

UC Davis Health

Division 27 & 28

Master Specifications

Communications and Electronic Safety & Security

Consolidated specification set

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Division 27 - Communications

27 05 00	Common Work Results For Communications	4
27 05 26	Grounding And Bonding For Communications Systems	20
27 05 29	Hangers And Supports For Communications Systems	29
27 05 33	Conduits And Backboxes For Communications Systems	36
27 05 36	Cable Trays For Communications Systems	41
27 05 41	Fire-Stopping Systems	45
27 05 43	Underground Ducts And Raceways For Communications Systems	49
27 05 53	Identification For Communications Systems	60
27 11 16	Communications Cabinets, Racks, Frames, And Enclosures	74
27 11 19	Communications Termination Blocks And Patch Panels	78
27 11 23	Communications Cable Management And Ladder Rack	82
27 11 26	Communications Rack Mounted Power Protection And Power Strips	86
27 13 00	Communications Backbone Cabling	91
27 13 43	Communications Services Cabling	100
27 15 00	Communications Horizontal Cabling	111
27 41 16	Integrated Audio Visual Systems And Equipment	119
27 41 33	Master Antenna Television Systems	173
27 51 16	Public Address Systems	181
27 51 19.11	Sound Masking Systems	187
27 52 23	Nurse Call Systems	200
27 53 13	Clock Systems	209
27 53 19	Distributed Antenna System Cellular	213
27 53 29	Emergency Responder Radio Communication System	224

Division 28 - Electronic Safety and Security

28 10 00	Access Control	234
28 20 00	Video Surveillance	249
28 31 00	Intrusion Detection	258
28 49 00	Electronic Personal Protection Systems	265

SECTION 27 05 00
COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes, but is not limited to, the standard procedures and best practices for Communications work.
- B. This section defines the areas of responsibility for the Owner, Architect, and Contractor.
- C. The Owner shall participate in a collaborative process to determine the most cost-effective and efficient methods for providing communications throughout the facility, including evaluating user requirements and establishing necessary pathways. The Owner shall be available, upon request, to provide support at no additional cost. Construction team management is responsible for engaging the Owner at key project stages to ensure effective collaboration.
- D. The construction team shall design, engineer, and provide all required support, including suspension, attachment, fastening, bracing, and restraint (hereinafter "support"), for the Communications Systems. All support engineering shall be performed by professionals licensed to perform such work within the project jurisdiction.

1.2 ITEMS PROVIDED BY OWNER

- A. Registered Communications Distribution Designer (RCDD) support services
- B. IT project management
- C. Submittal approvals
- D. Network equipment
- E. 802.11 Wireless Access Point hardware
 - 1. The construction team shall perform all rough-in work for wireless access point (WAP) supports, including seismic support, screwing, drilling, welding, and other related tasks.
 - 2. The construction team is responsible for providing and installing all required boxes, all-thread rods, anchors, conduit, and associated hardware necessary to complete the rough-in.
 - 3. Owner will provide 802.11 design services
- F. Rack and Stack
- G. Patch Cords and Patching (excluding Work Area Outlet end of Wireless Access Points, Cameras, and Control Panels)
- H. IT UPS System specifications (CFCI)
- I. PDU Power distribution Equipment
- J. VOIP Router, Voice Gateway, VOIP equipment

- K. Camera NVR/Server

1.3 ITEMS PROVIDED BY CONSTRUCTION TEAM

- A. Building Drawings and Floor Plans
- B. Site Plans
- C. Furniture Plans
- D. Shop Drawings and Product data per section 1.9
- E. As-Built Drawings per section 1.10
- F. Horizontal and backbone cabling.
- G. Horizontal and backbone cabling supports
- H. Work Area Outlet rough in
- I. Cabling test results
- J. Patch Panels
- K. Horizontal Wire Managers
- L. Vertical Wire Managers
- M. Racks for mounting cabling and equipment
- N. All horizontal cabling, jacks, faceplates, surface-mount boxes, cable trays, termination hardware, and other materials required to provide a complete horizontal cabling system, as defined in this Section, associated Sections, and the construction documents, unless otherwise specified for provision by the Owner.
- O. Fiber housing, cassettes, and splicing.
- P. Telecommunications Rooms final cleaning.

