UNIONCOUNTY
north carolina

Invitation for Bid No. 2021-090

Union County Structured Cabling & Audio Visual

ADDENDUM No. 3

ISSUE DATE: August 10, 2021

Responding Offerors on this project are hereby notified that this Addendum shall be made a part of the above named IFB document.

The following items add to, modify, and/or clarify the IFB documents and shall have the full force and effect of the original Documents. This Addendum shall be acknowledged by the Offeror in the IFB document.

Addendum No. 3 Drawings are available at this link:

Duncan Parnell Planroom

Union county Structured Cabling and Audio Visual — Union County, Owner
Project No.: 2021-090 — Contract Document Date: June 14, 2021
Issue to: Bidders — Addendum Date: Aug 10, 2021

A. NOTICE TO BIDDER

1.1 This Addendum is issued pursuant to the Conditions of the Contract and is hereby made part of the Contract Documents. The addendum serves to clarify, revise, and supersede information in the Project Manual, the Drawings, and previously issued Addenda. The Bidder shall acknowledge receipt of this Addendum in the appropriate space on the Bid Form. Failure to do so may subject the Bidder to disqualification. A list of attachments, if any, is part of this document.

1.2 The date for receipt of bids for this project is unchanged by this Addendum.

1.3 The date for receipt of Requests for information for this project is unchanged by this Addendum.

B. RESPONSES TO QUESTIONS FROM POTENTIAL BIDDERS

1.4 Question #1: At the meeting yesterday when we were talking about the color coding in respect to cable and jack colors, it was stated that the color code only applied to the ESC. However color F, which is Orange in Interview Rooms for Data, I am only seeing Interview Rooms in the Sheriffs Office…..Therefore wouldn't it be best that color coding applies to all three sites for consistency? Response as follows:

a) The above is a misunderstanding of the color coding requirements. The color codeing APPLIES to all project. It was emphasized for the ESC due its importance.

1.5 Question #2: Scope of work quotes "Room build out includes all Plywood backboards" yet on TE001 in the contractor general matrix it says plywood is the responsibility of general contractor. Can you clarify? Response as follows:

a) The plywood backcoards are NOT in the scope of work for this Bid.

1.6 Question #3: Will any other manufacturer be accepted for bidding besides Berktek Leviton? (Panduit, Commscope, Siemon)? Response as follows:

a) Specifications will be revised in Addendum #3.

1.7 Question #4: Electrical Contractor responsible for Cable tray? Response as follows:

a) Drawings will be revised to clarify responsibilities. Refer to TE001 and floor plan general notes.

1.8 Question #5: Electrical Contractor responsible for Grounding? Busbars? Response as follows:

a) Grounding conductors and PBB/SBB will be provided by Electrical Contractor. Structured Cabling contractor shall provide rack busbars and connection to local TR busbar. Drawings will be revised to clarify responsibility.

1.9 Question #6: What type of floor boxes will be used so we can price the correct plates for communications? Response as follows:

a) Emergency Services Complex – Legrand EFB8 for Floor Boxes.
b) Sheriff's Office – Legrand RFB6 Floor Boxes and Legrand 6AT Poke Thru
c) SWRL – Spec'd Legrand EFB45S and EFB6s-OG

1.10 Question #7: Is a permit required for communications? Response as follows:

a) Yes, it will be as an additional sub to the Construction Manager.

1.11 Question #8: Where is the projector screen located? Response as follows:

a) Projector screen not required. Video wall system will be provided. Refer to revised drawings.

1.12 Question #9: Line drawings appear to be missing a receiver at the projector location? Response as follows:

a) Projector screen not required. Video wall system will be provided. Refer to revised drawings.

1.13 Question #10: Large Meeting Room 133: Will there need for distributed ceiling speakers within the meeting space or will audio be via the display's integrated speakers? Response as follows:

a) Overhead speakers will be provided. Refer to revised drawings.

1.14 Question #11: Can the client confirm that there is not going to be any conferencing in any of the spaces? Response as follows:

a) Video Conferencing added. Refer to revised drawings.

1.15 Question #12: Confirm that all control is going to be via the Extron push button wall controllers. Response as follows:

a) Confirmed.

1.16 Question #13: Is the AV integrator to provide all network switches ons? Response as follows:

a) Network switches for LAN will be provided by owner.

1.17 Question #14: Is the AV integrator to provide the fiber enclosure shown on the AV rack drawings ations? Response as follows:

a) Structured cabling contractor will provide the fiber enclosure. Refer to revised elevation.

1.18 Question #15: By the time of this submittal, we will be outside of the 14 days requested notice for approved alternate equipment. What is the updated process for receiving/granting approved alternate products? Response as follows:

a) - Manufactures in the specifications shall be considered pre-approved as long as alternate equipment meets specifications outlined in the basis of design. Please let us know the manufacture in which you would like to use and we will run it by the owner. Detailed shops will not be required prior to bid if the owner accepts the manufacturer and the specs meet the basis of design.

1.19 Question #16: Matrix on TE001 Racks and Cabinets are to be provided by Telecom Contractor. For the ESC Building, the A/V cabinet in room 109 which will house, by drawings, both A/V and network equipment the Telecom Contractors responsibility or the A/V Contractors responsibility to provide? – Shared Equipment rack in AV Room 109 shall be provided by Telecom contractor.

a) Shared Equipment rack in AV Room 109 shall be provided by Telecom contractor.

1.20 Question #17: Also we have elevation drawings for racks and cabinets for Sheriffs Office and Library but not for ESC. Can these be provided?

a) The exact ESC server room elevations for the owner's equipment has not yet been determined. Please provide a fiber enclosure and patch panels to terminate cabling in contract plus 25% spare.

1.21 Question #1) Server Room 157 at the ESC has 10 Cabinets in it. Do we need to install fiber or copper backbone between each of the cabinets? If so what quantities and types? Response as follows:

a) Copper or Fiber backbone between cabinets within Server Room 157 are not required in the bid.

1.22 Question #2: 121 - FM Work Area - No source/input or wiring reference shown for desks area displays. Response as follows:

a) Architecture updated.

1.23 Question #3: 132 - Dining - No source/input or wiring reference shown for display. Response as follows:

a) Architecture updated.

1.24 Question #4: 113 - EOC - Video Wall requirements are unclear. There is a conflict between drawings (Tiled LCD) and addendum (DVLED). Please clarify/define quantity, types and locations for input sources to video wall processor. Currently, only one PC and one satellite receiver are shown. Architecture updated.Question #3: 132 - Dining - No source/input or wiring reference shown for display. Response as follows:

a) Architecture updated.

