021 @ 2:00 PM**

This project is a public works project and is subject to prevailing wage rate laws. A copy of the prevailing rates of wages is on file with the Contracts & Purchasing Office of the Contra Costa Community College District. Said rates of wages will be included in the contract for the work.

Attention is directed to Section 4100 through 4113 of the Public Contract Code concerning Subcontractors, with emphasis on Section 4104, known as the “Subletting and Subcontracting Fair Practices Act, effective July 1, 2014”.

Attention is directed to Labor Code Section 1725.5 regarding Department of Industrial Relations (DIR) contractor registration process including registration criteria and implementation of DIR registration requirements. Labor Code Section 1771.7 establishes contractor’s obligation to submit Certified Pay Roll (CPR) to the Department of Labor and Standards Enforcement (DLSE) and public works monitoring and

enforcement. Labor Code Section 1773.3 requires the District to submit a PWC-100 to DIR for all public works contract awarded effective January 1, 2015.

Site Visit Certification (Section 00450) shall be authorized by the representative of the District and shall be submitted with the bid. Failure to submit all of the above may cause your bid to be non-responsive and disqualified for contract award.

For information directly from the District, you may log in to the District Website:

<http://www.4cd.edu/webapps/PurchasingViewBids/default.aspx>. Project documents available include, but are not limited to, plans, specifications, addenda, bidders' lists, bid results, etc., and can be viewed on this District webpage.

The District does not provide hardcopies of bid documents or reimburse cost of printing, delivery, or any expenses related to the bidding process.

All questions related to this project must be submitted electronically, no later than Wednesday, March 3, 2021, prior to 5:00 PM to:

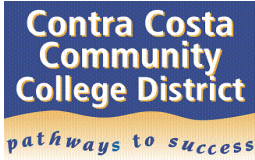
Ben M. Cayabyab, Contracts Manager
Contra Costa Community College District
Email: bcayabyab@4cd.edu

Each bid shall be made on the Bid Proposal Form, which is included in the Bid Documents. The successful bidder will be required to furnish a payment bond in an amount equal to one hundred percent (100%) of the contract price and a faithful performance bond in an amount equal to one hundred percent (100%) of the contract price, said bonds to be secured from a surety company acceptable to the Contra Costa Community College District and authorized to execute such surety in the State of California.

Certificates of Liability Insurance with proper endorsements shall be required for the successful bidder.

The contract time is **90 Calendar Days** between the Notice to Proceed date and the Contract Substantial Completion date. Liquidated Damages shall be set for **Five Hundred Dollars (\$500)** for each Calendar Day the Work is delayed beyond the contract Substantial Completion date; and **One Hundred Dollars (\$100)** for each Calendar Day Remaining Work is delayed beyond the Contract Final Completion Date. The Contra Costa Community College District reserves the right to reject any and all bids and/or waive any informality or irregularity in any bid received. No bidder may withdraw their Bid for a period of fifteen (15) Calendar Days after the date set for opening thereof.

END OF SECTION



**SECTION 00300
BID PROPOSAL FORM
(INFORMAL BIDS)**

Bidder's Name

**L-1161 CONFERENCE ROOM & COMMUNITY ROOM
AV UPGRADES**

LOS MEDANOS COLLEGE
2700 E Leland Rd.
Pittsburg, CA 94565

BID DATE: March 17, 2021, 2:00 PM

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INSTRUCTIONS TO BIDDERS:

- *Submit your BID Proposal via mail/overnight mail or deliver, in person, to:
Contra Costa Community College District
500 Court Street
Martinez, CA 94553
Attn: Ben M. Cayabyab, Contracts Manager*
- *Don't forget to include a Bid Bond for 10% of the Bid amount; (copy attached to Bid Proposal is accepted, original by mail to follow); ~~and signed Certification of Site Visit;~~*
- *Bid results shall be sent to you via email message and posted at the District Website;
For clarification, please email: **Ben M. Cayabyab, Contracts Manager, bcayabyab@4cd.edu***

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Attention is directed to Labor Code Section 1725.5 regarding Department of Industrial Relations (DIR) contractor registration process; registration criteria and implementation of DIR registration requirements. Labor Code Section 1771.7 establishes contractor's obligation to submit Certified Payroll (CPR) to the Department of Labor and Standards Enforcement (DLSE) and public works monitoring and enforcement. Labor Code Section 1773.3 requires the District to submit a PWC-100 to DIR for all public works contract awarded effective January 1, 2015.

1. INTRODUCTION

- A. The Bidder proposes to perform the Work for the Contract Sum and within the proposed time, based upon an examination of the Job Site and Specifications.
- B. The Bidder certifies this proposal is submitted in good faith.
- ~~C. The signed copy of the Certification of Visit to the Site shall be attached to the Bid Proposal Form.~~
- D. The Bidder shall attach a Bid Security for ten percent (10%) of the Bid Amount in the form of Bid Bond, or Certified Check payable to the District.
- E. The District shall award the contract to the lowest responsive and responsible Bidder. The evaluation of the low bid shall be based on the total of Base Bid.**

Please Note: PCC 20651 (b); In the event, the successful bidder fails to provide the required Payment and Performance bonds, the Bid Security shall be forfeited in favor of the District and Contractor shall not be entitled for contract award.

2. BID AMOUNT

For labor, materials, insurances, bonds, fixtures, equipment, tools, transportation, services, sales taxes and other costs necessary to complete the public project in accordance with Contract Drawings and Specifications, for a stipulated Contract Sum in the amount of:

Quote for the BASE BID Scope of Work:

_____ \$ _____
 (Write amount of Base Bid)

3. ADDENDUM (if applicable): #1 Received Date: _____; #2 Received Date: _____;

4. SUBCONTRACTORS LIST (If Any)

Attention is directed to Section 4100 through 4113 of the Public Contract Code concerning Subcontractors, with emphasis on Section 4104, known as the "Subletting and Subcontracting Fair Practices Act, effective July 1, 2014.

	Type of Work	Subcontractor's Name	Address/Phone	Business License # & DIR Registration #
(1)		_____	_____	_____
(2)		_____	_____	_____
(3)		_____	_____	_____

4. COMPLETION TIME

- A. For establishing the Date of Substantial Completion, the contract time shall be **90 calendar days** after date of Notice to Proceed.
- B. Final Completion shall be **30 calendar days** after the date of Substantial Completion.
- C. Prior to the Notice to Proceed issued by the District, the Contractor shall provide a CPM construction schedule, prepared in Microsoft Project format, utilizing the entire time allowed to complete the project. Schedule shall be subject to District's approval.

5. ACCEPTANCE AND AWARD

The District reserves the right to waive minor irregularities or reject all bids; or negotiate changes before or after execution of the Contract. This Bid shall remain open and shall not be withdrawn for a period of 10 days after Bid Opening date.

If written notice of acceptance of this Bid is mailed or delivered to the Bidder within 10 days after the date set for the receipt of this Bid, or other time before it is withdrawn, the Bidder shall execute and deliver to

the District a Contract prepared by District with the required Surety Bonds and Certificates of Insurance, within 10 days after personal delivery or deposit in the mail of the notification of acceptance.

Notice of acceptance or request for additional information may be addressed to the Bidder at the address provided.

The undersigned hereby certifies under penalty of perjury under the laws of the State of California that all the information submitted by the bidder in connection with this proposal and all the representations herein made are true and correct.

Firm Name CSLB License No.: _____ Exp: _____

Address DIR Registration No.: _____

Phone: _____

Email: _____

Authorized Signature Print Name Date

SECTION 00500
PAYMENT BOND
(CALIFORNIA PUBLIC WORK)

KNOW ALL MEN BY THESE PRESENTS:

THAT WHEREAS, the Contra Costa Community College District (sometimes referred to hereinafter as "Obligee") has awarded to _____ (hereinafter designated as the "Principal" or "Contractor"), an agreement for the work described as follows: _____ (hereinafter referred to as the "Public Work"); and

WHEREAS, said Contractor is required to furnish a bond in connection with said Contract, and pursuant to California Civil Code Section 9550;

NOW, THEREFORE, We, _____, the undersigned Contractor, as Principal; and _____, a corporation organized and existing under the laws of the State of _____, and duly authorized to transact business under the laws of the State of California, as Surety, are held and firmly bound unto the Contra Costa Community College District and to any and all persons, companies, or corporations entitled by law to file stop notices under California Civil Code Section 9100, or any person, company, or corporation entitled to make a claim on this bond, in the sum of _____ Dollars (\$ _____), said sum being not less than one hundred percent (100%) of the total amount payable by said Obligee under the terms of said Contract, for which payment will and truly to be made, we bind ourselves, our heirs, executors and administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that if said Principal, its heirs, executors, administrators, successors, or assigns, or subcontractor, shall fail to pay any person or persons named in Civil Code Section 9100; or fail to pay for any materials, provisions, or other supplies, used in, upon, for, or about the performance of the work contracted to be done, or for any work or labor thereon of any kind, or for amounts due under the Unemployment Insurance Code, with respect to work or labor thereon of any kind; or shall fail to deduct, withhold, and pay over to the Employment Development Department, any amounts required to be deducted, withheld, and paid over by Unemployment Insurance Code Section 13020 with respect to work and labor thereon of any kind, then said Surety will pay for the same, in an amount not exceeding the amount herein above set forth, and in the event suit is brought upon this bond, also will pay such reasonable attorneys' fees as shall be fixed by the court, awarded and taxed as provided in California Civil Code Sections 9550 et seq.

This bond shall inure to the benefit of any person named in Civil Code Section 9100 giving such person or his/her assigns a right of action in any suit brought upon this bond.

It is further stipulated and agreed that the Surety of this bond shall not be exonerated or released from the obligation of the bond by any change, extension of time for performance, addition, alteration or modification in, to, or of any contract, plans, or specifications, or agreement pertaining or relating to any scheme or work of improvement herein above described; or

pertaining or relating to the furnishing of labor, materials, or equipment therefor; nor by any change or modification of any terms of payment or extension of time for payment pertaining or relating to any scheme or work of improvement herein above described; nor by any rescission or attempted rescission of the contract, agreement or bond; nor by any conditions precedent or subsequent in the bond attempting to limit the right of recovery of claimants otherwise entitled to recover under any such contract or agreement or under the bond; nor by any fraud practiced by any person other than the claimant seeking to recover on the bond; and that this bond be construed most strongly against the Surety and in favor of all persons for whose benefit such bond is given; and under no circumstances shall the Surety be released from liability to those for whose benefit such bond has been given, by reason of any breach of contract between the Obligee and the Contractor or on the part of any obligee named in such bond; that the sole condition of recovery shall be that the claimant is a person described in California Civil Code Sections 9100, and who has not been paid the full amount of his or her claim; and that the Surety does hereby waive notice of any such change, extension of time, addition, alteration or modification herein mentioned.

IN WITNESS WHEREOF, we have hereunto set our hands and seals this _____ day of _____, 20____.

PRINCIPAL/CONTRACTOR:

By: _____

SURETY:

By: _____

Attorney-in-Fact

**CONTRACT PERFORMANCE BOND
(CALIFORNIA PUBLIC WORK)**

KNOW ALL MEN BY THESE PRESENTS:

THAT WHEREAS, Contra Costa Community College District (sometimes referred to hereinafter as "Obligee") has awarded to _____ (hereinafter designated as the "Principal" or "Contractor"), an agreement for the work described as follows: _____ (hereinafter referred to as the "Public Work"); and

WHEREAS, the work to be performed by the Contractor is more particularly set forth in that certain contract for said Public Work dated _____, (hereinafter referred to as the "Contract"), which Contract is incorporated herein by this reference; and

WHEREAS, the Contractor is required by said Contract to perform the terms thereof and to provide a bond both for the performance and guaranty thereof.

NOW, THEREFORE, we, _____, the undersigned Contractor, as Principal, and _____, a corporation organized and existing under the laws of the State of _____, and duly authorized to transact business under the laws of the State of California, as Surety, are held and firmly bound unto the Contra Costa Community College District in the sum of _____ Dollars (\$ _____), said sum being not less than one hundred percent (100%) of the total amount payable by said Obligee under the terms of said Contract, for which amount well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH THAT, if the bounded Contractor, his or her heirs, executors, administrators, successors or assigns, shall in all things stand to and abide by, and well and truly keep and perform the covenants, conditions, and agreements in said Contract and any alteration thereof made as therein provided, on his or her part, to be kept and performed at the time and in the manner therein specified, and in all respects according to their intent and meaning; and shall faithfully fulfill guarantees of all materials and workmanship; and indemnify, defend and save harmless the Obligee, its officers and agents, as stipulated in said Contract, then this obligation shall become null and void; otherwise it shall be and remain in full force and effect.

The Surety, for value received, hereby stipulates and agrees that it shall not be exonerated or released from the obligation of this bond (either by total exoneration or pro tanto) by any change, extension of time, alteration in or addition to the terms of the contract or to the work to be performed there under or the specifications accompanying the same, nor by any change or modification to any terms of payment or extension of time for any payment pertaining or relating to any scheme of work of improvement under the contract. Surety also stipulates and agrees that it shall not be exonerated or released from the obligation of this bond (either by total exoneration or pro tanto) by any overpayment or underpayment by the Obligee that is based upon estimates approved by the Architect. The Surety stipulates and agrees that none of the aforementioned

changes, modifications, alterations, additions, extension of time or actions shall in any way affect its obligation on this bond, and it does hereby waive notice of any such changes, modifications, alterations, additions or extension of time to the terms of the contract, or to the work, or the specifications as well notice of any other actions that result in the foregoing.

Whenever Principal shall be, and is declared by the Obligees to be, in default under the Contract, the Surety shall promptly either remedy the default, or shall promptly complete the Contract through its agents or independent contractors, subject to acceptance and approval of such agents or independent contractors by Obligees as hereinafter set forth, in accordance with its terms and conditions and to pay and perform all obligations of Principal under the Contract, including, without limitation, all obligations with respect to warranties, guarantees and the payment of liquidated damages; or, at Obligees's sole discretion and election, Surety shall obtain a bid or bids for completing the Contract in accordance with its terms and conditions, and upon determination by Obligees of the lowest responsible bidder, arrange for a contract between such bidder and the Obligees and make available as Work progresses (even though there should be a default or succession of defaults under the contract or contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the "balance of the Contract price" (as hereinafter defined), and to pay and perform all obligations of Principal under the Contract, including, without limitation, all obligations with respect to warranties, guarantees and the payment of liquidated damages. The term "balance of the Contract price," as used in this paragraph, shall mean the total amount payable to Principal by the Obligees under the Contract and any modifications thereto, less the amount previously paid by the Obligees to the Principal, less any withholdings by the Obligees allowed under the Contract.

Surety expressly agrees that the Obligees may reject any agent or contractor which may be proposed by Surety in fulfillment of its obligations in the event of default by the Principal. Unless otherwise agreed by Obligees, in its sole discretion, Surety shall not utilize Principal in completing the Contract nor shall Surety accept a bid from Principal for completion of the work in the event of default by the Principal.

No final settlement between the Obligees and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

The Contractor and Surety shall remain responsible and liable for all patent and latent defects that arise out of or are related to the Contractor's failure and/or inability to properly complete the Public Work as required by the Contract and the Contract Documents. The obligation of the Surety hereunder shall continue so long as any obligation of the Contractor remains.

Contractor and Surety agree that if the Obligees is required to engage the services of an attorney in connection with enforcement of the bond, Contractor and Surety shall pay Obligees' reasonable attorneys' fees incurred, with or without suit, in addition to the above sum.

In the event suit is brought upon this bond by the Obligees and judgment is recovered, the Surety shall pay all costs incurred by the Obligees in such suit, including reasonable attorneys' fees to be fixed by the Court.

IN WITNESS WHEREOF, we have hereunto set our hands and seals this _____ day of _____, 20____.

PRINCIPAL/CONTRACTOR:

By: _____

SURETY:

By: _____

Attorney-in-Fact

The rate of premium on this bond is _____ per thousand.

The total amount of premium charged: \$ _____ (This must be filled in by a corporate surety).

IMPORTANT: **THIS IS A REQUIRED FORM.**

Surety companies executing bonds must possess a certificate of authority from the California Insurance Commissioner authorizing them to write surety insurance defined in California Insurance Code Section 105, and if the work or project is financed, in whole or in part, with federal, grant or loan funds, Surety's name must also appear on the Treasury Department's most current list (Circular 570 as amended).

Any claims under this bond may be addressed to:

(Name and Address of Surety)

(Name and Address of agent or representative for service for service of process in California)

Telephone: _____

Telephone: _____

STATE OF CALIFORNIA)
) ss.
COUNTY OF)

On _____ before me, _____
(insert name and title of the officer)

On _____, before me, _____, a Notary

Public in and for said State, personally appeared _____, who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument as the Attorney-in-Fact of the _____ (Surety) and acknowledged to me that he/she/they subscribed the name of the _____ (Surety) thereto and his own name as Attorney-in-Fact on the executed instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Notary Public in and for said State

(SEAL)

Commission expires: _____

NOTE: A copy of the power-of-attorney to local representatives of the bonding company must be attached hereto.

**SECTION 00510
NOTICE OF AWARD**

DATE: _____

TO: _____

ADDRESS: _____

PROJECT: _____

The Contract Sum of your contract is _____ Dollars,
(\$_____).

You must comply with the following conditions within **ten (10)** calendar days of the date of this Notice of Award, that is, by _____.

1. You must deliver to the District two fully executed counterparts of Section 00600, "Construction Agreement."
2. You must deliver to the District the "Contract Performance Bond," and "Payment Bond," executed by you and your surety, which are included in Section 00500.
3. You must deliver to the District the Contractor's CPM Schedule, prepared in Microsoft Project format, including both PDF and electronic file for the District's review.

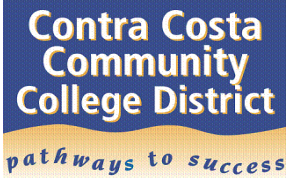
Failure to comply with these conditions within the time specified will entitle District to consider your bid abandoned, to annul this Notice of Award, and to declare your Bid Security forfeited. Within **ten (10)** calendar days after you comply with these conditions, the District will return to you one fully signed counterpart of the Construction Agreement.

Contra Costa Community College District

By: _____

Title: _____

END OF DOCUMENT



CONTRACT NO. _____
(Construction Agreement)

=====

1. **SPECIAL TERMS.** These special terms are incorporated below by reference.

(§1.1) Parties: (Public Agency) CONTRA COSTA COMMUNITY COLLEGE DISTRICT
500 Court St, Martinez, CA 94553

(Contractor) _____
Address: _____

(§1.2) Effective Date: See Section (§1.4) Completion Time, below

(§1.3) The Work: L-1161 CONFERENCE ROOM & COMMUNITY ROOM AV UPGRADES

(§1.4) Completion Time: **90 Calendar Days** from the Notice to Proceed to Substantial Completion, and **30 Calendar Days** from Substantial Completion to Final Completion (Remaining Work).

(§1.5.1) Liquidated Damages, Substantial Completion: **\$500** per Calendar Day beyond the Contract Substantial Completion Date.

(§1.5.2) Liquidated Damages, Remaining Work/Final Completion: **\$100/** per Calendar Day Remaining Work is delayed beyond the Contract Final Completion Date.

(§1.6) Public Agency's Agent: CONTRA COSTA COMMUNITY COLLEGE DISTRICT (The District)

(§1.7) Contract Price: _____

2. **SCOPE OF WORK**

The scope of work includes, but is not limited to, the construction of Audio-Visual systems for the Community Room L-113, two small adjacent conference rooms L-108 & L-109, and Conference Rooms 409 and 420.-. For the complete scope of Work, see SECTION 00010 TABLE OF CONTENTS that includes a complete listing of the Contract Drawings and Specifications.

3. **WORK CONTRACT, CHANGES**

- (a) By their signatures below, effective on the above date, these parties promise and agree as set forth in this Agreement, incorporating by these references labor and materials contained in Section 2, Scope of Work.
- (b) Contractor shall, at Contractor's own cost and expense, and in a workmanlike manner, fully and faithfully perform and complete the work; and will furnish all materials, labor, services, equipment, and transportation necessary, convenient and proper in order fairly to perform the requirements of this contract, all strictly in accordance with the Scope of Work in Section 2 above, and the Public Agency's plans, drawings and specifications, and with Supplementary General Conditions, if any.
- (c) The work can be changed only with Public Agency's prior written order specifying such change and its cost agreed to by the parties; and the Public Agency shall never have to pay more than specified in Section 7 without such an order.

4. TIME: NOTICE TO PROCEED

Contractor shall start this work as directed in Section 1.4 Completion Time above or as directed by the Notice to Proceed, if any, and shall complete it as specified in Section 1.4, Completion Time.

5. LIQUIDATED DAMAGES

If the Contractor fails to complete this contract and this work within the time fixed therefore, allowance being made for contingencies as provided herein, he becomes liable to the Public Agency for all its loss and damage there from; and because, from the nature of the case, it is and will be impracticable and extremely difficult to ascertain and fix the Public Agency's actual damage from any delay in performance hereof, it is agreed that Contractor will pay as liquidated damages to the Public Agency the reasonable sum specified in Section 1, the result of the parties' reasonable endeavor to estimate fair average compensation therefore, for each calendar day's delay in finishing said work; and if the same be not paid, Public Agency may, in addition to its other remedies, deduct the same from any money due or to become due Contractor under this contract. If the Public Agency for any cause authorizes or contributes to a delay, suspension of work or extension of time, its duration shall be added to the time allowed for completion, but it shall not be deemed a waiver nor be used to defeat any right of the Agency to damages for non-completion or delay hereunder. Pursuant to Government Code Section 4215, the Contractor shall not be assessed liquidated damages for delay in completion of the work, when such delay was caused by the failure of the Public Agency or the owner of a utility to provide for removal or relocation of existing utility facilities.

6. INTEGRATED DOCUMENTS

The plans, drawings and specifications or special provisions of the Public Agency's call for bids, and Contractor's accepted bid for this work are hereby incorporated into this contract; and they are intended to cooperate, so that anything exhibited in the plans or drawings and not mentioned in the specifications or special provisions, or vice versa, is to be executed as if exhibited, mentioned and set forth in both, to the true intent and meaning thereof when taken all together; and differences of opinion concerning these shall be finally determined by the Public Agency.

7. PAYMENT

- (a) For strict and literal fulfillment of these promises and conditions, and full compensation for all this work, the Public Agency shall pay the Contractor the sum specified in Section 1, except that in unit price contracts the payment shall be for finished quantities at unit bid prices.
- (b) On or about the first day of each calendar month, the Contractor shall submit to the Public Agency a verified application for payment, supported by a statement showing all materials actually installed during the preceding month, the labor expended thereon, and the cost thereof; whereupon, after checking, the Public Agency shall issue to Contractor a certificate for the amount determined to be due, minus five (5%) percent thereof, but not until defective work and materials have been removed, replaced and made good. Payment of the approved amount will be made to the Contractor within 30 calendar days from the date the Public Agency approves in writing the Contractor's application for payment.

8. PAYMENTS WITHHELD

- (a) The Public Agency or its agent may withhold any payment, or because of later discovered evidence nullify all or any certificate for payment, to such extent and period of time only as may be necessary to protect the Public Agency from loss because of:
 - (1) Defective work not remedied, or work not completed, or
 - (2) Claims filed or reasonable evidence indicating probable filing, or
 - (3) Failure to properly pay subcontractors or for material or labor, or
 - (4) Reasonable doubt that the work can be completed for the balance then unpaid, or

- (5) Damage to another contractor, or
 - (6) Damage to the Public Agency, other than damage due to delays.
- (b) The Public Agency shall use reasonable diligence to discover and report to the Contractor, as the work progresses, the materials and labor which are not satisfactory to it, so as to avoid unnecessary trouble or cost to the Contractor in making good any defective work or parts.
- (c) Thirty-five (35) calendar days after Public Agency files its notice of completion of the entire work, it shall issue a certificate to the Contractor and pay the balance of the contract price after deducting all amounts withheld under this contract, provided the Contractor shows that all claims for labor and materials have been paid, no claims have been presented to the Public Agency based on acts or omissions of the Contractor, and no liens or withhold notices have been filed against the work or site, and provided there are not reasonable indications of defective or missing work or of late-recorded notices of liens or claims against Contractor.

9. **INSURANCE**

Before the commencement of the Work, the Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in California as admitted carriers, or a District approved equal, with a financial rating of at least A status as rated in the most recent edition of Best's Insurance Reports or as amended by the Supplementary General Conditions, such insurance as will protect the Public Agency from claims set forth below, which may arise out of or result from the Contractor's operations under the Contract and for which the Contractor may be legally liable, whether such operations are by the Contractor, by a Subcontractor, by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable.

- (a) Claims for damages because of bodily injury, sickness, disease, or death of any person District would require indemnification and coverage for employee claim;
- (b) Claims for damages insured by usual personal injury liability coverage, which are sustained by a person as a result of an offense directly or indirectly related to employment of such person by the Contractor or by another person;
- (c) Claims for damages because of injury or destruction of tangible property, including loss of use resulting therefrom, arising from operations under the Contract Documents;
- (d) Claims for damages because of bodily injury, death of a person, or property damage arising out of the ownership, maintenance, or use of a motor vehicle, all mobile equipment, and vehicles moving under their own power and engaged in the Work;
- (e) Claims involving contractual liability applicable to the Contractor's obligations under the Contract Documents, including liability assumed by and the indemnity and defense obligations of the Contractor and the Subcontractors; and
- (f) Claims involving Completed Operations, Independent Contractors' coverage, and Broad Form property damage, without any exclusions for collapse, explosion, demolition, underground coverage, and excavating. (XCU)
- (g) Claims involving sudden or accidental discharge of contaminants or pollutants.

Additional Insured Endorsement Requirement: The Contractor shall name, on any policy of insurance, the District, Architect, Inspector, the State of California, their officers, employees, agents and independent contractors as Additional Insured. Subcontractors shall name the Contractor, the District, Architect, Inspector, the State of California, their officers, employees, agents and independent contractors as Additional Insured. The Additional Insured Endorsement included on all such insurance policies shall state that coverage is afforded the additional insured with respect to claims arising out of operations performed by or on behalf of the insured. If the Additional Insured, have other insurance which is applicable to the loss, such other insurance shall be on an excess or contingent basis. The insurance provided by the Contractor must be designated in the policy as primary

to any insurance obtained by the Public Agency. The amount of the insurer's liability shall not be reduced by the existence of such other insurance.

Specific Insurance Requirement: Contractor shall take out and maintain and shall require all subcontractors, if any, whether primary or secondary, to take out and maintain:

- (a) Comprehensive General Liability Insurance with an aggregate of not less than \$2,000,000.00; Per occurrence, \$1,000,000.00
- (b) Automotive (any auto) where operated in amounts \$1,000,000.00
- (c) Workers' Compensation Insurance: \$1,000,000.00; Contractor is aware of and complies with Labor Code Section 3700 and the Worker's Compensation Law.

10. **BONDS**

(Not Required for Public Projects below \$25,000; Civil Code 9550; Public Contract Code 7103.)

Bond Requirements: Prior to commencing any portion of the Work, the Contractor shall furnish separate payment and performance bonds for its portion of the Work which shall cover 100% faithful performance of and payment of all obligations arising under the Contract Documents and/or guaranteeing the payment in full of all claims for labor performed and materials supplied for the Work. All bonds shall be provided by a corporate surety authorized and admitted to transact business in California as sureties.

To the extent, if any, that the Contract Price is increased in accordance with the Contract Documents, the Contractor shall, upon request of the Public Agency, cause the amount of the bonds to be increased accordingly and shall promptly deliver satisfactory evidence of such increase to the Public Agency. To the extent available, the bonds shall further provide that no change or alteration of the Contract Documents (including, without limitation, an increase in the Contract Price, as referred to above), extensions of time, or modifications of the time, terms, or conditions of payment to the Contractor will release the surety. If the Contractor fails to furnish the required bonds, the Public Agency may terminate the Contract for cause.

On signing this contract, Contractor shall deliver to Public Agency for approval good and sufficient bonds with sureties, in amount(s), specified in the specifications or special provisions, guaranteeing faithful performance of this contract and payment for all labor and materials hereunder.

11. **FAILURE TO PERFORM**

If the Contractor at any time refuses or neglects, without fault of the Public Agency or its agent(s), to supply sufficient materials or workers to complete this agreement and work as provided herein, for a period of ten days or more after written notice thereof by the Public Agency, the Public Agency may furnish same and deduct the reasonable expenses thereof from the contract price.

12. **LAWS APPLY: General**

Both parties recognize the applicability of various federal, state and local laws and regulations, especially Chapter 1 of Part 7 of the California Labor Code (beginning with Section 1720, and including Sections 1735, 1777.5, 1777.6, forbidding discrimination) and intend that this agreement complies therewith. The parties specifically stipulate that the relevant penalties and forfeitures provided in the Labor Code, especially in Sections 1775, 1777.6, and 1813, concerning prevailing wages and hours, shall apply to this agreement as though fully stipulated herein.

13. **REGISTRATION WITH DEPARTMENT OF INDUSTRIAL RELATIONS**

Contractor shall be registered pursuant to Section 1725.5 of the California Labor Code to be qualified to bid on, be listed in a bid proposal, subject to the requirements of Section 4104 of the Public Contract Code, or engage in the performance of any public work contract that is subject to the requirements of Section 1725.5. For the purposes of this requirement, "contractor" includes a subcontractor as defined by Labor Code Section 1722.1.

The requirement to list only registered contractors and subcontractors on bids becomes effective on March 1, 2015. The requirement to only use registered contractors and subcontractors on public works projects applies to all projects awarded on or after April 1, 2015.

14. SUBCONTRACTORS

Public Contract Code Sections 4100-4113 are incorporated herein.

15. WAGE RATES

- (a) Pursuant to Labor Code Section 1773, the Director of the Department of Industrial Relations has ascertained the general prevailing rates of wages per diem, and for holiday and overtime work, in the locality in which this work is to be performed, for each craft, specified in the call for bids for this work and are on file with the Public Agency, and are hereby incorporated herein.
- (b) This schedule of wages is based on a working day of eight (8) hours unless otherwise specified; and the daily rate is the hourly rate multiplied by the number of hours constituting the working day. When less than that number of hours are worked, the daily wage rate is proportionately reduced, but the hourly rate remains as stated.
- (c) The Contractor, and all subcontractors, must pay at least these rates to all persons on this work, including all travel, subsistence, and fringe benefit payments provided for by applicable collective bargaining agreements. All skilled labor not listed above must be paid at least the wage scale established by collective bargaining agreement for such labor in the locality where such work is being performed. If it becomes necessary for the Contractor or any subcontractor to employ any person in a craft, classification or type of work (except executive, supervisory, administrative, clerical or other non-manual workers as such) for which no minimum wage rate is specified, the contractor shall immediately notify the Public Agency which shall promptly determine the prevailing wage rate therefore and furnish the Contractor with the minimum rate based thereon, which shall apply from the time of the initial employment of the person affected and during the continuance of such employment.

16. HOURS OF LABOR

Eight hours of labor in one calendar day constitutes a legal day's work, and no worker employed at any time on this work by the Contractor or by any subcontractor shall be required or permitted to work longer thereon except as provided in Labor Code Sections 1810-1815.

17. APPRENTICES

Properly indentured apprentices may be employed on this work in accordance with Labor Code Sections 1777.5 and 1777.6, forbidding discrimination.

18. SUBMISSION OF CERTIFIED PAYROLL RECORDS

Contractors and subcontractors on all public works projects will be required to submit certified payroll records (CPRs) to the Labor Commissioner unless excused from this requirement. This requirement will be phased in as follows:

- (a) Applies immediately to public works projects that have already been under CMU monitoring, i.e. contractors on ongoing projects that have been submitting CPRs to the CMU will continue doing so.
- (b) Will apply to any new projects awarded on or after April 1, 2015.
- (c) May apply to other projects as determined by Labor Commissioner.
- (d) Will apply to all public works projects, new or ongoing, on and after January 1, 2016.

19. PREFERENCE FOR MATERIALS

The Public Agency desires to promote the industries and economy of Contra Costa County, and the Contractor therefore promises to use the products, workers, laborers and mechanics of this County in every case where the price, fitness and quality are equal.

20. ASSIGNMENT

This agreement binds the heirs, successors, assigns, and representatives of the Contractor; but Contractor cannot assign it in whole or in part, nor any monies due or to become due under it, without the prior written consent of the Public Agency and the Contractor's surety or sureties, unless they have waived notice of assignment.

21. NO WAIVER BY PUBLIC AGENCY

Inspection of the work and/or materials, or approval of work and/or materials inspected, or statement by any officer, agent or employee of the Public Agency indicating the work or any part thereof complies with the requirements of this contract, or acceptance of the whole or any part of said work and/or materials, or payments therefore, or any combination of these acts, shall not relieve the Contractor of Contractor's obligation to fulfill this contract as prescribed; nor shall the Public Agency be thereby stopped from bringing any action for damages or enforcement arising from the failure to comply with any of the terms and conditions hereof.

22. HOLD HARMLESS AND INDEMNITY

- (a) Contractor promises to and shall hold harmless and indemnify from the liabilities as defined in this section.
- (b) The indemnities benefited and protected by this promise are the Public Agency and its elective and appointive boards, commissions, officers, agents and employees.
- (c) The liabilities protected against are any liability or claim for damage of any kind allegedly suffered, incurred or threatened because of actions defined below, including personal injury, death, property damage, inverse condemnation, or any combination of these, regardless of whether or not such liability, claim or damage was unforeseeable at any time before the Public Agency approved the improvement plan or accepted the improvements as completed, and including the defense of any suit(s) or action(s) at law or equity concerning these.
- (d) The actions causing liability are any act or omission (negligent or non-negligent) in connection with the matters covered by this contract and attributable to the contractor, subcontractor(s), or any officer(s), agent(s), or employee(s) of one or more of them.
- (e) Non-conditions: The promise and agreement in this section is not conditioned or dependent on whether or not any Indemnities has prepared, supplied, or approved any plan(s), drawing(s), specifications(s) or special provision(s) in connection with this work, has insurance or other indemnification covering any of these matters, or that the alleged damage resulted partly from any negligent or willful misconduct of any Indemnities.

23. EXCAVATION

Contractor shall comply with the provisions of Labor Code Section 6705, if applicable, by submitting to Public Agency a detailed plan showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during trench excavation.

24. GOVERNMENT CODE SECTION 10532

Contractor shall be subject to the examination and audit of the Auditor General for a period of three years after final payment under the contract.

25. WARRANTY

The Contractor warrants to the Public Agency that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted by the Contractor Documents, that the Work will be free from defects not inherent in the quality required or permitted, and that the Work shall conform to the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage.

26. CONSEQUENTIAL DAMAGES

The Contractor and Public Agency waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes:

- (a) Damages incurred by the Public Agency for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- (b) Damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.
- (c) This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination. Nothing contained in this subparagraph shall be deemed to preclude an award of liquidated direct damages, when applicable, in accordance with the requirements of the Contract Documents.

27. HAZARDOUS MATERIALS

- (a) If reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos, lead or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Public Agency in writing.
- (b) The Public Agency shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to verify that it has been rendered harmless. The Public Agency shall furnish in writing to the Contractor the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written notification from the Public Agency and Contractor. The Contract Time shall be extended appropriately.

28. SAFETY:

- (a) **Safety Programs.** The Contractor shall be solely responsible for initiating, maintaining and supervising all safety programs required by applicable law, ordinance, regulation or governmental orders in connection with the performance of the Contract, or otherwise required by the type or nature of the Work. The Contractor's safety program shall include all actions and programs necessary for compliance with California or federally statutorily mandated workplace safety programs, including without limitation, compliance with the California Drug Free Workplace Act of 1990 (California Government Code §§8350 et seq.). Without limiting or relieving the Contractor of its obligations hereunder, the Contractor shall require that its Subcontractors similarly initiate and maintain all appropriate or required safety programs. Prior to commencement of Work, the

Contractor shall meet with the campus Buildings and Grounds Manager, Project Manager, and Construction Manager to review Contractor's safety precautions and implementation of safety programs during the Work.

- (b) **Safety Precautions.** The Contractor shall be solely responsible for initiating and maintaining reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to: (i) employees on the Work and other persons who may be affected thereby; (ii) the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and (iii) other property or items at the site of the Work, or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction. The Contractor shall take adequate precautions and measures to protect existing roads, sidewalks, curbs, pavement, utilities, adjoining property and improvements thereon (including without limitation, protection from settlement or loss of lateral support) and to avoid damage thereto. Without adjustment of the Contract Price or the Contract Time, the Contractor shall repair, replace or restore any damage or destruction of the foregoing items as a result of performance or installation of the Work.
- (c) **Safety Signs, Barricades.** The Contractor shall erect and maintain, as required by existing conditions and conditions resulting from performance of the Contract, reasonable safeguards for safety and protection of property and persons, including, without limitation, posting danger signs and other warnings against hazards, promulgating safety regulations and notifying Districts and users of adjacent sites and utilities.
- (d) **Safety Notices.** The Contractor shall give or post all notices required by applicable law and comply with applicable laws, ordinances, rules, regulations and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.
- (e) **Safety Coordinator.** The Contractor shall designate a responsible member of the Contractor's organization at the Site whose duty shall be the prevention of accidents and the implementation and maintenance safety precautions and programs. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Project Inspector and the Architect.
- (f) **COVID19 SMALL PROJECT SAFETY PROTOCOL: The Contractor shall adhere to the requirements set forth by Appendix B-1 Small Construction Safety Protocol of the Contra Costa County Health Officer Order No. HO-COVID19-09 dated April 29, 2020 (see attachment titled Appendix B-1 Small Construction Safety Protocol).**

29. SIGNATURES AND ACKNOWLEDGEMENT

Public Agency:

By: _____
 Assistant Secretary, Governing Board
NAME, Director of Purchasing & Contracts

Note to Contractor: (1) Execute acknowledgement form below, and (2) if a corporation, affix Corporate Seal.

Contractor hereby also acknowledging awareness of and compliance with Labor Code S1861 concerning Worker's Compensation Law.

Contractor:

By: _____ (CORPORATE SEAL)
 (Designate Official Capacity – **NAME**)

 Print NAME and TITLE

 License Number

 Federal ID Number

NOTARY PUBLIC

=====

STATE OF CALIFORNIA)
) ss.
 COUNTY OF CONTRA COSTA)

On _____, before me, _____, Notary Public,

personally appeared _____, personally known to me (or proved to me on the basis of satisfactory evidence) to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing is true and correct.