1.4 RELATED SECTIONS

- A. 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS
- B. 27 05 29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS
- C. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS
- D. 27 05 36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS
- E. 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
- F. 27 11 16 COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

- G. 27 11 19 COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS
- H. 27 11 23 COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK
- I. 27 11 26 COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS
- J. 27 13 00 COMMUNICATIONS BACKBONE CABLING
- K. 27 13 43 COMMUNICATIONS SERVICES CABLING
- L. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING
- M. 27 41 33 MASTER ANTENNA TELEVISION SYSTEMS
- N. 27 51 16 PUBLIC ADDRESS SYSTEMS
- O. 27 52 13 PATIENT MONITORING AND TELEMETRY SYSTEMS
- P. 27 52 23 NURSE CALL/CODE BLUE SYSTEMS
- Q. 27 53 13 CLOCK SYSTEMS
- R. 27 53 19 INTERNAL CELLULAR, PAGING, AND ANTENNA SYSTEMS

1.5 REFERENCES AND STANDARDS

- A. References to codes, standards, specifications, and recommendations of technical societies, trade organizations, and governmental agencies shall mean the latest edition adopted and published prior to the bid submittal. Such codes and standards are considered part of this Specification as if fully reproduced herein.
 - 1. UC Davis Owner Project Requirements
 - 2. American National Standards Institute (ANSI)
 - 3. Telecommunications Industry Association (TIA)
 - 4. Building Industry Consulting Services International (BICSI)
 - 5. American Society for Testing and Materials (ASTM)
 - 6. Institute of Electrical and Electronic Engineers (IEEE)
 - 7. National Electrical Manufacturers Association (NEMA)
 - 8. Underwriters Laboratories, Inc. (UL)
 - 9. Local Authorities Having Jurisdiction (AHJ)
- B. All work executed under this Section shall comply with applicable requirements of the latest editions of governing codes, rules, and regulations, including, but not limited to, the following minimum standards, whether statutory or not.
 - 1. United States Department of Labor (DOL) Regulations (Standards - 29 CFR)
 - 2. Part 1910, "Occupational Safety and Health Standards"
 - 3. California Code of Regulations (CCR) Title 24, California Building Standards Code Part 2, Basic Building Regulations and Part 3, California Electrical Code (CEC).
 - 4. California Building Code (CBC), current version.

5. California Fire Code (CFC), current version.
6. California Mechanical Code (CMC), current version.
7. National, State and any other binding building and fire codes.
8. NFPA 75 – Standard for the Fire Protection of Information Technology Equipment
9. NFPA 99 – Health Care Facilities Code.
10. NFPA 101 – Life Safety Code (for fire-rated penetrations and pathway integrity)
11. FCC Regulations:
 - a. Part 15 – Radio Frequency Devices & Radiation Limits
 - b. Part 68 – Connection of Terminal Equipment to the Telephone Network
12. Underwriter's Laboratories (UL): Applicable listing and ratings, including but not limited to the following standards:
 - a. UL 444: Communications Cables
 - b. UL 497: Protectors for Paired-Conductor Communication Circuits.
 - c. UL 1651: Optical Fiber Cable
 - d. UL 1690: Data-Processing Cable
 - e. UL 1963: Communications-Circuit Accessories
 - f. UL 2024A: Optical Fiber Cable Routing Assemblies.
13. ANSI/TIA-568.1-E 2023 Commercial Building Telecommunications Cabling Standard.
14. ANSI/TIA-569-E-1 2023 Commercial Building Standard for Telecommunications Pathways and Spaces.
15. ANSI/TIA-598-D-2 2018 Optical Fiber Cable Color Coding.
16. ANSI/TIA-606-D 2021 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
17. ANSI/TIA-607-E 2024 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
18. ANSI/TIA-758-C Customer-Owner Outside Plant Telecommunications Cabling Standard.
19. EIA testing standards.
20. Insulated Cable Engineers Association (ICEA):
 - a. ANSI/ICEA S-83-596-2021 Fiber Optic Premises Distribution Cable
 - b. ANSI/ICEA S-87-640-2016 Fiber Optic Outside Plant Communications Cable
 - c. ICEA S-104-696-2019 Standard for Indoor-Outdoor Optical Cable
21. Telecommunications Distribution Methods Manual 15TH edition (TDMM)

1.6 ABBREVIATIONS

- A. ADA Americans with Disabilities Act
- B. AFC Above Finished Ceiling
- C. AFF Above the Finished Floor
- D. BDF Building Distribution Frame – See Telecommunications Room (TR)

- E. BLDG Building
- F. CAT Category (Related to network cable types)
- G. DIV Division
- H. (E) Existing
- I. ER IT Equipment Room – See Telecommunications Room (TR)
- J. GE Grounding Equalizer – Part of the Telecom Grounding System
- K. HR Homerun
- L. ID Inside Diameter
- M. IDF Intermediate Distribution Frame – See Telecommunications Room (TR)
- N. IT UC Davis Health IT Department (also UC, UCDH, UCD IT, IT Facilities)
- O. LAN Local Area Network
- P. MAX Maximum
- Q. NIC Not in Contract
- R. OD Outside Diameter
- S. PBB Primary Bonding Busbar
- T. SGB Secondary Grounding Busbar
- U. TR Telecommunications Room, TR may also be used interchangeably with ER, IDF, MDF, or Communications Room
- V. TYP Typical
- W. UCD UC Davis Health IT Department (also UC, UCDH, UCD IT, IT Facilities)
- X. UFE University Furnished Equipment
- Y. UON Unless Otherwise Noted