1.25 Question #5: 114 - 911/COMM - Video Wall requirements are unclear. There is a conflict between drawings (Tiled LCD) and addendum (DVLED). Please clarify/define quantity, types and locations for input sources to video wall processor. Currently, only one PC and one satellite receiver are shown. Architecture updated.Question #3: 132 - Dining - No source/input or wiring reference shown for display. Response as follows:

a) Architecture updated.

1.26 Question #6: 155 - Training Room - Floorplan/infrastructure show dual displays, but line diagram shows only one: Please confirm requirement for second display. If yes, please confirm mirrored source selection (no independent selection). Yes, these displays are mirrored.Question #3: 132 - Dining - No source/input or wiring reference shown for display. Response as follows:

a) Architecture updated.

1.27 Question #7: 2337 Chief Deputy Ops - Display at round table: Should there be a wall plate input under the display? Response as follows:

a) No wall plate needed.

1.28 Question #8: 2336 - Large CR - Please confirm mirrored displays (no independent source selection). Response as follows:

a) Yes, these displays are mirrored.

1.29 Question #9: 2106 - Real Time Crime CR - Are tables to be movable? Wiring diagram provided does not match room architecture, e.g., Input for table located in FB with switcher under table. HDMI cabling over extended distances. Recommend modifying architecture. Response as follows:

a) Architecture updated.

1.30 Question #10: 2201 - Small CR - Architecture does not make sense, e.g., Input for table located in FB with switcher under table. Response as follows:

a) Architecture updated.

1.31 Question #11: 2221 - Conference Room - Are tables to be movable? Wiring diagram provided does not match room architecture, e.g., Input for table located in FB with switcher under table. HDMI cabling over extended distances. Recommend modifying architecture. Response as follows:

a) Architecture updated.

1.32 Question #12: 2117 - Conference Room - Wiring diagram provided does not match room architecture, e.g., Input for table located in FB with switcher under table. Response as follows:

a) Architecture updated.

1.33 Question #13: 1301 - Patrol Squad Bullpen - Are tables to be movable? Wiring diagram provided does not match room architecture, e.g., Input for table located in FB with switcher under table. HDMI cabling over extended distances. Recommend modifying architecture. Response as follows:

a) Architecture updated.

1.34 Question #14: 1400 - Community/Training Room - Please confirm projector and display are mirrored (no independent selection). Response as follows:

a) Projector has been removed from the design for this area.

1.35 Question #15: Drawing AV301 references AV304 Details 1 & 2 for Office & Signage displays. This drawing does not exist in package. Please confirm correct drawing reference (appears to be AV601 Details 1 & 2?). Response as follows:

a) Drawing reference has been corrected.

1.36 Question #16: Please provide additional information regarding Intercom/paging system: Are there any zoning requirements? (For paging content as well as volume control) Number and location of user inputs? Dedicated system for paging? Telephone interface? Is there a preferred vendor? Response as follows:

a) SIP interface only for all call. No zoning or additional inputs required. Volume control at equipment location.

1.37 Question #15: 101 - Lobby - Please confirm intercom speaker type and location in the grid ceiling area.

C. MODIFICATIONS TO PROJECT MANUAL

1.38 SECTION 00 41 13 – BID FORM: Revised as follows:

a) Added Unit Prices:
   1) Video Wall Basis of Design (8x8)
   2) Video Wall Basis of Design (5x5)

1.39 SECTION 27 05 26 – GROUNDING AND BONDING

a) Revised Equipment Rack BB

1.40 SECTION 27 11 16 – COMMUNICATIONS RACKS

a) Revised Power Strip and PDU Info

1.41 SECTION 27 15 13 – COPPER HORIZONTAL CABLING

a) Clarified Basis of Design

1.42 SECTION 27 41 16 – INTEGRATED AV SYSTEMS

a) General Revisions

D. MODIFICATIONS TO DRAWINGS

1.43 This Addendum includes the attached full sheets:

a) Telecommunications Sheet TE001 (ESC), (Revision 2)
   1) Added Notes Notes C, D, & E to contractor / Integrater Responsibility Matrix.
   2) Modified General Notes EE, FF, HH, II & JJ.
b) Telecommunications Sheet TE101 (ESC), (Revision 2)
   1) Removed General Notes C, D, E, & F.
   2) Modified General Notes A & B.
c) Telecommunications Sheet TE102 (ESC), (Revision 2).
   1) Modified General Notes C.
d) Telecommunications Sheet TE103 (ESC), (Revision 2).
   1) Added viewports #2 & #3.
e) Telecommunications Sheet TE200 (SO), (Revision 2).
   1) Removed General Notes B & CF.
   2) Modified General Notes A.
f) Telecommunications Sheet TE201 (SO), (Revision 2).
   1) Added General Notes B & C.

2) Modified floor box layout in Training Room 1400.
3) Added (3) floor boxes to training Room 1400 near stage area.

g) Telecommunications Sheet TE202 (SO), (Revision 2).
1) Added General Notes A & B.

h) Telecommunications Sheet TE203 (SO), (Revision 2)
1) Added (2) 2-post equipment racks to Server Room 2222.
2) Added cable tray to Server Room 2222.

i) Telecommunications Sheet TE301 (SWRL), (Revision 2)
1) Added General Note A.

j) Telecommunications Sheet TE400, (Revision 2)
1) Modified Details #1, #2, #, & #4.

k) AV Sheet AV101, (Revision 2).
1) Added Audio in ESC/911.

l) AV Sheet AV101, (Revision 3).
1) Added wall input plates for room 121.

m) AV Sheet AV401, (Revision 2).
1) Added Video Conferencing (Soundbar/Camera)

n) AV Sheet AV401, (Revision 3).
1) Updated line diagram for conference room 115.
2) Updated line diagram for breakout 116.
3) Modified drawing note #6.

o) AV Sheet AV402 (ESC), (Revision 2).
1) Removed Telecommunications rack mounted equipment from viewport #3 – Equipment Rack Elevation.
2) Removed equipment rack from viewport #1 – Eqipment Rack Elevation.
3) Added Drawing Note #11.
4) Removed equipment rack from viewport #1 – AV Enlarged Plan.

p) AV Sheet AV402, (Revision 3).
1) Added 1U shelf in AV rack
2) Updated line diagram and floor plan for training 155.
3) Modified drawing note #3.

q) AV Sheet AV403, (Revision 2).
1) Revised Video Wall

r) AV Sheet AV403, (Revision 3).
1) Added assistive listening system for EOC/911 rooms
2) Added connections for conference room 115 & breakout 116 to tie into video wall system.