Witness my hand and official seal.

Notary Public

[SEAL]

Appendix B-1

Small Construction Project Safety Protocol

1. Any construction project meeting any of the following specifications is subject to this Small Construction Project Safety Protocol (“SCP Protocol”), including public works projects unless otherwise specified by the Health Officer:
 - a. For residential projects, any single-family, multi-family, senior, student, or other residential construction, renovation, or remodel project consisting of 10 units or less. This SCP Protocol does not apply to construction projects where a person is performing construction on their current residence either alone or solely with members of their own household.
 - b. For commercial projects, any construction, renovation, or tenant improvement project consisting of 20,000 square feet of floor area or less.
 - c. For mixed-use projects, any project that meets both of the specifications in subsection 1.a and 1.b.
 - d. All other construction projects not subject to the Large Construction Project Safety Protocol set forth in Appendix B-2.
2. The following restrictions and requirements must be in place at all construction job sites subject to this SCP Protocol:
 - a. Comply with all applicable and current laws and regulations including but not limited to OSHA and Cal-OSHA. If there is any conflict, difference, or discrepancy between or among applicable laws and regulations and/or this SCP Protocol, the stricter standard shall apply.
 - b. Designate a site-specific COVID-19 supervisor or supervisors to enforce this guidance. A designated COVID-19 supervisor must be present on the construction site at all times during construction activities. A COVID-19 supervisor may be an on-site worker who is designated to serve in this role.
 - c. The COVID-19 supervisor must review this SCP Protocol with all workers and visitors to the construction site.
 - d. Establish a daily screening protocol for arriving staff to ensure that potentially infected staff do not enter the construction site. If workers leave the jobsite and return the same day, establish a cleaning and decontamination protocol prior to entry and exit of the jobsite. Post the daily screening protocol at all entrances and exits to the jobsite. More information on screening can be found online at: <https://www.cdc.gov/coronavirus/2019-ncov/community/index.html>.
 - e. Practice social distancing by maintaining a minimum six-foot distance between workers at all times, except as strictly necessary to carry out a task associated with the construction project.



Appendix B-1

- f. Where construction work occurs within an occupied residential unit, separate work areas must be sealed off from the remainder of the unit with physical barriers such as plastic sheeting or closed doors sealed with tape to the extent feasible. If possible, workers must access the work area from an alternative entry/exit door to the entry/exit door used by residents. Available windows and exhaust fans must be used to ventilate the work area. If residents have access to the work area between workdays, the work area must be cleaned and sanitized at the beginning and at the end of workdays. Every effort must be taken to minimize contact between workers and residents, including maintaining a minimum of six feet of social distancing at all times.
- g. Where construction work occurs within common areas of an occupied residential or commercial building or a mixed-use building in use by on-site employees or residents, separate work areas must be sealed off from the rest of the common areas with physical barriers such as plastic sheeting or closed doors sealed with tape to the extent feasible. If possible, workers must access the work area from an alternative building entry/exit door to the building entry/exit door used by residents or other users of the building. Every effort must be taken to minimize contact between worker and building residents and users, including maintaining a minimum of six feet of social distancing at all times.
- h. Prohibit gatherings of any size on the jobsite, including gatherings for breaks or eating, except for meetings regarding compliance with this protocol or as strictly necessary to carry out a task associated with the construction project.
- i. Cal-OSHA requires employers to provide water, which should be provided in single-serve containers. Sharing of any of any food or beverage is strictly prohibited and if sharing is observed, the worker must be sent home for the day.
- j. Provide personal protective equipment (PPE) specifically for use in construction, including gloves, goggles, face shields, and face coverings as appropriate for the activity being performed. At no time may a contractor secure or use medical-grade PPE unless required due to the medical nature of a jobsite. Face coverings must be worn in compliance with Section 5 of the Health Officer's Order No. HO-COVID19-08, dated April 17, 2020, or any subsequently issued or amended order.
- k. Strictly control "choke points" and "high-risk areas" where workers are unable to maintain six-foot social distancing and prohibit or limit use to ensure that six-foot distance can easily be maintained between individuals.
- l. Minimize interactions and maintain social distancing with all site visitors, including delivery workers, design professional and other project consultants, government agency representatives, including building and fire inspectors, and residents at residential construction sites.



Appendix B-1

- m. Stagger trades as necessary to reduce density and allow for easy maintenance of minimum six-foot separation.
- n. Discourage workers from using others' desks, work tools, and equipment. If more than one worker uses these items, the items must be cleaned and disinfected with disinfectants that are effective against COVID-19 in between use by each new worker. Prohibit sharing of PPE.
- o. If hand washing facilities are not available at the jobsite, place portable wash stations or hand sanitizers that are effective against COVID-19 at entrances to the jobsite and in multiple locations dispersed throughout the jobsite as warranted.
- p. Clean and sanitize any hand washing facilities, portable wash stations, jobsite restroom areas, or other enclosed spaces daily with disinfectants that are effective against COVID-19. Frequently clean and disinfect all high touch areas, including entry and exit areas, high traffic areas, rest rooms, hand washing areas, high touch surfaces, tools, and equipment
- q. Maintain a daily attendance log of all workers and visitors that includes contact information, including name, phone number, address, and email.
- r. Post a notice in an area visible to all workers and visitors instructing workers and visitors to do the following:
 - i. Do not touch your face with unwashed hands or with gloves.
 - ii. Frequently wash your hands with soap and water for at least 20 seconds or use hand sanitizer with at least 60% alcohol.
 - iii. Clean and disinfect frequently touched objects and surfaces such as work stations, keyboards, telephones, handrails, machines, shared tools, elevator control buttons, and doorknobs.
 - iv. Cover your mouth and nose when coughing or sneezing, or cough or sneeze into the crook of your arm at your elbow/sleeve.
 - v. Do not enter the jobsite if you have a fever, cough, or other COVID-19 symptoms. If you feel sick, or have been exposed to anyone who is sick, stay at home.
 - vi. Constantly observe your work distances in relation to other staff. Maintain the recommended minimum six feet at all times when not wearing the necessary PPE for working in close proximity to another person.
 - vii. Do not carpool to and from the jobsite with anyone except members of your own household unit, or as necessary for workers who have no alternative means of transportation.
 - viii. Do not share phones or PPE.



SECTION 00650

NOTICE TO PROCEED

DATE: _____

TO: _____

ADDRESS: _____

PROJECT: _____

You are notified that the Contract Time under the above contract will commence to run on _____. By that date, you are to start performing your obligations under the Contract Documents. In accordance with Section 00600, Construction Agreement, the date of Substantial Completion is _____, and the date for Final Completion is _____.

CONTRA COSTA COMMUNITY COLLEGE DISTRICT

By : _____

Ines Zildzic
Vice Chancellor, Facilities Planning and Construction

END OF SECTION 00650

**SECTION 00800
SUPPLEMENTARY GENERAL CONDITIONS**

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Refer to Scope of Work in Section 00600 Construction Agreement.

1.2 REFERENCES

- A. The publications listed below form a part of this specification by reference.
 1. Current California Occupational Safety and Health Act Regulations
 2. Current California Occupational Safety and Health Construction Safety Orders
 3. This work will be contracted using the District’s Short Form Construction Agreement; See Section 00600.

1.3 SUBMITTALS

- A. Provide submittals in the format, and as described below:
 1. **Submittals shall be submitted to the District, electronically in PDF format, within seven (7) Calendar Days from the Notice to Proceed, except as otherwise noted.**
 2. ~~Submit three (3) original (not less than 8 1/2" x 11", nor more than 30" x 42") wet-signed, and one (1) color PDF file for submittals that require shop drawings, unless otherwise directed by District and accepted by the Electrical Engineer.~~
 3. Submittals that require local and State agency approval, shall conform to this Specification and the requirements of the local or State agency.
 4. **District will review and provide a response to submittals within seven (7) calendar days (excluding holidays).** Submittals that include design documents prepared by a licensed California Engineer will be submitted for the District’s records. Any District review and response to the Contractor’s design documents by a licensed California Engineer will be for format and general compliance only. Contractor and Contractor’s licensed California Engineer are responsible for compliance with all applicable State of California codes, laws and regulations applicable to this project.
- B. Provide submittals for all equipment, if any, listed on the Drawings or in the Specifications.
- C. The Schedule of Values shall be submitted to the District within seven (7) calendar days after the Notice of Award. The Schedule of Values shall be broken down by the following minimum categories:
 1. Mobilization
 2. Demolition
 3. Electrical raceways and wiring
 4. Framing and patching

5. Installation of Audio-Visual Equipment per each room.
6. Testing and Training on Audio-Visual Equipment
7. Owner and Maintenance Manuals and Warranties
8. As-Built Drawings

The District will only pay for Work installed at the Site.

- D.** CPM construction schedule shall be submitted within **ten (10) calendar days** from the Contract Award date. District and Contractor shall meet and review the schedule. The Notice to Proceed will not be issued until the District accepts the schedule or accepts it with conditional changes. Below are the minimum activity types that shall be included in the schedule:

1. Contractor Submittals
2. Submittal Reviews by District
3. Procurement and Fabrication of Equipment and Materials
4. Construction activities corresponding to the Schedule of Values
5. Substantial Completion Milestone
6. Project Closeout Activities.
7. Final Completion Milestone

- E.** Submittals are for review of conformance with the requirements of the Contract.

1.4 SUBSTITUTIONS.

- A.** *One Product Specified.* Unless the Specifications state that no substitution is permitted, whenever the Contract Documents indicate any specific material, product, thing or service, or any specific name, make, trade name, or catalog number, with or without the words “or equal,” such specification shall be deemed to be used for the purpose of facilitating description of the material, product, thing or service desired and shall be deemed to be followed by the words “or equal” unless the Contract Documents specify “no substitution allowed”, “no equal”, “no equivalent”, or other language with similar meaning, in which case no substitutions will be allowed. Pursuant to Paragraph 1.3.F.3, the Contractor may, unless otherwise stated, within three (3) work days after the bid opening, submit a substitution request for any material, product, thing or service, which shall be materially equal or better in every respect to that so indicated or specified (“Specified Item”) and will completely accomplish the purpose of the Contract Documents.

1. *Products Specified which are Commercially Unavailable.* If the Contractor fails to make a request for substitutions for products, within three (3) work days after bid opening, and such products subsequently become commercially unavailable, the Contractor may request a substitution for such commercially unavailable item. The decision to grant this request is solely at the District’s discretion. The written approval of the District, consistent with the procedure for Change Orders, shall be required for the use of a proposed substitute material. The District may condition its

approval of the substitution upon the delivery to District of an extended warranty or guaranty or other assurances of adequate performance of the substitution as well as an equitable deduction in the contract sum should the substituted item cost less than the Specified Item. All risks of delay due the approval of a requested substitution by the District, DSA, or any other governmental agency having jurisdiction, shall be on the requesting party. All additional costs, all procurement and construction delays, and all costs for review by the Architect or its consultants shall be the responsibility of the Contractor and will be deducted from Contractor's pay request.

B. Substitution Request Form. Requests for substitutions of materials, products, things or services in place of a Specified Item must be submitted to the District in writing on the District's Substitution Request Form ("Request Form") within three (3) work days after bid opening, except as provided for in Paragraph 1.3.F.1.

1. The Substitution Request Form must be accompanied by evidence as to whether the proposed substitution:
 - (a) Is equal in quality/service/ability to the Specified Item;
 - (b) Will entail no changes in detail, construction, and scheduling of related work;
 - (c) Will be acceptable in consideration of the required design and artistic effect;
 - (d) Will provide no cost disadvantage to the District;
 - (e) Will require no excessive or more expensive maintenance, including adequacy and availability of replacement parts; and
 - (f) Will required no change of the construction schedule.

2. In completing the Substitution Request Form, the bidder shall state, with respect to each requested substitution, that the bidder will agree to provide the Specified Item in the event that the District denies the bidder's request for such requested substitution. In the event the District denies the bidder's requested substitution for a Specified Item, the bidder shall provide the Specified Item without any additional cost or charge to the District and waives all rights to submit a claim.

C. After Bid Opening. After bids are opened, the apparent lowest bidder shall provide, within three (3) days of opening such bids, any and all Drawing, Specifications, samples, performance data, calculations, and other information, as may be required to assist the Design Consultant and the District in determining whether the proposed substitution is acceptable. The burden of establishing these facts shall be upon the bidder.

1. After the District's receipt of such evidence by the bidder, the District will make its final decision as to whether the bidder's request for substitution for any Specified Items will be granted. The decision as to whether a proposed request for substitution is equal to a Specified Item shall be at the sole discretion of the District. Any request for substitution that is granted by the District shall be documented and processed through a Change Order. The District may condition its approval of any substitution upon delivery to the District of an extended warranty or guaranty or other assurances of adequate performance of the substitution. Any and all risks of delay due to approval by the District, DSA or any other governmental agency having jurisdiction shall be on the bidder.

2. If the Design Consultant and District accept a proposed substitution, the Contractor agrees to pay for all District expenses, including but not limited to Division of the State Architect fees, engineering and design services, compensation to the Design Consultant for their required time to process such substitution through the Division of the State Architect, if required, and to make all changes and adjustments in materials or the work of all trades directly or indirectly affected by the substituted item or items at no cost to the District

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Contractor Provided Materials: The Contractor provided materials shall include any associated equipment and appurtenances required for performing the contract properly and in accordance with the equipment manufacturer's literature.
- B. All materials shall be new, unless otherwise authorized or specified in the scope of work of this specification.

PART 3 - EXECUTION AND RELATED REQUIREMENTS

3.1 GENERAL

- A. **Work Restrictions:** Contractor shall maintain a safe path of travel for all pedestrians and vehicles during construction. Contractor is required to provide safety barricades and alternative routes of travel for pedestrians and vehicles at all times, unless otherwise approved by the District. Anytime the Contractor anticipates it will block and divert existing paths of travel for pedestrians or vehicles, it shall provide a hard copy plan along with proposed wayfinding signage for review by the District at least 3 work days prior to such blockage and diversion. Said plan shall be reviewed and approved by the District prior to commencement of this work by the Contractor.
- B. Contractor shall provide barricades, wayfinding signage, safety signage, and COVID-19 signage around the construction site through Substantial Completion to deter access by students, faculty, and the public to areas under the control of the Contractor.
- C. Contractor will be allowed to have access and use Campus utilities for temporary water and electricity, but Contractor shall be responsible to investigate prior to bid, and for all work necessary to connect to existing utilities for temporary use.
- D. Contractor shall control all construction-generated dust during construction, and clean-up said dust and debris daily to prevent migration to other areas or rooms.
- E. **Scheduling and Coordination:** Before commencing work on a specific area, the Contractor shall confirm that all requirements have been met pertaining to scheduling of the work. The

Contractor shall further determine that all required written notices have been given to the District.

- F. **Scheduling and Sequence of Work:** The work shall be prosecuted in such a manner as to cause the least interference with the normal functions of the campus activity in the adjacent areas. Prior to beginning any work, the Contractor shall meet with the District and the Contractor's schedule shall be approved as noted in Article 1.3D above.
- G. **Interruption of Utilities Services:** Interruptions shall be kept to a minimum and shall be at such times and duration as approved ahead of time by the District. No interruption shall occur unless scheduled with the District and approved in advance in writing as to time and duration of such interruption. No utility interruptions that impact building operation during classes will be allowed, and these types of interruptions, if any, shall be scheduled for after normal hours when classes are not in session.
- H. **Material, equipment, tools and workmen** shall be scheduled and delivered to the Site in a timely manner to avoid delay in the work. Materials provided shall be inspected by the Contractor to make certain they follow the specifications and are free from defects and damage.
- I. **Measurements:** Before fabrication, obtain necessary field measurements and verify all measurements.
- J. **Bathroom Facilities:** **The Contractor will NOT be allowed to use College bathroom facilities and the Contractor shall provide porta-potties and cleaning stations to wash hands for construction personnel located at the Site. The location shall be approved in writing by the District before locating the porta-potties.**
- K. **Workmanship:** Skilled personnel shall execute in a careful, neat, and proficient manner and in compliance with accepted trade practices for all work. All work shall be executed in accordance with Cal/OSHA standards and safety orders. And all work on this contract shall comply with all Local, State, and Federal Environmental Laws.
- L. **Incidental Work:** Minor incidental materials and work not specifically mentioned herein, but necessary for the proper completion of the specified work, shall be provided without additional cost to the District
- M. **Administrative Forms:** District shall provide its standard forms for use by Contractor.

3.2 EXISTING CONDITIONS & DRAWINGS

- A. See Section 00210, Information Available to Bidders for documents available for review by the Contractor and its subcontractors prior to and after bid.

3.3 WORK BY CALIFORNIA LICENSED ENGINEER

- A. Note that modifications to existing building structures, fire systems, or ADA changes, if any are discovered during construction, will require DSA approval. Contractor will be granted a non-compensable time extension for the duration it takes to obtain DSA approval. A change order will be negotiated for added direct labor field construction costs, if any.

3.4 NOISE CONTROL

- A. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to building occupants.
 - 1. Notify District’s Representative not less than two days in advance of proposed disruptive operations.
 - 2. Obtain District’s Representative’s written permission before proceeding with disruptive operations.

3.5 SITE WORK-Not Used

3.6 PROJECT CLOSEOUT REQUIREMENTS (After Substantial Completion & Before Final Completion)

- A. Refer to the Drawings listed in Section 00010, Table of Contents for requirements, and these Supplementary General Conditions.
- B. Provide final clean-up of Site prior to Final Completion.
- C. Warranty
 - 1. The Contractor warrants to the District that material and equipment furnished under the Contract will be of the highest quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects not inherent in the quality required or permitted, and that the Work will conform with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. Contractor’s warranty and guaranty to District includes, but is not limited to the following representations:
 - a. In addition to any other warranties and guaranties provided elsewhere, Contractor shall, and hereby does, warrant all Work after the Certificate of Substantial Completion date issued by District and shall repair or replace any or all such work, together with any other work, which may be displaced in so doing that may prove defective in workmanship or materials within a one (1) year period from date of completion as defined in Public Contract Code Section 7107(c) without expense whatsoever to District, ordinary wear and tear, unusual abuse or neglect excepted. District will give notice of observed defects with reasonable promptness. Contractor shall notify District upon completion of repairs.
 - b. In the event of failure of Contractor to comply with above mentioned conditions within one week after being notified in writing, District is hereby authorized to proceed to have defects repaired and made good at expense of Contractor who hereby agrees to pay costs and charges therefore immediately on demand.

- c. If, in the opinion of the District, defective Work creates a dangerous condition or requires immediate correction or attention to prevent further loss to the District, the District will attempt to give the notice required by this Article. If the Contractor cannot be contacted or does not comply with the District's requirements for correction within a reasonable time as determined by the District, the District may, notwithstanding the provisions of this article, proceed to make such correction or attention which shall be charged against Contractor. Such action by the District will not relieve the Contractor of the guarantee provided in this Article or elsewhere in this Contract.
 - d. This Article does not in any way limit the guarantee on any items for which a longer warranty or guaranty is specified or on any items for which a manufacturer gives a guarantee for a longer period. Contractor shall furnish District all appropriate guaranty or warranty certificates upon completion of the project.
2. Format - All Warranties/Guaranties and shall include:
 - a. Contractor, subcontractor, and equipment supplier shall provide Warranties and Guaranties on their original company letterhead with original signature.
 - b. Contractor shall provide original Warranties and Guaranties. Photocopies, fax and e-mail copies are not acceptable.
 3. Preparation
 - a. Contractor shall obtain warranties and guaranties, executed in duplicate by each applicable and/or responsible subcontractor(s), supplier(s), and manufacturer(s), within fifteen (15) days after Certificate of Substantial Completion date of the applicable Work. Except for items put into use with District's permission, Contractor shall leave date of beginning of time of warranty or guaranty blank until the date of completion is determined by District.
 - b. Contractor's Response to Construction Warranty and Guaranty Service Requirements: Following oral or written notification by the District, respond to construction warranty and guaranty service requirements within 24 hours, or earlier in case of emergency.
 4. Warranty and/or Guaranty Tags
 - a. At the time of installation of mechanical equipment or other major system elements, tag each warranted or guaranteed item with a durable, oil and water-resistant tag approved by the District. Attached each tag with a copper wire and spray with a silicone waterproof coating. The date of Substantial Completion and the Contractor Authorized signature must remain blank until the date the District makes a determination of Substantial Completion. Show the following information on the tag:

WARRANTY/GUARANTY INFORMATION – [insert project number and name on actual tag]

- a. Type of product/material_____.
- b. Model number_____.
- c. Serial number_____.
- d. Contract number_____.
- e. Warranty/Guaranty period _____ (months) from _____ to _____.
- f. Inspector's signature_____.
- g. Construction Contractor_____.
- Address_____.
- Telephone number_____.
- h. Warranty or Guaranty contact_____.
- Address_____.
- Telephone number_____.
- i. **WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD.**

3.7 Project As-Built

- A. Contractor shall dedicate one complete full-size set of the Contract Drawings and one complete Project Manual for use in documenting as-built conditions, including but not limited to; RFIs, ASI, PCOs and Change Order.
- B. Contractor shall submit to District in hard copy one original and two copies of all Project As-Built Documents. In addition, one electronic copy shall be submitted to District. District reserves the right to require resubmittal in accordance with these Supplementary General Conditions if the documents are inaccurate or incomplete, or otherwise fail to meet the requirements of these Contract Documents.
- C. **Electronic Media Format:** Electronic media format for all Project As-Built Documents shall be Adobe PDF, with chapter markers and/or bookmarks inserted in place of the equivalent hard copy section tabs. Electronic copy shall include all tables, charts, drawings, codes and all other matters reflected in hard copies. Electronic media files shall be delivered on a unique CD-ROM or flash drive.

3.8 TIME OF COMPLETION

- A. See Section 00300, Bid Proposal Form for specific requirements to complete the Work. Time requirements are also included in Section 00600, Construction Agreement.
- B. **Substantial Completion:** The date on which the Work or designated portion thereof, as certified by the District and Architect, is sufficiently complete, in accordance with the Contract Documents, so the District may occupy or utilize the Work or designated portion thereof for the use for which it is intended.
- C. **Remaining Work after Substantial Completion:** If the Architect or District determines that the work required by the Contract is Substantially Complete during any inspection conducted pursuant to this Agreement, the Contractor shall be notified of that determination and the District shall determine if there is Remaining Work. A list of Remaining Work shall be issued only by the District or the Architect and only after the District has certified Substantial Completion. The District or Architect shall give the Contractor the necessary instructions for

correction or completion of the Remaining Work, and the Contractor shall immediately comply with and execute such instructions within the Contract Time. Upon completion of the Remaining Work, another inspection shall be made that shall constitute the Final Inspection, provided the Remaining Work has been completed to the satisfaction of the District. If the remaining work has been completed to the satisfaction of the District, the District shall make the final acceptance and notify the Contractor in writing of this acceptance as of the date of Final Inspection.

- D. Final Completion: The date when all Work for the total project has been completed in accordance with the terms of the Contract Documents and has been inspected following completion of Work identified in the Punch List Inspection and accepted by the Architect and the District. Final Completion is also sometimes referred to as Final Acceptance.

3.9 ADDITIONAL REQUIREMENTS FOR DSA-APPROVED PROJECTS

- A. All substitutions affecting DSA regulated items shall be considered as a Construction Change Document or Addenda and shall be approved by DSA prior to fabrication and installation, as required by IR A-6 and Section 4-338(c), Part 1. Substitutions shall be for any material, system or product that would otherwise be regulated by DSA.
- B. All Addenda must be signed by **Engineer of Record** and approved by DSA (Section 4-338, Part 1).
- C. The Construction Change Documents (Section 4-338(c), Part 1) must be signed by all the following:
 1. A/E of Record
 2. Structural Engineer (when applicable)
 3. Delegated Professional Engineer (when applicable)
 4. DSA



CONTRA COSTA COMMUNITY COLLEGE DISTRICT

500 Court Street, Martinez, CA 94553

SUBSTITUTION REQUEST FORM

Contractor Name: _____
Contract #: _____

RFS # _____ Date: _____

DSA Application #: _____

Campus: Contra Costa College

Project No., Name: _____

Contractor pursuant to General Conditions submits the proposed items. If the District accepts such items so described, the undersigned may furnish such item with all necessary labor, materials, equipment and incidentals to perform and complete the Work.

Item No.	SPECIFIED ITEM OR DRAWING	SPECIFICATION SECTION	PROPOSED SUBSTITUTION (and name of Subcontractor if different)

CERTIFICATION

Under penalty of perjury under the Laws of California, I certify that the proposed substitution will be readily available, perform adequately the functions and achieve the results called for by the design concept, be similar in substance to that specified, and be suited to the same use as that specified in Contract Documents.

Contractor: _____

(Please print name of company) Name and Title (print/type) Contractor Authorized Representative Date

A. Does the substitution affect dimensions shown on Drawings?
B. Will the undersigned pay for changes to the building design, including engineering and detailing costs caused by the requested substitution?
C. What effect does the substitution have on other trades?
D. Will substitution cause change to Project Schedule, or to critical delivery dates? Add ? Shorten ?
E. Differences between proposed substitution and specified item?
F. What is the Cost Differential including all mark-ups?
G. Are Manufacturer's guarantees for the proposed item the same as for item specified? Explain differences.
H. The undersigned accepts full responsibility for delays caused by redesign of other items of the Work necessitated by substitution.
I. The undersigned states that the function, appearance and quality are equivalent or superior to the specified item.

<p>A/E Response:</p> <p><input type="radio"/> Accepted</p> <p><input type="radio"/> Not Accepted</p> <p><input type="radio"/> Accepted As Noted</p> <p><input type="radio"/> Received Too Late</p> <p>BY: _____ Date: _____</p>	<p>District Representative Response:</p> <p><input type="radio"/> Accepted</p> <p><input type="radio"/> Not Accepted</p> <p><input type="radio"/> Accepted As Noted</p> <p><input type="radio"/> Received Too Late</p> <p>By: _____ Date: _____</p>
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END OF SECTION 00800

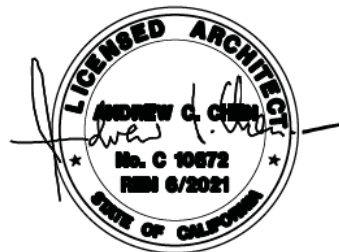


COMMUNITY AND CONFERENCE
ROOMS UPGRADES FOR
LOS MEDANOS COLLEGE
2700 E. LELAND ROAD
Pittsburg, California

**Permit/ Bid Set Submittal
Specifications**

29 October 2020

Prepared for Los Medanos College



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All technical sections (Divisions 02 through 33) are from the current AIA Masterspec library.

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NOT USED

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NOT USED

DIVISION 04 – MASONRY

NOT USED

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NOT USED

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

NOT USED

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

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DIVISION 09 – FINISHES

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DIVISION 21 - FIRE SUPPRESSION

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274108	AUDIOVISUAL CABINETS, RACKS, FRAMES AND ENCLOSURES
274109	AUDIOVISUAL CABLE MANAGEMENT
274116	INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

NOT USED

DIVISION 31 – EARTHWORK

NOT USED

DIVISION 32 - EXTERIOR IMPROVEMENTS

NOT USED

DIVISION 33 – UTILITIES

NOT USED

END OF SPECIFICATIONS TABLE OF CONTENTS

SECTION 27 41 00 COMMON WORK RESULTS FOR AUDIOVISUAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes, but is not necessarily limited to:
 - 1. Common standards and procedures for the Audiovisual Work.
 - 2. Design, engineer and provide complete, all means of support, suspension, attachment, fastening, bracing, and restraint (hereinafter "support") of the Audiovisual Systems. Provide engineering of such support by parties licensed to perform work of this type in the Project jurisdiction.
 - 3. Provide audiovisual and conferencing systems in Community Room, Conference Rooms 1&2, Conference Room 409, and Conference Room 420.
 - a. Remove (E) AV equipment as directed by plans. Coordinate disposal/disposition of removed equipment with District Representative.
 - b. Provide commissioning, programming, and training for installed AV systems.
 - c. For AV and conferencing equipment that connects to District networks, coordinate IP addressing with District IT Representative.
- B. Provisions of this Section apply to Audiovisual Work, including the following Sections:
 - 1. Section 27 41 01 – Grounding and Bonding for Audiovisual Systems
 - 2. Section 27 41 02 – Hangers and Supports for Audiovisual Systems
 - 3. Section 27 41 03 – Conduits and Backboxes for Audiovisual Systems
 - 4. Section 27 41 06 – Noise and Vibration Controls for Audiovisual Systems
 - 5. Section 27 41 07 – Identification for Audiovisual Systems
 - 6. Section 27 41 08 – Audiovisual Cabinets, Racks, Frames and Enclosures
 - 7. Section 27 41 09 – Audiovisual Cable Management
 - 8. Section 27 41 16 – Integrated Audio-Video Systems and Equipment

1.2 REFERENCES

- A. Usage: In accordance with Division 1 - Regulatory Requirements
- B. American National Standards Institute (ANSI)
 - 1. ANSI/TIA/EIA-568-B.1-2001, Commercial Building Telecommunications Cabling Standard – Part 1: General Requirements
 - 2. ANSI/TIA/EIA-568-B.2-2001, Commercial Building Telecommunications Cabling Standard – Part 2: Balanced Twisted Pair Cabling Components
 - 3. ANSI/TIA/EIA-568-B.3-2000, Optical Fiber Cabling Components Standard
 - 4. ANSI/TIA/EIA-606-A-2002, Administration Standard for Commercial Telecommunications Infrastructure

1.3 DEFINITIONS

- A. General Abbreviations used in these specifications. Refer additionally to the abbreviations list appearing on the Drawings.
 - 1. ADA Americans with Disabilities Act.
 - 2. AFC Above Finished Ceiling.
 - 3. AFF Above Finished Floor.

4.	BLDG	Building
5.	CAT	Category
6.	CL	Centerline
7.	DIV	Division
8.	(E)	Existing
9.	FBU	Furnished By Owner
10.	HR	Home Run
11.	ID	Inside Diameter
12.	LAN	Local Area Network
13.	MAX	Maximum
14.	NIC	Not In Contract.
15.	OD	Outside Diameter
16.	PSRH	Project Standard Receptacle Height.
17.	PSSH	Project Standard Switch Height.
18.	TYP	Typical
19.	UFE	Owner Furnished Equipment.
20.	UON	Unless Otherwise Noted.

- B. Electrical and electronics terms used in the Audiovisual Sections shall be as defined in:
1. ANSI/TIA/EIA-568-B.1
 2. ANSI/TIA/EIA-568-B.2
 3. ANSI/TIA/EIA-568-B.3
 4. ANSI/TIA/EIA-569-B
 5. ANSI/TIA/EIA-606-A
 6. IEEE Std 100
 7. This Section.
- C. Open Cable - Cabling that is not run in a raceway as defined by NFPA 70. This refers to cabling that is open to the space in which the cable has been installed and is therefore exposed to the environmental conditions associated with that space.
- D. Open Office - A floor space division provided by furniture, moveable partitions, or other means instead of by building walls.
- E. Pathway - A physical infrastructure utilized for the placement and routing of Audiovisual cable.

1.4 SUBMITTALS

- A. Within bidding documentation, Contractor to provide a room by room equipment list.
- B. Comply with Section 013300 and the following:
1. Submit all materials for review arranged in same order as Specifications, individually referenced to Specification Section, Paragraph and Contract Drawing number. Conform in every detail as applies to each referencing Section.
 2. Submit 8 ½"x 11" items bound in volumes and drawings in edge bound sets. Submit all drawings on sheets of the same size.
 3. Make each specified submittal as a coordinated package complete with all information specified herein. Incomplete or uncoordinated submittals will be returned with no review action.
 4. Progress Schedule: Comply with Section 013300.

- C. Contractor and Key Personnel Experience.
 - 1. A minimum of 30 days prior to installation, submit documentation of the experience of the low voltage systems, equipment and infrastructure contractor(s) and of their key personnel.
 - 2. Qualifications shall be provided for:
 - a. the low voltage systems, equipment and infrastructure contractor(s),
 - b. the low voltage systems, equipment and infrastructure installers,
 - c. and the supervisor(s) (if different from the installers).
 - 3. Refer to Quality Assurance paragraph in this section for complete requirements.
- D. Manufacturer's Product Data:
 - 1. Manufacturer's Product Data Sheets. Collate in sequence of List of Materials:
 - 2. Data sheet for each item in each Audiovisual Section, including all accessories, clearly marked for proposed product.
 - 3. Material Safety Data Sheet, where applies.
 - 4. List of Materials Schedule. For each item, include:
 - a. Referencing Specification Section
 - b. Referencing Paragraph
 - c. Referencing Drawing, if specified only on plans
 - d. Manufacturer.
 - e. Model number.
 - f. Listing, including name of Nationally Recognized Testing Laboratory.
 - g. Precede each submittal book with a summary schedule, with columns for each item above and rows for each item submitted.
 - i. Example:

Specification Section	Paragraph	Contract Drawing Reference	Manufacturer	Model No.	UL/CLA Listed
27 41 00	2.3 C.		XYZ	123	Y
27 41 03	2.7 A. 1.		AAA	34-56	Y
		TA7.02	ZZY	456	Y

- E. Field (Installation) Drawings:
 - 1. General
 - a. Drawings shall present the proposed installation using the makes and models of devices proposed for use this project; replace vendor neutral-nomenclature used in bid set with specific makes and models of devices proposed.
 - b. Where the existing systems and/or infrastructure are used and integrated into the work of the project, indicate them on drawings, including points of interface and demarcation of existing and new work.
 - c. Collate, in sequence, at least the following minimum drawings, for each infrastructure and system to be installed under the work of this contract:
 - 2. Drawing index/symbol sheet.
 - 3. Site plans, floor plans and reflected ceiling plans.
 - a. General
 - i. The identifier for each termination and cable shall appear on the drawings, either directly on the floor plans, through an associated schedule or a unique identifier associated with a fully annotated single line diagram.
 - ii. Include wiring diagrams and installation details of equipment indicating proposed

- location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.
- iii. At scale of Contract Documents, show:
 - (1) Device locations and type
 - (2) Rough-in.
 - (3) Mounting height.
 - (4) Conduit size.
 - (5) J-hook routes
 - (6) Wire type.
 - (7) Wire fill.
 - iv. On the floor plans, indicate floor and wall mounted devices and pathway below a height of 7 feet above finish floor. Indicate the locations of the Audiovisual Program and Control Rooms and provide reference to the enlarged Audiovisual Program and Control Rooms plans.
 - v. On the reflected ceiling plan, indicate ceiling and wall mounted devices and pathway above a height of 7 feet above finish floor. Indicate the locations of the Audiovisual Program and Control Rooms and provide reference to the enlarged Audiovisual Program and Control Rooms plans.
- b. Audiovisual Systems, including KMVT Systems
- i. Indicate:
 - (1) Device locations, orientation and depict integration of systems that need to be viewed from the complete building perspective.
 - (2) For distributed speaker systems, indicate limits of zones of coverage.
 - (3) Vertical and horizontal pathways
 - (4) Equipment rooms and racks
 - (5) Reference to enlarged plans and related details.
4. Enlarged Plans
- a. General
 - i. Indicate at least as much information as is provided in the Contract Documents, supplemented by the dimensions and arrangement of the proposed equipment, trade coordination and field conditions.
 - b. Audiovisual Systems:
 - i. At equipment rooms
 - (1) Rack elevations, showing
 - (a) all equipment occupying the actual number of rack units required
 - (b) blank panels
 - (c) vent panels
 - (d) aux panels
 - (e) power strips
 - (f) UPS
 - (g) Reference mounting details.
5. System Conduit and Riser Diagrams,
- a. General:
 - i. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment.
 - ii. Single line diagram of structured wiring

- iii. Grounding and bonding scheme
 - iv. Terminal cabinets.
 - v. Coordination with floor plans.
 - vi. Wire runs not shown on floor plans.
 - vii. Wire type.
 - viii. Wire fill.
 - ix. Interface to work provided by work of other Sections, Owner Furnished Equipment, existing equipment and/or future equipment.
 - x. For Audiovisual Systems, indicate digital or analog signal type and voltage levels (dBmV, microphone, line level, loudspeaker level) or optical signal levels.
6. Detail Drawings
- a. Mounting details:
 - i. Specific details of restraints including anchor bolts submitted under the Section 27 41 02 – Hangers and Supports for Audiovisual Systems for mounting and maximum loading at each location, showing compliance and coordination with Code and the project Architectural, Structural and Mechanical Documents.
 - ii. Stamped and signed by an Engineer licensed in the Project jurisdiction for work of this type.
 - (1) Submit an accompanying Engineering analysis stamped and signed by an Engineer licensed in California for work of this type, indicating that the Equipment Enclosure System will comply with California Building Code for the Project Seismic Zone when loaded with the weight of the equipment submitted.
 - (2) Show calculations on drawings or in bound volume for review by Authorities having jurisdiction.
 - iii. Show loads, type and strength of connections, sizes, dimensions, materials, etc.
 - iv. Provide details for:
 - (1) Equipment Rack anchorage.
 - (2) Wall and ceiling mounted projection screens.
 - (3) Wall and ceiling mounted projectors.
 - (4) Cameras and loudspeakers weighing 20 pounds or more.
 - (5) Wall and ceiling mounted flat panel displays.
 - b. Faceplate and Receptacles
 - i. Receptacle and jack arrangement for each condition.
 - ii. Labeling of receptacle/jacks and plate
 - iii. Plate material.
 - iv. Plate finish.
 - v. Connector types.
 - vi. Connector dimensioned layout.
 - c. Pathway
 - i. Firestopping
 - ii. Details of flexible raceway connections to be made to vibrating equipment
 - iii. Details of J-Box and sealant application for the typical conditions listed in Section 27 41 06 – Noise and Vibration Controls for Audiovisual System, and a schedule of rooms to receive application of mastic and sealant at J-Boxes
 - iv. An itemized list of all items of equipment to be fitted with flexible electrical connections.
 - v. Conduit racking details.
 - d. California Access Compliance Manual and Americans with Disabilities Act (ADA)

- compliance.
 - e. For systems with contractor or manufacturer programmed control and human interfaces submit at least:
 - i. Narrative of the sequence of operation.
 - ii. Color, full-size layouts of each touchpanel and/or computer screen (menu) image, cross-referenced to the sequence of operations.
 - iii. Show chaining of sub-menus.
 - f. Terminal cabinets: Terminations.
 - g. Voice cable plant: Cut sheets for use by Owner's Telephone Systems Contractor
- F. Samples: Samples for review by the Owner's Representative of all finishes/materials which will be visible to the public, including but not limited to:
- 1. The Contractor shall submit a sample of each type of label to be used for labeling cables, patch panels, termination frames, and faceplates for the telephone and data systems.
- G. Test Plan
- 1. Submit complete documentation of the proposed test plan and equipment to be used to document that the performance of the cabling, equipment, sub-systems and complete systems installed under the work of this project conform to the performance standards outlined in each specification section.
 - 2. Submit not less than 45 days prior to the proposed test date. Include procedures for certification, validation, and testing.
- H. Test Reports
- 1. Manufacturer's Field Reports
 - a. Factory reel tests
 - 2. Project Site Test Reports:
 - a. Submit following system completion and prior to and as condition precedent to Acceptance Review and Testing of the Work of this Section.
 - b. Schedule: Submit test reports in timely manner relative to Project schedule such that the Owner's Representative may conduct verification of submitted test data without delay of scheduled progress.
 - c. Project Site test report:
 - d. Content: Include at least:
 - i. Time and date of test.
 - ii. Personnel conducting test.
 - iii. Test equipment, including serial and date of calibration.
 - iv. Test object.
 - v. Procedure used.
 - vi. Results of test
 - vii. Numerical or graphical presentation.
 - e. Submit copy of final results on paper and in electronic form, organized by circuit number, consistent with circuit numbering scheme used in preparing submittal drawings and in labeling receptacles and terminations.
 - i. Submit machine-generated documentation and raw data of all test results in electronic form on CD-R media
 - ii. Where the electronic documentation requires use of a proprietary computer program to view the data, provide the Owner with 1 licensed copy of the software.