1.7 DEFINITIONS

- A. Telecommunications Room (TR) – An enclosed space for housing telecommunications equipment, cable, terminations, and cross-connects. The room is the recognized cross-connect between the backbone cable and the horizontal cabling. The minimum size of a TR shall be 12' x 16'. The minimum size for a TR that supports clinical spaces is 12' x 19'.
- B. Intermediate Distribution Frame (IDF) – See Telecommunications Room (TR)

- C. Entrance Facility (EF) (Telecommunications) – An entrance to the building for both private and public network service cables (including antennae) including the entrance point at the building wall and continuing to the entrance room or space.
- D. Pathway – A physical infrastructure utilized for the placement and routing of telecommunications cable.
- E. Infection Control – Clinical Environment Infection Control or ICRA
- F. “Cabling”: A combination of cables, wire, cords, and connecting hardware [e.g., cables, conductor terminations, connectors, outlets, patch panels, blocks, and labeling].
- G. “Identifier”: A unique code assigned to an element of the telecommunications infrastructure that links it to its corresponding record.

1.8 QUALITY ASSURANCE

- A. Contractor Firm Qualifications:
 - 1. All work associated with the installation of Communications (low-voltage) infrastructure shall be performed directly by the Communications Contractor. Subcontractors shall not be engaged by the Communications Contractor without prior approval from UCDH.
- B. Communications Contractor shall:
 - 1. Be a Panduit ONE Design and Installation partner or approved equal.
 - 2. Be a firm which is regularly and professionally engaged in the installation and testing of the specified communications equipment and infrastructure.
 - 3. Be licensed to install low voltage electronic cabling systems in the State of California where applicable (C7 License).
- C. The Communications Contractor shall demonstrate experience in the successful installation of data infrastructure systems.
 - 1. Submit documentation for a minimum of three and a maximum of five successful low-voltage communications infrastructure installation projects completed within the past three years.
- D. Contractor Key Personnel Qualifications
 - 1. Proposed key personnel shall be individuals who are regularly and professionally engaged in the application, installation, and testing of the specified low-voltage communications systems, equipment, and infrastructure. Depending on role requirements and individual experience, one or more key personnel may be proposed. Each individual shall demonstrate successful prior performance in the key roles relevant to this project.
 - 2. Each key person shall demonstrate successful experience within the past three years in providing low-voltage communications systems, equipment, and infrastructure. Such experience shall include direct participation in the installation, testing, and commissioning of systems comparable to those within the project scope.
- E. The Design-Builder shall employ a Registered Communications Distribution Designer (RCDD) who shall be actively engaged in all aspects of the project, including the design and installation of the communications infrastructure. The RCDD shall ensure compliance with all applicable standards and best practices and shall provide oversight and expertise throughout the project lifecycle.

1. The RCDD shall be a direct employee of the Communications Contractor, within the Design Build team structure.
 2. The RCDD shall provide oversight and supervision of the entire communications infrastructure installation process, including quality control.
 3. The RCDD shall serve as the Design-Builder's Designer of Record for the communications infrastructure scope of work.
 4. The RCDD shall be directly responsible for the following tasks, including, but not limited to:
 - a. Coordination: Conduct thorough coordination with the Owner for all design and installation activities related to the project.
 - b. Pre-Construction: Facilitate a pre-construction coordination meeting and perform a site inspection with the Owner before commencing any work.
 - c. Oversight: Provide oversight of all communications infrastructure installation activities, ensuring compliance with project requirements and applicable standards.
 - d. Documentation: Develop and submit detailed shop drawings and product data for approval.
 - e. Quality Control (As-Built): Conduct a quality control review, stamp, and submit finalized Communications as-built drawings to the Owner.
 - f. Quality Assurance (Construction Phase): Perform ongoing quality control reviews of communications systems installation throughout the construction phase, ensuring all work complies with approved construction drawings and industry standards.
- F. Critical on-site quality control installation reviews, conducted in conjunction with Owner technical staff, shall include, but are not limited to, the following:
1. Design Validation: Verify that the design conforms to Infection Control guidelines as applicable to the type of structure and services provided in each specific area.
 2. Installation Verification: Verify proper installation of all communications cable trays, backbone conduits, device back boxes, conduit infrastructure, and cabling pathways. Site inspection and sign-off shall be completed prior to concealing conduit infrastructure and before the installation of any low-voltage cabling.
 3. Telecom Room Verification: Verify the layout and installation of all equipment and cabling within the Telecom Rooms throughout the construction phase.
- G. Supervisors and installers assigned to the installation of this system or any of its components shall hold current Building Industry Consulting Services International (BICSI) certifications at the Technician Level or higher. Documentation of each key personnel's current BICSI certification shall be submitted for review.
1. Provide documentation of a minimum of three and a maximum of five successful cabling system installations completed by each key personnel in environments comparable to the project. Submissions shall include relevant project details to demonstrate each individual's qualifications and experience..
 2. In lieu of BICSI certification, supervisors and installers assigned to the installation of this system or any of its components shall have a minimum of three (3) years of experience in the installation of the specified copper and fiber optic cables and associated components.
- All personnel performing work on this project shall hold certifications specific to the systems being installed. Documentation of factory or factory-approved certifications from each equipment manufacturer shall be provided to verify qualifications for installing and testing the specified products.