s) AV Sheet AV501, (Revision 2).
1) Revised Video Wall
2) Added Video Conferencing (Soundbar/Camera)

t) AV Sheet AV501, (Revision 3).
1) Adjusted Layout for viewport #1 AV Enlarged Plan
2) Adjusted Layout for viewport #2 AV Line Diagram
3) Modified Drawing notes #7,8,9,10,11
4) Added drawing Note #15

u) AV Sheet AV502, (Revision 2).
1) Added Video Conferencing (Soundbar/Camera)

v) AV Sheet AV502, (Revision 3).
   1) Adjusted Layout for viewport #3 AV Enlarged Plan
   2) Adjusted Layout for viewport #4 AV Line Diagram
   3) Modified Drawing notes #8,9,10
   4) Added Drawing Notes #16,17

w) AV Sheet AV503, (Revision 2).
   1) Added Video Conferencing (Soundbar/Camera)

x) AV Sheet AV503, (Revision 3).
   1) Adjusted Layout for viewport #1 AV Enlarged Plan
   2) Adjusted Layout for viewport #2 AV Line Diagram
   3) Adjusted Layout for viewport #3 AV Enlarged Plan
   4) Adjusted Layout for viewport #4 AV Line Diagram
   5) Adjusted Layout for viewport #5 AV Enlarged Plan
   6) Adjusted Layout for viewport #6 AV Line Diagram
   7) Modified Drawing notes #6,8,9,10
   8) Added Drawing Notes #14,15,16

y) AV Sheet AV504, (Revision 2).
   1) Added Video Conferencing (Soundbar/Camera)

z) AV Sheet AV504, (Revision 3).
   1) Updated product part number.

aa) AV Sheet AV601, (Revision 2).
   1) Added Video Conferencing (Soundbar/Camera)

bb) AV Sheet AV601, (Revision 3).
   1) Removed redundant details.

cc) AV Sheet AV702, (Revision 3).
   1) Added detail #7 AV IN-WALL BOX

E. ATTACHMENTS

1.44 This Addendum includes the attached full sheets:
   a) Telecommunications Sheet TE001 (ESC), (Revision 2)
   b) Telecommunications Sheet TE101 (ESC), (Revision 2).
   c) Telecommunications Sheet TE102 (ESC), (Revision 2).
   d) Telecommunications Sheet TE202 (ESC), (Revision 2).
   e) Telecommunications Sheet TE200 (S0), (Revision 2).
   f) Telecommunications Sheet TE201 (S0), (Revision 2).
   g) Telecommunications Sheet TE202 (S0), (Revision 2).
   h) Telecommunications Sheet TE301 (SWRL), (Revision 2).
   i) Telecommunications Sheet TE400, (Revision 2).
   j) AV Sheet AV101, (Revision 2).
   k) AV Sheet AV101, (Revision 3).
   l) AV Sheet AV401, (Revision 2).
   m) AV Sheet AV401, (Revision 3).
   n) AV Sheet AV402 (ESC), (Revision 2).
   o) AV Sheet AV402, (Revision 3).
   p) AV Sheet AV403, (Revision 2).

q) AV Sheet AV403, (Revision3).
r) AV Sheet AV501, (Revision 2).
s) AV Sheet AV501, (Revision 3).
t) AV Sheet AV502, (Revision 2).
u) AV Sheet AV502, (Revision 3).
v) AV Sheet AV503, (Revision 2).
w) AV Sheet AV503, (Revision 3).
x) AV Sheet AV504, (Revision 2).
y) AV Sheet AV504, (Revision3).
z) AV Sheet AV601, (Revision 2).
aa) AV Sheet AV601, (Revision 3).
bb) AV Sheet AV702, (Revision 3).

END OF ADDENDUM

SECTION 27 05 26 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Grounding conductors.
2. Grounding connectors.
3. Grounding busbars.
4. Grounding labeling.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. As-Built Data: Plans showing as-built locations of grounding and bonding infrastructure, including the following:

1. BCT, PBB, SBBs, and routing of their bonding conductors.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Installation Supervision: Installation shall be under the direct supervision of ITS Technician, who shall be present at all times when Work of this Section is performed at Project site.
2. Field Inspector: Currently registered by BICSI as a RCDD to perform the on-site inspection.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

C. Comply with latest TIA-607 standard.

D. Comply with Motorola R56

2.2 CONDUCTORS

A. Manufacturers:

1. Panduit Corporation
2. The Siemon Company
3. Harger Lightning & Grounding.
4. Tyco Electronics Corp.
5. Burndy; Part of Hubbell Electrical Systems

B. Comply with UL 486A-486B.

C. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.

1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.
2. Cable Tray Equipment Grounding Wire: No. 6 AWG.

D. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmils, 14 strands of No. 17 AWG conductor, and 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Tinned-copper tape, braided conductors terminated with two-hole copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.3 CONNECTORS

A. Manufacturers:

1. Panduit Corporation
2. The Siemon Company
3. Harger Lightning & Grounding.
4. Tyco Electronics Corp.
5. Burndy; Part of Hubbell Electrical Systems

B. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.

C. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.

1. Electroplated tinned copper, C and H shaped.

D. Busbar Connectors: Cast silicon bronze, solderless compression-type, mechanical connector; with a long barrel and two holes for a two-bolt connection to the busbar.

E. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.4 GROUNDING BUSBARS

A. Manufacturers:

1. Panduit Corporation
2. The Siemon Company
3. Harger Lightning & Grounding.
4. Tyco Electronics Corp.
5. Burndy; Part of Hubbell Electrical Systems
6. Eaton B-Line

B. PBB: Predrilled, wall-mounted, rectangular bars of hard-drawn solid copper, 1/4 by 4 inches in cross section, length as indicated on Drawings. The busbar shall be NRTL listed for use as PBB and shall comply with latest TIA-607 standard.

1. Predrilling shall be with holes for use with lugs specified in this Section.
2. Mounting Hardware: Stand-off brackets that provide a 4-inch clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.

C. SBB: Predrilled rectangular bars of hard-drawn solid copper, 1/4 by 2 inches in cross section, length as indicated on Drawings. The busbar shall be for wall mounting, shall be NRTL listed as complying with UL 467, and shall comply with latest TIA-607 standard.

1. Predrilling shall be with holes for use with lugs specified in this Section.
2. Mounting Hardware: Stand-off brackets that provide at least a 2-inch clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.

D. Rack and Cabinet Grounding Busbars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with latest TIA-607 standard. Predrilling shall be with holes for use with lugs specified in this Section.