1.5 QUALITY ASSURANCE

- A. Contractor Firm and Personnel Qualifications:
- B. Designated Supervisor: Provide a designated supervisor present and in responsible charge in the fabrication shop and on the Project Site during all phases of installation and testing of the Work of this Section. This supervisor shall be the same individual through the execution of the Work unless illness, loss of personnel, or other circumstances reasonably beyond the control of the Contractor intervene.
- C. Reference Documents: At all times when the work is in progress, maintain at the workplace, fabrication shop or Project Site as applies.
 - 1. A complete set of the latest stamped, actioned submittals of record.
 - 2. A complete set of manufacturer's original operation, instruction and service manuals for each equipment item.
- D. Standard Products
 - 1. Audiovisual Systems Equipment. Provide Audiovisual Systems materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for six months prior to bid opening. The six month period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the six month period.
 - a. Alternative Qualifications. Products having less than a 1-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 2500 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.
 - 2. Material and Equipment Manufacturing Date
 - a. Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.
- E. Test Equipment
 - 1. Requirements:
 - a. Maintain and operate test equipment at the fabrication shop and the job site for both routine and Acceptance Testing of the Work of this Section.
 - b. Maintain test equipment at the job site while work is in progress from installation of equipment racks until Owner Acceptance of this Work; thereafter remove all of this test equipment from the job site.
 - c. Unless otherwise indicated, test equipment shall remain property of the Contractor.
 - d. Provide all required test cables, jigs and adapters.
 - e. Provide equipment with traceable calibration, with calibration date not greater than one year prior to the date of the use of the equipment to perform the specified testing.
- F. Qualifications
 - 1. Audiovisual Qualifications
 - a. Audiovisual Systems work shall be performed by and the equipment shall be provided by the Audiovisual Systems contractor and key personnel. Qualifications shall be provided for:
 - i. the Audiovisual Systems contractor,

- ii. the Audiovisual Systems installer,
 - iii. and the supervisor (if different from the installer).
 - b. A minimum of 30 days prior to installation, submit documentation of the experience of the Audiovisual Systems and of the key personnel.
- 2. Audiovisual Systems Installer
 - a. The installer of the Audiovisual systems shall be a firm regularly and professionally engaged in the business of installation, configuration and testing of the specified Audiovisual systems and equipment.
 - i. Where the manufacturers of the specified and contractor proposed systems provide mandatory installer and programming training programs, the Contractor's programming and installation staff shall provide documentation to demonstrate their successful completion of the relevant training programs for the types and versions of equipment proposed for installation on this Project.
 - ii. Where the manufacturer of the specified and contractor proposed systems and equipment lawfully restricts sales of their equipment to a network of dealers, the contractor shall provide documentation to their standing as such a dealer in good standing at the time of bid submittal.
 - iii. The Audiovisual systems contractor shall demonstrate experience in providing successful Audiovisual systems of a similar scope and nature of those required by the work of this Project within the past 3 years.
 - iv. Submit documentation for a minimum of three and a maximum of five successful Audiovisual system installations for the Audiovisual systems contractor.
 - b. Key Personnel
 - i. Provide key personnel who are regularly and professionally engaged in the business of the installing, programming, configuring and testing of the specified Audiovisual systems and related presentations and equipment.
 - (1) There may be one key person or more key persons proposed for this project depending upon how many of the key roles each has successfully provided.
 - (2) Each of the key personnel shall demonstrate experience in providing successful Audiovisual systems of a similar nature scope and extent to those required by the work of this Project within the past 3 years.

1.6 REGULATORY REQUIREMENTS

- A. Regulations Applicable: Including but not limited to those defined in Section 014200 – Definitions, References, and Regulations:
 - 1. Nothing in the Contract Documents shall be construed to permit Work not conforming to applicable laws, ordinances, rules, or regulations.
 - 2. Safety Agency Listing: All devices provided under the Work of this Section which are connected to the Project electrical system shall be listed by a Nationally Recognized Testing Laboratory, and shall be so labeled.
 - 3. In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Owner's Representative. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.7 DELIVERY, STORAGE AND HANDLING

A. Procedures:

1. As specified in the individual sections of Division 27 and the following.
 - a. Provide protection from weather, moisture, extreme heat and cold, dirt, dust, and other contaminants for cabling and equipment placed in storage.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Connecting hardware shall be rated for operation under ambient conditions of 32 to 140 degrees F and in the range of 0 to 95 percent relative humidity, non-condensing.

1.9 SEQUENCING

- A. Not Used

1.10 OPERATING AND MAINTENANCE DATA

- A. Commercial off the shelf manuals shall be furnished for operation, installation, configuration, and maintenance of products provided as a part of the low voltage systems, equipment and infrastructure work of this Project. Precede the manuals with a systems narrative specific to this Project, outlining the major systems functionality, the major systems components, and identifying which manuals document the performance of which subsystems.
1. Submit operations and maintenance data in accordance with Section 017800 – Project Record Documents and as specified herein not later than 2 months prior to the date of beneficial occupancy.

1.11 PROJECT RECORD DOCUMENTS

- A. Comply with Section 017800 – Project Record Documents, and the following. Include at least as much information as required for the submittal drawings.
1. Record Drawings
 - a. CAD.
 - i. Use a computer aided drafting (CAD) system in the preparation of record drawings for this Project. CAD system shall produce files in AutoCAD® .DWG format, version 2000 or later.
 - b. Except where prohibited by Contract, Owner's Representative will furnish CAD backgrounds in AutoCAD® .DWG format, for use by the Contractor in preparing Record Drawings.
 - c. Contractor shall be responsible for updating building and Audiovisual plans to reflect as-built conditions.
 - i. Indicate actual work on Drawings; indicate actual products used, replace vendor neutral nomenclature used in bid set with makes and models of actual installed devices.
 - d. Disk copy of Record Drawings: Provide 2 separate copies of each drawing file in the format noted above. Submit on CD-R disk.
 - e. Reproduceables: Provide 1 set of Mylars.
 2. Software
 - a. Controls and DSP Systems
 - i. Provide licensing for project specific software programming at programmable devices.
 - ii. Provide licensing and original software copies for each device provided that uses software for operation, configuration or control.

- iii. Provide licensing for required workstation operating systems, and required third party software.
- iv. For controls systems, provide a complete copy of the source code, including the device interface driver code modules.
- v. Upgrade each software package to the release in effect at the end of the Warranty Period.
- b. Provide at least a copy of software with at least 1 user license if required to view submitted test data.
- 3. Spare Parts
 - a. In addition to the requirements of Division 01 – Record Documents, provide a complete list of parts and supplies, with current unit prices and source of supply, and a list of spare parts recommended for stocking.

1.12 WARRANTY SERVICE

- A. In addition to provisions of Section 017800 – Guaranties, Warranties, Bonds and Maintenance Contracts, provide the following.
 - 1. Response Time: Provide a qualified technician familiar with the work at the Project Site within 24 hours after receipt of a notice of malfunction. Provide the Owner's Representative with telephone number attended 8 hours a day, 5 days a week, to be called in the event of a malfunction.
- B. Provide all additional Warranties as defined in each Communication Systems Section.

1.13 ACCEPTANCE REVIEW AND TESTING PROCEDURES

- A. Complete all Work of this Section. Submit Test Report. Submit review copies of Operating and Maintenance Manuals, less reduced set of Record Drawings. Notify the Owner's Representative in writing that the Work of these Sections is complete and fully complies with the Contract Documents. Request Acceptance Review and Testing. The Owner's Representative will conduct Verification of Submitted Test Data, and otherwise direct testing and adjustment of this Work. These procedures may be performed at any hour of the day or night as required by the Owner's Representative to comply with the Project Schedule and avoid conflict with Residents. Provide all specified personnel and equipment at any time without claim for additional cost or time.
- B. Personnel: Provide services of the designated supervisor and additional technicians familiar with work of this Section. Provide quantity of technicians as required to comply with Project Schedule.
- C. In Addition, Provide:
 - 1. All tools appropriate for performance of adjustment of and corrections to this Work. Include spare wire and connectors and specified tooling for application.
 - 2. Ladders, scaffolding and/or lifts as required to access high devices.
 - 3. All test equipment.
 - 4. Complete set of latest stamped, actioned submittals of record for reference.
 - 5. Complete set of Test Reports.
 - 6. Complete set of manufacturer's original operation, instruction and service manuals for each equipment item for reference.
 - 7. Demonstrate: Complete operation of all systems and equipment, including Portable Equipment.
 - 8. Adjust: As directed by the Owner's Representative.

9. Correct: In timely manner, failure to comply with the Contract Documents, as reasonably determined by the Owner's Representative.
- D. Temporary Equipment: Provide and operate, without claim for additional cost or time, temporary equipment and/or systems to provide reasonably equivalent function, as determined by the Owner's Representative, in place of the Work of this Section which is incomplete or found not in conformance with the Contract Documents as of seven (7) days prior to the scheduled completion date. Provide such temporary equipment until Acceptance of the Work of this Section. Thereafter, remove such temporary equipment.

1.14 CLOSEOUT

- A. Punch List: Perform any and all remedial work, at no claim for additional cost or time. Where required, retest and submit Test Report. Notify the Owner's Representative of completion of Punch List.
- B. Portable Equipment: Furnish all portable equipment and spares to the Owner's Representative, along with complete documentation of the materials presented. Where applicable, furnish portable equipment in the original manufacturer's packing.
- C. Operating and Maintenance Data: Install framed operating and maintenance instructions. Submit Manuals.
- D. Project Record Documents: Submit print and digital copies. Digital files shall be in CAD system shall produce files in AutoCAD® .DWG format, latest version at time of bid. (Owner Standard, no substitution permitted) as defined above.
- E. Keys: If applicable, replace construction locks with permanent locks. Provide 5 sets of keys to the Owner's Representative.
- F. Instruction: Conduct specified instruction.
- G. Warranty: Submit Warranty dated to run from date of Acceptance of the Work of this Section.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Where a particular material, device, piece of equipment or system is specified directly, the current manufacturer's specification for the same shall be considered to be a part of these specifications, as if completely contained herein in every detail.
- B. Each material, device or piece of equipment shall comply with all of the manufacturer's current published specifications for that item.
- C. Products shall be made by manufacturers regularly engaged in the production of such products.
- D. Provide quantity as shown on Contract Drawings, or as otherwise indicated.
- E. Provide all auxiliary and incidental materials and equipment necessary for the operation and protection of the Work of this Section as if specified in full herein.
- F. Unless recycled content is specified, provide new materials.

- G. Provide the manufacturer's latest design/model, permanently labeled with the manufacturer's name, model number and serial number.
- H. Where products are of similar type or use, provide products of the same manufacturer, unless otherwise indicated.
- I. Components
 - 1. UL or third party certified. Cabling and interconnecting hardware and components for Audiovisual systems shall be UL listed or third party independent testing laboratory certified, and shall comply with NFPA 70 and conform to the requirements specified herein.
 - 2. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations, submit proof of such compliance.
 - a. The label or listing by the specified organization will be acceptable evidence of compliance.
 - b. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Owner's Representative.
 - c. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.
- J. Enclosures:
 - 1. Provide steel frames and enclosures designed and wired to eliminate all induced currents.
 - 2. Make bolted connections with self-locking devices.
- K. Finishes: Any item or component of the Work of this Section which is visible shall comply with the following.
 - 1. Finishes noted or scheduled on the Contract Drawings take precedence.
 - 2. Where design location requires that products, materials or equipment are visible to the public, no manufacturer's logos larger than 1/2 inch shall be visible. Unless otherwise noted or directed, neatly remove or permanently paint out such logos.
 - 3. Where finishes are not noted or otherwise defined in the Contract Documents, submit manufacturer's standard finish samples for selection by the Owner's Representative.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine existing conditions before starting work. Submit conflicts in a timely manner for resolution

3.2 WIRING CLASSIFICATION AND RELATED

A. Audio Signal Wiring Classification:

- 1. Type A-1: Microphone level wiring less than -30 dBu, 20 Hz to 20 kHz.
- 2. Type A-2: Line level wiring -30 dBu to +24 dBu, 20 Hz to 20 kHz.
- 3. Type A-3: Loudspeaker level or circuit wiring greater than +24 dBu, from 20 Hz to 20 kHz.

B. Video and Related Signal Wiring Classification:

- 1. Type V-1: Baseband and composite video wiring 1 volt peak-to-peak into 75 ohms, 0 to 10.0 MHz.
- 2. Type V-2: Synchronization and switching pulse wiring 4 volts peak-to-peak into 75 ohms, 15.62

to 15.75 kHz.

3. Type V-3: Color subcarrier wiring 0 to 4 volts peak-to-peak into 75 ohms, 3.57 to 4.43 MHz.
4. Type V-4: KMVT system wiring 0.1 to 1000 microVolts peak-to-peak into 50 or 75 ohms, 47 to 890 MHz.

C. Control Signal Wiring Classifications:

1. Type C-1: DC control wiring 0 to 50 volts.
2. Type C-2: Synchronous control or data wiring 0 to 40 volts, peak-to-peak.
3. Type C-3: AC control wiring 0 to 48 volts, 60 Hz.

D. Additional Wiring Classifications:

1. Type M-1: DC power wiring 0 to 48 volts.
2. Type M-2: AC power wiring greater than 50 volts, 60 Hz.
3. Wiring Combinations:

E. Except as indicated herein, conduit, wireways and cable bundles shall contain only wiring of a single classification. The following combinations are acceptable in conduit, or cable harnesses. Additional acceptable combinations may be indicated on the Drawings.

1. Types A-1, C-1, and M-1.
2. Types A-2, C-1, C-2, and M-1, runs less than 20 feet.
3. Types A-2, C-1, and M-1.
4. Types A-3, C-1, C-2, and M-1.
5. Types A-2, V-1, and V-3.
6. Types V-1, V-2, V-3, and C-1.
7. Types M-2 and C-3.

3.3 PREPARATION

- A. Protection: Cover all computers, electronic equipment, desks, chairs, furniture and other articles when working at ceiling level and/or performing dust producing tasks.

3.4 REPAIR AND RESTORATION

- A. Where working in spaces occupied by the Owner, return to their original positions any furniture or articles relocated to perform the work.

3.5 CLEANING

- A. Where working in spaces occupied by the Owner:
1. Immediately after completing work within each space, clean up and remove all materials, scrap and dust.
 2. All scrap material in work area shall be picked up and removed from the building at the end of each day. See also Section 017800 - Project Record Documents for additional requirements.
 3. All dust resulting from work performed shall be vacuumed up daily.
 4. All scrap material shall be removed and disposed of in an authorized disposal site. Refer to Section 017410 - LEED Waste Management.

END OF SECTION

SECTION 27 41 01 GROUNDING AND BONDING FOR AUDIOVISUAL SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Section includes grounding and bonding of Audiovisual Work, including but not limited to:
 - 1. Audiovisual Raceways
 - 2. Cable Runway
 - 3. Cable Shields
 - 4. Protector Fields
 - 5. Audiovisual Cabinets and enclosures.
- B. Related Work Under Other Sections
 - 1. Section 27 41 00 – Common Work Results for Audiovisual Systems
 - 2. Section 27 41 02 – Hangers and Supports for Audiovisual Systems
 - 3. Section 27 41 03 – Conduits and Backboxes for Audiovisual Systems
 - 4. Section 27 41 08 – Audiovisual Cabinets, Racks, Frames and Enclosures
 - 5. Section 27 41 09 – Audiovisual Cable Management
 - 6. Section 27 41 16 – Integrated Audio-Video Systems and Equipment

1.2 SYSTEM DESCRIPTION

- A. Provide Audiovisual system grounding conductor as described herein and indicate on drawings.
- B. Except as otherwise indicated, the complete Audiovisual installation including the metallic conduits and raceways, cable trays, boxes, cabinets and equipment shall be completely and effectively grounded in accordance with all code requirements, whether or not such connections are specifically shown or specified.
- C. Resistance:
 - 1. Resistance from the farthest ground bus through the ground electrode to earth shall not exceed 5 Ohms or the requirements of ANSI-J-STD-607-A-2002, whichever is more restrictive.

1.3 REFERENCES

- A. American National Standards Institute (ANSI)
 - 1. ANSI/TIA/EIA-606-A-2002 Administration Standard for Commercial Telecommunications Infrastructure
 - 2. ANSI-J-STD-607-A-2002 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
 - 3. Underwriters Laboratories (UL)
 - 4. UL 467 (1993); R 2004 Grounding and Bonding Equipment

1.4 SUBMITTALS

- A. Conform with the requirements of Division 1 and Section 27 41 00 - Common Work Results for Audiovisual Systems.

PART 2 - PRODUCTS

2.1 Equipment Rack, Wall-Mount, 4RU

- A. Drawing Reference: WR4
- B. Features:
 - 1. Dimensions: 7.5"H, 19.75"W, 21.63"D.
 - 2. Weight capacity: 75 lbs.
 - 3. Rack Spaces: 4U Shipping Weight 21 lbs.
- C. Manufacturer:
 - 1. Middle Atlantic SPM-4
 - 2. Great Lakes WR4
 - 3. Or equal.
- D. Zone 4 Slide Out Rack, Steel Enclosure
 - 1. Drawing Reference: R35
 - 2. Features:
 - a. Rack cabinet, 1 bay, steel frame mounted, with slide out inner frame for rear access of equipment from front of rack, floor supported.
 - b. Zone 4 rated for up to 500 pounds of uniformly distributed load.
 - c. 41 useable rack units.
 - d. Fan System, 100 cfm minimum mounted into slide out inner frame.
 - e. Locking, vented front doors.
 - f. No rear doors.
 - g. 26" deep inner frame, 32" deep outer frame.
 - h. Open top outer frame.
 - 3. Manufacturer:
 - a. Middle Atlantic Products AXS Slide Out System in MRK Steel Host Enclosure, configured with:
 - i. MRK-4431AXS-26
 - ii. MRK Z4 mounting brackets
 - iii. AXS-WT50 Cable Management Tray
 - iv. TRACK50 Service Track
 - v. TRACKL Service Stand for Steel Cabinets
 - vi. 1 each MW-4FT fan top (openings only) in outer frame
 - vii. 2 each AXS-FAN with GUARD, 2 fans installed in the top of inner frame.
 - viii. 1 each FC-4-1C Thermostatic Fan Control
 - ix. At raised floor conditions, provide with SRB series base to match floor construction.
 - b. Or equal (no known equal).

2.2 MANUFACTURERS

- A. Equal products by the following manufacturers will be considered providing that all features of the specified product are provided:
 - 1. Ground Rod:
 - a. High strength high carbon steel, with electrolytically bonded jacket of copper on surface
 - b. UL spec. 467
 - c. ANSI C-33.8-1072.
 - d. Manufacturer:
 - i. Allied Bolt
 - ii. Inwesco 12A60

- iii. Blackburn
 - iv. Cooper Power Systems
 - v. Weaver.
 - vi. Erico "Cadweld" Products, Inc.
 - vii. ITT Blackburn.
 - viii. Or equal.
 2. Ground Wells:
 - a. Christy Concrete Products, Inc.
 - b. Forni Corp.
 - c. Or equal.
 3. Ground Bushings, Connectors, Jumpers and Bus:
 - a. O-Z/Gedney.
 - b. Thomas & Betts Corp.
 - c. Or equal.
 4. Compression Connector Lug
 - a. Panduit
 - b. B-Line SB-479 Series
 - c. Thomas & Betts
 - d. Or equal.
 5. Audiovisual Ground Bus Bar
 - a. CPI
 - b. B-Line
 - c. Panduit
 - d. or equal.
 6. Rack and Cabinet Grounding
 - a. Panduit Structured Ground Kit
 - b. Chatsworth Products Inc.
 - c. or equal.
 7. Bonding Ribbon:
 - a. Annealed solid copper 3/8 inch wide x 1/16 inch thick, tin plated.
 - b. Manufacturer:
 - i. Inwesco 12A55
 - ii. Corning Cable Systems
 - iii. Preformed Line Products.
 - iv. or equal.
 8. Bonding Ribbon Clamp:
 - a. Soft lead
 - b. 1/16 inch thick
 - c. Bolt hole for attachment
 - d. Manufacturer:
 - i. Inwesco 12A56
 - ii. Corning Cable Systems
 - iii. Preformed Line Products.
 - iv. Or equal.
 9. Fargo Clamp:
 - a. Cast copper, silver plated, furnished with copper bolt.
 - b. RUS Listed

- c. Manufacturer:
 - i. Allied Bolt
 - ii. Inwesco 12A57
 - iii. Corning Cable Systems
 - iv. or equal.
- 10. Ground Inserts:
 - a. Cast Bronze w 1/4 Copper Rod.
 - b. Provide minimum one each maintenance hole or vault.
 - c. Manufacturer:
 - i. Inwesco 12H69
 - ii. or equal by vault or manhole manufacturer.
 - iii. or equal.

2.3 GROUND CONDUCTORS

- A. General purpose insulated: UL listed and code sized copper conductor, with dual rated THHN/THWN insulation, color identified green. Where continuous color-coded conductors are not commercially available, provide a minimum 4" long color band with green, non-aging, plastic tape in accordance with NEC.
- B. Bonding pigtails: Insulated copper conductor, identified green, sized per code, and provided with termination screw or lug. Provide solid conductors for #10 AWG or smaller and stranded conductors for #8 AWG or larger.

2.4 COMPRESSION CONNECTOR LUG

- A. Description
 - 1. Connector lug with compression connection to conductor.
 - 2. Copper alloy body.
 - 3. Provide lug size to match conductor being terminated.
 - 4. Provide 2-hole pattern lugs.
 - 5. Provide each lug with silicon bronze hardware, including 2 bolts, 2 split lock washers and 2 nuts.

2.5 INSULATED GROUNDING BUSHINGS

- A. Plated malleable iron or steel body with 150 degree Centigrade molded plastic insulating throat and lay-in grounding lug.

2.6 CONNECTIONS TO PIPE

- A. For cable to pipe: UL listed bolted connection complying with CEC requirements.

2.7 CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS, OR SPLICES

- A. Where required by the Drawings or Specifications, grounding conductors shall be spliced together, connected to ground rods or connected to structural steel using exothermic welds or high pressure compression type connectors.
 - 1. Exothermic welds shall be used for cable-to-cable and cable-to-ground rod and for cable to structural steel surfaces. Exothermic weld kits shall be as manufactured by Cadweld, Thermoweld or equal. Each particular type of weld shall use a kit unique to that type of weld.

2. High-pressure compression type connectors shall be used for cable-to-cable and cable-to-ground rod connections. Connections shall be as manufactured by Thomas & Betts #53000 series, Burndy "Hy-Ground" or equal.

2.8 EXTRA FLEXIBLE, FLAT BONDING JUMPERS

- A. Where required by the drawing or specified herein.

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide Grounding and Bonding according to the most restrictive requirements of:
 1. ANSI-J-STD-607-A.
 2. California Electrical Code Article 250 and references therein.
 3. California Electrical Code Article 800.
- B. In the event of conflicting requirements, National Electrical Code requirements shall prevail.
- C. Point of Connection
 1. Under Work of this Section, make connections to Audiovisual Ground Busbars. Coordinate with District Electrical Representative and conform to District requirements for electrical Grounding and Bonding
 2. Mechanical Connections
- D. Make connections bare metal to bare metal.
 1. Where required, remove paint to bare metal, make grounding or bonding connection, and touch up paint.
 2. Torque threaded fasteners to manufacturer's recommended values.
- E. Compression Connections
 1. Make compression connections with the lug or fitting manufacturer's recommended tooling, with the tooling set to the recommended force and stroke.
- F. Audiovisual Raceways and Sleeves
 1. Bond metallic raceway and sleeves to the Audiovisual Ground Busbar at the Audiovisual Room that serves the related Audiovisual Receptacle.
 2. Where a metallic raceway connects two or more Audiovisual Rooms, bond to the Audiovisual Ground Busbar at each.
- G. Cable Shields
 1. Comply with California Electrical Code Article 800.
- H. Protector Fields
 1. Comply with California Electrical Code Article 800.
- I. Audiovisual Cabinets and enclosures
 1. Bond to the Audiovisual Ground Busbar at the Audiovisual Room.

3.2 LABELING

- A. Provide labeling according to the requirements of:

1. ANSI/TIA/EIA-606-A.
2. Section 27 41 07 - Identification for Audiovisual Systems.

END OF SECTION

SECTION 27 41 02 HANGERS AND SUPPORTS FOR AUDIOVISUAL SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, and services to completely execute the provision of Audiovisual supports and cable hook system as described in this specification, including but not limited to:
 - 1. Strut supports
 - 2. Cable Hooks (J-hooks)
 - 3. Beam clamps
 - 4. Concrete Fasteners
 - 5. Touch-Up Materials
 - 6. Conduit supports.
 - 7. Equipment supports.
 - 8. Fastening hardware.
- B. Related work: Consult all other Sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.
 - 1. Section 27 41 00 – Common Work Results for Audiovisual Systems
 - 2. Section 27 41 01 – Grounding and Bonding for Audiovisual Systems
 - 3. Section 27 41 03 – Conduits and Backboxes for Audiovisual Systems
 - 4. Section 27 41 06 – Noise and Vibration Controls for Audiovisual Systems
 - 5. Section 27 41 07 – Identification for Audiovisual Systems
 - 6. Section 27 41 08 – Audiovisual Cabinets, Racks, Frames and Enclosures
 - 7. Section 27 41 09 – Audiovisual Cable Management
 - 8. Section 27 41 16 – Integrated Audio-Video Systems and Equipment

1.2 SYSTEM DESCRIPTION

- A. Provide devices specified in this Section and related Sections for support of Audiovisual equipment specified for this Project.
- B. Provide support systems that are adequate for the weight of equipment, conduit and wiring to be supported.

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM A123/A123M-02 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - 2. ASTM A153/A153M-04 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - 3. ASTM B633-98e1 Specification for Electro-deposited Coatings of Zinc on Iron and Steel.
 - 4. ASTM A653/A653M-04a Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- B. American National Standards Institute (ANSI)

1. ANSI/TIA/EIA-568-B.1-2001, Commercial Building Telecommunications Cabling Standard – Part1: General Requirements
 2. ANSI/TIA/EIA-568-B.2-2001, Commercial Building Telecommunications Cabling Standard – Part2: Balanced Twisted Pair Cabling Components
 3. ANSI/TIA/EIA-568-B.3-2000, Optical Fiber Cabling Components Standard
 4. ANSI/ TIA/ EIA 569-B Commercial Building Standard for Telecommunications Pathways and Spaces
- C. National Fire Protection Association
1. NFPA 70, National Electrical Code

1.4 SUBMITTALS

- A. Conform with Division 1 and Section 27 41 00 - Common Work Results for Audiovisual Systems and the following:
1. As part of the project submittals, the contractor to provide engineered shop drawings indicating the proposed design for mounting all work of this Division weighing more than 20 pounds, inclusive of mounting systems, and for equipment mounted at the exterior, inclusive of its effective wind load under conditions the range of conditions experience
 - a. Shop drawings to be accompanied by anchorage calculations indicating that it shall remain attached to the mounting surface after experiencing forces in conformance with CCR, Title 24, Table 23P, Part II and with Section 2312 "Earthquake Regulations" of the "Uniform Building Code" for Seismic Zone 4 Area, Importance Factor of 1.25.
 - b. Structural Calculations shall be prepared and signed by a California Registered Structural Engineer. Specify proof loads for drilled-in anchors, if used.

1.5 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacturer.
- B. Cable hooks shall be listed and labeled by Underwriters Laboratories (UL) as required.
- C. Cable hooks shall have the manufacturers name and part number stamped in the part itself for identification.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

- A. General
1. Supports to be sized to suit load and selected to match mounting conditions
- B. Manufacturers
1. Equal products by the following manufacturers will be considered providing that all features of the specified product are provided:
 - a. Concrete fasteners:
 - i. Phillips "Red-Head".
 - ii. Remington.

- iii. Ramset.
 - iv. Hilti
 - v. Simpson Strong-Tie
 - vi. or equal.
 - b. Concrete inserts and construction channel:
 - i. Unistrut Corp.
 - ii. GS Metals "Globe Strut."
 - iii. Thomas & Betts "Kindorf" Corp.
 - iv. Or equal.
 - c. Conduit straps:
 - i. O-Z/Gedney.
 - ii. Erico "Caddy" Fastening Products.
 - iii. Thomas & Betts "Kindorf" Corp.
 - iv. Or equal.
 - d. Beam Clamps
 - i. Cooper B-Line
 - ii. SuperStrut
 - iii. Unistrut
 - iv. or equal
 - e. Aircraft Cable Sway Braces
 - i. Mason Industries
 - ii. M.W. Sausse/Vibrex
 - iii. Loos & Company, Inc.
 - iv. or equal.
- C. Concrete Fasteners
 - 1. Provide expansion-shield type concrete anchors.
 - 2. Provide powder driven concrete fasteners with washers. Obtain approval by Owner's Representative prior to use.
- D. Concrete Inserts
 - 1. Provide pressed galvanized steel, concrete spot insert, with oval slot capable of accepting square or rectangular support nuts of ¼ inch to ½ inch diameter thread for rod support.
- E. Aircraft cable sway braces
 - 1. Steel rope sized to meet load.
- F. Construction Channel:
 - 1. Construction:
 - a. 1-5/8" square galvanized channel formed from U.S.S.G No. 12 or 0.109 inch cold formed steel with 17/32-inch diameter bolt holes, and 1-1/2 inch on center in the base of the channel.
 - b. 10 foot sections.
 - 2. All supporting materials by same manufacturer.
- G. Beam Clamps
 - 1. Malleable iron electro-galvanized steel beam clamps selected to match building structural steel members.

- H. Conduit Straps
 - 1. One hole strap, steel or malleable iron, with malleable iron clamp-back spacer for surface mounted wall and ceiling applications.
 - a. Use malleable strap with spacers for exterior and wet locations.
 - b. Use steel strap without spacers for interior locations.
 - 2. Steel channel conduit strap for support from construction channel.
 - 3. Steel conduit hanger for pendant support with threaded rod
 - 4. Steel wire conduit support strap for support from independent #12 gauge hanger wires.
- I. Threaded rods, couplings, screws and nuts:
 - 1. Electrolytically coated with zinc, 2 oz. zinc per square foot of surface, ASTM A123 or A153.
- J. Miscellaneous Parts
 - 1. Hot dipped galvanized after fabrication; after cutting, de-burring and hole drilling. Coated with zinc, 2 oz. zinc per square foot of surface, ASTM A123 or A153.
- K. Paint/Tape for Touch-up:
 - 1. Zinc: CRC "Zinc-It", Glyptal, Enterprise Galvanizing "Galambra", or equal.

2.2 CABLE HANGERS

- A. Ceiling Hung J-Hooks
 - 1. Drawing Reference(s):
 - a. WMJ
 - b. ACJ
 - 2. Features/Functions/Construction
 - a. Specifically intended to carry the load of up to 50 Audiovisual cables without applying excess forces to cables at bottom of bundle.
 - b. Integral broad bottom edge to spread cable load with flat bottom and provide a minimum of 1-5/8 inch cable bearing surface.
 - c. Integral hanger rod attachment hardware at top.
 - d. Load rated for application.
 - e. Incorporates smooth 90-degree radiused edges to prevent snagging cable jackets on installation.
 - f. Designed so the mounting hardware is recessed to prevent cable damage.
 - g. Integral mechanical cable latch retainer to provide containment of cables within the hook. The retainer shall be removable and reusable.
 - h. Suitable for direct attachment to walls, hanger rods, beam flanges, purlins, strut, floor posts, etc. to meet job conditions.
 - i. Multi-tiered cable hooks to be used where required to provide separate cabling compartments, or where additional capacity is needed.
 - j. Finishes:
 - i. Cable hooks for non-corrosive areas shall be pre-galvanized steel, ASTM A653. Where additional strength is required, cable hooks shall be spring steel with a zinc-plated finish, ASTM B633, SC3.
 - ii. Cable hooks for corrosive areas shall be stainless steel, AISI Type 304.
 - 3. Manufacturer
 - a. Cooper B-Line series BCH21, BCH32, BCH64
 - b. Caddy/Erico CableCat

c. or equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Owner's Representative reserves the right to request additional supports where in their sole opinion said supports are required. Any additional supports shall be installed at no additional cost to the Owner.

3.2 EXAMINATION

- A. Thoroughly examine site conditions for acceptance of supporting device installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.3 PREPARATION

- A. Coordinate size, shape and location of concrete pads required for equipment installation with Base Building General Contractor.
- B. Layout support devices to maintain headroom, neat mechanical appearance and to support the equipment loads.
- C. Where shown on the Drawings or Specifications, install freestanding Audiovisual equipment on concrete pads.

3.4 INSTALLATION

- A. Furnish and install supporting devices as noted throughout the Audiovisual Systems work.
- B. Audiovisual device and conduit supports shall be independent of all other system supports that are not structural elements of the building, unless otherwise noted.
- C. Fasten hanger rods, conduit clamps, outlet and junction boxes to building structure using precast inserts, expansion anchors, preset inserts or beam clamps.
- D. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster or gypsum board partitions and walls.
- E. Use expansion anchors or preset inserts in solid masonry walls.
- F. Use self-drilling anchors, expansion anchor, or preset inserts on concrete surfaces.
- G. Use sheet metal screws in sheet metal studs and wood screws in wood construction.
- H. Do not fasten supports to piping, ductwork, mechanical equipment, conduit, or acoustical ceiling suspension wires.
- I. Do not drill structural steel members unless first approved in writing by the Owner's Representative.
- J. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

- K. Install surface-mounted cabinets with minimum of four anchors. Provide additional support backing in stud walls prior to sheet rocking as required to adequately support cabinets and panels.
- L. Bridge studs top and bottom with channels to support flush mounted cabinets and panelboards in stud walls.

3.5 ERECTION OF METAL SUPPORTS

- A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS "Structural Welding Code."

3.6 WOOD SUPPORTS

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

3.7 DISTRIBUTION PATHWAY VIA CEILING HUNG CABLE HOOKS (J-HOOKS):

- A. Void, Plenum or Suspended Ceiling Exposed Cable Installation. Where drawings specifically show or permit use of exposed cable installation in voids, conform to the most restrictive requirements of Code, TIA-569-B and this Section.
- B. Provide support for all cabling. Do not place or attach directly to T-bar grid, concealed spline grid, flexible or rigid ductwork, HVAC registers, sprinkler piping or fixtures, light fixtures or building structure. Conform to the California Electric Code.
- C. Placement:
 - 1. All pathways created by ceiling hung cable hooks shall be reviewed by the Owner's Representative prior to installation.
 - 2. Ceiling hung cable hooks and cabling supported by same shall not obscure access to access doors, hatches, air dampers, valves, filter sections, VAV boxes, cable trays, junction boxes, pull boxes or similar areas of access required by other trades.
 - 3. All ceiling hung cable hooks shall be mounted close enough together such that upon completion of the station cable installation a minimum amount of cable droop occurs between adjacent rings. The distance between supporting rings shall not exceed 48 inches or as required by the current edition of TIA-569-B.
- D. Follow manufacturer's recommendations for allowable fill capacity for each size of cable hook.
 - 1. Cable hooks shall be capable of supporting a minimum of 30 pounds with a safety factor of 3.
 - 2. Spring steel cable hooks shall be capable of supporting a minimum of 100 pounds with a safety factor of 3 where extra strength is required.

END OF SECTION

SECTION 27 41 03 CONDUITS AND BACKBOXES FOR AUDIOVISUAL SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK:

- A. Provide Audiovisual pathways in accordance with EIA TIA/EIA-569-B, as specified in this Section and as shown on the plans. Provide system furniture pathways in accordance with UL 1286. Provision of all low voltage Audiovisual Systems Pathway, including:
 - 1. Rigid steel conduit and fittings.
 - 2. PVC insulated rigid steel conduit and fittings.
 - 3. Intermediate metal conduit and fittings.
 - 4. Electrical metallic tubing and fittings.
 - 5. Flexible metallic conduit and fittings.
 - 6. Liquidtight flexible metallic conduit and fittings.
 - 7. Miscellaneous conduit fittings and products.
 - 8. Junction Boxes
 - 9. Floor Boxes
 - 10. Hinged cover enclosures.
 - 11. Pullboxes and Terminal Cabinets.
- B. At Hazardous Occupancies, installation conforms to the requirements of California Electric Code for Class and Division rating of spaces.