3. For each key personnel, provide documentation of at least two (2) installations comparable in system size and construction complexity to the telecommunications system proposed for this project. Submissions shall specifically highlight experience in installing and testing telecommunications systems and include the names and locations of at least two (2) successfully completed projects utilizing both optical fiber and copper cabling systems.
 4. All telecommunications system installations cited by key personnel as part of their successful experience shall have been in continuous, full-time service for a minimum of eighteen (18) months prior to the project's issuance date.
 5. Provide, for each referenced project, the name and role of the key person, the project title, location, and completion date. Include the Owner's point of contact information—name, organization, title, and telephone number—as well as a project description detailing system size and construction complexity.
- H. All key personnel must be either currently employed by the Communications Contractor or have a documented commitment to work on this project with the Communications Contractor. At the time of project issuance, all key personnel shall be employed by the Communications Contractor. Alternatively, if not yet employed, they must have a formal commitment to join the Communications Contractor specifically for this project no later than the bid submission deadline to the Owner's Representative.
1. Only the key personnel approved by the Owner's Representative in the successful proposal shall be permitted to perform work on this project's low-voltage systems, equipment, and infrastructure. These personnel shall perform the same roles under this contract as those demonstrated in the proposal. Any substitutions or replacements of the Communications Contractor's approved key personnel must receive prior written approval from the Owner's Representative
- I. Designated Supervisor:
1. A key person shall be designated as the Project Supervisor for this project. This individual shall be present on-site and responsible for overseeing all phases of installation and testing of the work outlined in this Section.
 2. The designated Project Supervisor shall remain consistent throughout the execution of the work. Changes to this role shall only be permitted in cases of illness, personnel loss, or other circumstances reasonably beyond the Contractor's control. Any such changes must be promptly communicated to the Owner's Representative for approval.
- 1.9 SUBMITTALS
- A. Conform with UCDH Division 1 submittal requirements and procedures.
 - B. All product data Submittals shall be provided electronically in PDF format. All Drawing Submittals shall be provided in PDF and AutoCAD (latest version) DWG format. DI sheet submittals shall be provided in Excell format.
 - C. Submittals shall be organized as a coordinated package, complete with all information specified herein. Incomplete or uncoordinated submittals shall be returned without review.
 - D. Contractor shall submit the following items:
 1. Contractor Key Personnel and Certifications
 2. Complete Bill of Materials (BOM) List

3. Manufacturer Product Data Sheets, as defined below
4. Shop Drawings, as defined below
5. Proposed Installation Schedule
6. Cabling Certification Test Plan and proposed test equipment
7. Shop Drawing Submittals shall include:
 - a. Drawing index/symbol/schedule sheet.
 - b. Clearly indicate all new work versus existing work.
 - c. Site Plans, Floor Plans, and Reflected Ceiling (work 7' AFF+)
 - d. Drawings shall be developed in AutoCAD .DWG format, utilizing most current architectural backgrounds available for the project.
 - e. All drawings shall be properly scaled.
 - f. Indicate all device locations and types. Include addressing for all network outlets.
 - g. Indicate all cabling routes, types and quantities.
 - h. Indicate all conduit routing, quantities, sizes, and wire fill. Indicate basket tray and J-hook routes.
 - i. Indicate fire stopping requirements for all penetrations.
8. Desktop Inventory sheet (DI). This document (provided to the project by UCDH) shall be coordinated and submitted along with Telecommunications Shop Drawing.

E. Manufacturer Product Data Submittals shall include:

1. Submittals shall include a table of contents (TOC) that lists equipment, components, etc. Submittals with incomplete lists will be rejected. The TOC shall include the following:
 - a. Specification Section
 - b. Drawing Reference
 - c. Manufacturers Model No.
2. Submittals shall include a description of where the products will be installed or the products' application. Submittals with no reference to where the products are to be installed will be rejected.
3. Submit product data sheets for all equipment being provided.
4. Collate in sequence by Section Number, and clearly mark proposed product on data sheet. Include Safety Data Sheet, where applicable.
5. Indicate (arrow, highlight, or other designator) on each product's cutsheet the manufacturer model/part number, accessories, options, or color as applicable. Where this information is not already provided on the cutsheet, manually input this information and a brief description.

F. The shop drawing package must be stamped and signed by a Registered Communications Distribution Designer (RCDD).

1.10 CLOSEOUT SUBMITTALS

A. Contractor shall submit the following items:

1. Record As-Built Drawings indicating the final, 'as-built' condition of all associated equipment, infrastructure, and work.