2.5 IDENTIFICATION

A. Comply with requirements for identification products in Section 27 05 53 "Identification for Communications Systems."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the ac grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of the electrical system.

B. Inspect the test results of the ac grounding system measured at the point of BCT connection.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with connection of the BCT only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Bonding shall include the ac utility power service entrance, the communications cable entrance, and the grounding electrode system. The bonding of these elements shall form a loop so that each element is connected to at least two others.

B. Comply with NECA 1.

C. Comply with latest TIA-607 standard.

3.3 APPLICATION

A. Conductors: Install solid conductor for No. 8 AWG and smaller and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

1. The bonding conductors between the SBB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.
2. The bonding conductors between the PBB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.

B. Underground Grounding Conductors: Install tin plated copper conductor, No. 2 AWG minimum.

C. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Structural Steel: Welded connectors.

D. Conductor Support:

1. Secure grounding and bonding conductors at intervals of not less than 36 inches.

E. Grounding and Bonding Conductors:

1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
2. Install without splices.
3. Support at not more than 36-inch intervals.
4. Install grounding and bonding conductors in 3/4-inch PVC conduit until conduit enters a telecommunications room. The grounding and bonding conductor pathway through a plenum shall be in EMT. Conductors shall not be installed in EMT unless otherwise indicated.

    a. If a grounding and bonding conductor is installed in ferrous metallic conduit, bond the conductor to the conduit using a grounding bushing and bond both ends of the conduit to a SBB.

3.4 GROUNDING ELECTRODE SYSTEM

A. The BCT between the PBB and the ac service equipment ground shall not be smaller than No. 3/0 AWG.

3.5 GROUNDING BUSBARS

A. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers 2 inches minimum from wall, 60 inches above finished floor unless otherwise indicated.

B. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

3.6 CONNECTIONS

A. Bond metallic equipment in a telecommunications equipment room to the grounding busbar in that room, using equipment grounding conductors not smaller than No. 6 AWG.

B. Stacking of conductors under a single bolt is not permitted when connecting to busbars.

C. Daisy chaining of connections is not permitted. Individual bonding conductors must be utilized for components needing to be connected to the SBB or PBB.

D. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

E. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:

1. Use crimping tool and the die specific to the connector.
2. Pretwist the conductor.
3. Apply an antioxidant compound to all bolted and compression connections.

F. Primary Protector: Bond to the PBB with insulated bonding conductor.

G. Interconnections: Interconnect all SBBs with the PBB with the telecommunications backbone conductor. If more than one PBB is installed, interconnect PBBs using the grounding equalizer conductor. The telecommunications backbone conductor and grounding equalizer conductor

size shall not be less than 2 kcmils/linear foot of conductor length, up to a maximum size of No. 3/0 AWG unless otherwise indicated. Refer to R56 table 5-3

H. Telecommunications Enclosures and Equipment Racks: Bond metallic components of enclosures to the telecommunications bonding and grounding system. Install ~~top-mounted~~ vertical-mounted rack grounding busbar unless the enclosure and rack are manufactured with the busbar. Bond the equipment grounding busbar to the SBB minimally No. 2 AWG bonding conductors. Harger RGBVKIT145872A

I. Structural Steel: Where the structural steel of a steel frame building is readily accessible within the room or space, bond each SBB and PBB to the vertical steel of the building frame.

J. Electrical Power Panelboards: Where an electrical panelboard for telecommunications equipment is located in the same room or space, bond each SBB to the ground bar of the panelboard.

K. Shielded Cable: Bond the shield of shielded cable to the SBB in communications rooms and spaces. Comply with TIA-568-C.1 and TIA-568-C.2 when grounding shielded balanced twisted-pair cables.

L. Rack- and Cabinet-Mounted Equipment: Bond powered equipment chassis to the cabinet or rack grounding bar. Power connection shall comply with NFPA 70; the equipment grounding conductor in the power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this Section.

M. Access Floors: Bond all metal parts of access floors to the SBB.

N. Cable Tray: Bond all segments of cable tray to the adjacent segments of cable tray using bonding jumper. Bond all corners using bonding jumper. At a location near the SBB, bond the tray system to the SBB using a No. 2 AWG bonding conductor. No. 6 AWG shall be acceptable up to 13 feet in length.

O. Sleeve systems: Bond all sleeve systems entering the telecommunications spaces to the local SBB using a No. 2 AWG bonding conductor. No. 6 AWG shall be acceptable up to 13 feet in length.

3.7 IDENTIFICATION

A. Labels shall be preprinted or computer-printed type.

1. Label PBB(s) with "fs-PBB," where "fs" is the telecommunications space identifier for the space containing the PBB.
2. Label SBB(s) with "fs-SBB," where "fs" is the telecommunications space identifier for the space containing the SBB.
3. Label the BCT and each telecommunications backbone conductor at its attachment point: "WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
2. Test the bonding connections of the system using an ac earth ground-resistance tester, taking two-point bonding measurements in each telecommunications equipment room containing a PBB and a SBB and using the process recommended by BICSI TDMM. Conduct tests with the facility in operation.

    a. Measure the resistance between the busbar and the nearest available grounding electrode. The maximum acceptable value of this bonding resistance is 100 milliohms.

3. Test for ground loop currents using a digital clamp-on ammeter, with a full-scale of not more than 10 A, displaying current in increments of 0.01 A at an accuracy of plus/minus 2.0 percent.

    a. With the grounding infrastructure completed and the communications system electronics operating, measure the current in every conductor connected to the PBB and in each SBB. Maximum acceptable ac current level is 1 A.

C. Excessive Ground Resistance: If resistance to ground at the BCT exceeds 5 ohms, notify Engineer promptly and include recommendations to reduce ground resistance.

D. Grounding system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION

SECTION 27 11 16 - COMMUNICATIONS RACKS, FRAMES, AND ENCLOSURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. 19-inch equipment racks.
2. 19-inch equipment cabinets.
3. Power strips.
4. Power Distribution Units

1.2 DEFINITIONS

A. Access Provider: An operator that provides a circuit path or facility between the service provider and user. An access provider can also be a service provider.

B. Service Provider: The operator of a telecommunications transmission service delivered through access provider facilities.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For communications racks, frames, and enclosures. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Detailed Rack Elevations indicating layout of equipment. Coordinate with ITS department.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

B. Seismic Qualification Data: Certificates, from manufacturer.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Cabling installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under direct supervision of RCDD.

2. Installation Supervision: Installation shall be under direct supervision of Technician, who shall be present at all times when work of this section is performed at project site.
3. Field Inspector: Currently registered by BICSI as RCDD to perform on-site inspection.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. UL listed.