1.2 RELATED WORK IN OTHER SECTIONS:

- A. Patching and Painting – Patching, painting, and repair of existing finishes shall be coordinated by the Contractor with District Representatives.
- B. Related work: Consult all other Sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.
 - 1. Section 27 41 00 – Common Work Results for Audiovisual Systems.
 - 2. Section 27 41 01 – Grounding and Bonding for Audiovisual Systems
 - 3. Section 27 41 02 – Hangers and Supports for Audiovisual Systems
 - 4. Section 27 41 03 – Conduits and Backboxes for Audiovisual Systems
 - 5. Section 27 41 06 – Noise and Vibration Controls for Audiovisual Systems
 - 6. Section 27 41 16 – Integrated Audio-Video Systems and Equipment

1.3 REFERENCES

- A. Usage: In accordance with Section 14200—Definitions, References, and Regulations.
 - 1. American National Standards Institute (ANSI)
 - a. ANSI C80.1 1994 Rigid Steel Conduit - Zinc Coated
 - b. ANSI C80.3 1991 Electrical Metallic Tubing - Zinc Coated
 - 2. National Electrical Manufacturers Association (NEMA)
 - a. NEMA 250-2003 Enclosures for Electrical Equipment (1000 Volts Maximum)
 - b. NEMA FB 1 (ANSI/NEMA FB 1-2003) Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable
 - c. FB 2.10 2000 Selection and Installation Guidelines For Fittings For Use With Non-

- Flexible Metallic Conduit Or Tubing (Rigid Metal Conduit, Intermediate Metal Conduit, And Electrical Metallic Tubing).
- d. FB 2.20 2000 Selection and Installation Guidelines for Fittings for use with Flexible Electrical Conduit and Cable
 - e. NEMA ICS 6 1988 (Rev. 1) Enclosures for Industrial Control and Systems
 - f. NEMA OS 3-2002 Selection and Installation Guidelines for Electrical Outlet Boxes.
 - g. NEMA RN 1-1998 Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 - h. NEMA TC 7 2000 Smooth Wall Coilable Polyethylene Electrical Plastic Duct
 - i. NEMA TC 13 2000 Electrical Nonmetallic Tubing (ENT).
 - j. NEMA TC 14 1984(R 1986) Filament-Wound Reinforced Thermosetting Resin Conduit and Fittings
3. Underwriters Laboratories, Inc. (UL)
- a. UL 1 2000 Flexible Metal Conduit
 - b. UL 6 2004 Electrical Rigid Metal Conduit - Steel
 - c. UL 50 (1995; R 1999, Bul. 2001) Enclosures for Electrical Equipment
 - d. UL 360 1986 (Bul. 1991) (R 1993) Liquid-Tight Flexible Steel Conduit
 - e. UL 514A 1991 (R 2004) Metallic Outlet Boxes
 - f. UL 514B 1989 (R 2004) Conduit, Tubing and Cable Fittings
 - g. UL 514C 1996 (R 2000) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers.
 - h. UL 651 1989 (R 1989) (Bul. 1993) Schedule 40 and 80 Rigid PVC Conduit.
 - i. UL 797 1993 (R 2004) Electrical Metallic Tubing - Steel
 - j. UL 1242 1983 (R1993) (Bul. 1993) Intermediate Metal Conduit.
 - k. UL 1286(1999; R 2001, Bul. 2002) Office Furnishings
 - l. UL 1479 Fire Tests of Through Penetration Firestops
 - m. UL Fire Resistance Directories

1.4 SUBMITTALS

- A. Conform with the requirements of Division 1 and Section 27 41 00 - Common Work Results for Audiovisual Systems.

1.5 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacturer.
- B. Only products and applications listed in this Section may be used on the project unless otherwise submitted and approved by the Owner's Representative.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide the following types of conduit systems listed by their commonly used generic name.

2.2 RACEWAY

- A. Manufacturers:
 - 1. Raceway:
 - a. Allied Tube and Conduit Co.

- b. Triangle PWC, Inc.
 - c. Western Tube and Conduit Corp.
 - d. Spring City Electrical Manufacturing Co.
 - e. Occidental Coating Co. (OCAL).
 - f. Alflex Corp.
 - g. American Flexible Metal Conduit Co.
 - h. Anaconda.
 - i. Or equal.
 2. Fittings:
 - a. Appleton Electric Co.
 - b. OZ/Gedney.
 - c. Thomas & Betts Corp.
 - d. Spring City Electrical Manufacturing Co.
 - e. Occidental Coating Co. (OCAL).
 - f. Carlon.
 - g. or equal.
- B. Rigid Steel Conduit.
 1. Drawing and Spec Reference: RSC.
 2. Construction:
 - a. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and UL 6.
 - b. Standard threaded couplings, locknuts, bushings, and elbows: Only materials of steel or malleable iron are acceptable. Locknuts shall be bonding type with sharp edges for digging into the metal wall of an enclosure.
 - c. Three piece couplings: Electroplated, cast malleable iron.
 - d. Insulating bushings: Threaded polypropylene or thermosetting phenolic rated 150 degree C minimum.
 - e. Insulated grounding bushings: Threaded cast malleable iron body with insulated throat and steel "lay-in" ground lug with compression screw.
 - f. Insulated metallic bushings: Threaded cast malleable iron body with plastic insulated throat rated 150 degrees C.
 - g. All fittings and connectors shall be threaded.
- C. Coated Rigid Steel Conduit:
 1. Drawing and Spec Reference: CRSC.
 2. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and NEMA RN-1 with nominal 40 mil thermoplastic vinyl coating, heat fused and bonded to the exterior of the conduit.
 3. Fittings:
 - a. Conduit couplings and connectors shall be as specified for galvanized rigid steel conduit and shall be factory PVC coated with an insulating jacket equivalent to that of the coated material.
 - b. Fittings over-sleeve to extend 1 conduit diameter or 1-1/2" beyond fitting, whichever is less.
 4. Performance:
 - a. Tensile Strength: 3500 psi.
 5. Approvals:

- a. NEMA RN1 (Type 40 - 40 mils thick)
 - b. CalTrans Type 2
 6. Manufacturers:
 - a. Plastibond by RobRoy Industries.
 - b. Occal-40 by Occidental Coating Company.
 - c. KorKap by Plastic Applicators.
 - d. Ocal-Blue
 - e. or equal.
- D. Intermediate Metal Conduit
 1. Drawing Reference: IMC
 2. Conduit: Hot dip galvanized steel meeting the requirements of CEC Article 345 and conforming to ANSI C80.6 and UL 1242.
 3. Fittings: Conduit couplings, connector and bushing shall be as specified for galvanized rigid steel conduit. Integral retractable type IMC couplings are also acceptable.
- E. Electrical Metallic Tubing.
 1. Drawing and Spec Reference: EMT.
 2. Conduit: Shall be formed of cold rolled strip steel, electrical resistance welded continuously along the longitudinal seam and hot dip galvanized after fabrication. Conduit shall conform to ANSI C80.3 specifications and shall meet UL classifications.
 3. Set screw type couplings: Electroplated, steel or cast malleable iron, UL listed concrete tight. Use set screw type couplings with four setscrews each of conduit sizes over 2 inches. Setscrews shall be of case hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.
 4. Set screw type connectors: Electroplated steel or cast malleable iron UL listed concrete tight with male hub and insulated plastic throat, 150 degree C temperature rated. Setscrew shall be same as for couplings.
 5. Raintight couplings: Electroplate steel or cast malleable iron; UL listed raintight and concrete tight, using gland and ring compression type construction.
 6. Raintight connectors: Electroplated steel or cast malleable iron, UL listed raintight and concrete tight, with insulated throat, using gland and ring compression type construction.
- F. Flexible Conduit:
 1. Drawing Reference: FLEX
 2. Construction:
 - a. Flexible steel, zinc coated on both inside and outside by hot-dipping process.
 - b. Interlocking spirally wound continuous steel strip.
 - c. 3/4" minimum size.
 3. Fittings: Connectors shall be of the single screw clamp variety with steel or cast malleable iron bodies and threaded male hubs with insulated throats. Exception: Pressure cast screw-in connectors shall be acceptable for fixture connection in suspended ceilings and cut-in outlet boxes within existing furred walls.
 4. Approvals:
 - a. UL 1
- G. Liquidtight Flexible Metallic Conduit
 1. Drawing Reference: Liquidtight
 2. Conduit: Shall be fabricated in continuous lengths from galvanized steel strips, interlocking

spirally wound, covered with extruded liquid-tight jacket of polyvinyl chloride (PVC) and conforming to UL 360. Provide conduit with a continuous copper-bonding conductor wound spirally between the convolutions.

3. Fittings: Connector body and gland nut shall be of cadmium plated steel or cast malleable iron, with tapered, male, threaded hub; insulated throat and neoprene "O" ring gasket recessed into the face of the stop nut. The clamping gland shall be of molded nylon with an integral brass push-in ferrule.

2.3 MISCELLANEOUS CONDUIT FITTINGS AND PRODUCTS

A. General

1. UL 514B.
2. Listed in UL Electrical Construction Materials List.

B. Conduit Fittings, Insulated Throat Grounding Bushings

1. Description
 - a. Threaded for Rigid Steel Conduit and Intermediate Metal Conduit.
 - b. UL Listed for use with copper conductors.
 - c. Thermoplastic insulated liner for 105 degrees Celsius.
 - d. Body of malleable iron, zinc plated; or die cast zinc.
2. Manufacturer
 - a. Thomas & Betts (Steel City) BG-801 Series
 - b. O-Z/Gedney
 - c. or equal.

- ### C. Watertight conduit entrance seals: Steel or cast malleable iron bodies and pressure clamps with PVC sleeve, neoprene sealing grommets and PVC coated steel pressure rings. Fittings shall be supplied with neoprene sealing rings between the body and PVC sleeve.

- ### D. Watertight cable sealing bushings: One piece, compression molded sealing ring with PVC coated steel pressure disks, stainless steel sealing screws and zinc plated cast malleable iron locking collar.

- ### E. Expansion fittings: Multi-piece unit comprised of a hot dip galvanized malleable iron or steel body and outside pressure bussing designed to allow a maximum of 4" conduit movement (2" in either direction). Furnish with external braid tinned copper bonding jumper. Unit shall be UL listed for wet or dry locations.

- ### F. Expansion/deflection couplings: Multi-piece unit comprised of a neoprene sleeve with internal flexible tinned copper braid attached to bronze end couplings with stainless steel bands. Coupling shall accommodate .75-inch deflection, expansion, or contraction in any direction, and allow 30-degree angular deflections. Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber jacket and stainless steel jacket clamps. Unit shall comply with UL467 and UL514.

1. Manufacturer:
 - a. OZ/Gedney Type DX
 - b. Steel City Type EDF
 - c. or equal.

- ### G. Fire rated penetration seals:

1. UL classified.
2. Conduit penetrations in fire rated separation shall be sealed with a UL classified assembly

- consisting of fill, void or cavity materials.
3. The fire rated sealant material shall be the product best suited for each type of penetration, and may be a caulk, putty, composite sheet or wrap/strip.
 4. Penetrations of rated floors shall be sealed with an assembly having both F and T ratings at least equal to rating of the floor.
 5. Penetrations of rated walls shall be sealed with an assembly having an F rating at least equal to the rating of the wall.
- H. Standard products not herein specified:
1. Submit for review a listing of standard electrical conduit hardware and fittings not herein specified prior to use or installation, i.e. locknuts, bushings, etc.
 2. Listing shall include manufacturers name, part numbers, and a written description of the item indicating type of material and construction.
 3. Miscellaneous components shall be equal in quality, material, and construction to similar items herein specified.
- I. Hazardous area fittings: UL listed for the application.

2.4 FLOORBOXES AND POKE-THROUGHS

A. Floor Box High Capacity, 4 Compartment

1. Drawing Reference: FC6
2. Features
 - a. UL Listed
 - b. Box
 - i. Size at least 13.5 inches by 12 inches by 6 inches deep.
 - ii. Four compartments, with voltage barriers, with standard electrical plate mounting brackets for at least:
 - (1) One 6 gang
 - (2) One 3 gang
 - (3) Two single gang
 - c. Knockouts concentric, combination 1 inch and 1.25 inch.
 - d. Flat cover - metallic finish. Confirm finish w/ District Representative.
 - e. Cover size approximately 14 inches by 12.5 inches.
 - f. At least 11 gage steel.
 - g. Within cover, provide a lift-off, full-access door, open area approximately 6.5 inches by 8 inches.
 - h. Within the lift-off, full-access door, provide a hinged, fold-back cable exit port.
 - i. Open area approximately 2 inches by 2 inches.
 - j. Flush in closed position.
3. Applications:
 - a. FC6: Concrete floor systems. Provide "pour pan" protection at slab on grade conditions
4. Approvals:
 - a. UL 514A scrub water
5. Manufacturers
 - a. FSR Inc.
 - i. FC6: FL-600P with cover. Submit cover finish for approval by the Architect.

Provide manufacturer's "Pour Pan" FL-GRD2 or FL-GRD4 to protect from moisture at installations at grade level.

- b. or equal (No known equal).

2.5 JUNCTION AND DEVICE BOXES

A. Junction and Device Boxes

1. Drawing References: As shown on Symbol Schedule
2. Construction:
 - a. Concealed/Flush Mounted:
 - b. One or two piece welded knockout boxes.
 - c. UL 514A, cadmium or zinc-coated 1.25 oz/sq. ft., if ferrous metal.
 - d. Pressed sheet steel, for indoor locations.
 - e. UL 514C approved if non-metallic.
 - f. At hollow masonry, tile walls and plaster walls, provide with device rings as required.
 - g. Surface mounted:
 - i. Exterior - Conform to the Junction and/or PullBox construction scheduled on the Plans. Where construction not otherwise scheduled or noted on the plans, conform to the following:
 - (1) Cast iron or aluminum with threaded hubs and mounting lugs.
 - (2) Gasketed cover with spring lid.
 - ii. Concrete floor embedded:
 - (1) Cast iron concrete pour boxes with screwed brass cover, unless otherwise noted.
 - (2) Cadmium plated screw cover attachment at least 6" on center.
 - h. If size not otherwise noted, at least 4S (4" square) by 2-1/8" deep, or Code minimum size, whichever is larger.
 - i. Wherever 4S is indicated, contractor may at their option substitute 4-11/16" square boxes while maintaining the minimum depth required by these specifications and the drawings.
 - ii. At recessed masonry wall installations, provide gangable masonry boxes.
 - i. Provide complete with approved type of connectors and required accessories, including attachment lugs or hangers. Provide raised device covers as required to accept scheduled device.
3. Approvals.
 - a. UL 514A
4. Manufacturers:
 - a. Interior:
 - i. Steel City.
 - ii. Bowers
 - iii. or equal.
 - b. Exterior, exposed with cover of same construction.
 - i. Appleton
 - ii. Pyle-National
 - iii. or equal.
 - c. Other conditions:
 - i. Any meeting approvals and requirements.

- B. Flat-panel Wall Box
1. Drawing reference: FPWB
 2. Features, functions and construction:
 - a. Box provides means to install Audiovisual, network and power receptacles flush in wall behind flat-panel display. With box cover installed, connectors are concealed and cables, both power and communications pass through slot at base of cover plate into connection points on back of flat-panel.
 - b. Cover plate protrudes less than 1/2" from face of wall.
 - c. 16 gauge box construction with 1/16" inch thick minimum cover plate, white finish baked enamel or powder coat, field paintable
 - d. Box incorporates provisions to mount up to two electrical device boxes for provision of duplex power receptacles either from above or below.
 - e. Additionally box mounts manufacturers low-voltage conduit entry box which accommodates manufacturer's line of Audiovisual connector inserts. Design of FP WB permits installation of up to two low-voltage conduit entry boxes, which may be mounted either above or below the FPWB.
 - f. Manufacturers Audiovisual insert line shall support at least the following receptacles:
 - i. BNC, in combinations of 1 to 5 BNC's, color-coded for composite, component analog and RGBHV video formats, as required.
 - ii. RCA, in combinations of 1 to 3 RCA's color-coded for Composite and component analog video formats, as required.
 - iii. S-Video.
 - iv. XLR, 3 and 4 pin.
 - v. DB-15
 - vi. DB-9
 - vii. Neutrik Speakon.
 - viii. DVI
 - ix. HDMI
 - x. 1/4" and mini TRS.
 - g. Provide with manufacturer's connector inserts as required to terminate cabling types and applications indicated on the single-line diagrams. Punch blank panel inserts and provide other receptacle types as required or indicated to fulfill the requirements of the contract documents. Fill remaining openings with blank inserts.
 3. Manufacturers:
 - a. FSR Inc. PWB-100 with:
 - i. (2) low voltage backboxes
 - ii. (2) electrical gem boxes
 - iii. Connectors and inserts from manufacturer's IPS series.
 - b. Or equal (no known equal).

2.6 CABINETS AND ENCLOSURES

- A. Terminal Cabinets:
1. Drawing Reference: As Scheduled.
 2. Construction:
 - a. Zinc Coated Sheet Steel, code gauge with standard concentric knockouts for conduit terminations.
 - b. Interior dimensions not less than those scheduled.

- c. Finish: Manufacturer's standard gray baked enamel finish.
 - d. Covers: Trim fitted, continuous hinged steel door, flush catch – lockable and keyed to match. Screw fastened doors not acceptable.
 - i. Door face to be not less than 95% of panel interior dimensions.
 - e. Provide with 3/4" fire retardant treated ply backboard.
3. Mounting:
- a. Flush cabinets shall be furnished with concealed trim clamps and shall be not less than 4 inches deep.
 - b. Surface cabinets shall be furnished with screw cover trim, flush hinged door and shall not be less than 6 inches deep.
 - c. Interior Applications:
 - i. NEMA 250 Type 1, unless otherwise noted. Refer to plans and schedules.
 - d. Exterior Applications:
 - i. NEMA 250 Type - As Scheduled, not less than NEMA 3R.
4. Manufacturers:
- a. B-Line Electrical Enclosures
 - b. Circle AW Products.
 - c. Hammond
 - d. Henessey.
 - e. Hoffman.
 - f. Myers Electric Products
 - g. Rittal.
 - h. or equal.

PART 3 - EXECUTION

3.1 CONDUIT APPLICATION

- A. General: Install the following types of conduits and fittings in the locations listed, unless otherwise noted in the drawings:
- 1. Exterior, Exposed:
 - a. Type RSC for applications up to 8 feet AFF or to first pull box, whichever is first, applications subject to physical abuse or for applications greater than 4" diameter.
 - b. EMT acceptable in all other applications not noted above up to 4", where used in conjunction with specified Raintight (compression) couplers.
 - 2. Interior, Exposed, Wet and Damp Locations:
 - a. Type RSC.
 - b. At interior locations over 8 feet above finished floor, EMT acceptable.
 - 3. Interior, Hazardous Locations
 - a. Type RSC
 - b. Type IMC, where permitted by the CEC.
 - 4. Interior, exposed or concealed, dry locations:
 - a. RSC, if subject to physical abuse.
 - b. EMT, if not subject to physical abuse.
 - 5. Interior, concealed, damp locations, including in masonry walls.
 - a. RSC
 - 6. Embedded in Concrete
 - a. RSC or rigid non-metallic conduit.

- b. PVC Type DB-120.
- 7. Transition from walls to open plan furniture systems:
 - a. Liquidtight

3.2 GENERAL REQUIREMENTS

- A. Refer to the manufacturer's instructions and conform thereto.
- B. Distribution Pathway via EMT Raceway:
 - 1. The EMT conduit is to be installed meeting the NEC handbook Article 348 Installation Specifications.
 - 2. Provide escutcheon plates for all through wall conduit stubs.
 - 3. All ends of conduits shall be cut square, reamed and fitted with insulated bushing.
 - 4. All conduit which passes through fire walls shall be sealed with fire stop putty after all station wire has been installed.

3.3 MOUNTING AND INSTALLATION – DEVICE BOXES

- A. Conform to the more restrictive of NEMA OS 3-2002 and the following.
- B. Provide backboxes at all Audiovisual systems devices. Installation of device plates directly to wall surface without use of a backbox, unless specifically directed on plans, is unacceptable.
- C. The distance between pull boxes shall not exceed 150 feet or more than two 90 degree bends.
- D. Align boxes plumb with floor and surrounding construction. At door frames, locate 4" from frame. Verify placement with Owner's Representative details to ensure that box clears all trim, etc.
- E. Support and fasten boxes securely. At stud walls use rigid bar hangers, attached to hanger with stud and nut.
- F. At existing locations, provide cutting, patching and finishing as required to maintain or restore finishes so that resulting installation is integrated into the Architectural decor of the particular location.
- G. Mounting Height: the mounting height of a wall-mounted outlet box is defined as the height from the finished floor to the horizontal center line of the cover plate.
- H. Mount outlet boxes with the long axis vertical. Three or more gang boxes shall be mounted with the long axis horizontal.
- I. Install wiring jacks and outlet devices only in boxes which are clean; free from excess building materials, dirt, and debris.
- J. Install wiring jacks and outlet devices after wiring work is complete.

3.4 TERMINAL CABINETS, JUNCTION BOXES AND PULL BOXES

- A. General
 - 1. Thoroughly examine site conditions for acceptance of cabinets and enclosures installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

- B. Set cabinets and enclosures plumb and symmetrical with building lines. Furnish and install all construction channel bolts, angles, etc. required to mount all equipment furnished under this Section of the Specifications.
- C. Cabinets and enclosures shall be anchored and braced to withstand seismic forces calculated in accordance with standards referenced in Section 27 41 02 – Hangers and Supports for Audiovisual Systems.
- D. "Train" interior wiring, bundle and clamp using specified plastic wire wraps. Separate power and signal wiring.
- E. Replace doors or trim exhibiting dents, bends, warps or poor fit that may impede ready access, security or integrity.
- F. Terminate conduit in cabinet with lock nut and grounding bushing.
- G. Cleaning
 - 1. Touch-up paint any marks, blemishes or other finish damage suffered during installation.
 - 2. Vacuum clean cabinet on completion of installation.

3.5 SUPPORT

- A. Provide supports for raceways as specified in Section 27 41 02 – Hangers and Supports for Audiovisual Systems.
- B. All raceways installed in exposed dry locations shall be grouped in a like arrangement and supported by means of conduit straps, wall brackets or trapeze hangers in accordance with Code and the requirements of the this Section and Section 27 41 02 – Hangers and Supports for Audiovisual Systems. Fasten all hangers from the building structural system.
- C. Provide supports and mounting attachments per the most restrictive of Code and the following.

Raceway Size (inches)	No of cables in run	Location	Support Spacing (feet)	
			RSC	EMT
Horizontal Runs				
½, ¾	1-2	Flat Ceiling Wall Runs	5	5
½, ¾	1-2	Where access limited to building structure	7	7
½, ¾	3≥	Any location	7	7
1≥	1-2	Flat ceiling or wall	6	6
1≥	1-2	Where access limited to building structure	10	10
1≥	3≥	Any locations	10	10
Any	Any	Concealed	10	10
Vertical Runs				
½, ¾	Any	Exposed	7	7
1, 1-1/4	Any	Exposed	8	8
1-1/2≥	Any	Exposed	10	10

- D. Install no more than one coupling or device between supports.
- E. Conduit support
 - 1. As specified in Section 27 41 02 – Hangers and Supports for Audiovisual Systems
- F. The Owner's Representative reserves the right to request additional supports where in their sole opinion said supports are required. Any additional supports shall be installed at no additional cost to the Owner.

3.6 PENETRATIONS

- A. Gypsum Wall Board Penetrations: Provide circular penetrations maximum 1/8" inch larger than outer diameter of conduit being used. On both sides of the wall fill space between conduit and wall with joint compound, depth to match gypsum board thickness.
- B. Install UL listed fire-stop system whenever a raceway penetrates a firewall in conformance with the manufacturer's directions, the published systems assembly requirements, CBC Section 709 and 710 and CEC 300-21, whichever is the most restrictive. At cable tray penetrations, provide pillow type removable fire stop per CBC Section 709 and 710, the published systems assembly requirements and the manufacturer's directions, whichever is the most restrictive.
- C. All Audiovisual systems conduit openings in walls and floors are the responsibility of the Contractor. Install sleeves shown on the drawings when the concrete is poured. Any openings required after the concrete has set maybe core drilled.

3.7 RACEWAY INSTALLATION, GENERAL

- A. Raceway runs are shown schematically. Install concealed unless specifically shown otherwise. Supports, pull boxes, junction boxes and similar generally not indicated. Provide where designated.
 - 1. Install exposed conduit and raceway parallel and perpendicular to nearby surfaces or exposed structural members, and follow the surface contours. Level and square conduit and raceway runs.
 - 2. Raceway runs shall be mechanically and electrically continuous between all each equipment rack and utility demarcation point, receptacle and/or surface raceway strip, as applies.
 - 3. Each conduit shall enter and be securely connected to a cabinet, junction box, pull box, or outlet by means of a locknut on the outside and a bushing on the inside or by means of a liquid-tight, threaded, self-locking, cold-weld type wedge adapter.
 - 4. Bends
 - a. All bends or elbows shall have a minimum radius as follows:

Conduit Size	Min. Radius (Inches)
3/4"	8
1"	12
1-1/4"	18
2"	24
2-1/2"	24
3"	30
3-1/2"	30
4"	30
5"	36

6" | 42

- b. Use factory elbows or machine bends for conduit bends 1-1/4" and larger.
 5. Make bends and offsets so the inside diameter is not effectively reduced. Make bends in parallel or banked runs from the same center line so that the bends are parallel.
 6. Install at least one (1) 3/8", 200 pound strength nylon pull cord in all empty raceways.
 7. Raceways crossing building expansion joints or in straight runs exceeding 100 feet shall be provided with UL listed expansion fittings.
 8. Install conduit seals and drains to prevent accumulated moisture in conduits from entering Audiovisual System enclosures.
- B. Do not install conduit in concrete slabs unless specifically directed by Owner's Representative. Embedded conduits in concrete slab walls, and columns shall be installed in center third between upper and lower layers of reinforcing steel as directed by the Owner's Representative. Space conduits 8" on center except at cabinet locations where slab thickness shall be increased as directed by the Owner's Representative.
- C. All conduits to be kept 12" away from steam or hot water lines. Install horizontal conduit and raceway runs below water and steam piping.
- D. Conduit dropping down to equipment shall be as straight as possible without any offsets, parallel or perpendicular to walls, ceilings and other building features.
- E. Conduit installed on any equipment shall be run symmetrical with the equipment and in such a manner as to:
1. not to be exposed to damage;
 2. not interfere with access to components of the equipment that will interfere with maintenance operation or;
 3. not to be in a manner that the Owner deems detrimental to its operation.
- F. Whenever an installation such as that listed occurs, the Contractor shall make all necessary changes at no additional cost to the Owner.
- G. All cut ends of conduit, scratches, tool marks, etc. on any metallic raceway installed in the ground or on the exterior of the building shall be treated with two coats of specified Touch Up Paint/Tape.
- H. Exposed conduit and metallic surface raceway installed in finished spaces shall be painted to match surrounding surfaces using paint and methods directed by the Owner's Representative.
- I. All raceways stubbing up into equipment or racks shall be sealed. Raceways with conductors shall be plugged with duct-seal. Spare raceways shall be capped. Prevent foreign matter from entering conduit and raceway; use temporary closure protection. Replace conduits containing concrete, varnish or other foreign material.
- J. Complete installation of conduit and raceway runs before starting installation of cables/wires within conduit and raceway.
- K. Use specified conduit and raceway fittings that are of types compatible with the associated conduit and raceway and suitable for the use and location. Join and terminate conduit and raceway with fittings designed and approved for the purpose of the conduit and raceway system and make up tight.

- L. Where chase nipples are used, align the raceway and coupling square to the box and tighten the chase nipple so no threads are exposed.
- M. Horizontal conduit or EMT runs, where required and permitted, shall be installed as close to ceiling or ceiling beams as practical.
- N. Conduit and EMT connected to wall outlets shall be run in such a manner that they will not cross water, steam or waste pipes or radiator branches.
- O. Conduit and EMT shall not be run through beams, purlins or columns except where permission is granted by Owner's Representative in writing.
- P. Bond installed metallic raceway in accordance with the requirements of the CEC.

3.8 HAZARDOUS LOCATIONS

- A. Use rigid steel conduit only.
- B. Install UL listed sealing fittings that prevent passage of explosive vapors in accordance with the manufacturers written instructions. Locate fittings at suitable, accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank coverplate having a finish similar to that of adjacent plates or surfaces.
- C. Install raceway sealing fittings at the following points and elsewhere as indicated:
 - 1. Where conduits enter or leave hazardous locations.

END OF SECTION

SECTION 27 41 06 NOISE AND VIBRATION CONTROLS FOR AUDIOVISUAL SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Provisions of:
 - 1. Flexible Audiovisual raceway connections to vibrating machinery
 - 2. Sealing of Audiovisual device boxes related installed in sound rated walls.
 - 3. Coordination of airtight installation requirements at Mechanical and Electrical Rooms and/or duct enclosures.

1.2 RELATED WORK IN OTHER SECTIONS

- A. Consult all other Sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.
 - 1. Division 15
 - a. Energy Management Panels mounted on vibrating equipment connected to the Audiovisual Work.
 - 2. Division 27
 - a. UPS equipment connected to the Audiovisual Work.
 - b. Section 27 41 03 - Conduits and Backboxes for Audiovisual Systems

1.3 REFERENCES

- A. American National Standards Institute (ANSI)
 - 1. ANSI/UL 1479-2003 Fire Tests of Through Penetration Firestops
- B. American Society for Testing and Materials (ASTM)
 - 1. ASTM E814-02 Standard Test Method for Fire Tests of Through Penetration Fire Stops.
- C. Underwriters Laboratories, Inc. (UL)
 - 1. UL Fire Resistance Directories

1.4 SUBMITTALS

- A. Comply with the requirements of Section 01 33 23 - Shop Drawings, Product Data and Samples and Section 27 41 00 – Common Work Results for Audiovisual Systems.

PART 2 - PRODUCTS

2.1 FLEXIBLE AUDIOVISUAL CONNECTIONS:

- A. Make Audiovisual connections to vibrating equipment flexible as follows:
 - 1. For conduit over 1" O.D. make Audiovisual connections to vibrating equipment via a flexible expansion/deflection conduit coupling sized as required. Coupling shall have flexible and watertight outer jacket, internal grounding strap, plastic inner sleeve to maintain smooth wireway, and end hubs with threads to fit standard threaded metal conduit.
 - 2. Manufacturers:

- a. XD Xpansion Deflection Coupling by Crouse-Hinds of Syracuse, N.Y.
 - b. Type DF Expansion and Deflection fitting by Spring City Electrical Mfg. Co.
 - c. or equal.
3. For conduit under 1" O.D. utilize FLEX or LIQUIDTIGHT conduit as specified in Section 27 41 03 – Conduits and Backboxes for Audiovisual Systems with slack at least 3' or 15 diameters long, whichever is the longer or provide a flexible coupling as defined above.

2.2 J-BOX MASTIC:

- A. At all electrical boxes penetrating sound isolating partitions, utilize sheet form adhesive mastic as directed elsewhere herein
- B. Manufacturers:
1. Insul-Pad by Dottie Corp.
 2. Duct-Seal by Gardner Bender, Inc.
 3. Duxseal by Manville
 4. Outlet Pad by Lowry
 5. or equal.

2.3 RESILIENT PENETRATIONS:

- A. For conduit:
1. Sleeves: Sleeves of appropriate gage galvanized sheet metal shall be formed to at least the thickness of the penetrated construction and 3/4" to 1" larger in each cross-sectional dimension than the penetrating element.
 - a. Manufacturers:
 - i. Century-Line Sleeves by Thunderline Corporation
 - ii. Custom by Contractor
 - iii. or equal.
 2. Batt: Glass fiber of batt or mineral wool, 1 to 3 lb./cu. ft. density.
 - a. Manufacturers:
 - i. Certain-Teed
 - ii. Johns-Manville
 - iii. Owens-Corning
 - iv. or equal.
 3. Acoustical Sealant:
 - a. Manufacturers:
 - i. DAP
 - ii. Pecora
 - iii. Tremco
 - iv. U.S. Gypsum
 - v. or equal.
 4. Firestop Sealant:
 - a. Where required, resilient firestop caulking may be used in lieu of Acoustical Sealant when installed in strict conformance with the manufacturer's directions. Fully hardened firestop caulk shall develop a Shore A hardness of no greater than 35. Refer to the requirements of Section 27 41 03 – Conduits and Backboxes for Audiovisual Systems.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS, CONNECTION TO VIBRATING EQUIPMENT

- A. The Contractor shall not install any vibrating equipment or conduit attached thereto which makes rigid contact with the "building" unless it is approved in this specification or by the Owner's Representative. "Building" includes, but is not limited to slabs, beams, columns, walls, partitions, ceilings, studs, ceiling framing and suspension systems.
- B. Prior to installation, the Contractor shall bring to the Owner's Representative's attention any conflicts between trades which will result in unavoidable rigid contact at equipment, conduit, piping, ducts, etc., as described herein, due to inadequate space or other unforeseen conditions. Corrective work necessitated by conflicts after installation shall be at the responsible contractor's expense.
- C. The Contractor shall obtain inspection and approval from the Owner's Representative of any installation to be covered or enclosed, prior to such closure.

3.2 INSPECTION OF CONDITIONS:

- A. Examine related Work and surfaces before starting Work of this Section. Report to the Owner's Representative, in writing, conditions which will prevent proper provision of this work. Beginning the Work of this Section without reporting unsuitable conditions to the Owner's Representative constitutes acceptance of such conditions by Contractor. Perform any required removal, repair, or replacement of this Work caused by unsuitable conditions at no additional cost to the Owner.
- B. Coordination
 - 1. Coordinate with the work of the Base Building Construction Contract. Coordinate Work of this Section with all other impacted trades.

3.3 INSTALLATION REQUIREMENTS, FLEXIBLE ELECTRICAL CONNECTIONS

- A. The installation of flexible electrical connections to vibration isolated equipment shall in no way impair or restrain the function of the vibration isolation installed by the work by Others.
 - 1. Using gross slack. Install flexible conduit in a grossly slack loop form or shallow "U" form. Install stranded conductors with sufficient slack to accommodate maximum possible movement.
 - 2. Using flexible coupling. The flexible coupling shall be free and not in contact with any nearby building construction and shall be installed slack, and free of strain in any direction. Install stranded conductors as above

3.4 INSTALLATION REQUIREMENTS, J-BOX MASTIC

- A. Application: All Audiovisual Systems work in sound isolating assemblies, including but not limited to residential rooms, offices, mechanical rooms, electrical rooms and related to utilize backboxes for all services, including but not limited to low voltage communication. Installation of backboxes to conform with following:
 - 1. Space outlet boxes on opposite faces of the wall by more than 24" o.c. Where daisy chained conduits indicated on the plans, connect such boxes by slack flexible conduit (2 times longer than distance between outlets).
 - 2. Cutouts for electrical boxes and penetrating piping/conduit shall be no more than 1/4" oversize.
 - 3. Caulk gap between drywall and electrical boxes and/or piping/conduit airtight with Acoustical

Sealant. Apply J-Box mastic to back of all penetrating electrical boxes and press firmly at joint to wallboard to provide an airtight seal.

3.5 INSTALLATION REQUIREMENTS, RESILIENT PENETRATIONS

- A. Penetrations included in this Section of the Specifications include all Audiovisual conduit connected to vibrating equipment within 30 feet of such equipment
- B. Method for round or rectangular penetrations.
 - 1. Cut a clean opening in the penetrated construction very nearly the size of the sleeve for each penetrating element. Provide lintels above, relief structure below and vertical framing between and to the sides, as required. Provide the above, escutcheon plates and such related construction as is necessary to make the penetrated structure as solid and massive near the penetrations as the surrounding construction.
 - 2. Set the metal sleeve into the penetrated construction in an airtight manner around its outer periphery, using grout, dry packing, plaster or drywall compound full depth and all around - but only to a maximum width of ½" - or the requirements of the above paragraph shall not have been satisfied.
 - 3. Pack annular opening with glass fiber between metal sleeve and penetrating element full depth, all around to a firm degree of compaction. Leave a ½" deep annular opening free at each end of the metal sleeve; fill this fully with sealant.

3.6 MECHANICAL AND ELECTRICAL ROOMS REQUIREMENTS

- A. All mechanical and electrical rooms, plenums, duct shafts and drywall duct enclosures and other enclosures of high noise sources shall be constructed airtight. This means that every precaution shall be taken to maintain construction completely airtight around a room so designated. Construction joints, duct penetrations, electrical boxes, frames, supports, cabinets, doors, access panels, fixtures, etc., all shall be built or installed in such a manner as to prevent sound transmission through any construction enclosing a room horizontally or vertically. Appropriate lintels, frames, blocking, escutcheons, grouting, gaskets, packing, caulking, taping, filling, etc., all shall be employed to prevent sound transmission. Refer to requirements of this Section for Resilient Penetrations.
- B. All work under this section is to comply with the above. Contractor to report to Owner's Representative any construction conditions which arise which might compromise compliance with this requirement.

END OF SECTION

SECTION 27 41 07 IDENTIFICATION FOR AUDIOVISUAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY:

- A. Provide all labor, materials, tools, and equipment required for permanent intelligible labeling on, or adjacent to, all cabling, connectors, innerduct, faceplates, jacks, receptacles, controls, fuses, circuit breakers, patching jacks, and racks.
- B. This section includes minimum requirements for the following:
 - 1. Labeling Audiovisual Cabling
 - 2. Labeling Closet Hardware
 - 3. Labeling Work Stations
 - 4. Labeling Pathways, Spaces, Grounding and Bonding.
- C. Refer to detailed plans for additional requirements.
- D. Clearly and distinctly indicate the function of the item.
- E. Coordinate with Record Drawings

1.2 REFERENCES:

- A. Usage: In accordance with Section 014200 – Definitions, References, and Regulations
- B. American Society for Testing and Materials (ASTM)
 - 1. ASTM D 709(2001) Laminated Thermosetting Materials
- C. Electronic Industries Alliance (EIA)
 - 1. EIA TIA/EIA-606-A(2002) Administration Standard for Commercial Telecommunications Infrastructure (ANSI/TIA/EIA-606)
- D. Underwriters Laboratories (UL)
 - 1. UL 969 (1995; R 2001) Marking and Labeling Systems

1.3 QUALITY ASSURANCE

- A. Identification and administration work specified herein shall comply with the applicable requirements of:
 - 1. ANSI/TIA/EIA – 606-A Administration Standards.
 - 2. ANSI/TIA/EIA – 569B Pathway and Spaces
 - 3. ANSI/TIA/EIA – 568B Telecommunications Cabling Standard.
 - 4. BICSI Telecommunications Distribution Methods Manual.
 - 5. UL 969 (1995; R 2001) Marking and Labeling Systems.