- B. Riser Diagrams indicating:
 - 1. Backbone cabling and termination locations. Associated cabling pathways, sizes and cable fill. Telecommunications Grounding System.
- C. Provide dimensioned drawings for all telecommunications rooms. Complete, dimensioned rack and wall elevations of all equipment. Consideration must be given to equipment heights within. Plywood backboards and grounding equipment.
- D. As-built drawings shall indicate racks, cabinets, cable tray, ladder rack, wire management. Termination equipment for all copper and fiber cabling. Conduit and cable entrance points and fire stopping. Electrical panels, power circuits and HVAC provisions.
- E. Details of other associated devices and equipment.
- F. Cable Certification Test Results. Submit electronically in native format and include associated software license as applicable.
- G. Completed punch list reports.
- H. Manufacturer Operation and Maintenance (O&M) Manuals.
- I. Warranty information.
- J. Keys and any portable equipment.

1.11 WARRANTY SERVICE

- A. Warranties and Guarantees, provide the following:
 - 1. Response Time: A qualified technician familiar with the work shall be provided at the project site within four (4) hours of receipt of a notice of malfunction. The Owner's Representative shall be provided with a telephone number attended ten (10) hours per day, five (5) days per week, to be used in the event of a malfunction.
 - 2. Provide all Warranties as defined in each Communication Systems Section.
- B. Panduit Certification Plus System Warranty
 - 1. The Contractor shall provide a Panduit Certification Plus System Warranty on all installed copper and fiber permanent links. The warranty shall guarantee end-to-end performance for all applications designed to operate over the installed cabling class. The guarantee shall cover all connectivity components and cable within the permanent link and shall remain in effect for a period of twenty-five (25) years.

PART 2 - MATERIAL

2.1 COMMUNICATIONS SYSTEMS PRODUCTS SUMMARY

- A. The following is a general summary of Communications Systems equipment, components, and cabling required for the project. This list is not comprehensive. Refer to other Sections for complete material requirements.
- B. Racks will be 8' high for new builds and remodels where space is available. 7' high racks will be used as an alternate where space is not available

1. 8' Seismic racks shall be RXL-2823-BK80T or approved equal.
 2. 8' Standard racks shall be RXL-2200-BK80T, RXL-2020-BK80T or approved equal.
 3. 7' Seismic racks shall be RXL-2823-BK70T or approved equal.
 4. 7' Standard racks shall be RXL 2200-BK70T, RXL-2020-BK70T or approved equal.
- C. Wire Managers: Panduit PE2V Series full height vertical cable manager.
1. 10" Wide Front/Back unless otherwise noted on plans, PE2VD1096 / PE2VD10 or approved equal.
 2. 96 inch or 84 inch sized to match the racks being installed.
- D. Primary Bonding Busbar (PBB) & Secondary Bonding Busbar (SBB):
1. Provide 4" x 20" PBB in each BDF TR, CPI # 40153-020 or approved equal.
 2. Provide 4" x 12" SBB in each TR, CPI # 40153-012 or approved equal.
- E. Data Patch Panels:
1. 48-port: Panduit CP48BLY or approved equal.
 2. 24-port: Panduit CP48BLY or approved equal.
- F. Analog / Voice Patch Panels
1. Panduit CPP48HDWBLY
- G. Fiber Terminations:
1. Fiber Termination Unit (FTU)
 - a. 1-RU FTU:
 - 1) Provide Panduit HD Flex, FLEX1U06 or approved equal.
 - b. 2-RU FTU:
 - 1) Provide Panduit HD Flex, FLEX2U06 or approved equal.
 - c. 4-RU FTU:
 - 1) Provide Panduit HD Flex, FLEX4U06 or approved equal.
 - d. All FTUs shall be provided with a slack plate and rear cover.
 - 1) Provide Panduit FLEX-PLATE1UR, FLEX-PLATE2UR, and FLEXPLATE-4UR for 1,2 and 4-RU FTUs respectively.
 2. Splice Cassette:
 - a. Ribbon Fiber Cassette: Panduit HD Flex Splice Cassette LC UPC, FHS9N-12-10R or approved equal.
 - b. Loose Tuber Fiber Cassette: Panduit HD Flex Splice Cassette LC UPC, FHS9N-12-10P or approved equal.
- H. Modular Jack CAT-6A
1. Panduit Mini-Com CJ6X88TGV
- I. Horizontal Work Area Outlet Copper cabling, Category 6A
1. High Speed, TIA Category 6A cabling, Plenum Rated
 2. General Cable GenSpeed 6A Part No. 7151855 Purple
- J. Horizontal Indoor / Outdoor Copper Cabling, Category 6A