B. RoHS compliant.

2.2 19-INCH EQUIPMENT RACKS – ESC

A. Description: Four post racks with threaded rails designed for mounting telecommunications equipment. Width is compatible with EIA/ECIA 310-E, 19-inch equipment mounting.

B. Manufacturers:

1. APC Netshelter (ESC Only)

C. General Requirements:

1. Frames: Modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Material: Steel (Four-Post).
3. Finish: Manufacturer's standard, baked-polyester powder coat.
4. Color: Black.

D. Floor-Mounted Racks:

1. Overall Height: 84 inches
2. Overall Depth: 30 inches (Four-Post)
3. Two-Post Load Rating: 1000 lb
4. Four-Post Load Rating: 2500 lb
5. Number of Rack Units per Rack: 45

a. Numbering: Every rack unit, on interior of rack.

6. Threads: 12-24.
7. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, and a power strip.
8. Base shall have a minimum of four mounting holes for permanent attachment to floor.
9. Top shall have provisions for attaching to cable tray or ceiling.
10. Self-leveling.

E. Wall-Mounted Racks:

1. Height: As indicated on Drawings.
2. Depth: 24 inches
3. Load Rating: 150 lb
4. Number of Rack Units per Rack: As indicated on Drawings.

5. Threads: 12-24.
6. Wall Attachment: Four mounting holes.
7. Equipment Access: Dual hinges open to right or left, stopping in 90° position.

F. Cable Management:

1. Metal or Plastic, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.3 19-INCH EQUIPMENT CABINETS - ESC

A. Description: Manufacturer-assembled four-post frame enclosed by side and top panels and front and rear doors, designed for mounting telecommunications equipment. Width is compatible with EIA/ECIA 310-E, 19-inch equipment mounting.

B. Manufacturers:

1. APC Netshelter (ESC Only)

C. General Cabinet Requirements:

1. Modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Material: Aluminum.
3. Finish: Manufacturer's standard, baked-polyester powder coat.
4. Color: Black.

D. Modular Freestanding Cabinets:

1. Overall Height: 84 inches
2. Overall Depth: 42″ inches
3. Load Rating: 3000 lb.
4. Number of Rack Units: As indicated on Drawings.

a. Numbering: Every rack unit, on interior of rack.

5. Threads: 12-24.
6. Removable and lockable side and top panels.
7. Hinged and lockable front and rear doors.
8. Adjustable feet for leveling.
9. Screened ventilation openings in roof and rear door.
10. Cable access provisions in roof and base.
11. TGB.
12. Roof - mounted, 550-cfm fan with filter.
13. Power strip.
14. All cabinets keyed alike.

E. Cable Management:

1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at top of each relay rack, with a minimum height of two rack units each.

2.4 19-INCH EQUIPMENT RACKS – SHERIFFS OFFICE AND SWRL

A. Description: Two-post racks with threaded rails designed for mounting telecommunications equipment. Width is compatible with EIA/ECIA 310-E, 19-inch equipment mounting.

B. Manufacturers:

1. Leviton

C. General Requirements:

1. Frames: Modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Material: Aluminum (Two-Post)
3. Finish: Manufacturer's standard, baked-polyester powder coat.
4. Color: Black.

D. Floor-Mounted Racks:

1. Overall Height: 84 inches
2. Overall Depth: 30 inches (Four-Post)
3. Two-Post Load Rating: 1000 lb
4. Four-Post Load Rating: 2500 lb
5. Number of Rack Units per Rack: 45

    a. Numbering: Every rack unit, on interior of rack.

6. Threads: 12-24.
7. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, and a power strip.
8. Base shall have a minimum of four mounting holes for permanent attachment to floor.
9. Top shall have provisions for attaching to cable tray or ceiling.
10. Self-leveling.

E. Wall-Mounted Racks:

1. Height: As indicated on Drawings.
2. Depth: 24 inches
3. Load Rating: 150 lb
4. Number of Rack Units per Rack: As indicated on Drawings.
5. Threads: 12-24.
6. Wall Attachment: Four mounting holes.
7. Equipment Access: Dual hinges open to right or left, stopping in 90° position.

F. Cable Management:

1. Metal or Plastic, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.

3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.5 POWER STRIPS

A. Power Strips: Transtector OP8-20B (All Equipment Racks)

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Rack mounting, with flanges.
3. Height: ~~1~~ 3 RU.
4. Housing: Metal.
5. ~~(12)~~ (8) 120-VAC, 5-15R Receptacles.
6. ~~(2) Front and (10) Rear Receptacles.~~
7. LED indicator lights for power and protection status.
8. ~~LED indicator lights for reverse polarity and open outlet ground.~~
9. ~~Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.~~
10. ~~Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.~~
11. Cord connected with 12-foot line cord.
12. ~~Rocker-type on-off switch~~
13. ~~Surge Protection: UL 1449, Type 3.~~

    a. ~~Maximum Surge Current, Line to Neutral: 72 kA.~~
    b. ~~Protection modes shall be line to neutral, line to ground, and neutral to ground.~~
    c. ~~UL 1449 Voltage Protection Rating for line to neutral and line to ground shall be 600 V and 500 V for neutral to ground.~~

2.6 POWER DISTRIBUTION UNITS

A. Power Distribution Units: Tripplite PDUMV20NETLX

1. 1.9kW 120V single-phase switched 0U PDU
2. 24 individually controllable NEMA 5-15/20R outlets
3. NEMA L5-20P input with 10 ft. AC power cord and 5-20P adapter

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI TDMM for layout of communications equipment spaces.

C. Comply with BICSI ITSIMM for installation of communications equipment spaces.

D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. Coordinate layout and installation of communications equipment in racks and room. Coordinate service entrance configuration with service provider.

1. Meet jointly with system providers, equipment suppliers, and Owner to exchange information and agree on details of equipment configurations and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust configurations and locations of distribution frames, cross-connects, and patch panels in equipment spaces to accommodate and optimize configuration and space requirements of telecommunications equipment.
4. Adjust configurations and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in equipment room.

F. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

END OF SECTION

SECTION 27 15 13 - COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Category 6A twisted pair cable.
2. Twisted pair cable hardware, including plugs and jacks.
3. Cable management system.
4. Grounding provisions for twisted pair cable.

1.2 COPPER HORIZONTAL CABLING DESCRIPTION

A. Horizontal cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.

1. TIA-568-C.1 requires that a minimum of two equipment outlets be installed for each work area.
2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
3. Bridged taps and splices shall not be installed in the horizontal cabling.