1.4 SUBMITTALS

- A. Conform with the requirements of Section 013300 – Submittal Procedures and Section 27 41 00 - Common Work Results for Audiovisual Systems.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Procedures: In accordance with Section 011100 – Summary of Work.

1.6 SEQUENCING

- A. Not Used.

PART 2 - PRODUCTS

2.1 COMMUNICATION CABLING LABELS, INTERIOR

- A. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.
- B. Shall be preprinted or computer printed type. Hand written labels are not acceptable.
- C. Provide vinyl substrate with a white printing area and black print. If cable jacket is white, provide cable label with printing area that is any other color than white, preferably orange or yellow – so that the labels are easily distinguishable.
- D. Shall be flexible vinyl or other substrates to apply easy and flex as cables are bent.
- E. Shall use aggressive adhesives that stay attached even to the most difficult to adhere to jacketing.
- F. Manufacturers:
 - 1. Cable Type – Audiovisual Cabling, General Purpose
 - a. Brady TLS2200 labels – PTL-31-427, PTL-32-427
 - b. Brady Laser tab labels – LAT-18-361, LAT-53-361
 - c. Hubbell
 - d. Leviton
 - e. Panduit.
 - f. or equal.
 - 2. Cable Type – RG-6 Coax
 - a. Brady TLS2200 labels – PTL-31-427, PTL-32-427
 - b. Brady Laser tab labels –LAT-18-361, LAT-53-361
 - c. Panduit.
 - d. or equal.
 - 3. Cable Type – RG-59 Coax
 - a. Brady TLS2200 labels – PTL-31-427, PTL-32-427
 - b. Brady Laser tab labels – LAT-18-361, LAT-53-361
 - c. Panduit.
 - d. or equal.
 - 4. Cable Bundles
 - a. Brady TLS2200 labels – PTL-12-109
 - b. Panduit.
 - c. or equal.

2.2 GROUNDING AND BONDING, PATHWAY, AND SPACE LABELS

- A. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.
- B. Shall be preprinted or computer printed type. Hand written labels are not acceptable.
- C. Manufacturers:

1. Brady Corporation
 - a. TLS2200 labels
 - i. PTL-20-422, Size 2.0" x 1.0"
 - ii. PTL-22-422, Size 3.0" x 1.0"
 - iii. PTL-37-422, Size 3.0" x 1.9"
 - iv. PTL-23-422, Size 4.0" x 1.0"
 - v. PTL-38-422, Size 4.0" x 1.0"
 - b. Laser tab labels
 - i. LAT-13-747, Size 1.875" x 0.833"
 - ii. LAT-24-747, Size 1.75" x 1.0"
 - iii. LAT-32-747, Size 3.0" x 0.9 "
 - iv. LAT-33-747, Size 2.0" x 1.437"
 - v. LAT-34-747, Size 3.0" x 1.437"
 - c. Continuous tape for TLS2200
 - i. PTL-8-422, Size 0.5" white polyester
 - ii. PTL-8-430, Size 0.5" clear polyester
 - iii. PTL-8-439, Size 0.5" white vinyl
 - iv. PTL-42-439, Size 1.0" white vinyl
 - v. PTL-43-439, Size 1.9" white vinyl
2. Panduit.
3. or equal.

2.3 NAMEPLATES

A. Field Fabricated Nameplates

1. Features/Function/Construction
 - a. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings.
 - b. Comply with ASTM D 709.
 - c. Each nameplate inscription shall identify the function and, when applicable, the position.
 - d. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core.
 - e. Surface shall be matte finish.
 - f. Corners shall be square.
 - g. Accurately align lettering and engrave into the core.
 - h. Minimum size of nameplates shall be one by 2.5 inches.
 - i. Lettering shall be a minimum of 0.25 inch high normal block style

PART 3 - EXECUTION

3.1 GENERAL

- A. Apply labeling to clean surfaces free of oil, dust, solvents or loose material.
- B. Apply after Project painting in area of application is complete.
- C. Apply to locations where labeling will not be damaged, covered over or in the way of the ordinary maintenance and operation of the installed Audiovisual infrastructure or system.
- D. Apply labeling right side up, parallel to major edges of surfaces to which it is applied. When no line is evident, apply parallel to floor line. Correct conditions of labeling applied out of true.

- E. Protect installed labeling from damage.
- F. Replace labeling that is defaced, illegible or peeling off of the surface to which it is applied.

3.2 IDENTIFICATION & LABELING

A. Pathways

- 1. Pathways shall be marked at each endpoint and at all intermediate pull or junction boxes. In the case of partitioned pathways (i.e. innerduct) each partition shall have a unique identifier.
- 2. Label pathways using the appropriate abbreviation and a number.
- 3. Use adhesive type labels.

B. Labels shall be affixed at the entry to all Audiovisual Control Rooms and spaces (Includes entrance facilities, communication equipment rooms, communication equipment spaces and work areas)

- 1. Use adhesive type labels for all Audiovisual space labeling,
- 2. Affix labels to entrance doors – coordinate location with Owner's Representative.

C. Cables

- 1. Horizontal shall be marked within 12" of each endpoint or to innerduct in which the cable is installed.
- 2. Except where installed in innerduct or conduit, all backbone fiber optic cable shall have affixed to the outer jacket, labels of a bright color that contain at least the legend "FIBER OPTIC CABLE." These labels must be affixed at separations no greater than 10 ft.
- 3. Any cable installed in conduit shall be labeled at all intermediate pull or junction boxes.
- 4. Label cables using the appropriate circuit ID.
- 5. Use adhesive type labels for all AV cable labels.
- 6. Affix labels to cables – marking cable is not permitted.
- 7. Where cable is fully encased in innerduct label the outside of the innerduct with the cable label and, where the contents are fiber optic cabling, the "FIBER OPTIC CABLE" label.

D. Grounding and Bonding

- 1. The AVGB(s) (Audiovisual main ground bar) shall be labeled as such with an adhesive type label(s) affix label(s) to TMGB.
- 2. The conductor connecting the AVGB (Audiovisual main ground bar) to the building ground shall be labeled at each end with an affixed label in a visible location as close as practicable to the bonding point at each end of the conductor.

E. Firestopping

- 1. Each firestopping location shall be labeled at each location where firestopping is installed, on each side of the penetrated fire barrier, within 12 in. of the firestopping material.

END OF SECTION

SECTION 27 41 08 AUDIOVISUAL RACKS, CABINETS, & ACCESSORIES

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Audiovisual racks and cabinets.
- B. Production Desks and Mobile Production Racks.

1.2 RELATED WORK IN OTHER SECTIONS

- A. Section 27 41 01 – Grounding and Bonding for Audiovisual Systems
 - 1. Bonds racks and cabinets.
- B. Section 27 41 03 – Conduits and Backboxes for Audiovisual Systems
 - 1. Signal systems raceways at Audiovisual Control Rooms

1.3 REFERENCES

- A. American National Standards Institute (ANSI)
 - 1. EIA-310-D (1992) Cabinets, Racks, Panels, and Associated Equipment (ANSI/EIA/310-D)
 - 2. ANSI-J-STD-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications (ANSI/J-STD-607-A-2002)
- B. International Conference of Building Officials (ICBO)
 - 1. AC156 ICBO ES Acceptance Criteria for Seismic Qualification Testing of Nonstructural Components (Jul. 2004)
- C. Telecordia Technologies
 - 1. Network Equipment Building System (NEBS) GR-63-CORE (Seismic Zone 4)

1.4 SUBMITTALS

- A. Conform with the requirements of Section 013300 – Submittal Procedures and Section 27 41 00 - Common Work Results for Audiovisual Systems.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Procedures: In accordance with Section 011100 – Summary of Work.

PART 2 - PRODUCTS

2.1 GENERAL

- A. KEYS
 - 1. Key all boxes, cabinets, enclosures, panels, controls, doors and related provided for similar usage within a system identically.

2.2 EQUIPMENT ENCLOSURE SYSTEMS

- A. General:
 - 1. Provide enclosure systems including, but not limited to enclosures, cabinets, cases and related

- panels and accessories as specified herein. Provide size and quantity as shown on drawings or scheduled.
2. Provide color as shown on drawings. If no color is shown on drawings, submit manufacturer's standard color chips for selection.
 3. Provide enclosure systems conforming to the UBC/CBC, latest edition, for seismic design.
 4. Equipment Enclosures: Each rack provided with frame angles tapped 10-32, ANSI/EIA 310-D Universal Spaced.
- B. Zone 4 Undercounter Slide-Out Rack, Steel Enclosure
1. Drawing Reference: R18
 2. Features
 - a. Rack cabinet, 1 bay, steel frame mounted, with slide out inner frame for rear access of equipment from front of rack, floor supported.
 - b. Zone 4 rated for up to 500 pounds of uniformly distributed load.
 - c. 41 useable rack units.
 - d. Fan System, 100 cfm minimum mounted into slide out inner frame.
 - e. No front except where called for on the plans - at such conditions, provide fully perforated steel door.
 - f. No rear doors
 - g. Locking side panels.
 - h. Open top outer frame
 - i. Raised floor base - provide engineered means of support where installation at raised floor conditions are indicated sufficient to maintain racks Zone 4 rating.
 - j. Provide vertical power strips in accordance with Section 27 11 26.
 - k. Provide sliding shelf.
 3. Manufacturer:
 - a. Middle Atlantic SRSR-4-12
 - b. or equal (No known equal).

2.3 RACK PANELS AND ACCESSORIES

- A. Rack Mounting Screws:
1. Screws 10-32; length as required for at least 1/4" excess when fully seated; oval head with black plastic non marring cup washer or equivalent ornamental head; nickel, cadmium or black plated; Phillips, Allen Hex, Square-Tip or Torx drive. Slotted screws are not acceptable.
- B. Sliding Shelf:
1. Plan Reference: SLIDING SHELF
 2. Construction/Features:
 - a. 16 gauge minimum cold rolled steel
 - b. Powder coat finish to match rack color, unless otherwise noted
 - c. 19" Wide Pull out with handhole or knob.
 - d. Solid or perforated surface
 - e. Depth: At least 20", u.o.n.
 - f. 50 pound minimum load capacity

3. Manufacturers:
 - a. Atlas Sound
 - b. BGW Systems, Inc. Sliding Shelves
 - c. Chatsworth Products 32" Deep Megaframe Sliding Shelf.
 - d. Elkay SLSH series
 - e. Homaco Adjustable Pull-Out Equipment Shelves
 - f. Hubbell MCCTELSHLF
 - g. Middle Atlantic Heavy-Duty Sliding Shelf
 - h. APW SSSDC30.
 - i. AFCO AS-SO-19-24.
 - j. Or equal.
- C. Fixed Shelf - 4 post rack applications
 1. Plan Reference(s):
 - a. FIXED SHELF
 - b. SHELF
 2. Construction:
 - a. 16 gauge minimum cold rolled steel
 - b. Powder coat finish to match rack color, unless otherwise noted
 - c. Holds 100 lbs load
 - d. Mounts to front and rear rails, U.O.N.
 - e. Solid or Perforated bottom panel to suit equipment being mounted.
 - f. Depth to equal not less than 75% of depth of equipment rack.
 - g. Not more than 1 RU in height.
 3. Manufacturers:
 - a. Atlas Sound Heavy Duty Shelves, SH series.
 - b. BGW Systems, Inc. Rack Mount Trays
 - c. Elkay SSH Series
 - d. Homaco Adjustable Equipment Shelves and Fixed Dual Shelves
 - e. Lowell Rack Mounted Utility Shelves
 - f. Middle Atlantic Universal Rackshelves
 - g. Rack Innovations, Inc.
 - h. ZERO/Stantron Stationary Shelves
 - i. AFCO AS-SF-19-24
 - j. APW ESDC30.
 - k. Hubbell MCCPSHLF
 - l. Chatsworth Products 29" Deep Megaframe Fixed Shelves.
 - m. or equal
- D. Keyboard/Mouse Shelf
 1. Drawing Reference: Keyboard/Mouse Shelf
 2. Stores fullsize keyboard and mouse inside rack.
 3. Upon retraction to rack front, pivots 90 degrees for operator access.
 4. Manufacturers
 - a. APC 19" Rotating Keyboard Drawer.
 - b. Middle Atlantic
 - c. or equal.

- E. Grommet Panel
 - 1. Features/Functions/Construction
 - a. 1 RU steel or aluminum panel with 18" wide x 1" tall smooth edged opening in face
 - b. Cable management panel protrudes below opening perpendicular to rear face.
 - 2. Manufacturers:
 - a. Middle Atlantic BR1
 - b. Custom by Contractor using Blank Panel
 - c. or equal.

- F. Blank Panels:
 - 1. Construction
 - a. 16 gauge minimum cold rolled steel
 - b. Powder coat finish to match rack color, unless otherwise noted
 - 2. Manufacturers
 - a. Middle Atlantic Products SB Series.
 - b. Atlas Sound S19 Series.
 - c. BGW Systems Inc. Flanged Steel Blank Panels
 - d. Dukane
 - e. Elkay
 - f. Lowell Series L3
 - g. Zero ZP112000 Series.
 - h. Hubbell
 - i. or equal.

- G. Vent Panels:
 - 1. Construction
 - a. 20 gauge minimum cold rolled steel
 - b. 1/8" minimum holes, at least 70% open total panel cross-section.
 - c. Powder coat finish to match rack color, unless otherwise noted
 - 2. Manufacturers
 - a. Atlas Sound SVP Series.
 - b. BGW Systems Inc. Perforated Vent Panels
 - c. House of Metal Enclosures (HOME) Series PRP.
 - d. Lowell Series L5
 - e. Middle Atlantic Products VT Series.
 - f. Zero.
 - g. or equal.

- H. Drawers
 - 1. Construction
 - a. 16 gauge minimum cold rolled steel
 - b. Powder coat finish to match rack color, unless otherwise noted
 - c. Suitable for mounting from face of 4 post rack
 - d. At least 14-1/2" deep.
 - e. Full extension ball bearing slides with trigger release disconnect.
 - f. Rated for at least 100 pound load.
 - g. Flush handle does not protrude from drawer face.

- h. Provide key lock where indicated.
- 2. Manufacturers
 - a. BGW Systems Inc. Rack Mount Drawer Systems.
 - b. Middle Atlantic Heavy Duty D or TD series.
 - c. Atlas Sound SD*-165FP Series.
 - d. Elkay SSD Series.
 - e. or equal.
- I. Vertical Lacer Strips
 - 1. 44RU high vertical steel strips with points for attachment of velco cable ties at at least 6" o.c.
 - 2. Manufacturers:
 - a. Middle Atlantic LACE-44LP
 - b. APW
 - c. or equal.
- J. Horizontal Lacer Bars
 - 1. EIA 19" Width steel strips or bars suitable to provide support to large cable dressed horizontally through racks
 - 2. Size to suit load and mounting width.
 - 3. Manufacturers:
 - a. Middle Atlantic LBP-1R4, LBP-1.5 and LBP-1S.
 - b. APW
 - c. or equal.
- K. Seismic Hold-down Equipment Straps
 - 1. Drawing Reference: None - Provide as required to secure equipment that cannot be screw fastened to mounting shelves.
 - 2. Manufacturers:
 - a. BGW Systems
 - b. Everest Electronic Equipment Lock Down Kit
 - c. Ergotron
 - d. Chatsworth Products
 - e. Middle Atlantic Products
 - f. Q-Safety, Inc.
 - g. or equal.

PART 3 - EXECUTION

3.1 MOUNTING

- A. Unless otherwise noted, all floor supported equipment racks shall be bolted to the structure in accordance with the requirements of the CBC, the UBC and the contractors approved structural engineering submittal demonstrating the method to be used to conform to these requirements.
- B. Rows of identical racks shall be bolted together in addition to being bolted to the floor and bonded to form a single electrical ground plane.
- C. Wall mounted equipment racks and cabinets shall similarly be bolted to structural members in accordance with the requirements of the CBC, the UBC and the contractors approved structural engineering submittal demonstrating the method to be used to conform to these requirements.

3.2 EQUIPMENT ENCLOSURE (RACK) AND EQUIPMENT BACKBOARD FABRICATION

- A. Combustible material, other than incidental trim of indicated equipment, is prohibited within equipment racks.
- B. Provide permanent labels for all equipment and devices.
- C. Floor racks to be bolted floor unless otherwise indicated.
- D. Access shall not require demounting or de-energizing of equipment. Install access covers, hinged panels, or pull-out drawers to insure complete access to terminals and interior components.
- E. Provide a permanent label on the front of each equipment rack including the rack designation, and the circuit breaker number and associated electrical distribution panel designation servicing same.
- F. Where wiring of mixed types are called for on the plans, maintain separation of wiring classifications as specified in the individual sections of the Audiovisual Work. Separately dress, route and land microphone, audio line level and data cables and related on the right side of the equipment enclosure, as viewed from the rear; dress, route, and land loudspeaker level, data and control cables on the left side of the equipment enclosure, as viewed from the rear.
- G. Provide vertical wire management of cabling within the rack independent of the adjustable EIA mounting rails. Vertical wiring management provided by the contractor within the rack shall not prevent such rails from being moved as required by the Owner.
- H. Dress and support cabling at a minimum of 24 inch on center.
- I. Access shall not require demounting or de-energizing of equipment or cabling. Install access covers, hinged panels, or pull-out drawers to insure complete access to terminals and interior components.
- J. Fasten removable covers containing any wired component with a continuous hinge along one side, with associated wiring secured and dressed to provide an adequate service loop. Provide an appropriate stop locks to hold all hinged panels and drawers in a serviceable position.
- K. Provide permanent labels for all equipment and devices. Where possible, fasten such labels to the rack frame or to blank or vent panels which will remain in place when active equipment is removed for possible service.
- L. At audio and video jackfields, provide service loop to permit removal of jackfields from rack sufficient to conveniently access all jack contacts for routine cleaning and maintenance. Organize the service loop and harness such that reasonable reconnection of jacks and jack normals is possible without cutting apart the harness.
- M. Coordinate the design and execution of wire harnessing of multi-bay audio and video rack ensembles with conditions of delivery to installation locations at Project Site, and with the requirement herein for test of the completely wired system in the shop prior to delivery to the Project Site. Organize the wiring harnesses such that they will fold within one shippable unit without risk of damage, or provide polarized multipin connectors and related interconnect systems as specified elsewhere herein.

3.3 SIGNAL GROUNDING & BONDING PROCEDURES

- A. Comply with National Electrical Code and the California Electric Code. Bond equipment racks to ground in accordance with the California Electric Code and ANSI/ EIA/ TIA 607 and Section 27 41 01 – Grounding and Bonding for Audiovisual Systems.
- B. Unless otherwise noted maintain a unipoint ground scheme.
- C. Equipment enclosures shall not be permitted to touch each other unless bolted together and electrically bonded.

END OF SECTION

SECTION 27 41 09 AUDIOVISUAL CABLE MANAGEMENT

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Section includes provision of cable management for cabling installed under the work of this Project as well as for Owner furnished patch cords at equipment racks
- B. Scope includes:
 - 1. Innerduct
 - 2. Cable End Spillway
- C. Backboard Cable Management
- D. Patch Panel Cable Management at racks and cabinets

1.2 RELATED WORK IN OTHER SECTIONS

- 1. Section 27 41 03 – Conduits and Backboxes for Audiovisual Systems
- 2. Section 27 41 07 – Identification for Audiovisual Systems
- 3. Section 27 41 08 – Audiovisual Cabinets, Racks, Frames and Enclosures

1.3 REFERENCES

- A. American Society For Testing and Materials (ASTM)
 - 1. ASTM D2239-03 Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
- B. Underwriters Laboratories (UL)
 - 1. UL 910 Test for Flame-Propagation and Smoke-Density Values for Electrical and Optical-Fiber Cables used in Spaces Transporting Environmental Air (Nov. 1998)

1.4 SUBMITTALS

- A. Conform with the requirements of Section 013300 – Submittal Procedures and Section 27 41 00 - Common Work Results for Audiovisual Systems.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Procedures: In accordance with Section 011100 – Summary of Work.

PART 2 - PRODUCTS

2.1 INNERDUCT

- A. Innerduct, Single Chamber
 - 1. Drawing and spec reference(s):
 - a. ID*, Innerduct ("*" denotes cross sectional area of innerduct referenced to standard conduit trade size).
 - b. IDP*, Innerduct, Plenum ("*" denotes cross sectional area of innerduct referenced to standard conduit trade size).
 - 2. Construction:

- a. Selected product suitable for:
 - i. underground installation in ductbank,
 - ii. plenum (IDP)
 - iii. exposed, in interior utility rooms where indicated.
 - b. High density polyethylene.
 - c. Ribbed or similar exterior construction to resist crushing surface to promote fiber cable installation.
 - d. Provides an interior chamber with a capacity equal to a trade size conduit referenced above.
3. Approvals:
 - a. ASTM D2239(1985) Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
 - b. IDP - UL Standard Test Method 2024 of UL 910.
 4. Manufacturers, ID in underground ductbanks:
 - a. Carlon Optic-Gard/PE.
 - b. Arnco.
 - c. Vikimatic.
 - d. or equal.
 5. Manufacturers, ID in interior, non-plenum applications:
 - a. Carlon Optic-Gard/PVC.
 - b. Arnco.
 - c. Vikimatic.
 - d. or equal.
 6. Manufacturers, IDP:
 - a. Carlon Plenum-Gard.
 - b. Arnco.
 - c. Vikimatic.
 - d. or equal.
- B. Innerduct, Multi-Chamber:
1. Drawing and spec reference: #ID*, Innerduct ("#" denotes number of chambers, "*" denotes cross sectional area of each chamber referenced to standard conduit trade size).
 2. Construction:
 - a. Multi-Chamber Innerduct shall be installed within an outer diameter CRSC or PVC Conduit per manufacturer's recommendation, and as described elsewhere herein.
 - b. Shall provide independent interior chambers each with a capacity equal to a trade size conduit referenced above.
 3. Approvals:
 - a. ASTM D2239(1985) Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
 4. Manufacturers, MultiChamber Innerduct:
 - a. AMP OptiDuct (Design Basis) Provide in combinations to meet scheduled requirement.
 - i. 3ID1 - Provide one (1) Three Cell innerduct in one-half of a 4" diameter PVC conduit. Each cell to have 1" cross-sectional area.
 - ii. 1ID3 - Provide one (1) Single Cell innerduct in one-half of a 4" diameter PVC conduit, with 3" cross-sectional area.
 - iii. 2ID1.25 - Provide one (1) Two cell innerduct in one-half of a 4" diameter PVC conduit. Each cell to have 1.25" cross-sectional area.

- b. Carlon Multi-Gard
 - c. North Supply Multi-Guard Multi-Cell Conduit.
 - d. Tamaqua.
 - e. or equal
 5. Manufacturers - Independent InnerDuct runs in overall PVC conduit - Multiple runs of single chamber inner duct may be provided in lieu of single, multiple chamber innerduct provided above. Contractor bears burden of selected innerduct quantity to provide an exact match of cross-sectional area of each chamber of multi-chamber assembly and to re-size overall PVC conduit to accommodate this use.
 - a. Carlon.
 - b. American Plastics
 - c. Vikimatic
 - d. Or equal
 6. Manufacturers, for direct burial or boring:
 - a. Tamaqua
 - b. Carlon
 - c. Or equal
- C. Innerduct, UV Rated
 1. Drawing Reference: ID, UV Rated*, where "*" denotes cross sectional area of each chamber referenced to standard conduit trade size).
 2. Approvals:
 - a. ASTM D2239(1985) Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
 3. Construction.
 - a. Listed for UV exposure.
 4. Manufacturers:
 - a. Tamaqua Plus II Series Telecom Duct.
 - b. Allwire Black AllDuct.
 - c. or equal.
- D. Woven Mesh Innerduct
 1. Drawing Reference: MID, WMID
 2. Features/Functions
 - a. Three inch wide woven mesh assembly contains at least three continuous pullable sleeves, each can accommodate a cable of at least 1" diameter.
 - b. Systems providing fewer than 3 integrally woven sleeves per WMID assembly not acceptable.
 - c. Includes color coded pull tape in each sleeve.
 - d. Pre-Lubricated for cable pulling
 - e. Non-Hydroscopic
 - f. 2500 Pound Tensile Strength
 - g. 480 degree F melting point.
 - h. At least 5 years prior field use including at least 25 million feet of product in use.
 - i. Provide plenum rated assembly at plenum locations as defined by the California Electric Code.
 3. Manufacturers:
 - a. Maxcell/TVC 3" 3-cell in three unique colors per duct.

- b. or equal (No known equal with identical 3 sleeves woven into a single assembly nor equal industry usage).

2.2 CONDUIT CABLE MANAGEMENT

A. Conduit End Waterfall Spillway

- 1. Drawing Reference: CEW
- 2. Features/Functions
 - a. Spillway fastens to end of EMT conduit, provides radius sweep, open on top, solid from below
 - b. Maintains proper bend radii for fiber/cable
 - c. Provides tie points for fire pillow retention
 - d. Supports up to 100 lbs. of hanging fiber/cable
 - e. Clamp for securing to EMT
 - f. Self-fastening tie down system for supporting cabling
- 3. Construction:
 - a. Fire Retardant ABS
- 4. Manufacturers:
 - a. Bejed BJ-2049 Spillway.
 - b. or equal (no known equal).

PART 3 - EXECUTION

3.1 INNERDUCT INSTALLATION

A. Schedule of Application

- 1. At plenum tray conditions, provide IDP.
- 2. At 4" and larger interior conduits, provide WMID. Provide plenum rated WMID at plenum ceiling conditions.

3.2 CONDUIT END WATERFALL

- A. Fasten securely to conduit end wherever cabling will exit conduit 18" or more above the cable tray to prevent damage due to cabling due to weight of cable bearing on a conduit end.
- B. Secure cabling with integral cable restraint system.

END OF SECTION

SECTION 27 41 16 INTEGRATED AUDIOVISUAL SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Provide all labor, materials, transportation and equipment to complete the furnishing, installation, assembly, set up, and testing of the Sound and Audiovisual System work indicated on the drawings and specified herein. Notwithstanding any detailed information in this Section, provide complete, working systems.
- B. Design, engineer and provide complete, all means of support, suspension, attachment, fastening, bracing, and restraint (hereinafter "support") of the Work of this Section. Provide engineering of such support by parties licensed to perform work of this type in the Project jurisdiction.

1.2 AUDIOVISUAL SYSTEMS AND EQUIPMENT

- A. Provide the following, in addition to work shown on the drawings, along with any additional equipment and accessories required for a complete, working system:
 - 1. Provide and install (N) Audiovisual, DSP, conferencing, and control systems and equipment and Presentation Lectern in Community Room and (4) Conference Rooms at Los Medanos College. Remove and/or relocate existing equipment as indicated.
 - 2. Confirm code-required clearances at (E) full-height AV equipment rack serving Community Room, adjusting position and re-securing to slab as required to obtain clearance.
 - 3. Provide and install new loudspeakers, loudspeaker enclosures and mounts, assistive listening equipment, cabling, and conduit to new locations. Commission, aim, test, and verify maximum sound pressure levels of installed devices.
 - 4. Remove projectors from existing mounts. Install new projectors re-using existing mounts where indicated. Provide new mounting hardware where required.
 - 5. Remove existing projection screens. Install new tab-tensioned screens with 16:10 aspect ratio viewing area and blackout perimeter.
 - 6. Install (N) AV equipment and cabling in (E) AV floorboxes and pathway. Remove obsolete cabling and AV connectors/baluns.
 - 7. Remove abandoned AV connectors throughout spaces cover abandoned AV backboxes with blank faceplates, color to be coordinated with District Representative.
 - 8. Develop user interface for control systems with District Representative familiar with the operation of Community Room and Conference Room spaces. Provide system programming, training, and support to Owner during first-substantial-use.
- B. Loudspeaker/Audio Processing, general:
 - 1. Program audio and speech content to output through overhead loudspeakers.
- C. Racking compartment, general:
 - 1. Provide blank plates at all unused openings.
 - 2. Provide fans as required to keep the interior of each equipment rack at a temperature at least 5-10 degrees cooler than equipment manufacturer's recommended operating temperature.
 - a. Fans to emit not more than 30 dB of noise.
- D. Control Systems, general:

1. Review all push button and touch panel button nomenclature with Owner Representative prior to system programming.
 2. Provide graphic indication of program volume level on control touch panel when volume control I s selected.
 3. Provide Main Menu selection button on all touch panel screens to route user back to main touch panel menu.
- E. Control Functions:
- a. Control: Confirm all control functions and layouts with Owner Representative prior to system programming.
 - b. Functions to operate by scene/mode, not by device.
 - c. Provide user-interface (manual) selection to operate system in unified or subdivided modes, depending on how the ballroom’s moveable partitions are configured.
 - d. End user selection of a single A/V input source (push buttons) automates:
 - i. Presets recalled.
 - ii. Sets audio chain to loudspeakers.
 - e. End user selection on an Audio Only input automates:
 - i. Sets audio chain.
 - f. Touch Panel Menus:
 - i. Startup Page: “Press here to Begin”
 - ii. Home Page:
 - (1) “Select Source”: provides sub-menus of source selections.
 - (2) “Power Off”: Provides sub-menu selection of “Do you want to power off the system?” with “Yes” and “No” selections. Upon selection of “Yes”, menu reads “Please wait, shutting down system.”
 - iii. All menus, except Home Page, to include “Home” button to revert back to Home Page.

1.3 REFERENCE STANDARDS

- A. Conform to the applicable portions of the current standards published by these organizations:
1. SMPTE Society of Motion Picture and Television Engineers.
 2. NAB National Association of Broadcasters.
 3. EIA Electrical Industries Association of America.
 4. UL Underwriters Laboratories.
 5. AES Audio Engineering Society.
 6. NEC National Electrical Code.
 7. UBC Uniform Building Code.
 8. NFPA National Fire Protection Association.
 9. EIAJ Electrical Industries Association of Japan.
 10. IEC International Electrotechnical Commission.
 11. FCC Federal Communications Commission.
 12. NTC Network Transmission Committee of the Video Transmission Engineering Advisory Committee.
 13. NCTA National Cable Television Association.
 14. BTSC Broadcast Television Stereo Committee.
 15. TASO Television Allocation Study Organization.

- B. Conform additionally to the following specific standards:
1. American National Standards Institute (ANSI)
 - a. ANSI S1.4-1983 (R2001) American National Standard Specification for Sound Level Meters
 - b. ANSI S1.11-1986 (R2001) American National Standard Specification for Octave-Band and Fractional Octave-Band Analog and Digital Filters
 - c. ANSI S1.42-1986 (R2001) American National Standard Design Response of Weighting Networks for Acoustical Measurements
 - d. ANSI IT 7.214-89 Audio-visual Systems - Front Projection Screens (Tripod/Free-Standing) - Methods for Testing and Reporting Performance Characteristics.
 2. Audio Engineering Society Incorporated (AES)
 - a. AES2-1984 (r1997) AES Recommended Practice Specification of Loudspeaker Components Used in Professional Audio and Sound Reinforcement
 - b. AES5-1998 (Revision of AES5-1984) AER recommended practice for professional digital audio – Preferred sampling frequencies for applications employing pulse-code modulation
 - c. AES14-1992 (r1998) AES standard for professional audio equipment – Application of connectors, part 1, XLR-type polarity and gender
 - d. AES20-1996 AES recommended practice for professional audio – Subjective evaluation of loudspeakers
 - e. AES26-2001 Revision of AES26-1995 AES recommended practice for professional audio interconnections – Conservation of the polarity of audio signals
 - f. AES-R2-1998 AES project report for articles on professional audio and for equipment specifications – Notations for expressing levels
 3. Electronic Industries Association of America (EIA)
 - a. EIA-160 Sound Systems
 - b. EIA-310-E Racks, Panels and Associated Equipment
 - c. EIA-101-A Amplifiers for Sound Equipment
 - d. SE-103 Speakers for Sound Equipment
 - e. SE-104 Engineering Specifications for Amplifiers for Sound Equipment
 4. International Electrotechnical Commission (IEC)
 - a. IEC 268-3 (1988) Sound system equipment – Part 3: Amplifiers
 - b. IEC 268-5 (1989) Sound system equipment – Part 5: Loudspeakers
 - c. IEC 268-12 (1987) Sound system equipment – Part 12: Application of Connectors for Broadcast and Similar Use
 - d. IEC 651 (1979) Sound level meters
 5. International Organization for Standardization (ISO)
 - a. ISO 1996-1 Acoustics – Description and measurement of environmental noise – Part 1: Basic quantities and – Composite Analog Video Signal – NTSC for Studio Applications
 6. Federal Specifications (FS)
 - a. GG-S-00172D Screen, Projection. Federal Supply Classification (FSC) 670.
 7. Federal Standards (Fed-Std)
 - a. 191A Textile Test Methods.
 - i. 5760 Mildew Resistance of Textile Materials; Mixed Culture Method.
 - ii. 5903.1 Flame Resistance of Cloth; Vertical.
 8. NFPA
 - a. 255 Method of Testing Surface Burning Characteristics of Building Materials.
 - b. 701 Methods of Fire Tests for Flame-Resistant Textiles and Films.
 9. Society of Motion Picture Engineers (SMPTE).

- a. SMPT 196M-86 Motion Picture - Screen Luminance and Viewing Conditions - Indoor Theater Projection Guide.
 - b. SMPTE 202M-1998 Motion Pictures – B Chain Electroacoustic Response – Dubbing Theaters, Review Rooms and Indoor Theaters
 - c. SMPTE RP167-1995 Alignment of NTSC Color Picture Monitors
 - d. SMPTE EG1-1990 Alignment Color Bar Test Signal for Television Picture Monitors
 - e. SMPTE EG27-1994 Supplemental Information for ANSI/SMPTE 170M and Background on the Development of NTSC Color Standards (R1999)
 - f. RP 94 Recommended Practice for Gain Determination of Front Projection Screens.
 - g. SMPTE RP 95 Recommended Practice for Installation of Gain Screens.
 - h. SMPTE RP 98 Recommended Practice for Measurement of Screen Luminance in Theatres.
10. Underwriters Laboratories Incorporated (UL)
- a. UL 813 Commercial Audio Equipment 1996
 - b. UL 1419 Professional Video and Audio Equipment 1997
 - c. UL 1492 Audio-Video products and Accessories 1996
 - d. UL 6500 Audio/Video and Musical Instrument Apparatus for Household, Commercial and Similar General Use 1999

1.4 RELATED WORK IN OTHER SECTIONS

- A. Section 27 41 01 – Grounding and Bonding for Audiovisual Systems
- B. Section 27 41 02 – Hangers and Supports for Audiovisual Systems
- C. Section 27 41 03 – Conduits and Backboxes for Audiovisual Systems
 1. Raceway system for work of this Project, including floorboxes.
- D. Section 27 41 06 – Noise and Vibration Controls for Audiovisual Systems
 1. Outlet box pads for the work of this Project.
- E. Section 27 41 07 – Identification for Audiovisual Systems
- F. Section 27 41 08 – Audiovisual Cabinets, Racks, Frames
 1. Floor Mounted and Casework Equipment Racks for the work of this Section.
- G. Section 27 41 09 – Audiovisual Cable Management

1.5 QUALITY ASSURANCE

- A. Test Equipment - Refer to 27 41 00:
 1. Sound Systems:
 - a. Wide band oscilloscope, 50 MHz, analog. (Example: Tektronix TAS-250 or 2212).
 - b. True RMS audio digital volt-ohm-millimeter (Example: Fluke 8060A).
 - c. Integrated audio test set (Example: Audio Precision or Neutrik A1 or A2 System).
 - d. Acoustic polarity tester (Example: BSS Audio Ltd. Phasecheck System AR 130).
 - e. Pink Noise generator (Example: Ivie IE-20B).
 - f. Calibrated microphone and pre-amplifier assembly (Example: Ivie IE-2P preamplifier/power supply with Ivie/ACCO, Bruel & Kjaer, or Larson-Davis microphone capsule).
 - g. Real time audio spectrum analyzer, one-third octave (Example: Ivie IE-30A or JBL Smart system).

- h. Frequency/time audio analyzer (Example: Crown TEF system or JBL Smart system).
- B. Baseband Video Systems:
 - 1. Wide band oscilloscope, 50 MHz, analog. (Example: Tektronix TAS-250 or 2212).
 - 2. Analog composite test generator (Example: Tektronix TSG 170A or TSG 100 Opt. 01).
 - 3. Analog composite waveform/vector monitor (Example: Tektronix 1740A or WFM 90.)
- C. RGBHV Wideband Component Analog Video Systems:
 - 1. Wide band oscilloscope, 200 MHz, analog. (Example: Tektronix TAS-485).
 - 2. RGBHV test generator (Example: Extron VTG 100).
- D. Projection Systems:
 - 1. Luminance meter. (Example: Tektronix J17/J18 with J1803 8 degree luminance head.).
 - 2. Grey scale chart.
 - 3. Precision optical comparator. (Example: Phillips or Tektronix J17/J18 with J1810/J1820 chromaticity head.).
- E. High-bandwidth Digital Content Protection (HDCP) check
 - 1. Quantum Data 882E HDMI-HDCP Compliance Test Tool
- F. Any other items of equipment or materials required to demonstrate conformance with the Contract Documents.

1.6 SUBMITTALS

- A. Conform with Section 27 41 00 - Common Work Results for Audiovisual Systems

1.7 CONFLICTS

- A. Present any conflicts between codes, regulations, specifications and/or requirements at least thirty (30) days prior to the commencement of the scheduled work.