1. High Speed, CAT-6A 23AWG .30"OD Indoor-Outdoor Plenum Rated cable suited for installation in below grade conduit, slab-on-grade conduit, duct, and other wet environments.
 2. General Cable GenSpeed 10 UTP Indoor/Outdoor Plenum CAT-6A cable, Part No. 7141007, or approved equal.
- K. VOIP paging speaker Copper cabling, Category 6A
1. High Speed, TIA Category 6A cabling, Plenum Rated
 2. General cable GenSpeed 6A Part No. 7151855 purple
- L. Security and Video Surveillance Camera copper cabling Category 6A
1. High Speed, TIA Category 6A cabling, Plenum Rated
 2. General cable GenSpeed 6A Part No. 7151855 purple
- M. Furniture Telecommunications Outlets (Workstation side)
1. Modular Furniture Faceplate, 4-port, back – Panduit # CFFP4BL
 2. Modular Surface Mount Box Blank Insert - Panduit CMB(BL)
- N. BMS / Intrusion / Access Control / Lighting Control / Power Metering
1. High Speed, TIA Category 6A cabling, Plenum Rated
 2. General Cable GenSpeed 6A Part No. 7151855 Purple
 3. Modular Surface Mount Box Blank Insert - Panduit CMB(BL) sized accordingly.
 4. Modular Surface Mount Box Blank Insert - Panduit CMB(BL)
- O. Typical Work Area Outlet (Workstation side)
1. Panduit Mini-Com Stainless Steel Faceplates Single Gang CFP {2,4,6} SY
 2. Faceplate Blank Insert – Panduit CMB(GY)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Conditions: Verify conditions, provided under other sections, are acceptable for product installation in accordance with manufacturer's instructions.
- B. Pathways: Verify that pathways and supporting devices, provided under other sections, are properly and permanently installed, and that temporary supports, devices, etc., have been removed.
- C. Field Measurements: Verify dimensions of pathways, including length of pathways. For example, "true tape" the conduits to verify cabling distances.

3.2 TELECOMMUNICATIONS SPACES

- A. A minimum of one Telecommunications Room (TR) shall be provided on each floor of a building and shall be located within 275 feet (including slack) of all telecommunications outlet locations. If a floor's usable area exceeds 10,000 square feet, or if the distance limitation cannot be met,

additional TRs shall be provided to ensure adequate coverage (CBC 1224). If more than 960 cables are required to serve the 10,000 square feet assigned to a TR, an additional TR shall be provided.

- B. The minimum size of a 4-rack Telecommunications Room (TR) shall be 12' x 16'. A 4-rack TR is intended for nonclinical spaces and is designed to support up to 672 CAT-6A horizontal cables. The minimum size of a 5-rack Telecommunications Room (TR) shall be 12' x 19'. A 5-rack TR is the standard for clinical spaces and is designed to support up to 960 CAT-6A horizontal cables.
- C. Telecommunication Spaces shall use EZ-Path Fire-Rated Pathways systems for cable access.
- D. Provide a minimum of 36 inches of working clearance at the front and rear of all racks and electronic equipment. In addition, provide a minimum of 36 inches of clearance at the end of each rack row.
- E. Provide a 24/7 HVAC system capable of maintaining the TR temperature between 68°F and 72°F under full equipment load.
- F. Walls shall be covered with fire-resistant, A/C-grade treated plywood from 6 inches AFF to 12 feet AFF. All surfaces shall be sealed to mitigate airborne dust. Plywood shall be installed with the A-side exposed and the treatment stamp visible.
- G. Telecommunications Rooms typically utilize 4-rack or 5-rack configurations with seismic-rated equipment racks. Vertical wire managers shall be 10 inches wide unless otherwise indicated on the drawings.
- H. Provide a minimum maintained light level of 500-lux (50 fc) measured 36" above finished floor across all working and equipment areas. Lighting fixtures shall provide uniform shadow free illumination. Fixtures shall be positioned to avoid casting shadows over equipment racks. Do not place light fixtures directly over cable trays or ladder racks where access may be obstructed. Provide battery back-up or connection to emergency power to maintain safe working illumination. Install fixtures at a height that ensures clearance for ladder rack, conduit, racks, and mechanical systems while providing adequate coverage. Fixtures shall be positioned to allow easy access for maintenance.
- I. TR floors shall be finished with Electrostatic Discharge (ESD) composition tile or ESD epoxy. Sealed concrete is not acceptable. All flooring materials shall be electrostatically dissipative and rated for forklift traffic. ESD Tile: Nora Norament 928 Grano ED, #5301, or equal as approved by UCDH IT. Red-listed tile products are prohibited. ESD Epoxy: Must be electrostatically dissipative and suitable for forklift traffic.
- J. Mechanical equipment and fixtures that are not directly related to the support of the TR shall not be installed or pass through the TR per California Mechanical Code (current version) Article 320.4.2.
- K. Plumbing Equipment and fixtures that are not directly related to the support of the TR shall not be installed in or pass through the TR per California Plumbing Code (current version) Article 310.13
- L. Telecommunications rooms shall not share walls with spaces containing plumbing, water, or other building services that pose a leakage or moisture risks.