B. A work area is approximately 100 sq. ft and includes the components that extend from the equipment outlets to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Floor plans indicating cable category, cable color and jack color at each location for designer/owner approval prior to purchasing materials.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For RCDD, Installer, installation supervisor, and field inspector.

B. Product Certificates: For each type of product.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. As-builts with cabling administration information

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of shop drawings, cabling administration drawings, and field-testing program development by an RCDD.
2. Installation: Installer shall be manufacturer certified to install cabling system submitted.
3. Installation Supervision: Installation shall be under the direct supervision of Technician, who shall be present at all times when work of this section is performed at project site.
4. Testing Supervisor: Currently certified by BICSI as a RCDD to supervise on-site testing.

B. Testing Agency Qualifications: Testing agency must have personnel certified by BICSI on staff.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as a RCDD.

1.7 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.

2.2 GENERAL CABLE CHARACTERISTICS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:

1. Communications, Plenum Rated: Type CMP complying with UL 1685

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.

C. RoHS compliant.

2.3 CATEGORY 6A TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable, with internal spline, certified to meet transmission characteristics of Category 6A cable at frequencies up to 500MHz.

B. Manufacturers:

1. Berk-Tek SST (Owner Preferred Alternate)
2. Panduit
3. Siemon

C. Standard: Comply with TIA-568-C.2 for Category 6A cables.

D. Conductors: 100-ohm, 23 AWG solid copper.

E. Shielding/Screening: Unshielded twisted pairs (UTP)

F. Cable Rating: Plenum.

G. Jacket: Refer to drawings for system specific color coding.

2.4 TWISTED PAIR CABLE HARDWARE

A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.

B. Manufacturers:

1. Leviton ATLAS-X1 (Owner Preferred Alternate)
2. Panduit
3. Siemon

C. General Requirements for Twisted Pair Cable Hardware:

1. Comply with the performance requirements of Category 6 & Category 6A.
2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
3. Cables shall be terminated with connecting hardware of same category or higher.

D. Source Limitations: Obtain twisted pair cable hardware from single source from single manufacturer.

E. Connecting Blocks:

1. 110-style IDC for Category 6A.
2. Provide blocks for the number of cables terminated on the block, plus 25% spare, integral with connector bodies, including plugs and jacks where indicated.

F. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

1. Number of Terminals per Field: One for each conductor in assigned cables.

G. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables.

1. Features:

a. Universal T568A and T568B wiring labels.
b. Labeling areas adjacent to conductors.
c. Replaceable connectors.
d. 24 or 48 ports.

2. Construction: 16-gauge steel and mountable on 19-inch equipment racks.
3. Number of Jacks per Field: One for each four-pair cable indicated

H. Patch Cords: Factory-made, four-pair cables in 36-inch lengths; terminated with an eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.
2. Patch cords shall have color-coded boots for circuit identification.

I. Plugs and Plug Assemblies:

1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Standard: Comply with TIA-568-C.2.
3. Marked to indicate transmission performance.

J. Jacks and Jack Assemblies:

1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Designed to snap-in to a patch panel or faceplate.
3. Standard: Comply with TIA-568-C.2.
4. Marked to indicate transmission performance.

K. Faceplate:
1. Shall match adjacent receptacle material and finish. Coordinate with Architect.
2. For use with snap-in jacks accommodating any combination of twisted pair, optical fiber, and coaxial work area cords.

L. Legend:

1. Machine printed, in the field, using adhesive-tape label.
2. Snap-in, clear-label covers and machine-printed paper inserts.

PART 3 - EXECUTION

3.1 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

A. Comply with NECA 1 and NECA/BICSI 568.

B. Wiring Method: Install cables in raceways and cable trays, except within consoles, cabinets, desks, and counters. Conceal all raceway, except where not possible in unfinished mechanical/electrical spaces.

C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.

D. General Requirements for Cabling:

1. Comply with TIA-568-C.1.
2. Comply with BICSI's Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Do not untwist twisted pair cables more than 1/2 inch from the point of termination to maintain cable geometry.
5. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
6. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
8. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.
9. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
10. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
11. In the communications equipment room, install a minimum 10-foot long service loop unless otherwise noted.
12. Pulling Cable: Comply with BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.

E. Group connecting hardware for cables into separate logical fields.

F. Separation from EMI Sources:

1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.

3.2 FIRESTOPPING

A. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with "Firestopping Systems" Article in BISCI's "Telecommunications Distribution Methods Manual."

3.3 GROUNDING

A. Comply with requirements in Section 27 05 26 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Comply with latest TIA-607 standard and NECA/BICSI-607.

3.4 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 27 05 53 "Identification for Communications Systems."

B. Paint and label colors for equipment identification shall comply with TIA-606-B.

C. Equipment grounding conductors.

D. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
3. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.

    a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
    b. Label each unit and field within distribution racks and frames.

4. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and -connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

E. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements for the following:

1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections

B. Tests and Inspections:

1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments and inspect cabling connections for compliance with TIA-568-C.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.

D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.6 WARRANTY

A. Cable Manufacturer shall warranty cabling and cabling hardware for a 20-year period.

END OF SECTION

SECTION 27 41 16 – INTEGRATED AV SYSTEMS AND EQUIPMENT

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. Work in this section includes the engineering, manufacture, furnishing, coordination and installation of sound systems and video systems.
B. Equipment by manufactures specified.
    a. Any alternate equipment much be approved by the specifying authority. Bidders supplying an alternate system must make the authority aware of their intentions and provide adequate information, including specification sheets, working and shop drawings, and a demonstration of approved equipment at least 14 days prior to bid date. Any prior approval of an alternate system does not exempt the supplier from meeting the intent of these specification. If the alternate system fails to provide all the requirements specified in this document the contractor shall be responsible for all costs associated with the removal and replacement of said equipment.
C. Coordination
    a. Division 26: Electrical
        i. Conduit and back boxes from faceplate locations to the equipment racks is provided under Division 26 as per the drawings, and under the supervision of Division 274116 contractor so as to ensure proper coordination.
        ii. Wiring and cable in the field and to the racks is provided under Division 274116
        iii. Wiring above 90V is provided under Division 26.

1.2 SUBMITTALS

A. Equipment list, itemizing major system components
    a. Data sheets shall be provided on all equipment being provided
B. Copies of Integrators Certifications as outlined in section 1.4 Quality Assurance
C. Shop Drawings:
    a. Internal control cabinet drawings showing internal block diagram connections shall be provided
    b. Block diagrams showing field wiring connections shall be provided
        i. Show all equipment, faceplates, and interconnection wires with unique labels
D. Rack Elevation Drawings

1.3 MAINTENANCE SERVICE

A. The contractor shall provide a one-year guarantee of the installed system against defect in material and workmanship. All labor and materials shall be provided at no expense to the owner. Guarantee period shall begin on the date of acceptance by the owner or engineer.
B. A maintenance contact offering continued factory authorized service of this system shall be made available after initial one year period.