1.8 SYSTEM PERFORMANCE REQUIREMENTS, AUDIO-VISUAL SYSTEM

- A. Using the listed test equipment, document that the installed systems meet or exceed the performance standards below.
- B. Audio Playback and Sound Reinforcement Systems:
 - 1. Electrical Performance; Source Input to Power Amplifier Output:
 - a. Frequency Response (Equalizer flat): +0.5 dB 30 Hz to 15 kHz.
 - b. Total Harmonic Distortion (THD): Less than 0.5%, 30 Hz to 15 kHz, +4 dBm line level.
 - c. Signal to Noise: At least 70 dB, 30 Hz to 15 kHz, referenced to input of +4 dBm.
 - d. Crosstalk: At least -60 dB, 30 Hz to 15 kHz.
 - 2. Electro/Acoustic Performance:
 - a. Uniformity of Coverage: ± 4 dBA, 5 feet above the floor.
 - b. Minimum Sound Pressure Level at Center of Target - at indicated aiming point, down centerline of device. 83 dBA, 5 feet above the floor.
 - 3. Equipment: Specified individually.
 - 4. Audio Signal Path: Shall not degrade performance of connected equipment.

- C. Video Systems:
 - 1. Video Signal System: NTSC to EIA RS-170A, except as noted.
 - 2. Video Signal Path: To EIA RS-250B short haul where equalized, otherwise to the performance limit of the specified video cable.
- D. RGBS Video Systems:
 - 1. Video Signal: Pass 300 Hz to 120 MHz sine wave from any input to any output with losses of less than 1 dB over cable loss at cable manufacturer specified performance points without amplification.
- E. Projection and Display Systems:
 - 1. Consistent with performance of specified displays, projectors and screens.
 - 2. Brightness, convergence per ANSI standard procedures for device.
- F. High-bandwidth Digital Content Protection (HDCP) check
 - 1. At spaces with HDMI transmission:
 - a. Run HDCP check to ensure all devices are HDCP compliant.
 - b. Test with sample source device with quantity of HDCP keys as required to operate by the system.

1.9 TRAINING

- A. Conduct training on completed system at reasonable convenience of the District during normal business hours.
- B. Operator Training: Sixteen (16) hours.
- C. Initial Use Support: Provide standby trainer/system engineer during two (2) system uses, each not to exceed four (4) hours of training.

1.10 DEFINITIONS

- A. Definitions of Terms: The following definitions and conditions apply to each of the respective parameters and the measurements of those parameters, unless specifically stated otherwise:
 - 1. Frequency Response: The minimum acceptable frequency band over which the amplitude response is within 3 dB (or any specified range), or the specified limits of the response relative to the reference frequency (1 kHz for audio, 1.0 MHz for video) under design load conditions, at any operating level up to and including the specified maximum output while fully in compliance with all other performance specifications.
 - 2. Maximum Output Level: The minimum acceptable maximum signal output level (voltage, current or power) attained under design load conditions attained while fully in compliance with all other performance specifications.
 - 3. Harmonic Distortion: The maximum acceptable harmonic distortion measured at any operating level, up to and including the specified maximum output, with an applied sine wave signal of any frequency in the range of the specified frequency response.
 - 4. Audio Intermodulation Distortion: The maximum acceptable intermodulation distortion resulting from the introduction of 60 Hz and 7 kHz signals in a ratio of 4:1 under design load conditions at any operating level up to and including the specified maximum output level.

5. Signal to Noise Ratio: The minimum acceptable ratio of signal to noise levels derived from broadband measurements under design load at maximum output over the entire range of the specified frequency response.
 6. Clipping Level: The minimum acceptable maximum level of signal applied to the device under design load conditions while fully in compliance with all other performance specifications.
 7. Sensitivity: The maximum acceptable level of input signal applied to the device that is necessary to provide the maximum output under design load conditions.
 8. Design Load: The load (in ohms) specified by usage of the particular device input or output.
 9. Composite Triple Beat Ratio: The ratio of visual carrier level to composite third order distortion products.
 10. Cross Modulation Ratio: The ratio of visual carrier level to coherent spurious signal level (i.e. intermodulation products).
 11. Carrier to Noise Ratio: The ratio of visual carrier to noise levels derived from broadband measurements under design load at maximum output over the entire range of the specified frequency response.
- B. Signal Levels: The following voltage levels shall be considered the standard operating levels for the particular circuitry, unless specifically noted otherwise (0.775 Volt = 0 dBu = 0 dbm for a 600 ohms terminated circuit):
1. Microphone Circuits: -30 dBu or less.
 2. Audio Line Level Circuits: -30 dBu to +24 dBu; equivalent to -30 dBm to +24 dBm for a 600 ohms terminated circuit.
 3. Loudspeaker Level Circuits: More than +24 dBu.
 4. Video Line Level Circuits: 1.0 Volt, peak to peak composite signal.
 5. Radio Frequency (RF), Television (TV) Circuits: +6 to +72 dBmV (0 dBmV = 1,000 microvolts).
- C. Characteristic Impedances: The following operating impedances shall be considered to be the standard operating impedances for the particular circuitry, unless specifically noted otherwise:
1. Microphone Circuits: 50-250 ohms source, 150-1500 ohms terminating, electrostatically and electromagnetically balanced to ground.
 2. Audio Line Level Circuits: 600 ohms maximum source, 600 ohms minimum terminating, line to line, electrostatically and electromagnetically balanced to ground.
 3. Video Line Level Circuits: 75 ohms maximum source, 75 ohms minimum terminating to shield and signal ground, with Vertical Standing Wave Ratio (VSWR) not to exceed 1.2.
 4. Radio Frequency (RF) Television Circuits: 75 ohms nominal to shield and signal ground, with Vertical Standing Wave Ratio (VSWR) not to exceed 1.2.

1.11 SOFTWARE LICENSING

- A. Provide licensing for project specific software programming at programmable devices.
- B. Provide licensing and original software copies for each device provided under Work of this Section that uses software for operation, configuration or control.
 1. Provide licensing for required workstation operating systems, and required third party software.
 2. For the Control System, provide a complete copy of the source code, including the device interface driver code modules.
- C. Upgrade each software package to the release in effect at the end of the Warranty Period.

PART 2 - PRODUCTS

2.1 POWER AMPLIFIERS AND RELATED

- A. Power Amplifiers, General
1. Drawing Symbol: PA [number].
 2. Provide the following functions and/or features
 - a. Employ solid state devices (integrated circuits and/or transistors) throughout and employ positive protection of circuit components.
 - b. With amplifier input driven 10 dB beyond input level required to produce full rated output, amplifier shall withstand for at least 15 seconds any of the following load conditions without instability or operation of main over current protection (i.e. no blown fuses or circuit breakers).
 - i. "Short" circuit of 0.1 ohm.
 - ii. Open circuit (no load).
 - iii. Standard Reactive Load: 5.4 ohms in series with the parallel combination of 12.5 microhenrys; 800 microfarads and 18.3 ohms resistive.
 - c. Peak voltage of turn-on and/or turn-off transients not greater than 20 dB below maximum rated amplifier output.
 - i. Time duration of transients not to exceed 3 seconds.
 - d. Input level controls for each output channel to be calibrated, stepped attenuators with at least 50 dB range.
 - i. For 0 to 34 dB of attenuation, steps not to be greater than 2.0 dB.
 - ii. Attenuators to track calibration within 0.5 dB.
 - iii. Stepped attenuators are not required at Power Amplifiers where the connected driving source device includes a precision attenuator under digital control with precision not less than that specified herein.
 - e. Input Connectors: XLR connector or tip sleeve (standard) phone jack or barrier strip.
 - f. Output Connectors: Standard 0.75 inch spacing "5-way" binding posts, or barrier strip.
 - g. Where integral cooling fans are provided, such fans shall have a minimum life rating of 50,000 hours at 25 degree Centigrade ambient temperature.
 - h. Where indicated, provide balanced input, differential or transformer. Provide matching accessory to implement if not a standard feature of the product provided.
 - i. Listed by a Nationally Recognized Testing Laboratory.
 3. Minimum performance requirements with all channels driven
 - a. Power Output Per Channel: As scheduled on Drawings as Minimum Amplifier (Min Amp) and specified below; continuous average sine wave power into 70 Volt line over a bandwidth of 40 Hz to 20 kHz.
 - i. Frequency Response: plus 0 dB, minus 0.5 dB, 40 Hz to 20 kHz at rated output.
 - ii. Total Harmonic Distortion: Less than 0.25 percent at rated output, 40 Hz to 20 kHz.
 - iii. Intermodulation Distortion: Less than 0.04 percent at rated output using frequencies of 60 Hz and 7 kHz, mixed in a ratio of 4:1.
 - iv. Input Impedance: 15,000 ohms minimum; unbalanced, or balanced as shown on drawings.
 - v. Hum & Noise: At least 94 dB signal-to-noise ratio.
 - vi. Channel Separation: At least 75 dB at 1 kHz.

- vii. Phase Shift: Less than plus20 degrees from 20 Hz to 20 kHz.
- viii. D.C. Offset: Less than 10 millivolts.

B. Power Amplifiers, 2 Channel, Low Impedance

1. Drawing Symbols
 - a. PA 25
 - b. PA100
 - c. PA200
 - d. PA300
2. Comply with Power Amplifiers, General, in this Section.
3. Power Output Per Channel, continuous average sine wave power into 8 ohm voice coil impedance, not less than:
 - a. PA25, 25 Watts
 - b. PA100, 100 Watts
 - c. PA200, 200 Watts
 - d. PA300, 275 Watts
4. Dimensions
 - a. PA 25, not to exceed 1 rack unit for 2 channels.
 - b. PA100, PA200 and PA300, not to exceed 3 rack units for 2 channels.
5. Manufacturer, PA25
 - a. Crown D-45
 - b. Stewart Electronics
 - c. Or equal
6. Manufacturer, PA100
 - a. Crown CL1
 - b. Crown Cdi in low impedance mode.
 - c. QSC
 - d. Stewart Electronics
 - e. Electro-Voice
 - f. Peavey
 - g. Or equal
7. Manufacturer, PA200
 - a. Crown CL1
 - b. Crown Cdi in low impedance mode.
 - c. QSC
 - d. Stewart Electronics
 - e. Electro-Voice
 - f. Peavey
 - g. Or equal
8. Manufacturer, PA300
 - a. Crown CL1
 - b. Crown Cdi in low impedance mode.
 - c. QSC
 - d. Stewart Electronics
 - e. Electro-Voice
 - f. Peavey
 - g. Or equal

C. Power Amplifiers, 2 Channel, 70 Volt

1. Drawing Symbol
 - a. PA50-70
 - b. PA100-70
 - c. PA200-70
 - d. PA300-70
 - e. PA600-70
2. Comply with Power Amplifiers, General, in this Section.
3. Power Output Per Channel, continuous average sine wave power into 70 Volt line impedance, not less than.
 - a. PA50-70, 50 Watts
 - b. PA100-70, 100 Watts
 - c. PA200-70, 200 Watts
 - d. PA300-70, 300 Watts
 - e. PA600-70, 600 Watts
4. Dimensions: Not to exceed 3 rack units for 2 channels.
 - a. Manufacturer, PA50-70
 - i. Stewart CVA-50-1
 - ii. Crown
 - iii. QSC
 - iv. Peavey
 - v. Or equal
 - b. Manufacturer, PA100-70
 - i. Crown CH-1
 - ii. QSC
 - iii. Peavey
 - iv. Or equal
 - c. Manufacturer, PA200-70
 - i. Crown CH-1
 - ii. QSC
 - iii. Peavey
 - iv. Or equal
 - d. Manufacturer, PA300-70
 - i. Crown CH-1
 - ii. QSC
 - iii. Peavey
 - iv. Or equal
 - e. Manufacturer, PA600-70
 - i. Crown CH-2
 - ii. QSC
 - iii. Peavey
 - iv. Or equal

2.2 DISTRIBUTED LOUDSPEAKER ASSEMBLIES AND RELATED

A. Distributed Loudspeakers – Ceiling, Flush-mount

1. Drawing Reference: SA

2. Complete Assembly to consist of:
 - a. Four-inch loudspeaker.
 - b. Provide integral 70V transformer, or provide bracket to attach 70 volt tap transformer specified elsewhere herein.
 - c. Nominal Diameter: Four (4) inches.
 - d. Minimum Performance:
 - i. Frequency Response, on-axis: +/-4 dB, 200 Hz to 10 kHz.
 - ii. Frequency Response, 45 degrees off-axis: Within 10 dB envelope of centerline of on-axis, 200 Hz to 5 kHz.
 - iii. Pressure Sensitivity: Not less than 92 dB 1 Watt/4 foot.
 3. Manufacturers:
 - a. Atlas FC 104-T87.
 - b. JBL Control series
 - c. AMK Innovations CX 402.
 - d. Lowell JR410T70
 - e. Or equal.
- B. Compact Package 2-way Program Audio Speakers
1. Drawing Reference: SP
 2. General:
 - a. Two-way speaker system, including
 - i. Point source time-coherent driver system, or
 - ii. 6-1/2" Woofer and 1" Softdome HF driver
 - b. Minimum Features, Functions, Performance:
 - i. Frequency Response, on axis: 80Hz to 16kHz + 2.5dB
 - ii. Power Handling Capacity: 100 watts rms, as per EIA RS-426-A.
 - iii. Pressure Sensitivity: Not less than 90 dB at 1M with 1 watt from 100Hz to 10kHz.
 - iv. Nominal Impedance: 4-8 ohms
 - v. Dispersion: 120 degrees horizontal, 120 degrees vertical nominal 6dB down at 2 kHz.
 - c. Construction:
 - i. Maximum Dimensions: 9" (H) x 6" (W) x 5" (D)
 - ii. Maximum Weight: 6 lbs.
 - iii. Integral anchorage for mounting hardware.
 - iv. All direction adjustable anchorage.
 - v. Black or White Plastic enclosure, black or white painted grill. Color selected by City's Representative.
 3. Manufacturers:
 - a. JBL Control 25 with Omnimount 60 WB mount.
 - b. Tannoy T8 or i7 Contour with Omnimount 60 WB mount.
 - c. Cambridge Sound Newton Series M60 or M80 with Omnimount 60 WB mount.
 - d. QSC Audio
 - e. Or equal.

2.3 ASSISTIVE LISTENING SYSTEM (ALS):

- A. General
 1. Provide Radio Frequency Type, Frequency Modulated

2. 72 MHz Assistive Listening band.
 3. Quantity of Devices:
- B. ALS Transmitter
1. Drawing Symbol: ALS TX
 2. Features
 - a. Balanced bridging line input.
 - b. Rack mounted.
 - c. Connector for remote-mounted antenna.
 - d. Selectable transmitting frequency.
 3. Manufacturer
 - a. Listen Technologies LT-800-072 Stationary Transmitter with LA-326 Rack Mounting Kit
 - b. Phonic Ear
 - c. Williams Sound Corp
 - d. Or equal.
- C. ALS Remote Transmitting Antenna
1. Drawing Symbol: A
 2. Features
 - a. Antenna system with mounting hardware, matching specified ALS TX.
 3. Manufacturer
 - a. Listen Technologies LA-123
 - b. Phonic Ear
 - c. Williams Sound Corp
 - d. Or equal.
- D. Receivers and Accessories
1. Receiver
 - a. Battery powered, rechargeable.
 - b. Volume control.
 - c. Receptacle for earphone/accessory.
 - d. Rechargeable battery.
 - e. Tuneable to channel in use by the user.
 - f. Quantity: As Scheduled on the plans
 2. Earphone
 - a. Ear hung, not inserted in the ear canal.
 - b. Hearing-Aid Compatible - For hearing-aid compatible receivers:
 - c. Wireless neck loop compatible with "T" coil hearing aids.
 - d. Built-in antenna
 - e. Operates with provided receivers
 3. Manufacturer
 - a. Listen Technologies LR-500-072-0-M-C, LA-164 earphones, and LA-166 neck loops
 - b. Phonic Ear
 - c. Williams Sound Corp
 - d. Or equal.
- E. Battery Charger/Storage/Carry Case
1. Features

- a. Store and charge up to 16 Receivers and related accessories.
- b. Cover, latches and carrying handles.
- c. Removable lid.
2. Quantity: To simultaneously recharge each received as scheduled on the plans
 - a. Manufacturer
 - b. Listen Technologies LA-325
 - c. Phonic Ear
 - d. Williams Sound Corp
 - e. Or equal.

2.4 AUDIO SIGNAL SOURCE AND STORAGE:

A. Microphone, Gooseneck, Top-set with Switch

1. Drawing Reference: GMIC
2. Features/Functions:
 - a. Gooseneck integrated microphone with desktop base with integrated programmable switch and indicator.
 - b. Element: Cardioid condenser.
 - c. Frequency response: +/- 3 dB, 80 Hz to 15,000 Hz
 - d. Output impedance 200 Ohms or less.
 - e. Total harmonic distortion: Less than 3% at 110 dB SPL.
 - f. Output level (Open circuit Voltage at 1,000 Hz): at least -78.0 dB (0dB= 1 V/microbar).
 - g. Maximum SPL: 120 dB.
 - h. Signal to noise ratio: 65 dB at 1 kHz at 94 dB SPL.
 - i. Power: Phantom (Simplex) 12 to 48 VDC operating range.
 - j. Windscreen: Foam or metal and foam.
 - k. Gooseneck: Flexible, miniature. Stiff center section, flexible both ends.
 - l. LED indicator: On when microphone is on.
 - m. Connector: 5 pin circular audio connector, male, on 10 foot cable.
 - n. Finish: Flat black.
 - o. Length: Approximately 18 inches overall
 - p. Base: Weighted desktop base.
 - q. Switch: Membrane switch, programmable function. Configure for push on/push off function.
3. Manufacturer
 - a. Shure MX418D/C and accessory mic cable (black).
 - b. AudioTechnica ES915C18 Gooseneck Microphone with AT8666RSC Base and accessory mic
 - c. Or equal.

B. Microphone, Ceiling Microphone Array

1. Drawing Reference: CM, CMIC, CMICPROC
2. Features:
 - a. Lay-in Ceiling 2x2 tile format
 - b. Beam-forming microphone pickup pattern

- c. Dedicated microphone processor with audio line output
 3. Manufacturer:
 - a. Sennheiser SL Ceiling Microphone with TeamConnect CB & CU1 Processor and Control units.
 - b. Shure.
 - c. Or equal
 - B. Digital Signal Processing (DSP) System
 1. Drawing Symbol(s): DSP
 2. Function/Features:
 - a. Implement functions shown on Drawings using Digital Signal Processing (DSP) hardware and software.
 - b. System implements in software at least the following functions as indicated on the plans:
 - i. AMIX - automatic microphone mixer - MIC and LINE INPUTS as indicated
 - ii. REMOTE - Remote power on/off, gain control, auxiliary mixer select, System Mode - controlled through interface to Control System specified elsewhere in this Section.
 - iii. DELAY - multi-channel delay, output quantity as indicated with 0-100 ms delay assignable to each output on selection of delay mode operation.
 - iv. LEVEL - Gain control under control of REMOTE
 - v. X02WAY 24dB - Crossover network, 2 port, 24 dB/octave
 - vi. HP - High Pass Filter
 - vii. LIM - Limiter
 - viii. SHELF - Shelving Filter
 - ix. FBX - Automatic Feedback Suppressor
 - x. PEQ* - Parametric Equalizer, where * indicates bands provided
 - xi. MIX* - Mixer, where * indicates channel count
 - xii. LP - Low pass filter
 - c. Field reconfigurable functions and parameters.
 - d. Performance:
 - i. Sample at 48 kHz or greater.
 - ii. At least 20 bit input/output quantization.
 - iii. Noise performance within 3 dB of theoretical limit.
 - iv. Minimum of 24 bit internal processing.
 - v. Provide control with true status feedback.
 - e. Priority volume attenuator implemented as indicated on the drawings/specification narrative.
 3. Manufacturer - DSP System
 - a. QSYS 113f
 - b. Symetrix Prism
 - c. BSS
 - d. Or equal.

C. Boundary Microphone, Table-top, Conferencing

1. Drawing Reference: BMIC (note "BMIC PROC" microphone processor may be omitted for products that do not require it)
2. Manufacturer:
 - a. MXL AC-404-Z
 - b. Shure
 - c. Or equal.

D. Radio Frequency Receiver/Wireless Microphone System:

1. Drawing Reference(s):
 - a. WMRX
 - b. WMIC LAV - Wireless Mic, Lavalier
 - c. Wireless microphone symbol.
2. Provide quantity of complete systems to match quantity of WMIC LAV microphone symbols shown.
 - a. Coordinate operating frequency with other UHF local sources, including but not limited to current television operating frequencies and DTV frequency allocations and/or local public safety operating frequencies to eliminate any interference from outside RF sources.
 - b. Provide Receiver unit configured for diversity reception.
 - c. Allows the expansion of wireless microphone systems by splitting one pair of antennas to multiple receivers. It also amplifies RF signals to compensate for insertion loss that results from splitting signal power to multiple outputs. A single system can support up to four wireless receivers.
3. Function/Features/Performance:
 - a. WMRX/WMIC LAV
 - i. Operating Range Under Typical Conditions: 100m (300 ft.) Note: actual range depends on RF signal absorption, reflection, and interference.
 - ii. Audio Frequency Response (+/- 2 dB): Minimum: 45 Hz; Maximum: 15 kHz
 - iii. Total Harmonic Distortion (ref. +/- 38 kHz deviation, 1 kHz tone): 0.5%, typical
 - iv. Dynamic Range: >100 dB A-weighted
 - v. Operating Temperature Range: -18°C (0°F) to +57°C (+135°F)
Note: battery characteristics may limit this range
 - vi. Transmitter Audio Polarity: Positive pressure on microphone diaphragm (or positive voltage applied to tip of WA302 phone plug) produces positive voltage on pin 2 (with respect to pin 3 of low impedance output) and the tip of the high impedance 1/4-inch output.
4. Manufacturer, WMIC LAV System:
 - a. Shure QLXD24/SM58 Digital Wireless Handheld System w/ SM58 Cartridge, Shure QLXD14 Bodypack System, and Shure WCE6T Omnidirectional Condenser Rigid Earset Microphone, tan.

- b. Or equal.
- E. Audio-deembedder
 - 1. Drawing Reference: ADE
 - 2. Manufacturer:
 - a. C2G CG40695
 - b. Extron
 - c. Or equal
- F. 1x2 Audio Distribution Amplifier
 - 1. Drawing Reference: ADA2
 - 2. Manufacturer:
 - a. RDL ST-DA3
 - b. Or equal

2.5 CONTROL SYSTEM, SWITCHING AND RELATED

A. General

- 1. Products provide under this Section shall be made by manufacturers regularly engaged in the production of programmable commercial audio-visual control systems. Such manufacturers shall have at least 5 years prior production experience in the manufacture of such goods.
- 2. Provide control system to perform functions scheduled on drawings and herein.
 - a. System to be field programmable.
 - b. Provide programming allowance to implement system as required to provide the functionality indicated herein and as defined by the City during design and construction phase meetings, including closely matching the user interface of the existing control panels used elsewhere at the City in style, color and organization to the extent directed by the City's Representative.
- 3. In addition to providing programming to meet the requirements outlined in part one of this specification section and as outlined by the City during the reconstruction programming meetings, Contractor to provide an allowance of up to \$6000 to implement new functions in the audiovisual systems programming identified by the City after the substantial completion of this project. Allowance may not be expended by the Contractor in completing the base bid scope of work including Warranty defect items.

B. Control Processor

- 1. Drawing References:
 - a. Control3
 - b. CBlock
 - c. Control PS - A/V Net power supply
- 2. Features/Functions/Performance:

- a. Control System shall utilize a processor at no less that of sufficient capacity to provide the indicated control functions without degradation due to system overload.
- b. I/O Ports:
 - i. At least 3 RS-232/422/485 Ports.
 - ii. At least 8 IR/Serial Ports.
 - iii. At least 8 Isolated Relay Ports
 - iv. At least 8 I/O Ports.
 - v. At least 1 Port for the control system manufacturer's proprietary A/V network.
 - vi. At least 1 TCP/IP Ethernet Network connection via an RJ-45 connector.
- c. Control System shall be fully compatible with the control system manufacturer's projector and A/V equipment status monitoring and
- d. management software.
- e. Control System shall include a 10/100 BaseT Ethernet Port that supports
- f. all of the following features:
 - i. TCP/IP Communications
 - ii. DHCP and DNS Support
 - iii. IEEE 802.11b and Bluetooth Compatibility
 - iv. Native Email Client
 - v. Remote Diagnostics
 - vi. Remote Program Loading and Administration
 - vii. Built-In Web Server
 - viii. FAT32 File System for easy data management
 - ix. SSL security plug-in
 - x. PDA Integration and Control, XPanel PDA - Pocket PC 2002
 - xi. WebTablet Integration and Control – Microsoft Tablet PC
 - xii. Self Generating Executable GUI, XPanel EXE – Microsoft Family of Operating Systems
 - xiii. Self Generating ActiveX powered Microsoft Internet Explorer Integration and Control, XPanel Microsoft Internet Explorer.
 - xiv. Self Generating Java powered Web Integration and Control
- g. Control System Processor shall utilize a real time, event driven, multitasking, multi-threaded operating system with a dual bus architecture.
- h. High speed processor shall communicate directly with Ethernet, control
- i. ports and proprietary control network utilizing high-speed, parallel bus
- j. infrastructure. Control processors that communicate via a serial bus shall
- k. not be accepted.
- l. Control processor shall contain sufficient memory for the applications indicated.
- m. Control System processor shall utilize a FAT32 file structure.
- n. Control System shall support internal communications speed via two, independent communications busses. First control bus speed shall be at least 40 mb/s, second control bus speed shall be at least 300 mb/s.

- o. Full API (Applications Interface) directly to control system via TCP/IP for integration with Visual Basic, C++, Java, etc. applications. API support through included control system manufacturer's ActiveX modules and/or their Dynamic Link Library (.DLL) file.
 - p. Control system manufacturer's to continuously monitor the integrity of the A/V control network for wiring faults, marginal communication
 - q. performance, network errors – all information is viewable.
 - r. System Support RS-485 token passing network with data communication for a minimum distance of 5000 feet.
 - s. Allow proprietary A/V Network network expansion via Ethernet or RS-232 ports, which can allow for high-speed network acceleration.
 - t. Support a minimum of 253 proprietary network devices simultaneously.
 - u. Control system shall support object-oriented logic based programming
 - v. language and a C-like language programming language. Both programming types are supported to run simultaneously and integral to
 - w. each other.
 - x. System shall supply Windows-based graphical
 - y. programming software for drag and drop object oriented programming for the control system operation.
 - z. System shall provide Windows-based graphical programming software, which is self-documenting in that it generates a symbolic flow diagram printout from the system program.
 - aa. The control system shall support a variety of wireless communication modes, including one-way and two-way radio frequency and infrared transmission.
 3. Provide supplemental AV Network power supplies and network segmentation (C Block) as necessary to conform with the manufacturer's recommendations for the total number of connected devices.
 4. Manufacturers:
 - a. Crestron Series 3 or CP2E with I/O expanders as required to match indicated functionality, CNTBLOCK and CNPWS-75 power supplies as required. Provide options and software kit as necessary to enable manufacturers XPanel IE functionality at clinicians desktops, and at desktop of of designated clinical lab administrative support personnel.
 - b. AMX
 - c. Extron
 - d. Or equal.
 - C. A/V Net distribution block
 1. Drawing Reference: CBLOCK
 2. Function/Features/Performance:
 - a. Parallel distribution block for termination of multiple 4-wire A/V net cables
 - b. NET 1 – 8: (8) 4-pin 3.5mm detachable terminal blocks

- c. Enclosure: Steel, black matte powder coat finish, surface mount box with (2) integral mounting flanges
 3. Manufacturers
 - a. Crestron CNTBLOCK
 - b. Extron
 - c. AMX
 - d. Or equal.
- D. Control Panel with integral processor and serial port, Hardwired, Module Style
 1. Drawing References: CBP
 2. Features:
 - a. Wall mount pushbutton control panel
 - b. Programmable buttons to accommodate control of a device's:
 - i. Power On and Off
 - ii. Volume Up and Down
 - iii. Source Select Toggle
 - (1) Multiple pushes of a single button switches between controlled device's input sources
 - c. Communication: RS232
 - d. 1-gang, Decora wall-mountable
 3. Manufacturer:
 - a. SP Controls PixiePlus PXE-DCM+
 - b. Crestron BPC-8
 - c. RTI
 - d. or equal
- E. Control Panels, Touch, 7" Diagonal, Topset (CTP), Wallmount (CTW)
 1. Drawing Reference: CTP/CTW
 2. Features/Functions
 - a. Touchscreen Display
 - i. Display Type TFT Active matrix color LCD
 - ii. Size 7 inch (178 mm) diagonal
 - iii. Aspect Ratio 15:9 WVGA
 - iv. Resolution 1024 x 600 pixels
 - v. Brightness 350 nits (cd/m²)
 - vi. Contrast 1100:1
 - vii. Color Depth 24-bit, 16.7M color
 - viii. Illumination Edgelit LED
 - ix. Viewing Angle $\pm 80^\circ$ horizontal, $\pm 80^\circ$ vertical
 - x. Touchscreen: Protected Capacitive, 5-point multi-touch capable
 - b. Graphics Engine: Crestron Smart Graphics, multi-language web browser, multi-language on-screen keyboard, screensaver, single scalable streaming video window.
 - c. Communications

- i. 10/100 Mbps, auto-switching, auto-negotiating, auto-discovery, full/half duplex, TCP/IP, UDP/IP, CIP, DHCP, SSL, TLS, SSH, SFTP (SSH File Transfer Protocol), IEEE 802.1X, SNMP, IPv4 or IPv6, IEEE 802.3af and 802.3at Type 1 compliant.
 - ii. USB 2.0 Type A (for future use)
 - iii. 8-pin RJ45 with 2 LED indicators; 10Base-T/100Base-TX Ethernet port, Power over Ethernet compliant; Green and yellow LEDs indicate Ethernet port status
 - iv. IEEE 802.3at Type 1 (802.3af compatible) Class 3 (12.95 W) PoE Powered Device
 - d. Enclosure
 - i. Plastic, smooth black or white finish, edge-to-edge glass with black or white surround 8"H x 11"W x 7"D
 - ii. Submit color choice for selection by City representative.
 3. Manufacturers
 - a. Crestron TSW-760 w/ table-top kit (CTP) or wall-mount kit (CTW)
 - b. Extron
 - c. AMX
 - d. Or equal.
- F. 100 Base-T Control LAN Ethernet Switch
 1. Drawing References: NSW/NSW24
 2. Port Count:
 - a. As Required plus at least 3 spare
 3. Features/Functions/Performance:
 - a. RJ-45 10/100Base-TX ports (IEEE 802.3 Type 10Base-T; 802.3u Type 100Base-TX) ports.
 - b. Each port can automatically provide 10 or 100 MBps Ethernet Layer 2 switching.
 - c. Each port can automatically sense maximum connection speed of attached device (10 or 100 MBps) and its ability to support full or half duplex connectivity and respond (auto-sensing) .
 - d. Performance - at least:
 - i. throughput: 1 million pps (64-byte packets)
 - ii. address table size: 2,000 entries
 - e. Communications - provides full support for the following standards:
 - i. IEEE 802.1p Priority;
 - ii. IEEE 802.1D Spanning Tree;
 - iii. IEEE 802.1Q VLANs;
 - iv. IEEE 802.3x Flow Control
 - f. Management - Provide at least:
 - i. SNMPv1/v2c

- g. Environmental - can operate normally within at the following range of conditions:
 - i. operating temperature: 0 degrees C to 55 degrees C (32 degrees F to 131 degrees F)
 - ii. relative humidity: 15 to 95% @ 40 degrees C (104 degrees F), non-condensing
 - h. Provides port filtering by MAC address.
 - i. Automatic shutdown of ports detecting jabber
 - j. Status lights indicating at least port activity on each port.
4. Construction.
- a. 1 Rack Unit maximum per 12 ports provided.
 - b. Provide accessories as required to rack mount.
5. Manufacturers:
- a. Netgear
 - b. DLink
 - c. Hewlett Packard
 - d. Cisco Systems
 - e. Or equal.

2.6 VIDEO SYSTEMS AND RELATED

A. General

- 1. Products provide under this Section shall be made by manufacturers regularly engaged in the production of programmable commercial audio-visual control systems. Such manufacturers shall have at least 5 years prior production experience in the manufacture of such goods.
- 2. Provide control system to perform functions scheduled on drawings and herein.
 - a. System to be field programmable.
 - b. Provide programming allowance to implement system as defined in Part 1 and as modified by Owner prior to first use. Provide an additional \$2,000 to implement system operation enhancements determined by Owner following first use.

B. Crestron Zoom Conferencing Hub

- 1. Drawing Reference: HUB
- 2. Manufacturer:
 - a. Crestron UC-100-BKT-ASSY
 - b. No known equal.

C. Integrated Conferencing Soundbar Speaker/Microphone/Camera

- 1. Drawing Reference: CONFSBS
- 2. Manufacturer:
 - a. Crestron Flex UC-B140-Z
 - b. No known equal.

D. Camera Controller

- 1. Drawing Reference: CAMCTL
- 2. Function/Features:
 - a. Capacity to provide PTZ control for up to (2) cameras.
- 3. Manufacturer:
 - a. Datavideo RC-190
 - b. Or equal.

- E. USB Web-Conferencing Camera, wallmount
 - 1. Drawing Reference: CCAM
 - 2. Manufacturer
 - a. Huddly IQ
 - b. Or equal

- F. Rack-mounted Network-accessible Solid-State HD Video Recorder/Archiver/Streamer
 - 1. Drawing Reference: NVR
 - 2. Features/Functions/Performance:
 - a. Video Input: 1080i 25, 29.97, 30, 1080PsF 23.98, 24, 25*, 29.97*, 1080p 23.98, 24, 25, 29.97, 720p 23.98*, 25*, 29.97*, 50, 59.94, 60, 625i 25, 525i 29.97.
 - b. Codec Support: Apple ProRes 422, Apple ProRes 422 (HQ), Apple ProRes 422 (LT), Apple ProRes 422 (Proxy), Avid DNxHD HOX (220x), Avid DNxHD SQ (145), Avid DNxHD LD (36) only provides support for the 1080p format.
 - c. Removable Storage: 2-slots w/ rollover recording.
 - d. Video Input Digital: SD/HD SDI, SMPTE-259/292/296, 10-bit, Single Link 4:2:2 (2 x BNC, input selection in software), HDMI v1.3
 - e. Video Output Digital: SD/HD SDI, SMPTE-259/292/296, 10-bit, Single Link 4:2:2 (1 x BNC), HDMI v1.3
 - f. Audio Input Digital: 8-Channel, 24-bit SMPTE-272/299 SDI embedded audio, 48 kHz sample rate, synchronous; 8-Channel, 24-bit HDMI embedded audio, 48 kHz sample rate, synchronous; 8-Channel, 24-bit AES/EBU audio, 48 kHz sample rate, synchronous or nonsynchronous, internal sample rate conversion (4 x BNC)
 - g. Audio Input Analog: 2-Channel, 24-bit A/D analog audio, 48 kHz sample rate, balanced (2 x XLR); +24 dBu full scale digital; +/- 0.2 dB 20Hz to 20 kHz frequency response (Note: Line or Mic selection via CONFIG menu parameters)
 - h. Audio Output Digital: 8-Channel, 24-bit SMPTE-272/299 SDI embedded audio, 48 kHz sample rate, synchronous; 8-Channel, 24-bit HDMI embedded audio, 48 kHz sample rate, synchronous; 8-Channel, 24-bit AES/EBU audio, synchronous or nonsynchronous, internal sample rate conversion (4 x BNC)
 - i. Audio Output Analog: 2-Channel, 24-bit D/A analog audio, 48 kHz sample rate, balanced (2 x XLR); +24 dBu full scale digital (0dbFS); +/- 0.2 dB 20 Hz to 20 kHz frequency response; Stereo unbalanced headphone (1 x 3.5mm mini jack)
 - j. Timecode: SDI RP188/SMPTE 12M via SDI BNC; HDMI (when used with compatible cameras); LTC Input (1 x BNC); LTC output (1 x BNC) (Note: active during playback not during record or EE)
 - k. RS-422 Machine Control
 - l. 1 RU
 - 3. Manufacturer:
 - a. Leightronix Ultranexus HD 5TB
 - b. Aja Ki Pro Rack
 - c. Or equal.

- G. HDMI Routing Switcher, with Signal Transport and Up-Conversion
 - 1. Drawing References: AVSW8x8, AVSW16x16, AVSW32x32
 - a. At AVSW Switchers the designation IxO, where I is 8, 16 or 32 and O is 8, 16, 32, the values of I and O indicate the minimum number of input and output ports to be provided

respectively.