3.3 RACK COMPONENTS AND ELEVATIONS

- A. In addition to the elevation diagrams provided by the design & construction team, the owner will develop an equipment layout and rack elevation including the Telecom Room (TR) layouts. Typical components within the TR include, but not limited to:
 - 1. Network Equipment
 - 2. UPS/ PDU I Power distribution
 - 3. Clinical Engineering Equipment
 - 4. Camera NVR /Server
 - 5. Nurse Call Devices
- B. See related Sections for materials provided by the Owner and those furnished by the Contractor.

3.4 FIELD QUALITY CONTROL

- A. Staffing: The Contractor shall provide a qualified Foreman to oversee all Work performed under this Section. The Foreman must always be present at the job site when Work is being conducted. The Foreman shall supervise the workforce to ensure the execution of the Work aligns with the approved construction schedule and complies with project requirements.
- B. Project Management: The Contractor shall coordinate and attend weekly status meetings to review the overall progress of the project and address any issues requiring resolution during construction. The Contractor shall prepare and distribute a meeting agenda in advance of each meeting and provide detailed meeting notes afterward. All documents must be formatted in a manner acceptable to the General Contractor and submitted within the agreed-upon timeframe.
- C. Scheduling: The Contractor shall prepare a comprehensive construction schedule based on the outcomes of planning meetings with the General Contractor. This schedule shall detail all key milestones and activities and be issued to the General Contractor for review and approval. Whenever modifications to the project timeline occur, the Contractor shall promptly prepare and issue updated schedules, ensuring they reflect the revised scope and deadlines. All schedules and updates must be submitted in a format acceptable to the General Contractor.

Inspection: The Contractor shall perform a thorough inspection upon completion of installation to verify compliance with project requirements. All areas of work must remain accessible for review. Notify the relevant code authorities or designated inspectors when the work is ready for inspection. The Contractor shall document the completion of work and any inspection results as required, maintaining detailed records for submission to the Owner's Representative and any other designated stakeholders.

3.5 INSTALLATION

- A. All work shall conform to applicable federal, state and local codes, and telecommunications standards.
- B. Prior to construction, the cabling contractor shall coordinate with the Owner to verify the requirements for the communications systems.
- C. The cabling contractor shall coordinate the entire installation with the General Contractor and their subcontractors to meet the construction schedule. Participate in coordination meetings as required to fulfill this obligation.

D. Manufacturer's Instructions:

1. Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation.

E. The cabling contractor shall maintain a jobsite file and comply with Material Safety Data Sheets (MSDS) for each product delivered to jobsite.

3.6 REPAIR/RESTORATION

A. The contractor shall restore all existing painted surfaces damaged as a result of the Work to match the original finish and color, at no additional cost to the Owner.

B. Punch List:

1. The Contractor shall conduct a joint inspection of the installed work with the General Contractor to verify compliance with project requirements. Any deficiencies or items requiring correction shall be identified and documented. The Contractor shall prepare a detailed punch list of these items and submit it to the General Contractor for review and resolution.
2. Provide punch list to Owner for review prior to performing punch walk with Owner.

C. Re-Installation:

1. The Contractor shall make all necessary adjustments to ensure the system operates at optimum performance for final use. The Contractor shall correct any defects in workmanship and ensure that all cables and associated termination hardware meet or exceed the minimum testing requirements.
2. Repair defects prior to system acceptance.

D. Cleaning

1. The project jobsite shall be cleaned daily. The Contractor shall remove temporary coverings and protection from adjacent work areas, as well as all unused products, debris, spills, and excess materials. Installation equipment shall be removed from the site when no longer in use. No combustible materials shall be stored in Telecommunications Rooms (TRs).
2. Leave finished work and adjacent surfaces in neat, clean condition with no evidence of damage.
3. Repair or replace damaged installed products.
4. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance.

3.7 DEMONSTRATION

A. Upon completion of the acceptance testing, the Contractor shall coordinate with the Owner or Owner's Representative to schedule a mutually convenient time for instruction on the configuration, operation, and maintenance of the system.

3.8 CERTIFICATION

A. Provide the Owner or Owner's Representative with a written form of acceptance for signature. All required corrections shall be completed prior to final acceptance by the Owner, Owner's Representative, and Engineer.

- B. Provide Panduit warranty certificate.

END OF SECTION

SECTION 27 05 26
GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes grounding and bonding of communications infrastructure, including but not limited to:
 - 1. Cable shields, communications racks, cabinets, pathways, and enclosures

1.2 SYSTEM DESCRIPTION

- A. Provide telecommunications grounding system as described herein.
- B. Unless otherwise specified, the entire communications installation—including racks, cabinets, panels, cable trays, runways, lightning protectors, cable shields, and splice cases—shall be properly and effectively grounded in compliance with all applicable codes and standards, regardless of whether such connections are explicitly detailed in the project documents.
- 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-D-2019, whichever is more restrictive.