1.4 QUALITY ASSURANCE

A. The contractor shall currently maintain a local run business for a minimum of five years and shall be an authorized dealer of the supplied equipment with full warranty privileges.
B. Contractor must have a physical office within 50 miles of the job site.
C. Contractor must be fully capable of providing 24/7/365 service, provide 24/7 service line with submittal.
D. The contractors employees dedicated to this project shall hold the following certifications:
    a. InfoComm Certified Technology Specialist (CTS)
    b. OSHA 30-Hour

E. Contractor must be Authorized Reseller of Equipment being proposed, as well as authorized to provide warranty services on components.
F. The contractor shall maintain at their facility the necessary spare parts in the proper proportion as recommended by the equipment manufacture to maintain and service the equipment being supplied. The facility shall be available for inspection by the engineer.
G. The supplying contractor shall have attended the manufacture installation and service school.
H. The contractor shall furnish manufactures manuals of the completed system including the individual specification sheets, schematics, inter panel and intra panel wiring diagrams. In addition all information necessary for the proper maintenance and operation of the system must be included. Any bidder using other than the specified equipment must provide this information prior to bidding.
I. As built drawings that include any changes to wiring, wiring designations, junction box labeling and any other pertinent information shall be supplied upon completion of project.
J. All equipment shall conform to appropriate U.L. Listings

1.6 WIRING

A. System wiring shall be in accordance with good engineering practices as established by the EIA and NEC. Wiring shall meet all established state and local electrical codes. All wiring shall test free from grounds and shorts.

PART 2: PRODUCTS

2.1 MANUFACTURES

Substitutions may not be made without prior written approval by the engineer. Requests for approval must be received at least 14 days prior to the bid due date. Manufactures below shall be considered pre-approved as long as alternate equipment meets specifications outlined in the basis of design.

A. Racks, Cabinets, and Cases
    a. Middle Atlantic – DWR Series
    b. SKB
    c. Gator Cases
B. Power Systems
    a. Middle-Atlantic
    b. Furman Sound
    c. Atlas Sound
C. Microphones
    a. Shure Brothers, Inc.
    b. Extron
    c. Approved Equal
D. Audio Mixers
    a. Extron
    b. JBL Professional
    c. Approved Equal
E. Audio Amplifiers
    a. Extron
    b. JBL Professional
    c. Approved Equal
F. Mixer-Amplifiers
    a. Extron
    b. JBL Professional
    c. Approved Equal

G. Soundbars
    a. Logitech – Meetup HD (960-001101) basis of design
    b. Extron
    c. JBL Professional
    d. Biamp
H. Assistive Listening Systems
    a. Audiofetch – Fetchexpress basis of design
    b. Alto
    c. Denon
    d. Approved Equal
I. Loudspeakers – 70V
    a. Extron
    b. JBL Professional
    c. Biamp
J. Digital Signal Processing – Certification on Manufacture Required
    a. Extron
    b. Crestron
    c. Biamp
~~K. Video Projectors~~
    ~~a. Epson – Pro L1495UNL basis of design~~
    ~~b. Sony~~
    ~~c. Approved Equal~~
L. Video and Control
    a. Source All Video and Control Elements from a Single Manufacture
    b. System Controller
        i. Extron
        ii. Crestron
        iii. Approved Equal
    c. HDBaseT Video Transport
        i. Extron
        ii. Crestron
        iii. Approved Equal
    d. Control Panels
        i. Extron
        ii. Crestron
        iii. Approved Equal
M. VTC Codec
    a. Extron
    b. Biamp
    c. Approved Equal
N. Cameras
    a. Vaddio
    b. Extron
    c. Approved Equal
O. Network Button Panels
    a. Extron
    b. Crestron
    c. Approved Equal
P. Video Wall Displays
    a. LG – 55VL5F-A basis of design
    b. Planar
    c. Approved Equal
Q. Video Wall Processors
    a. Extron – Quantum Ultra II 610 basis of design
    b. Planar
    c. Crestron
    d. Approved Equal

2.2 EQUIPMENT AND SYSTEMS

A. Racks, Cabinets, Cases
    a. Wall Mount Racks
        i. Rack shall be EIA compliant 19" Swing Rack made of 16-Gauge Steel
        ii. 200lb. Weight Capacity
        iii. Provide 20% Spare RU for future equipment
            1. Fill remaining open spaces with blank or vent panels
        iv. Determine rack depth by equipment inside provide minimum 2" clearance behind equipment
        v. Include Top Fan Kit, Thermostat Controlled
        vi. Provide Vertical Power Distribution for Always On Circuit
        vii. Rear knockouts in various sizes for EMT connection
    b. Lecterns
        i. Provide mounting equipment inside of lectern for AV equipment

B. Wire
    a. Microphone/Line: 22-1P OAS
    b. 70V Speaker: 16-1P OAS
    c. HDMI: Extron Pro Plenum or approved equal.
    d. Network Cable: 23-4P CAT6 Shielded
    e. Display port: Display port 2.2
    f. Microphone Antenna: RG 6/U, 18AWG Solid
    g. ALS Antenna: RG 8/U, 17AWG Stranded
    h. Control: Misc.

C. Power Systems
    a. Sequenced Power Distribution
        i. Provide 15A/20A Power Sequencers on Audio Systems
            1. Utilize Remote Power Control Modules for additional circuits
    b. Horizontal Rackmount Power
        i. Provide 15A/20A Rackmount power
        ii. Surge and Spike Protection, EMI Filtering
    c. Vertical Rackmount Power
        i. Provide additional vertical rackmount power to accommodate fixed racks

D. Microphones
    a. Wireless Microphones
        i. Receiver
            1. Auto Frequency Selection
            2. Auto Transmitter Setup
            3. Detachable Antennas
        ii. Transmitters
            1. Handheld Transmitter
                a. Molded PC/ABS Design
                b. 2 "AA" Alkaline or Rechargeable Batteries
                c. 10db Gain Adjustment
            2. Bodypack Transmitter
                a. Molded ABS Design
                b. 2 "AA" Alkaline or Rechargeable Batteries
                c. 30dB Gain Adjustment
    b. Ceiling mounted
        i. LED mute indicator

ii. Beam tracking
iii. Connection via category cable
iv. Frequency response 150Hz – 16kHZ
v. Max SPL 109dB

E. Audio Mixers
a. Rack Mount Mixer
i. 6-Channel, Stereo Mic/Line Mixer
ii. 2-Band EQ in each Input
iii. Aux send and return
iv. 19" Rack Mount – 2RU

F. Audio Amplifiers
a. Frequency Response: 20Hz-20KHz +/- 0.25dB
b. Signal to Noise Ration: ≥ 108db (A Weighted)
c. THD: < 0.35%
i. Amplifiers as Required
d. 70v capable
e. 2-channel minimum
f. Sized based on number of speakers and speaker types selected.