2. General
 - a. Provide and install as indicated on the drawing an HD Content Point-to-Point Transport System.
 - b. The HD Digital Transport and Distribution System shall include providing and integrating the following principal systems:
 - i. Audio/Video switching.
 - ii. Audio/Video distribution at native resolution without compression.
 - iii. Video interface equipment.
 - iv. Audio interface equipment.
 - v. HDMI signal transport.
 - vi. HDMI 1.3 support.
 - vii. Deep Color support.
 - viii. Resolution management.
 - ix. HDCP key handling/management.
 - x. EDID management.
 - xi. Fast HDMI switching with keep alive HDCP link.
 - xii. Multi-Channel Surround Sound Audio.
 - xiii. Digital diagnostic tools
 - c. Audio & Video Switching
 - i. The AV switching system shall support at least 6.75Gbps of data transfer on each input and output to support 1080p 36-bit (Deep) Color video resolutions without compression.
 - ii. The AV switching system shall support 8 channel audio.
 - iii. The AV switching system shall support audio breakaway from video.
 - iv. The AV switching system shall have less than 5 μ s of latency from AV input to AV output.
 - v. The AV switching system shall support the HDMI specification of less than 1 in 1x10⁹ bit errors at 1080p 36-bit (Deep) Color.
 - vi. The AV switching system shall downmix multi-channel audio into 2-channel audio so that the same audio content may be routed to both multi-channel and 2-channel sinks.
 - vii. The AV switching system shall be able to dither between standard and deep color video signals on each input and output.
 - viii. The AV switching system shall support the following AV signal inputs:
 - (1) HDMI 1.3a (High Definition MultiMedia Interface)
 - (2) DVI 1.1 (Digital Visual Interface)
 - (3) DisplayPort Multimode 1.1
 - (4) Analog RGB
 - (5) YPbPr
 - (6) S-Video

- (7) CVBS
 - (8) SPDIF
 - (9) Analog Stereo Audio
 - ix. The AV switching system shall transcode the AV signals to a single signal type for distribution.
- d. Audio Video Distribution
- i. The AV distribution system shall use multimode fiber or shielded twisted pair for AV signal distribution.
 - ii. The AV distribution system shall route AV signals from any input to any output with less than 1ms of latency.
 - iii. The twisted pair structured cabling used to carry the AV signals shall be shielded.
 - iv. The twisted pair structured cabling used to carry the AV signals shall be specified to 1.2GHz of bandwidth or greater.
 - v. The AV distribution system shall not require extra cabling to transmit the following control signals for AV sources and sinks:
 - (1) RS-232
 - (2) Infrared
 - (3) Ethernet
 - (4) USB Human Interface Device-class devices
 - (5) Contact closure
- e. EDID Management
- i. The AV switching system shall allow configuration of the EDID presented to sources on each AV input.
 - ii. Each input on the AV switching system shall be configured independently.
 - iii. The AV switching system shall by default present an EDID to each input that includes only the video timings and audio formats common all sinks connected to the outputs.
 - iv. The AV switching system shall allow the user to enter each input's EDID video timings individually.
 - v. The AV switching system shall allow the user to enable and disable support for the following items in each input's EDID.
 - (1) Deep color
 - (2) 3D support

- f. HDCP Management
 - i. The AV switching system shall support HDCP 1.1 or greater.
 - ii. The AV switching system shall detect the number of KSVs supported by each source. A KSV is commonly called an HDCP 'key'. A unique ID for each HDMI sink that must be sent to HDCP-enabled sources in order for the sinks to receive content.
 - iii. The AV switching system shall not send a source more KSVs than it supports.
 - iv. The AV switching system shall cache the KSVs from each connected sink.
 - v. The AV switching system shall authenticate all cached KSVs with each source up to the source's KSV limit, so that authentication does not need to be re-started each time content is routed to a new output.
- g. Signal Detection
 - i. The AV switching system shall report the following incoming signal information to an AV control system:
 - (1) Signal detect
 - (2) Horizontal and vertical resolution
 - (3) Signal refresh rate
 - (4) Presence of HDCP
 - ii. The AV switching system shall report the following information to an AV control system:
 - (1) HDCP authentication status for each source and sink
 - (2) EDID Preferred video timing for each sink
 - (3) Maximum number of KSVs supported by each source
- h. Troubleshooting
 - i. The AV switching system shall report the following information for troubleshooting:
 - (1) Maximum number of KSVs supported by each source
 - (2) The number of KSVs sent to each source
 - (3) EDID indicated Video timings and audio formats supported for each sink
 - (4) EDID presented to each source
 - ii. The AV switching system shall support off-site remote troubleshooting via Ethernet
- i. HD Digital Transport and Distribution System
 - i. The HD Digital Transport and Distribution System operate as part of a larger matrix switching system.
 - ii. HD Source/Sink Controller
 - (1) The HD Source/Sink Controller shall provide control of connected devices (i.e. Blu-Ray Players, LCD Monitors, Projectors, etc.) when used in conjunction with an AV Network Control System. It shall support IR and RS-232/422/485 protocols, closed-contact input, low-voltage relay, and HDMI CEC (Consumer Electronics Control). No additional cabling (above the required cabling for the HD Digital Transport and Distribution System) shall be required.
 - iii. The HD Content Transport System shall be an advanced signal extender system incorporating the following features:

- (1) HD Content Transmitter.
- (2) HD Content Receiver.
- (3) UTP/STP or Fiber Optic cabling.
- (4) HDCP 1.1 support.
- (5) Fast HDMI switching.
- (6) CEC support.
- (7) Uncompressed video and audio transport.
- (8) HDMI 1.3 with Deep Color.
- (9) 7.1 channel HD lossless audio.
- (10) Video resolutions up to 1920x1200 or 1080p/60.
- (11) Advanced video detection on every video type, including resolution, frame rate and color depth.
- (12) IR and RS-232 control over local device(s) (when used with a control system by same manufacturer).
- (13) Ethernet support.
- (14) Signal transmission up to 450 feet via UTP/STP cable.
- (15) Signal transmission up to 3000 feet via fiber.

j. Transmitters

- i. The HDMI Transmitters shall be able to extend HDMI (including audio) . Where two or more signal inputs are available, the transmitter shall include integrated switcher with signal sensing. The switcher shall switch to the last detected input (when not used with a control system by the same manufacturer). The HDMI transmitter types shall be as follows:
- ii. Transmitter Type WPI
 - (1) The WPI signal transmitters shall extend HDMI video, audio, and data over a single UTP/STP cable to compatible transmission receiver modules or ports. The following source formats shall be supported:
 - (a) HDMI
 - (b) DVI-I
 - (c) RGBHV
 - (d) VGA
 - (e) YPbPr
 - (f) Y/C
 - (g) Composite
 - (h) Analog 2-channel audio
 - (i) USB HID (Human Interface Device)
 - (2) Performance. The transmitter shall meet the following minimum requirements:
 - (a) One (1) HDMI video, audio, and control input:
Supports HDMI.
Supports HDCP.

- Supports Dolby Digital, Dolby Digital EX, DTS, DTS-ES, DTS 96/24, up to 8 channel PCM.
- Supports DVI-D with adaptor.
- Supports DisplayPort Multimode.
- CEC device control.
 - (b) One (1) DB15 input:
 - Component (YPbPr)
 - RGB
 - S-Video (Y/C)
 - Composite Video
 - (c) One (1) analog stereo audio input:
 - (1) 3.5mm TRS (L/R unbalanced)
 - (d) One (1) USB HID port.
- Supports USB HID class devices
- (3) Single UTP/STP cable transmission connection
 - (a) Supports HDBaseT signal specifications.
 - (b) Supports remote power injection through matrix switcher.
 - (c) Supports CAT5e.
- (4) Signal transmission up to 330 feet.
- (5) Power supply modes:
 - (a) Remote power supplied by matrix switcher through UTP/STP transmission cable.
 - (b) Local or remote DC power source.
- (6) Mounting:
 - (a) 2-gang wall box mount.
 - (b) 2-gang floor box mount.
- iii. Transmitter/Receiver Type WPIS
 - (1) HDMI transmission, as for WPI
 - (2) RS-232 transmission through use of matched transmitter receiver pairs.
 - (3) Signal transmission up to 330 feet.
 - (4) Mounting:
 - (a) 1-gang box mount.
- iv. Transmitter Type WPIH
 - (1) HDMI transmission, as for WPI
 - (2) Signal transmission up to 330 feet.
 - (3) Mounting:
 - (a) 1-gang box mount.
- k. Receivers, Fiber

- i. The receiver shall accept the HD signal via multimode fiber and convert it to one (1) HDMI output. When used with a supported control system, the receiver shall provide local control to device(s). In addition, when used with the Matrix switcher, the receiver shall provide Ethernet connectivity to any compatible devices.
- ii. The receiver shall meet the following minimum requirements:
 - (1) HDMI 1.3 digital video/audio output.
 - (2) One (1) 19-pin Type A HDMI female connector.
 - (3) One (1) USB 1.1 port for USB HID data.
 - (4) Mouse, keyboard, game controller, or other USB HID device support.
 - (5) USB Type A female connector.
 - (6) Two (2) relays.
 - (a) 4-pin 3.5mm detachable terminal block comprising (2) normally open, isolated relays.
 - (b) Rated 1 Amp, 30 Volts AC/DC.
 - (c) MOV arc suppression across contacts.
 - (7) One (1) bidirectional RS-232 port.
 - (a) One (1) 5-pin 3.5mm detachable terminal block.
 - (b) GND, TX, RX, CTS, RTS support.
 - (c) Up to 115.2k baud, hardware and software handshaking support.
 - (8) Two (2) IR/Serial ports.
 - (a) One (1) 4-pin 3.5mm detachable terminal block.
 - (b) IR output up to 1.1 MHz.
 - (9) 1-way serial TTL/RS-232 (0-5 Volts) up to 19200 baud.
 - (10) One (1) Digital/contact closure sensing input.
 - (a) One (1) 2-pin 3.5mm detachable terminal block
 - (b) Rated for 0-24 Volts DC, referenced to GND;
 - (c) Input Impedance: 2.2k ohms pulled up to 5 Volts DC;
 - (d) Logic Threshold: 2.5 Volts DC nominal with 1 Volt hysteresis band.
 - (11) One (1) 10/100 LAN port.
 - (12) One (1) Fiber input.
 - (13) Two (2) multi-mode fiber inputs.
 - (14) Two (2) SC multimode fiber connectors.
 - (15) One (1) power input.
 - (16) (1) 2-pin 3.5mm detachable terminal block.
 - (17) Shall support transmission distances of up to 1000ft.
 - (18) Flush mountable to a 2-gang, 4" square, or Euro electrical box.
- iii. Receivers, Copper with Scaler
 - (1) The signal receiver shall receive long distance transmission from compatible transmitter modules or ports. Receiver shall include the following outputs types and connections:

- (a) HDMI
- (b) USB HID (Human Interface Device)
- (2) Receiver shall include the following control port types for remote device control.
 - (a) Serial RS-232 communication.
 - (b) Infrared (IR) control.
- (3) Performance
 - (a) The receiver shall meet the following minimum requirements:
 - HDMI digital video, audio, and control output:
 - One (1) 19-pin Type A HDMI female connector
 - Supports HDMI with Deep Color and 3D.
 - Supports DVI-D with adaptor.
 - Supports HDCP.
 - (b) HDMI audio Support:
 - Dolby Digital, Dolby Digital EX, Dolby TrueHD, DTS, DTS-ES, DTS 96/24, DTS-HD Master Audio, and up to 8 channel PCM.
 - (c) CEC device control.
- (4) Integrated HD video scaling:
 - (a) Deinterlacing and interlacing.
 - (b) Frame rate conversion.
 - (c) Deep Color support.
 - (d) 3D to 2D conversion.
 - (e) Content adaptive noise reduction.
 - (f) Wide screen format selection:
 - Zoom.
 - Stretch.
 - Maintain source aspect ratio.
 - 1:1.
- (5) One (1) bidirectional RS-232 port:
 - (a) One (1) 5-pin 3.5mm detachable terminal block.
 - (b) GND, TX, RX, CTS, RTS support.
 - (c) Up to 115.2k baud, hardware and software handshaking support.
- (6) Two (2) IR/Serial ports:
 - (a) One (1) 4-pin 3.5mm detachable terminal block.
 - (b) IR output up to 1.1 MHz.
 - (c) 1-way serial TTL/RS-232 (0-5 Volts) up to 19200 baud.
- (7) One (1) USB HID port.
 - (a) USB type A female.
- (8) One (1) 10/100 LAN port.
 - (a) Single UTP/STP cable transmission connection
 - Supports HDBaseT signal specifications.

- (b) Supports CAT5e
 - (c) Signal transmission up to 330 feet
 - (9) Power supply:
 - (a) Local or remote DC power source.
 - (b) Mounts on a US 2-gang electrical box
- I. HD Content Matrix Switcher
 - i. The HDMI Matrix shall consist of a card-cage type unit, capable of accepting different input and output cards.
Any input shall be routable to any output. Matrix shall provide almost instantaneous HDMI switching for sources with HDCP. Breakaway audio, video, and USB switching shall also be available.
 - ii. The HDMI Matrix shall be compatible with the HD Content Point-to-Point Transport System.
 - iii. The matrix shall meet the following minimum requirements:
 - (1) Ethernet support.
 - (a) Gigabit uplink.
 - (b) Integrated 10/100 managed Ethernet switch.
 - (2) Eight, Sixteen or 32 field configurable input card slots corresponding to indicated input configuration
 - (3) Two, Four or Eight output card slots, where output card accommodates 4 signal outputs to provide eight, 16 or 32 outputs where indicated by indicated output configuration.
 - (4) Software based setup tool.
 - (5) Front panel LCD diagnostic screen.
 - (6) HDCP key register detection.
 - (7) HDMI Cable test tool.
 - (8) Automatic resolution management via EDID.
 - (9) HDCP digital rights key management.
 - (10) Fast HDMI switching with keep-alive HDCP link.
 - (11) CEC signal management.
 - (12) Intercept CEC data being sent from HDMI devices.
 - (13) Forwards AV control network information.
 - iv. Input Cards
 - (1) Input cards shall accept various signal types. Input signals shall be converted to HDMI format.
 - (2) HDMI Input Cards
 - (a) The HDMI input cards shall be compatible with the HDMI Matrix. Input cards shall provide HDMI (connector) buffered output of input signal. Input cards shall be field upgradeable/installable.
 - (b) The HDMI input card shall accept an HDMI signal. This signal shall be available as an output on the matrix.

(c) The HDMI input card shall meet the following minimum requirements:

One (1) HDMI input.

19-pin type A female HDMI connector.

Supports HDCP 1.1.

Supports HDMI 1.3 with Deep Color.

One (1) HDMI output.

Buffered output from input.

19-pin type A female HDMI connector.

Supports HDCP 1.1.

Supports HDMI 1.3 with Deep Color.

One (1) USB 1.1 port for USB HID data.

Mouse, keyboard, game controller, or other USB HID device support.

USB Type A female connector.

Digital to analog converter.

24-bit, 48 KHz

One (1) stereo analog audio output.

Two (2) RCA female connectors.

Unbalanced line-level output.

Provides pass-through signal converted from HDMI input.

Maximum Output Level: 2 Vrms.

Output Impedance: 100 ohms nominal.

Analog shall meet or exceed:

Frequency response: 20Hz to 20kHz ± 0.5 dB.

S/N Ratio: >95 dB, 20Hz to 20kHz A-weighted;

THD+N: $<0.005\%$ @ 1kHz;

Stereo Separation: >90 dB

(3) DVI Input Card

(a) The Video Input Card shall accept a DVI video signal, injected audio and convert to HDMI signal. This signal shall be available as an output on the matrix.

(b) The HDMI input card shall meet the following minimum requirements:

One (1) DVI input.

One (1) DVI-I female connector.

Auto-sensing multi-format analog video input.

(c) Support for the following video types:

DVI

YPbPr (component).

Y/C (S-Video).

RGB

(d) Support for the following video formats:

NTSC

PAL

(e) Support for the following video resolutions:

480i

480p

576i

576p

720p

1080i

1080p

(f) Video analog to digital converter.

10-bit, 170MHz.

(g) One (1) HDMI output.

Buffered output from input.

19-pin type A female HDMI connector.

(h) Pass through of video input signal (matched format/resolution).

(i) Pass through of audio input signal.

(j) One (1) analog audio input.

(k) One (1) 5 pin 3.5mm terminal block- detachable.

(l) Pass through to HDMI output.

(4) UTP/STP Input Card

(a) The UTP/STP Input Card shall accept UTP/STP signal and convert to HDMI signal and separate audio output. This signal shall be available as an output on the matrix.

(b) The UTP/STP input card shall meet the following minimum requirements:

(c) One (1) UTP/STP input.

(d) Two (2) 8 pin RJ45 UTP/STP connectors, female.

(e) Support for the following video resolutions:

480i

480p

576i

576p

720p

1080i

1080p

(f) Video analog to digital converter.

10-bit, 170MHz.

(g) One (1) HDMI output.

Buffered output from input.

19-pin type A female HDMI connector.

- (h) Pass through of video input signal (matched format/resolution).
 - (i) Support for various audio/surround formats:
 - Bypass.
 - Stereo.
 - PCM 96/24.
 - MLP Lossless.
 - Dolby Pro Logic IIx.
 - Dolby Digital 5.1.
 - Dolby Digital EX.
 - Dolby TrueHD.
 - DTS Neo:6.
 - DTS Virtual.
 - DTS Digital 5.1 Discrete.
 - DTS ES 6.1 Discrete.
 - DTS ES 6.1 Matrix.
 - DTS 96/24.
 - DTS-HD Master Audio.
 - (j) Pass through of audio input signal.
 - One (1) analog audio output.
 - (k) Two (2) RCA female connectors.
 - (l) Pass through to HDMI output.
 - (m) Digital to analog conversion: 24 bit 48 kHz
- v. Output Cards
 - (1) The HDMI output cards shall be compatible with the HDMI Matrix. Output cards shall transmit any input signal. Output cards shall have various arrangements of connector types. Output cards shall have up to four (4) outputs per card. Output card types shall be as follows:
 - (2) UTP/STP Output Card
 - (a) The UTP/STP Output Card shall provide transmission of any HDMI signal inputted to the matrix.
 - (b) The Output Card shall provide four (4) discrete outputs.
 - (c) The Output Card shall interface with unshielded twisted-pair or shielded twisted pair cable.
 - (3) HDMI Output Card
 - (a) The HDMI Output Card shall provide transmission of any HDMI signal inputted to the matrix.
 - (b) The Output Card shall provide four (4) discrete outputs.
 - (c) The Output Card shall interface with 19-pin Type A HDMI female connectors.
- m. Minimum Environmental Operating Conditions
 - i. Temperature: 32° to 104°F (0° to 40°C)

- ii. Humidity: 10% to 90% RH (non-condensing)
 - iii. Heat Dissipation: 1500 BTU/Hr
 - n. Enclosure
 - i. Chassis: Metal with black finish, vented sides, fan-cooled
 - ii. Faceplate: Extruded aluminum, black finish with polycarbonate label overlay
 - iii. Mounting: 7U 19-inch rack-mountable rack ears included)
 - o. Dimensions
 - i. Height: 12.22 in (311 mm) without feet
 - ii. Width: 17.28 in (439 mm), 19.00 in (483 mm) with ears
 - iii. Depth: 18.13 in (461 mm) without cards
- 3. Manufacturers:
 - a. Crestron
 - i. AVSW16x16: DM-MD16X16 DigitalMedia Switcher with input cards as required, including DMC-F-DSP, DMC-HD-DSP, DMC-DVI, DMC-CAT, and 8G output cards in quantities as required to provide the indicated functionality.
 - ii. HCMPO: DM-RMC-SCALER-C.
 - iii. HCMPOA: DM-RMC-200-C
 - iv. HCMPOF: DMC-150-S
 - v. HCAT RPTR: DM DR
 - vi. WPI: DM-TX-200-C-2G Wall Plate DigitalMedia CAT Transmitter in quantities as required to provide the indicated functionality.
 - vii. WPIS: HD-TX3-C and HD-RX3-C. Provide in pairs.
 - viii. WPIH: DM-TX-1G
 - ix. Provide MP-WP185 Media Presentation Wall Plate at floor box and similar locations where cable needs to be connectorized.
 - x. Adapter Cabling as required.
 - b. Extron
 - c. AMX/Autopatch
 - d. Or equal
- H. Wireless Presentation Transmitter
 - 1. Drawing Reference: WRTR, WIRELESS PRESENTATION ROUTER
 - 2. Functions/Features:
 - a. Provide wireless connectivity via Client Application on End-user device.
 - b. Secure isolated wireless network
 - c. Moderator function to allow queuing of up to 40 presenters and authorization of active presenter.
 - 3. Manufacturer:
 - a. Extron Sharelink 250
 - b. Crestron Air-media
 - c. Or Equal.
- I. High Definition A/V Transmitter
 - 1. Drawing Reference: DMTX, MP1

2. Functions/Features:
 - a. Provides 4k HDMI video input
 - b. Transmits audio, video and control signaling to specified receiver over a single UTP6-4P cable.
 - c. HDCP compatible.
 - d. Can be remotely powered by specified control system.
 3. Manufacturer
 - a. Crestron DM-TX-4KZ-100-C-1G-W
 - b. Or equal.
- J. USB Extender Balun
1. Drawing Reference: USB-X
 2. Features:
 - a. USB extension up to 100 m (330 ft) over solid-core CAT5e (or better) unshielded twisted pair (UTP) cable [1]
 - b. USB Device Support USB 1.1 and 2.0 compatible including mass storage and isochronous devices [2]
 - c. USB Hub Support Any signal chain may include up to 4 USB hubs plus one USB-EXT-2 system [2]
 - d. Maximum USB Devices 30 USB devices, or 4 USB hubs with 26 USB devices
 - e. Host Computer OS Support Windows, macOS, Linux
 - f. USB Throughput USB 2.0 up to 480 Mbps;
 - g. USB 1.1 up to 12 Mbps
 3. Connectors – Local Extender
 - a. 24V 1A (1) 2.1 x 5.5 mm DC power connector;
 - b. 24 Volt DC power input (power pack included)
 - c. Link (1) 8-pin RJ45 connector, female; Connects to Link port on the Remote Extender
 - d. USB (1) USB Type B connector, female (USB B to A cable included);
 - e. USB 2.0 device port for connection to the USB host computer, media server, game console, annotator, codec, etc.
 - f. Config (front) (For factory use only)
 4. Connectors – Remote Extender
 - a. 24V 1A (1) 2.1 x 5.5 mm DC power connector;
 - b. 24 Volt DC power input (power pack included) [3]
 - c. Link (1) 8-pin RJ45 connector, female; Connects to Link port on the Local Extender
 - d. Config (front) (For factory use only)
 - e. USB (front) (2) USB Type A connectors, female; USB 2.0 host ports for connection of USB mice, keyboards, whiteboards, game controllers, cameras, audio devices, mobile devices, printers, flash drives, hard drives, hubs, and other USB devices. Available USB Power: 1 Amp maximum per port, 1.5 Amps maximum total.
 5. Indicators – Local Extender
 - a. Mode (1) Recessed pushbutton (for factory use only).
 - b. Power (1) Blue LED, indicates operating power is supplied via the local power pack or via the Link connection.
 - c. Link (1) Green LED, indicates a valid Link connection to the Remote Extender.
 - d. Host (1) Green LED, indicates a valid connection to the USB host.
 - e. Activity (1) Amber LED, indicates data activity on the Link interface.

6. Indicators – Remote Extender
 - a. Power (1) Blue LED, indicates operating power is supplied via the local power pack or via the Link connection.
 - b. Link (1) Green LED, indicates a valid Link connection to the Local Extender.
 - c. Host (1) Green LED, indicates a valid connection to the USB host at the Local Extender.
 - d. Activity (1) Amber LED, indicates data activity on the Link interface.
 - e. Mode (rear) (1) Recessed pushbutton (for factory use only).
7. Power
 - a. Power Pack (included)
 - b. Input: 100-240 Volts AC, 50/60 Hz; Output: 1 Amp @ 24 Volts DC.
 - c. Available USB Power Supplies 1 Amp maximum per each of two USB Type A ports, 1.5 Amps maximum total.
8. Environmental
 - a. Temperature 32° to 122° F (0° to 50° C)
 - b. Humidity 20% to 80% RH (non-condensing)
9. Construction (Typical per Unit)
 - a. Housing Metal, black finish, adhesive rubber feet
 - b. Mounting Includes four slots for wire ties or other third-party mounting hardware
10. Dimensions (Typical per Unit)
 - a. Height 1.03 in (26 mm) without feet
 - b. Width 2.96 in (75 mm)
 - c. Depth 3.43 in (87 mm)
11. Compliance
 - a. CE, IC, FCC Part 15 Class B digital device.
12. Manufacturer:
 - a. Crestron USB EXT
 - b. Extron
 - c. Or equal
- K. RJ45 Keystone Jack Plate
 1. Drawing Reference: MP2
 2. Features:
 - a. RJ45 jack (passthrough) in quantity shown on drawings. Multiple jacks may be combined on single plate at floorbox locations.
 3. Manufacturer:
 - a. Panduit
 - b. Commscope
 - c. Or equal
- L. Multimedia Receiver w/ Scaler
 1. Drawing Reference: DMRX
 2. Features/Functions
 - a. Receives audio, video and control over a single UTP Cat 6 cable.
 - b. Outputs
 - i. HDMI 4k
 - ii. RS-232
 - iii. IR

- c. Communications: HDCP management, EDID format management, CEC
 - d. Compatible with specified switcher.
 - e. Enclosure
 - i. Metal, black finish, vented sides and front
 - f. Built-in video scaler: HD video scaler, motion-adaptive deinterlacer, interlacer, intelligent frame rate conversion, Deep Color support, 3D to 2D conversion, content-adaptive noise reduction
3. Manufacturers
- a. Crestron DM-RMC-4KZ-100-C
 - b. Or equal.

M. Pan-Tilt-Zoom Camera, Wall-mounted

1. Drawing Reference: PTZ
2. Features/Functions:
 - a. PTZ Camera, Signal Extender and CCU assembly.
 - b. 1/3-Type Exmor High-speed, Progressive Scan CMOS Sensor with 1.3 Megapixels
 - c. Video Output Resolutions: HD: 1080p/60/59.94/50/30/25, 1080i/59.94/50, 720p/59.94/50, SD: 480i/NTSC & 576i/PAL (Crop, Squeeze or Letterbox mode)
 - d. Lens/ Focal Length 19X Optical Zoom, F=4.5mm wide to 85mm tele (F1.6-F2.9), Min. Focus Distance 1.0m
 - e. Horizontal Viewing Angle 58.1° Wide End to 3.2° Tele End - 16:9 Format
 - f. Video S/N Ratio >52 dB
 - g. Minimum Illumination 0.7 LUX (F1.6, 50IRE)
 - h. Serial Control Protocol RS-232 (Modified VISCA)
 - i. Pan Range Pan: +170 degrees to -170 degrees, Tilt: +90 degrees to -30 degrees, Invertible for Ceiling Mount.
 - j. Preset Positions 16 (internal), 6 recalled via IR Remote
 - k. Tally Light Available through RS-232 Control Connectors • 12 VDC Power Input: EIAJ-04 Coaxial Power Connector
 - l. HD Video Outputs: YPbPr on DE-15 (D-Sub 15-pin HD)
 - m. SD Video Output: BNC Connector
 - n. RS-232/IR Out: RJ-45 Jack (RS-232 Communication and IR Out (with Quick-Connect -SR Interfaces)
 - o. EZ Power HD Video: RJ-45 Jack, for use with Quick-Connect SR Interface or Quick-Connect DVI/HDMI
 - p. SR Interface. Supplies power to the camera and returns HD video from the camera to the Quick-Connect - SR Systems.
 - q. HD Video Select 16-Position Rotary Switch: Used to set HD Video Resolution Output
 - r. Camera Settings 10-Position Dip Switch: Settings for IR Select, Baud Rate 9600, Image Flip, SD LB and SQ, Test Bars
 - s. OSD (On Screen Display) for fine tuning
3. Manufacturer:
 - a. ClearVIEW HD-19 North America 999-6940-000 (Black), 999-6940-000AW (Arctic White), confirm color with Owner's Representative prior to product submittal. Accessories:
 - i. Thin Profile Wall Mount 535-2000-230 (Black), 535-2000-230W (White)
 - ii. EZIM HD-SDI Slot Card PN# 998-6900-007
 - b. Sony

- c. Panasonic
- d. Or equal

2.7 FLAT PANEL DISPLAYS, PROJECTORS, AND PROJECTION SCREENS

A. 23" Flat Panel Display

1. Drawing Reference: LCD23
2. Features/Functions:
 - a. Panel Size: Wide Screen 23.0"(58.4cm) 16:9
 - b. True Resolution : 1920x1080
 - c. Full HD 1080P : Yes
 - d. Pixel Pitch : 0.2652mm
 - e. Brightness(Max) : 250 cd/m²
 - f. ASUS Smart Contrast Ratio (ASCR) : 50000000:1
 - g. Viewing Angle (CR \geq 10) : 170°(H)/160°(V)
 - h. Response Time : 2ms (Gray to Gray)
 - i. Display Colors : 16.7M
 - j. Stereo Speakers : 2W x 2 Stereo RMS
 - k. HDMI In
3. Manufacturer:
 - a. ASUS VH238H.
 - b. Or equal

B. LCD, 70" Diagonal

1. Drawing Reference: LCD70
2. Features/Functions:
 - a. Panel Type: LCD, LED Backlighting
 - b. Professional/commercial grade display warrantied by the manufacturer for continuous operation for not less than two years.
 - c. Minimum Viewable Panel Size: 80" diagonal, 16:9 aspect ratio
 - d. Maximum Pixel Pitch: 0.923 x 0.923 mm
 - e. Native Resolution: 1920 x 1080
 - f. Viewing Angle (H/V): 176°/176°
 - g. Brightness: 450 cd/m²
 - h. Maximum Response Time: 6 ms
 - i. Contrast Ratio: 5000:1
 - j. Inputs
 - i. VGA (D-sub 15 pin)
 - ii. HDMI
 - iii. Stereo Mini Jack
 - k. Control:
 - i. RS-232C
 - ii. RJ45
 - iii. IR, included IR Remote

- I. Power Consumption: In accordance with California Code of Regulations, Title 20: Division 2, Chapter 4, Article 4, Sections 1601-1608: Appliance Efficiency Regulations
 - m. Weight: 145 lbs. Maximum
 - n. Operating Temperature: 5-40 degrees C
 - o. Operating Humidity: 20-80%
 - p. Dimensions: Less than 2" deep.
 - 3. Manufacturer
 - a. Sharp PNR-703
 - b. Samsung
 - c. NEC
 - d. Or equal
- C. LCD, 80" Diagonal w/ Integral Audio or Soundbar Loudspeaker
- 1. Drawing Reference: LCD80
 - 2. Features/Functions:
 - a. Panel Type: LCD, LED Backlighting
 - b. Professional/commercial grade display warranted by the manufacturer for continuous operation for not less than two years.
 - c. Minimum Viewable Panel Size: 80" diagonal, 16:9 aspect ratio
 - d. Maximum Pixel Pitch: 0.923 x 0.923 mm
 - e. Native Resolution: 1920 x 1080
 - f. Viewing Angle (H/V): 176°/176°
 - g. Brightness: 450 cd/m²
 - h. Maximum Response Time: 6 ms
 - i. Contrast Ratio: 5000:1
 - j. Inputs
 - i. VGA (D-sub 15 pin)
 - ii. HDMI
 - iii. Stereo Mini Jack
 - k. Control:
 - i. RS-232C
 - ii. RJ45
 - iii. IR, included IR Remote
 - I. Power Consumption: In accordance with California Code of Regulations, Title 20: Division 2, Chapter 4, Article 4, Sections 1601-1608: Appliance Efficiency Regulations
 - m. Weight: 175 lbs. Maximum
 - n. Operating Temperature: 5-40 degrees C
 - o. Operating Humidity: 20-80%
 - p. Dimensions: Less than 2" deep.
 - 3. Manufacturer

- a. Sharp PNR-803
 - b. Samsung
 - c. NEC
 - d. Or equal
- D. Ceiling-mounted Projector
1. Drawing Reference : VPROJ
 2. Manufacturer :
 - a. District Standard Epson PRO G7200W or PRO G7200 WNL
 - b. No Known Equal
- E. Short-Throw Wall-mounted Projector
1. Drawing Reference : VPROJ1
 2. Manufacturer :
 - a. District Standard Brightlink PRO697UI
 - b. No Known Equal
- F. Projection Screen, Recessed Ceiling-Mount Motorized, Tab Tensioned, Wide Format
1. Drawing Reference(s): Projection screen, indicated
 2. Features/Functions:
 - a. Size: Custom, as indicated on drawings
 - b. 16:10 aspect ratio.
 - c. Seamless viewing and black drop area.
 - d. Electrical: 120 volts, single phase, 60 hertz.
 - e. Fabric: Flame and mildew resistant surface with black masking borders and flat black edge finish.
 - f. Black drop above the viewing surface to lower screen to indicated height above finished floor. Do not provide more black drop than required.
 - g. Motorized operation with automatic travel stops.
 - h. Motor and roller:
 - i. Reversible motor with permanent seal ball bearings, automatic thermal overload cut-out. Stressed truss roller minimum 5 inches (127 mm) diameter, mounted on steel brackets with heavy duty bearings.
 - ii. Access to motor from below.
 - i. Cable tensioning system at edges to ensure flatness - Provide as close to exact black drop as required to avoid varying tensioning which could cause potential screen wrinkling.
 - j. UL listed.
 - k. Finished housing mounts to wall. Housing can be delivered to site and rough-in prior to placement of screen to protect screen from damage.
 - l. Provision screen with all necessary screen manufacturer options to use indicated low voltage, closure operation. Receipt of serial control or contact closure from Audio-visual control system shall be sufficient to unroll screen for viewing, re-roll screen or to stop screen at intermediate point. Field adjustable down limit switch shall automatically stop screen in full down position.
 3. Performance:

- a. Minimum 1.0 gain on-axis gain ± 0.1 .
 - b. Minimum half gain angle of 50 degrees.
 - c. High contrast grey finish suitable for use with moderate to high output LCD or DLP projection. Absorbs moderate amount of stray ambient light.
4. Manufacturers
 - a. Da-Lite Tensioned Contour Electrol w/ High Contrast Cinema Vision screen material
 - b. Draper
 - c. Vutech
 - d. Stewart Filmscreen
 - e. Or equal.
- G. Dual Chamber Projection Support Mount
1. Construction
 - a. Pipe column or multiple joined runs of electrical support strut with vanity cover.
 - b. Channel and plate to mount to ceiling or wall as required.
 - c. Seismic restraint diagonal bracing as required.
 - d. Provide mount manufacturer's bottom plate to match projectors provided under work of this Section.
 - e. Mount rated load capacity not less than 50 pounds.
 - f. Allows safe adjustment of pitch, roll and yaw at least plus minus 5 degrees after installation of the mount and projector.
 - g. Allows for locking of pitch, roll and yaw settings after adjustment.
 - h. Allows removal and replacement of the projector without loss of the specific adjustment of pitch, roll and yaw.
 - i. Accepts City supplied padlock to prevent removal of projector from mount.
 - j. Where mounting fasteners are exposed during normal operations, secure mount with tamper-resistant fasteners.
 - k. Provide manufacturer's escutcheon plate to cover transition of support through the ceiling plane.
 2. Approvals
 - a. Provide OSHPD OPA assembly. Install in accordance with OPA.
 3. Manufacturer, Video Projector Mount to CMU Wall
 - a. Chief Manufacturing RPA Series Inverted LCD/DLP Projector Ceiling Mount with
 - i. WMA-300 Wall Mount Accessory Arm
 - ii. CMA-nnn Series Extension Column as required.
 - iii. CMA-640 Finishing Ring.
 - b. Westbrook Engineering, Inc. Promount Series.
 - c. Monger Mount.
 - d. Or equal.
 4. Manufacturer, Video Projector Mount to Structure Above
 - a. Chief Manufacturing RPA Series Inverted LCD/DLP Projector Ceiling Mount with
 - i. CMA-110 Ceiling Plate 8" x 8" with 1 1/2" NPT fitting.
 - ii. CMA-nnn Series Extension Column as required.
 - iii. CMA-640 Finishing Ring - Finish per City's Representative.

- iv. Lateral bracing per Contractor's engineered detail.
- b. Westbrook Engineering, Inc. Promount Series.
- c. Monger Mount MM series, including LB, LF, CMKP2, and SC-2.
- d. Or equal.

H. Flat-Panel Display Wall Mount

1. Drawing Reference: None - provide at locations where wall mount of LCD* and FPNL* devices are indicated except as otherwise provided herein.
2. Functions:
 - a. Can support the required LCD and Plasma Panels supplied by the work of this Project.
 - b. Holds rear of panel away from wall ~2" to permit A/V interface mounting behind display.
 - c. Permits display to be tilted in the vertical plane for optimum viewing as directed by the City's Representative.
 - d. Allows the complete mount and display assembly to not protrude more than 4" out from wall surface.
 - e. Designed to mount to 16", 20", 24" center stud systems
 - f. Panel can be securely fastened to mount using to prevent theft by adding a City furnished padlock.
 - g. Where mounting fasteners are exposed during normal operations, secure mount with tamper-resistant fasteners.
 - h. Designed to accommodate panels from at least Pioneer, Panasonic, Sharp, Samsung, & LG Electronics
 - i. Heavy duty construction with steel components
 - j. UL or ETL listed
 - k. California OSHPD OPA (seismic restraint pre-approval). Installation to be accordance with OPA.
3. Manufacturers:
 - a. Chief Manufacturing, Inc. LTM Series, selected for display and mounting conditions.
 - b. Or equal

2.8 SOUND CABLES AND RELATED

A. General

1. Provide cable with electrical conductors of soft drawn annealed copper, bare or tinned, solid or concentric stranded as applies, conductivity not less than 98 percent of pure copper.
2. Comply with applicable Code for insulation, jacket, marking and listing for applicable use.
 - a. Refer to California Electrical Code, Table 725-61. Cable Uses and Permitted Substitutions.
3. Manufacturer part number specified is for a Listed Type CM construction to indicate intended cable construction and quality.
 - a. Code requirements take precedence.
 - b. Provide type required by Code at no additional cost to the Owner.

B. Cable, Microphone and Line Level, General Purpose

1. Drawing Symbol(s): SP, 2A.

2. Description: Shielded, single twisted pair, with #20 AWG color coded stranded conductors and foil shield with drain wire.
 3. Performance/Construction
 - a. Conductors AWG #20.
 - b. Conductors Stranding: 7 by 28.
 - c. D.C. Resistance Per 1000 feet: 15 ohms maximum.
 - d. Shield: Aluminum polyester foil with #20 AWG stranded tinned copper drain wire.
 - e. Diameter 0.24 inch maximum.
 4. Where 2A indicated, provide 2 each SP
 5. Manufacturer
 - a. Belden 8762
 - b. West Penn.
 - c. Or equal.
- C. Cable, Microphone and Line Level, Miniature
1. Drawing Symbol: SP, 2A
 2. Restriction: For use within fixed equipment racks only.
 3. Description: Shielded, single twisted pair, with #22 AWG color coded stranded conductors and foil shield with drain wire.
 4. Performance/Construction:
 - a. Conductors AWG #22.
 - b. Conductors Stranding: 7 by 30.
 - c. D.C. Resistance Per 1000 feet: 20 ohms maximum.
 - d. Shield: Aluminum polyester foil with #24 stranded tinned copper drain wire.
 - e. Diameter 0.15 inch maximum.
 5. Where 2A indicated, provide 2 each SP
 6. Manufacturer
 - a. Belden 8451, 9451, 1266A.
 - b. Alpha.
 - c. West Penn.
 - d. Or equal.
- D. Cable, Antenna, Assistive Listening System and Wireless Microphone System
1. Description
 - a. Nominal 50 ohms (actual 51 or 52 ohms) coaxial cable.
 2. Minimum 97 percent shield coverage.
 3. Joint Army Navy (JAN) or Military (MIL) Construction
 - a. RG-8/U to JAN-C-17A
 - b. RG-8 A/U to MIL-C-17D
 - c. RG-9/U to JAN-C-17A.
 4. Manufacturer
 - a. Belden 8237, 9251 or 8242.
 - b. CommScope.
 - c. Or equal.
- E. Cable, Loudspeaker and D.C. Power
1. Drawing Symbol(s)
 - a. #18TP

- b. #16TP
- c. #14TP
- d. #12TP
2. Description
 - a. Twisted pair, jacketed, unshielded cables, #12, #14, #16, or #18, as shown on Drawings.
3. Plenum rated where installed in open plenum return voids.
4. Performance/Construction
 - a. Conductor, AWG: #12, #14, #16, and #18, as noted.
 - b. Maximum diameter
 - i. 0.384 inch (#12)
 - ii. 0.332 inch (#14)
 - iii. 0.256 inch (#16)
 - iv. 0.224 inch (#18).
5. Manufacturer
 - a. Belden.
 - i. #12TP, Belden 8477
 - ii. #14TP, Belden 8473
 - iii. #16TP, Belden 8471
 - iv. #18TP, Belden 9740
 - v. West Penn.
 - vi. Or equal.