G. Soundbars
a. Integrated microphone(s)
b. HD webcam
c. Forward firing integrated speakers

H. Loudspeakers
a. 6.5" ceiling mounted
b. Operating Range 75Hz – 22kHz
c. Sensitivity 86 dB SPL

I. Digital Signal Processing
a. 4 line level inputs, 8 line level outputs
b. RS-232 Serial Port
c. 4-pin GPIO

J. Assistive Listening Systems
i. Support for > 40 simultaneous listeners
ii. Transmit sound from source via wifi to smartphone app.
iii. Stable and clear sound transmission quality.

~~K. Video Projectors~~
~~a. 9000 lumen~~
~~b. Aspect ratios~~
~~i. 4:3~~
~~ii. 16:9~~
~~iii. 16:10~~
~~c. Resolution WUXGA~~
~~d. Business/commercial grade~~
~~e. 20,000 hour (or more) light source life~~

L. Video and Control
a. HDMI Extenders
i. Minimum of (2) HDMI inputs + (1) VGA input
ii. Signal extension over shielded category cable
iii. Auto-input switching

M. VTC Codec
    a. Network connection via category cable
    b. Power 24V DC 60W
    c. Integration with Microsoft Skype, Microsoft Teams, Zoom, Bluejeans, Google Meet
    d. Windows and Mac support

N. Cameras
    a. Image sensor 1/2.8 Exmor CMOS
    b. Resolution 1080p 60 fps
    c. Focus Auto/Manual
    d. Gain Auto/Manual
    e. Minimum Illumination 100+ Lux
    f. Contol via Web UI, Telnet, RS-232 and IR remote
    g. Pan +/- 165 degrees
    h. Tilt +90 to -30 degrees
    i. Zoom 10x

O. Network Button Panels
    a. LED indicators for buttons
    b. Volume control
    c. On/Off
    d. Customizable buttons

P. Video Wall Displays
    a. 55″ diagonal display size
    b. Video wall style bezel size (5mm or less)
    c. HDMI 2.0 support
    d. RS-232 control

Q. Video Wall Processors
    a. 4K/1080p resolution capable
    b. 24, 25, 30, 50, or 60 fps
    c. 5 RU
    d. Rack mountable
    e. Compatible with selected video wall screens

PART 3: EXECUTION

3.1 INSTALLATION
A. Provide all equipment, wiring, conduit and outlet boxes required for the installation of a complete and operating system in accordance with applicable local, state and national codes, and the manufactures recommendations.
    a. ALL Cabling must be labeled with a permanent computer printed cable label.
    b. All cables should be homerun, without field splicing.
B. Provide factory trained personnel to perform the installation, tests and adjustments as required. Integrator's personnel shall have certifications outlines in section 1.4 Quality Assurance
C. Nothing herein contained shall be construed to relieve the contractor from furnishing a complete and acceptable Gymnasium Sound System in all its categories. The engineer shall condemn and reject any materials or labor which are or may be detrimental to the accomplishment of the intents of these specifications

3.2 SYSTEM TESTS AND ADJUSTMENTS
A. The manufactures authorized representative shall provide supervision of final system connections, perform a complete functional test of the system as described above, and submit a written report to the contractor attesting to satisfactory operation of the system. In addition on-site instruction shall be provided to the owner's personnel.
B. Perform the following tests, and submit results to engineer and owner
    a. Speaker Impedance Testing
    b. Speaker Short to Ground Testing
    c. Speaker Polarity Testing

C. Initial settings - AUDIO
    a. Set gain structure to maximize dynamic range using the optimized method. Do this by setting gain structure so all devices in the system clip simultaneously with the mixer.
    b. Balance levels of the loudspeaker units driven by different amplifiers in the same system to ensure adequate coverage and level of sound from loudspeakers.
    c. Establish and record the normal settings for level controls. Adjust level controls on rack-mounted equipment for optimum signal to noise ratio and signal balance.
    d. Aim speakers to maximize even coverage and minimize spill on unoccupied areas, such as walls.
    e. Prior to equalization of the system use a sweeping sine wave at the systems input to check the permanent loudspeakers for extraneous noise.
    f. Confirm the even coverage of the system by use of pink noise and 1/3 octave real time analyzer. Observe variations in both level and spectrum shape while walking the seating area. If coverage problems are evident, attempt to improve coverage by re-aiming the loudspeakers.
    g. Response shall not vary at more than +/- 3dB at any given seat.
    h. Set delay to minimize the quantity of apparent arrivals of direct sound at any one location. A properly adjusted system will create the impression that the main speakers are providing the coverage.

D. Equalization - AUDIO
    i. Using a calibrated measuring microphone located in the seating area, established the unequaled acoustic amplitude response to a pink noise source. Tune System Flat in Speaker Frequency Range. Adjustments to these settings may be required following initial listening tests.
    j. Adjust the sound system gain until it reaches feedback. Determine the frequency, and adjust the appropriate filter until the observed feedback ceases.

E. Initial Settings – Video
    k. Verify proper termination of analog and digital wiring. Certify signal flow through systems. Verify function of each device in the system. Demonstrate functionality of the system with video tests including: Circles, Alternating Pixel Pattern, Crosshatch, Grayscale, Transient response, and Color bars.
    l. Demonstrate compliance with EDID and HDCP standards.

3.3 DOCUMENTATION

A. Closeout Documents – Provide close out documents as detailed in Division 01. Provide at minimum thee (3) hard copies, and one (1) electronic PDF copy
    i. As Built Drawings
        1. Provide three sets of as built drawings reflecting and changes made from initial project submittals.
        2. Provide one electronic copy of as built drawings in PDF format
    ii. Maintenance Manuals
        1. A summary selection detailing actions required and intervals at which they are to be performed
        2. Transfer all Manufacture Recommendations to a single manual
    iii. Operation Manuals
        1. Include custom devices and programming, and manufacture manuals

END OF SECTION 27 40 16.10 INTEGRATED AV SYSTEMS AND EQUIPMENT