2.9 VIDEO CABLES, COPPER COAX AND RELATED

A. General

1. Provide cable with electrical conductors of soft drawn annealed copper, bare or tinned, solid or concentric stranded as applies, conductivity not less than 98 percent of pure copper.
2. Comply with applicable Code for insulation, jacket, marking and listing for applicable use.
 - a. Refer to California Electrical Code, Table 725-61. Cable Uses and Permitted Substitutions.
 - b. Manufacturer part number specified is for a Listed Type CM construction to indicate intended cable construction and quality.
3. Code requirements take precedence.
 - a. Provide type required by Code at no additional cost to the Owner.

B. Cable, Data Monitor Precision Video

1. Plan Reference(s):
 - a. D5
 - b. 5DVideo
2. Construction
 - a. 5 miniature high resolution coax cables in an overall shielded overall jacket to transmit analog component video based on the Red-Green-Blue-Horizontal Sync-Vertical Sync (RGBHV) transmission method.
 - b. Sub cables are color coded Red, Green, Blue, Black, Grey; or approved alternate color coding scheme.
 - c. Jacket: Code approved equal for application.
 - d. Overall five sub cable assembly diameter: 0.56" maximum in raceway applications.
 - e. Center Conductor AWG: Twenty two (22) ga Silver Plated Copper.
 - f. Insulation: Foamed Teflon.

- g. Shield:
 - i. Each sub-cable is double shielded
 - ii. Overall cable has 100% tape shield.
 - 3. Approval/Rating:
 - a. UL: Recognized Type CL2P (Article 725 of NEC) for plenum application, riser rated elsewhere.
 - 4. Performance - each sub-cable:
 - a. Resistance: 0.0162 ohms/ft nominal @ 20C
 - b. Impedance: 75 ohm nominal
 - c. Capacitance: 17.5 pf/ft nominal
 - d. Velocity of Propagation: 80% nominal
 - e. Time Delay: 1.19ns/ft nominal
 - f. Maximum Attenuation Per 100':
 - i. 10 MHz: 0.8 dB/100 ft.
 - ii. 50 MHz: 2.5 dB/100 ft.
 - iii. 100 MHz: 3.5 dB/100 ft.
 - iv. 200 MHz: 4.6 dB/100 ft.
 - v. 300 MHz: 5.0 dB/100 ft.
 - vi. 400 MHz: 7.2 dB/100 ft.
 - vii. 1000 MHz: 14.6 dB/100 ft.
 - 5. Manufacturers:
 - a. Altinex CB5100PL in plenum spaces, riser rated elsewhere.
 - b. Extron
 - c. Belden
 - d. Gepco.
 - e. or equal.
- C. HDMI/DVI Cabling
- 1. Drawing Reference: DVI/HDMI
 - 2. Features/Functions
 - a. The plans indicate the required distances for HDMI format transmission. Contractor to provide a transmission system appropriate to the indicated lengths. Contractor engineered solutions may consist of:
 - i. Passive HDMI cabling, where the indicated length is within the service distance of such systems.
 - ii. Copper HDMI cabling and active HDMI repeaters
 - iii. Fiber Optic Cabling and HDMI transceivers.
 - b. Contractor to select and provide the method of transmission appropriate to the length and operating parameters of the selected transmission system as defined by the manufacturers of the cabling systems, the repeaters and/or transceivers and the HDMI transmission standard as defined at www.hdmi.com.
 - 3. Manufacturers, copper cabling and extenders:
 - a. Extron
 - b. Broaddata
 - c. Altinex
 - d. Liberty Cable
 - e. or equal.

2.10 CONTROL CABLING

A. General

1. Provide cable with electrical conductors of soft drawn annealed copper, bare or tinned, solid or concentric stranded as applies, conductivity not less than 98 percent of pure copper.
2. Comply with applicable Code for insulation, jacket, marking and listing for applicable use.
 - a. Refer to California Electrical Code, Table 725-61. Cable Uses and Permitted Substitutions.
 - b. Manufacturer part number specified is for a Listed Type CM construction to indicate intended cable construction and quality.
3. Code requirements take precedence.
 - a. Provide type required by Code at no additional cost to the Owner.

B. USB Cabling

1. Drawing Reference: USB
2. Features/Functions:
 - a. Conforms with minimum USB 2.0 standard
 - b. Provides USB input in a single gang wall plate
 - c. Extends USB signal up to at least 200' or distance as required by project requirements.
3. Manufacturers:
 - a. Extron
 - b. Trulink
 - c. or equal.

C. High Speed, TIA/TIA Category Cabling

1. Drawing Reference:** UTP6-4, where ** denotes cable count
2. Construction:
 - a. Provide horizontal copper cable in accordance with:
 - i. EIA ANSI/TIA/EIA-568-B.2
 - ii. UL 444,
 - iii. NEMA WC 66 (Performance Standard for Category 6 and Category 7 100 Ohm Shielded and Unshielded Twisted Pair)
 - iv. ICEA S-90-661
 - b. UTP (unshielded twisted pair),
 - c. 100 ohm impedance
 - d. Four each individually twisted pair, 22 or 24 AWG conductors,
 - i. Color code
 - (1) Pair 1 White/Blue Blue
 - (2) Pair 2 White/Orange Orange
 - (3) Pair 3 White/Green Green
 - (4) Pair 4 White/Brown Brown
 - e. No shield in the sheath.
 - f. Jacket
 - i. Thermoplastic jacket
 - ii. Color: Blue unless otherwise indicated.
 - iii. Cable imprinted with manufacturers name or identifier, flammability rating, gauge of conductor, transmission performance rating (category designation) at regular intervals not to exceed 2 feet.
 - iv. The word "FEET" or the abbreviation "FT" shall appear after each length marking.

- v. Provide communications general purpose (CM or CMG), communications plenum (CMP) or communications riser (CMR) rated cabling in accordance with NFPA 70.
 - vi. Type CMP and CMR may be substituted for type CM or CMG and type CMP may be substituted for type CMR in accordance with NFPA 70.
 - 3. Certification
 - a. Warrantied by the manufacturer to provide Category 6 performance when installed in accordance with applicable EIA/TIA standards and when terminated with the jacks supplied by the Contractor for this Project.
 - 4. Performance
 - a. Assembly electrically meets or exceeds EIA ANSI/TIA/EIA-568-B.2 Category 6 performance standards
 - 5. Manufacturers:
 - a. Berk-Tek LANmark-1000
 - b. Belden/CDT
 - c. Berk-Tek
 - d. Commscope/Systimax
 - e. Commscope/Uniprise
 - f. General Cable
 - g. Mohawk/CDT
 - h. Superior/Essex
 - i. or equal
- D. High Speed, Category 6 Cabling, Plenum Rated
 - 1. Drawing Reference:** UTP6-4P, where ** denotes cable count
 - 2. Construction:
 - a. As for non-plenum, with fire retardant overall jacket construction.
 - b. UL listed, NEC compliant for plenum installation.
 - c. CSA Certified type PCC FT4 FT6.
 - 3. Manufacturers
 - a. As for non-plenum Cat-6, plenum construction.

2.11 MISCELLANEOUS PRODUCTS

- A. Adjustable Height Accessible Presentation Lectern
 - 1. Drawing Reference: to replace (E) lectern in Community Room
 - 2. Manufacturer:
 - a. Spectrum Furniture Freedom One eLift Lectern w/ 55380 Customized Logo Panel, 99058 Power Module, and 55379 Keyboard Tray.
 - b. No known equal.
- B. Audio and Control Connectors and Related:
 - 1. Circular Audio Connector, Cord, 3 through 5 contacts, gold plated contacts, captive cable clamp strain relief, matte black chrome finish over nickel metal shell
 - a. Neutrik C-Series, X-Series.
 - b. Switchcraft.
 - c. Or equal.
 - 2. Circular Audio Connector, Panel mount, male and female devices to fit same panel cutout including fasteners, 3 through 5 contacts, gold plated contacts, matte black chrome finish over nickel metal shell, female receptacles locking type:

- a. Neutrik D Series Version L.
 - b. Switchcraft
 - c. Or equal.
 3. Loudspeaker Connector, Panel mount, female devices to fit same panel cutout including fasteners as other panel mount receptacles, 4 contacts, matte black finish Polyamid/graphite shell, female receptacles locking type. UL Component Recognized:
 - a. Neutrik NL4MP.
 - b. Switchcraft
 - c. Or equal.
- C. Video Connectors and Related
 1. Video Connector, BNC type, 75 ohms, Panel, recessed, flush with panel face, insulated from panel, double female
 - a. Manufacturer
 - i. Canare BCJ-JRU.
 - ii. Tec Nec
 - iii. Liberty Wire & Cable/Panelcraft
 - iv. or equal.
 2. Video Connector, BNC type, 75 ohms, Panel, recessed, flush with panel face, insulated from panel, single female to solder pin
 - a. Manufacturer
 - i. Canare BCJ-RU.
 - ii. Tec Nec
 - iii. Liberty Wire & Cable/Panelcraft
 - iv. or equal.
 3. Video connector, BNC type, 75 ohms, cord, crimp applied. Coordinate with cable.
 - a. Manufacturer
 - i. Amp.
 - ii. Amphenol.
 - iii. Augat/LRC Products
 - iv. Canare.
 - v. Kings.
 - vi. Liberty Wire & Cable/Panelcraft
 - vii. RFI/Celltronics.
 - viii. Trompeter.
 - ix. or equal.
 4. Video Precision 75 ohms Terminator, BNC:
 - a. Manufacturer
 - i. Canare BCP-TA
 - ii. Trompeter TNAI-1-75.
 - iii. or equal.
 5. DB15 Connectors
 - a. Drawing Reference HD15
 - b. Manufacturer
 - i. Amp.
 - ii. Amphenol.
 - iii. Canare.
 - iv. Kings.

- v. Liberty Wire & Cable/Panelcraft
 - vi. RFI/Celltronics.
 - vii. or equal.
- D. Custom Facility Panels, Rackmount Auxiliary Panels, Rack Lighting
- 1. Drawing Reference(s):
 - a. MP* - Media Panels, where * is a number indicating the panel type.
 - b. FP* - Facility Panels, where * is a number indicating the panel type.
 - c. Aux Panel
 - 2. Provide connector types and plate finish as shown. If none shown, provide:
 - a. Rack mount panels:
 - i. 16 gauge minimum, cold rolled steel or 1/8" minimum aluminum, finish to match rack finish.
 - ii. At contractor's option, fabricate using rack mount panels with Decora/Decorator openings and steel plates with specified connectors. Match insert color to panel color provided. Refer to Rack Panel with Decora Openings below.
 - b. Wall Panels: 16 gauge minimum cold rolled steel, finish to match surrounding electrical and other low voltage panels.
 - 3. Manufacturers, Rack Mount Panels
 - a. BGW Systems Inc.
 - b. Conquest
 - c. Middle Atlantic Products Universal Connector Panel
 - d. Middle Atlantic Products Universal Connector Panel, Modular Custom Connector Panel Systems
 - e. ProCo Sound, Inc.
 - f. Ultimate Plates and Panels
 - g. or equal.
 - 4. Manufacturers, Wall Panels
 - a. PanelCrafters Division of Liberty Wire & Cable, Classic Series
 - b. FSR
 - c. RCI Systems
 - d. Middle Atlantic
 - e. Ultimate Plates and Panels
 - f. Whirlwind
 - g. Or equal.
 - 5. Manufacturers, Decora/Decorator connector inserts:
 - a. Connector Plates by Radio Design Labs. Provide specified connectors rear mounted in D-Blank insert for connector combinations not available from RDL.
 - b. Grey by Pathway Connectivity Solutions. Provide specified connectors rear mounted in 5100 insert for connector combinations not available from Pathway Connectivity Solutions.
 - c. or equal.
 - 6. Manufacturers, Rack Mount Decora Panel Openings
 - a. Lowell Manufacturing LD8-RMP with Lowell DBB-4 blank Decora plates at openings not fitted with equipment.
 - b. Middle Atlantic DECP Series
 - c. or equal.
 - 7. Manufacturers, Rack Lighting

- a. Middle Atlantic PDLT-815RV-RN.
- b. or equal.

2.12 POWER DISTRIBUTION EQUIPMENT

- A. Comply with applicable Codes. Provide UL Listed devices suitable for commercial use. Provide all junction boxes, raceway, fittings, wire, supports and fastenings as required for complete installation. Contractor to coordinate plug end of selected strip with rack power receptacles installed under the work of Division 16. Unless otherwise noted, provide receptacles of NEMA 5-15R configuration.
- B. Power Sequencer System
 1. Drawing References: PSEQ
 - a. Power Sequencer
 - b. Fire Alarm Interface – provide where required to shunt system operation on receipt of closure from Fire Alarm system.
 - c. Solid State Relay (SSR) SSR1 through SSR7
 2. Features
 - a. Power sequencing system.
 - b. Solid state switching, zero crossing.
 - c. Sequencing on power up and power down.
 - d. Front panel button and external closure activation.
 - e. Alarm terminal to sequence the system down when tripped.
 - f. UL Listed.
 3. Manufacturer
 - a. FSR Inc. Power Products Group SPC-20 Power Sequencer and SPC-20X Solid State Relay
 - b. Furman
 - c. Or equal.
- C. Power Supplies and Related:
 1. Drawing Reference: PS24.
 2. Relay and Lamp Power Supply:
 3. 24 VDC, regulated within 5%. Ripple not greater than 1.5%. Output current rating at least 150% of maximum possible load. Circuit breaker or intrinsic over current protection. UL Recognized or UL Listed.
- D. Full Height Receptacle Strip, One (1) Circuit, 15A
 1. Features/Construction:
 - a. Not less than 60" Long
 - b. Not less than eleven (11) 15A receptacles
 - c. Integral circuit breaker
 - d. NEMA 5-15P plug on 6' cord.
 - e. UL Listed Assembly
 - f. Provide mounting hardware as necessary to attach to rack interior.
 2. Manufacturers.
 - a. Wiremold Series 7011ULBC.
 - b. Lowell ACS 1524
 - c. Geist NSVB200-101S15
 - d. Hubbell PR206
 - e. Leviton
 - f. Middle Atlantic
 - g. Chatsworth 12848-701

- h. or equal.
 - E. Full Height Receptacle Strip, One (1) Circuit, 20A
 - 1. Features/Construction:
 - a. Not less than 70" Long
 - b. Not less than eleven (11) 15A receptacles
 - c. Integral circuit breaker
 - d. NEMA 5-20P plug on 6' cord.
 - e. UL Listed Assembly
 - f. Provide mounting hardware as necessary to attach to rack interior.
 - 2. Manufacturers. Contractor to coordinate selected strip with rack power receptacles installed under the work of Division 26.
 - a. Geist NSVB200-102S20
 - b. Hubbell PR20820DRTL
 - c. Leviton P104x series
 - d. Lowell ACS-2024
 - e. Midde Atlantic PD-1020C-NS
 - f. Wiremold Series 7011ULBC20.
 - g. Chatsworth 12848-705
 - h. or equal.
 - F. Rackmount Power Panel, Horizontal Mount, User Aux device use:
 - 1. Drawing Reference: POWER.
 - 2. Functions/Features:
 - a. Front face of panel shall provide two electrical power outlets and a switch. An indicator lamp shall show the presence of AC power when on. The front face of panel shall have a black finish. The rear face shall provide a minimum of at least four receptacles. The panel shall be racked mounted in a maximum of two rack units. The panel shall be Code approved and UL rated for this application.
 - 3. Manufacturers:
 - a. Hubbell MCCPSS19TS
 - b. Leviton 4515
 - c. Geist SP124-1020

2.13 POWER PANEL:

- 1. Drawing Reference: POWER.
- 2. Functions/Features:
 - a. Front face of panel shall provide two electrical power outlets and a switch. An indicator lamp shall show the presence of AC power when on. The front face of panel shall have a black finish. The rear face shall provide a minimum of at least four receptacles. The panel shall be racked mounted in a maximum of two rack units. The panel shall be Code approved and UL rated for this application.
- 3. Manufacturers:
 - a. Hubbell MCCPSS19TS
 - b. Geist SP124-1020
 - c. Or equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Perform the Work of this Section in accordance with acknowledged industry and professional standards and practices, and the procedures specified herein.
- B. Furnish and install (herein, "provide") all materials, devices, components, and equipment required for complete, operational systems.
- C. Refer to Section 27 15 00 for additional execution requirements that apply to the work of this Section.

3.2 PRECONSTRUCTION PROGRAMMING MEETING

- A. Not less than 60 days prior to the scheduled completion of the project, Contractor to initiate a request of the Owner's Representative to schedule an Audiovisual Systems programming meeting.
 - 1. The Owner's Representative will schedule the meeting at the reasonable mutual convenience of the Contractor and the Owner's technical systems representatives.
 - 2. The purpose of the meeting is for the Owner's Representative to indicate to the contractor how the programmable interfaces of the Audiovisual systems are to be implemented, including:
 - a. Integration of VoIP conference dialing into AV controls.
 - b. Button assignments and labels for physical button panels
 - c. Touchscreen menu hierarchy, scene arrangement, button and background colors, text size, logos
 - d. When multiple panels control the same systems, which screens appear on which touchpanels.
 - e. Whether authorization codes or passwords will be required to access special functions/menus.
 - 3. Contractor to document the information received from the Owner's Representatives at this meeting.
 - 4. Contractor to submit the documentation of the requirements meeting, along with their proposed response to the Owner's programming requirements in the form of screen shots and system menu flow diagrams as required under Section 27 41 00 – Common Work Results for Audiovisual Systems, 1.4 D Submittals.

3.3 WIRING CLASSIFICATION AND RELATED

- A. Audio Signal Wiring Classification:
 - 1. Type A-1: Microphone level wiring less than -30 dB μ , 20 Hz to 20 kHz.
 - 2. Type A-2: Line level wiring -30 dB μ to +24 dB μ , 20 Hz to 20 kHz.
 - 3. Type A-3: Loudspeaker level or circuit wiring greater than +24 dB μ , from 20 Hz to 20 kHz.
- B. Video and Related Signal Wiring Classification:
 - 1. Type V-1: Baseband and composite video wiring 1 volt peak-to-peak into 75 ohms, 0 to 10.0 MHz.
 - 2. Type V-2: Synchronization and switching pulse wiring 4 volts peak-to-peak into 75 ohms, 15.62 to 15.75 kHz.

3. Type V-3: Color subcarrier wiring 0 to 4 volts peak-to-peak into 75 ohms, 3.57 to 4.43 MHz.
 4. Type V-4: TV system wiring 0.1 to 1000 uV peak-to-peak into 50 or 75 ohms, 47 to 890 MHz.
- C. Control Signal Wiring Classifications:
1. Type C-1: DC control wiring 0 to 50 volts.
 2. Type C-2: Synchronous control or data wiring 0 to 40 volts, peak-to-peak.
 3. Type C-3: AC control wiring 0 to 48 volts, 60 Hz.
- D. Additional Wiring Classifications:
1. Type M-1: DC power wiring 0 to 48 volts.
 2. Type M-2: AC power wiring greater than 50 volts, 60 Hz.
- E. Wiring Combinations:
1. Except as indicated herein, conduit, wireways and cable bundles shall contain only wiring of a single classification. The following combinations are acceptable in conduit, or cable harnesses. Additional acceptable combinations may be indicated on the Contract Drawings.
 - a. Types A-1, C-1, and M-1.
 - b. Types A-2, C-1, C-2, and M-1, runs less than twenty (20) feet.
 - c. Types A-2, C-1, and M-1.
 - d. Types A-3, C-1, C-2, and M-1.
 - e. Types A-2, V-1, and V-3.
 - f. Types V-1, V-2, V-3, and C-1.
 - g. Types M-2 and C-3.

3.4 WIRE AND CABLE INSTALLATION

- A. Provide permanent identification of run destination at all raceway terminations.
- B. All wire and cable shall be continuous and splice-free for the entire length of run between designated connections or terminations.
- C. All shielded cables shall be insulated. Do not permit shields to contact conduit, raceway, boxes, panels or equipment enclosures.
- D. Within buildings, make splices only in designated terminal cabinets and/or on designated equipment backboards. Outside buildings, make splices only in designated manholes and/or handholes. Protect splices outside of buildings with splicing kits equivalent to Scotchcast Re-entrantable. Make splices only with connectors or terminal devices specified herein. Document all splices on Record Drawings.
- E. Verify that all raceway has been de-burred and properly joined, coupled, and terminated prior to installation of cables. Verify that all raceway is clear of foreign matter and substances prior to installation of wire or cable.
- F. Inspect all conduit bends to verify proper radius. Comply with Code for minimum permissible radius and maximum permissible deformation.
- G. Apply a chemically inert lubricant to all wire and cable prior to pulling in conduit. Do not subject wire and cable to tension greater than that recommended by the manufacturer. Use multi-spool rollers where cable is pulled in place around bends. Do not pull reverse bends.

- H. Provide a box loop for all wire and cable routed through junction boxes or distribution panels. Provide tool formed thermal expansion loops at cable at manholes, handholes and at both sides of all fixed mounted equipment. Cable loops and bends shall not be bent at a radius greater than that recommended by the manufacturer.
- I. Secure all wire and cable run vertically for continuous distances greater than thirty (30) feet. Secure robust non-coaxial cables with screw-flange nylon cable ties or similar devices appropriate to weight of cable. For all other cables, provide symmetrical conforming nonmetallic bushings or woven cable grips appropriate to weight of cable.

3.5 SIGNAL POLARITY CONVENTION

- A. Maintain consistent absolute signal polarity at all connectors, patch points and connection points accessible in the system. Comply with AES26-2001. Where applicable, a positive polarity electrical signal shall yield positive acoustic pressure from the loudspeakers.

- B. Audio signal connector convention: Comply with AES 14-1992 (r1998)

Signal	Connector	Wire
Signal Phase	Pin 2	Red or White
Signal Anti-Phase	Pin 3	Black
Signal Ground	Pin 1	Drain Wire

- C. Video and RF/TV Connector Convention:

Signal	Connector	Wire
Signal Phase	Center Pin	Center conductor
Signal Anti-Phase	Shell	Shield
Signal Ground	Shell	Shield

3.6 WIRING PRACTICE

- A. Land all non-coaxial field wiring entering each equipment rack at specified terminal devices prior to connection to any equipment or devices within racks. At Contractor's option, such terminals may be located in the equipment racks or in the terminal cabinets provided. Coordinate such selection with Project construction sequence and test procedures specified herein.
- B. Identify all wire and cable clearly with permanent labels wrapped about the full circumference within one (1) inch of each connection. Indicate the number designated on the associated field or shop drawing or run sheet, as applies. Assign wire or cable designations consistently throughout a given system. Each wire or cable shall carry the same labeled designation over its entire run, regardless of intermediate terminations. Conform with the requirements of Section 27 41 00.
- C. Apply all crimp connectors only with manufacturer's recommended ratchet type tooling and correct crimp dies for connector and wire size. Plier type crimp tooling shall not be acceptable.
- D. Coordinate insulation displacement (quick connect) terminal devices with wire size and type. Comply with manufacturer's recommendations. Make connections with automatic impact type tooling set to recommended force.

- E. Make all connections to screw-type barrier blocks with insulated crimp-type spade lugs. Lugs are not required at captive compression terminal type blocks. Provide permanent designation strips designed for use with the terminal blocks provided. Make neat, intelligible markings with indelible markers equivalent to "Sharpie".
- F. Tin terminated shield drain wires and insulate with heat shrinkable tubing.
- G. Use only rosin core 60/40 tin/lead solder for all solder connections.
- H. Dress, lace or harness all wire and cable to prevent mechanical stress on electrical connections. No wire or cable shall be supported by a connection point. Provide service loops where harnesses of different classes cross, or where hinged panels are to be interconnected.
- I. Termination and build-out resistors and related circuit correction components shall be visible. Do not install in connector shells or internally modify equipment. Show locations on Record Drawings.
- J. Correct any and all of the following unacceptable wiring conditions:
 - 1. Deformed, brittle or cracked insulation.
 - 2. Insulation shrunken or stripped further than 1/8" away from the actual point of connection within a connector, or on a punch block.
 - 3. Cold solder joints.
 - 4. Flux joints.
 - 5. Solder splatter.
 - 6. Un-grommited, un-bushed, or uninsulated wire or cable entries.
 - 7. Deformation or improper radius of wire or cable.

3.7 SIGNAL GROUNDING PROCEDURES

- A. Comply with National Electrical Code.
- B. Unless otherwise noted maintain a unipoint ground scheme.
- C. Signal and electrical system grounds shall be isolated except at the Project ground field connection.
- D. Equipment enclosures shall not be permitted to touch each other unless bolted together and electrically bonded.
- E. Ground and bond equipment racks and similar equipment enclosures containing powered equipment exclusively via the ground conductors provided under Division 27.
- F. At each rack, provide a ground bus within the rack. At each rack, provide a lug bonded to the rack frame with a #12 TW stranded wire to the rack Ground bus.
- G. At each ensemble of racks, provide a single labeled Ground tubular-clamp bus bar terminal strip to land the individual rack Isolated Ground bus ground conductors. Connect the main Isolated Ground conductor from the Technical Power panelboard at this point.
- H. Equipment signal ground shall be to the Ground System via the green wire of the equipment power cord. Where equipment uses two (2) wire power cord, provide #12 green bond wire to rack ground bus bar. At equipment, provide crimp lug and suitable hardware for bonding.

- I. Shielded cables of this section shall be grounded exclusively to Isolated Ground by a single path. Shield shall be tied to Ground at one end only, i.e., at the low potential (receiving) end of run, unless otherwise noted.
- J. Unless otherwise noted, at audio jackfields, tie source shield at jackbay frame. Float shields at connections to output jacks. Bus each row of jack frames and run individual #12 green ground wire for each row to rack IG bus bar.
- K. Signal Ground provisions shall realize less than 0.15 ohms to the primary ground connection.

3.8 FINISHES

- A. Finishes and materials for contractor fabricated assemblies such as racks, custom control panels, brackets, blank panels, equipment mounting in furniture or casework, speaker baffles, speaker grille material and in general any item or component herein which is visible shall adhere to the following:
 - 1. Finish shall be as directed by the Owner's Representative.
 - 2. In the event that the Owner's Representative provides no direction as to finish, finish shall match exactly the surrounding and adjacent surfaces.
 - 3. Wooden speaker back boxes and baffles shall be painted flat black if not otherwise finished or stained.

3.9 EQUIPMENT ENCLOSURE (RACK) AND EQUIPMENT FABRICATION

- A. Combustible material, other than incidental trim of indicated equipment, is prohibited within equipment racks.
- B. Within each equipment enclosure, provide a full-height multi-circuit ground outlet strip with branch circuit count as shown on drawings; locate on the left side of the equipment enclosure, as viewed from the rear. In each enclosure provide number of receptacles required by present and future equipment indicated on drawings, plus at least two spare receptacles. Provide flexible steel raceway and junction box for connection of power service. Bond internal raceway to rack frame.
- C. Provide a permanent label on the front of each equipment rack including the rack designation, and the circuit breaker number and associated electrical distribution panel designation servicing same.
- D. Maintain separation of wiring classifications as specified herein. Separately dress, route and land microphone and line level cables and related on the right side of the equipment enclosure, as viewed from the rear; dress, route, and land loudspeaker level and control cables on the left side of the equipment enclosure, as viewed from the rear.
- E. Access shall not require demounting or de-energizing of equipment. Install access covers, hinged panels, or pull-out drawers to insure complete access to terminals and interior components.
- F. Fasten removable covers containing any wired component with a continuous hinge along one side, with associated wiring secured and dressed to provide an adequate service loop. Provide an appropriate stop locks to hold all hinged panels and drawers in a serviceable position.
- G. Provide permanent labels for all equipment and devices. Where possible, fasten such labels to the rack frame or to blank or vent panels which will remain in place when active equipment is removed for possible service.

- H. At jackfields, provide service loop to permit removal of jackfields from rack sufficient to conveniently access all jack contacts for routine cleaning and maintenance. Organize the service loop and harness such that reasonable reconnection of jacks and jack normals is possible without cutting apart the harness.
- I. Coordinate the design and execution of wire harnessing of multi-bay rack ensembles with conditions of delivery to installation locations at Project Site, and with the requirement herein for test of the completely wired system in the shop prior to delivery to the Project Site. Organize the wiring harnesses such that they will fold within one shippable unit without risk of damage, or provide polarized multipin connectors and related interconnect systems as specified elsewhere herein.
- J. At each equipment backboard, provide UL Listed surge suppressing multioutlet assembly with at least six (6) receptacles.

3.10 EQUIPMENT RACK AND EQUIPMENT TESTING AND ADJUSTING PROCEDURES

- A. Conduct procedures in fabrication shop. Verify safe and proper operation of all components, devices, or equipment, establish nominal signal levels within the systems and verify the absence of extraneous or degrading signals. Make all preliminary adjustments and document the setting of all controls, parameters of all corrective networks, voltages at key system interconnection points, gains and losses, as applicable. Submit test report. Request and coordinate verification of submitted test data by the Owner's Representative. Correct all non-conforming conditions prior to shipment to Project Site. Perform at least the following procedures:
 - 1. Grounding of devices and equipment. Integrity of signal and electrical system ground connections.
 - 2. Proper provision of power to devices and equipment.
 - 3. Integrity of all insulation, shield terminations and connections.
 - 4. Integrity of soldered connections. Absence of solder splatter, solder bridges.
 - 5. Absence of debris of any kind, tools, etc.
 - 6. Routing and dressing of wire and cable.
 - 7. All wiring, including polarity and continuity, including conformance with wire designations on running sheets, field and shop drawings.
 - 8. Mechanical integrity of all support provisions.
- B. Preliminary: Verify:
 - 1. Grounding of devices and equipment. Integrity of signal and electrical system ground connections.
 - 2. Proper provision of power to devices and equipment.
 - 3. Integrity of all insulation, shield terminations and connections.
 - 4. Integrity of soldered connections. Absence of solder splatter, solder bridges.
 - 5. Absence of debris of any kind, tools, etc.
 - 6. Routing and dressing of wire and cable.
 - 7. All wiring, including polarity and continuity, including conformance with wire designations on running sheets, field and shop drawings.
 - 8. Mechanical integrity of all support provisions.
- C. Rig temporary power and grounding. Comply with all applicable Codes, regulations and ordinances.
- D. Determine the proper sequence of energizing systems to minimize the risk of damage. Energize. Burn in for at least 168 hours.
- E. Sound Systems:

1. Gain control settings: Establish tentative normal settings for all gain controls. Set all equalizers flat. Set all automatic gain control devices to bypass. Terminate power amplifier outputs with power load resistors with resistance value within 10% the nominal output impedance of the respective amplifier. Adjust all gain controls on equipment for optimum signal-to-noise ratio and signal balance and, unless they are sub-panel mounted, cap them to prevent tampering. Unless specified or directed otherwise, adjust gains such that in a given system the "front end" operates at unity gain and maintains 10 dB of clip margin referenced to the first onset of clipping of the associated power amplifier(s). Measure and document system gains at 1 kHz. Settings may require further adjustment by the Contractor, a result of testing by the Owner's Representative.
 2. Freedom from parasitic oscillation and radio frequency pickup: Maintain previous setup. Set up for each mode of operation specified in the functional requirements; verify that all systems are free from spurious oscillation and radio-frequency pickup using broadband oscilloscope. Correct any such defects.
 3. Hum and noise level/signal to noise level/signal to crosstalk level: Maintain previous setup. Terminate microphone and line-level inputs with shielded resistors of 150 and 600 ohms, respectively. Set available variable gain controls such that full power amplifier output would be achieved with -40 dBm input level at a microphone input and +12 dBm at a line-level input. Measure and document the specified parameters of the system overall for each microphone input channel and line-level input channel. Compare with nominal signal level.
 4. Total Harmonic Distortion: Maintain previous setup. Measure at reference operating level at least at 63 Hz, 125 Hz, 1 kHz, 10 kHz.
- F. Baseband Video Systems:
1. Picture Monitors:
 - a. Apply crosshatch. Verify linearity.
 - b. Apply red field. Adjust purity.
 - c. Apply SMPTE bars and PLUGE. Adjust to standards.
 2. Video Path Test: Use manufacturer's procedures. Use full field or line signals.
- G. Data/Graphics Systems:
1. Projector:
 - a. Apply crosshatch. Converge at design distance. Verify linearity.
 - b. Apply red, green and blue field. Adjust purity.
 2. Wideband Component Analog Video Path Test: Use manufacturer's procedures.
- H. Control System:
1. Demonstrate complete operation.

3.11 PROJECTION SCREEN INSTALLATION

- A. Inspection
1. General: Examine surfaces and rough framing to determine suitability to install screen and mount. Do not start work until unsatisfactory conditions are corrected.
- B. Installation
1. Install screen and projector mount horizontal and plumb for proper operation per manufacturer's recommendations. Securely anchor to supporting structure to withstand all loading conditions and strain of service.

C. Adjustment

1. Adjust units as required for smooth operation and alignment as required.
2. Just prior to final acceptance of project, clean the screen surface according to the manufacturer's instructions.
3. Protect completed work from damage until acceptance by the Owner's Representative.

3.12 LOUDSPEAKER ASSEMBLY INSTALLATION

A. Loudspeakers:

1. Verify proper installation of loudspeaker enclosures and related support.
2. Verify that no loudspeaker assembly is subjected to stresses or loading effects in any way contributing to possible extraordinary failure.

3.13 VIDEO PROJECTOR ASSEMBLY INSTALLATION

- A. Design, engineer and provide complete, all means of support, suspension, attachment, fastening, bracing, and restraint (hereinafter "support") of such equipment. Provide engineering of such support by parties licensed to perform work of this type in the Project jurisdiction. Submit in timely manner.
- B. Comply with applicable Code and the requirements of the Authorities having jurisdiction.
- C. Provide safety factor greater than six (6) or as required by Code, whichever is greater.
- D. Do not apply any load to building structure without first obtaining written approval of the Owner's Representative. Obtain per Project procedures.
- E. During Acceptance Testing, adjust orientation of Video Projector as directed to achieve optimum picture. Provide workers and ladders as required. Perform such adjustment with no claim for additional cost or time.

3.14 SYSTEMS PERFORMANCE TESTING AND ADJUSTING PROCEDURES

- A. Upon completion of the installation of all equipment in an area, perform the following tests and record results. Verify safe and proper operation of all components, devices, or equipment, establish nominal signal levels within the systems and verify the absence of extraneous or degrading signals. Make all preliminary adjustments and document the setting of all controls, parameters of all corrective networks, voltages at key system interconnection points, gains and losses, as applicable. Submit test report. Correct all non-conforming conditions prior to requesting Acceptance Review and Testing. Perform at least the following procedures:
 1. Mechanical: Verify:
 - a. Integrity of all support provisions.
 - b. Absence of debris of any kind, tools, etc.
 2. Power and Isolated Ground: Verify:
 - a. Isolation of Isolated Ground system from raceway and related ground.
 - b. Grounding of devices and equipment. Integrity of signal and technical power system ground connections.
 - c. Proper provision of power to devices and equipment.
 3. Signal Wiring: Verify:
 - a. Integrity of all insulation, shield terminations and connections.
 - b. Integrity of soldered connections. Absence of solder splatter, solder bridges.

- c. Routing and dressing of wire and cable.
- d. Continuity, including conformance with wire designations on running sheets, field and shop drawings.
- e. Absence of ground faults.
- f. Polarity.
4. Use the proper sequence of energizing systems to minimize the risk of damage. Energize.
5. Sound Systems, Electronic Tests; confirm:
 - a. Gain at 1 kHz.
 - b. Maximum output.
 - c. Input clipping level.
 - d. Frequency response.
 - e. Total harmonic distortion.
 - f. Signal to noise ration.
 - g. Signal to crosstalk ratio.
6. Electro/Acoustic Tests:
 - a. Uniformity of coverage.
 - b. Electronic and acoustic frequency response/one-third octave equalization. Measure at ear level. Comply with applicable portions of ANSI (SMPTE) PH22.202M-1984, "B chain electro-acoustic response - control rooms and indoor theaters." Adjust to "curve X of B chain characteristic". Owner's Representative will direct final adjustment.
 - c. Maximum continuous sound pressure level (in the reverberant field). Drive systems with broadband pink noise. Sustain for at least five (5) minutes with no system damage. Measure for "A" and "C" weightings at ear level on loudspeaker axis. Turn off noise.
 - d. Acoustic signal-to-noise ratio referenced to the specified maximum continuous sound pressure level in the reverberant field. Measure for "A" and "C" weightings at ear level on loudspeaker axis with mechanical systems operating. Present comparison with previous measurement.
7. Video Systems:
 - a. Picture Monitors:
 - i. Apply crosshatch. Verify linearity.
 - ii. Apply red field. Adjust purity.
 - iii. Apply SMPTE bars and PLUGE. Adjust to standards.
 - b. Video Path Test: Use NTC Report No. 7 procedures. Use full field or line signals.
 - i. Insertion Gain.
 - ii. Gain/Frequency Distortion.
8. Control System: Demonstrate complete operation.

3.15 LABELING

- A. Conform with the requirements of Section 27 41 07 – Identification for Audiovisual Systems.
- B. Provide permanent "wedge" type labels on all controls, as applies, to indicate correct settings after systems performance testing and adjustment procedures have been successfully completed.

END OF SECTION