1.3 DEFINITIONS

- A. Definitions as described in Section 27 05 00 shall apply to this section.

1.4 RELATED SECTIONS

- A. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS
- B. 27 05 29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS
- C. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS
- D. 27 05 36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS
- E. 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
- F. 27 11 16 COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES
- G. 27 11 19 COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS
- H. 27 11 23 COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK
- I. 27 11 26 COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS
- J. 27 13 00 COMMUNICATIONS BACKBONE CABLING

- K. 27 13 43 COMMUNICATIONS SERVICES CABLING
- L. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING
- M. 27 41 33 MASTER ANTENNA TELEVISION SYSTEMS
- N. 27 51 16 PUBLIC ADDRESS SYSTEMS
- O. 27 52 13 PATIENT MONITORING AND TELEMETRY SYSTEMS
- P. 27 52 23 NURSE CALL/CODE BLUE SYSTEMS
- Q. 27 53 13 CLOCK SYSTEMS
- R. 27 53 19 INTERNAL CELLULAR, PAGING, AND ANTENNA SYSTEMS

1.5 SUBMITTALS:

- A. Submittals shall conform with Division 1 requirements Submittal Procedures.
- B. Submittals shall conform with Division-27 Section 27 05 00 Common Work Results for Communications.
- C. Submit shop drawings and product data with the following information:
 - 1. Provide manufacturer's data sheets for each piece of material incorporated into the Grounding and Bonding design.
 - 2. Provide single line drawings showing the manufacturer, model, location, and labeling for the Grounding and Bonding system.

1.6 QUALITY ASSURANCE

- A. Comply with Quality Assurance requirements of Section 27 05 00
- B. Strictly adhere to all Telecommunications Industry Association (TIA) recommended installation practices when installing Bonding and Grounding.
- C. Material and work specified herein shall comply with the applicable requirements of:
 - 1. ANSI/TIA-568.1-E 2023 Commercial Building Telecommunications Wiring Standard
 - 2. ANSI/TIA-569-E 2019 Commercial Building Standard for Telecommunications Pathways and Spaces
 - 3. ANSI/TIA-607-E 2024 Commercial Building Grounding and Bonding Requirements for Telecommunications
 - 4. ANSI/TIA- 606-D 2021 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

1.7 WARRANTY

- A. Reference warranty Section 27 05 00

PART 2 - PRODUCTS

2.1 PRIMARY BONDING BUSBAR (PBB) & SECONDARY GROUNDING BUSBAR (SBB)

- A. The Telecommunications Bonding Backbone (TBB) and Secondary Bonding Backbone (SBB) serve as central grounding attachment points for telecommunications bonding backbones, Telecommunications Room (TR) equipment, racks, cable runways, sleeves, and other systems within the TR. All grounding busbars shall be UL-listed and feature hole patterns compatible with two-hole lugs, as recommended by BICSI and TIA-607 standards. Insulators shall be provided to electrically isolate busbars from walls or other mounting surfaces.
- B. TBB and SBB specifications:
1. Provide 4" x 20" PBB in each BDF TR, CPI # 40153-020 or approved equal.
 2. Provide 4" x 12" SBB in each TR, CPI # 40153-012 or approved equal.

2.2 GROUNDING AND BONDING CONDUCTORS

- A. General purpose insulated: UL listed and code sized copper conductor, with dual rated THHN/THWN, insulation color green.
1. Cable jacket marking:
 - a. Must be legible and shall contain the following information: Manufacturer's name
 - b. Copper conductor gauge, UL listing
 - c. Cable jacket shall be green with black lettering
- B. Telecommunications Bonding Backbone (TBB) and telecommunications bonding conductor (TBC):
1. The TBB and TBC shall be sized per ANSI/TIA-607-E and the table below.
 2. Size TBBs and TBC as the greater of 6 AWG or based on length of run using 1000CM/linear foot.

TBB linear length m (ft)	TBB size (AWG)
less than 4 (13)	6
4 - 6 (14 - 20)	4
6 - 8 (20 - 26)	3
8 - 10 (26 - 33)	2
10 - 13 (33 - 44)	1
13 - 16 (44 - 52)	1/0
16 - 20 (52 - 66)	2/0
20 - 26 (67 - 84)	3/0
26 - 32 (85 - 105)	4/0

32 - 38 (106 - 125)	250 kcmil
38 - 46 (126 - 150)	300 kcmil
46 - 53 (151 - 175)	350 kcmil
53 - 76 (176 - 250)	500 kcmil
76 - 91 (251 - 300)	600 kcmil
Greater than 91 (301)	750 kcmil

C. Manufacturers:

1. General Cable
2. Harger Lightning & Grounding
3. Or approved equal

2.3 COMPRESSION CONNECTOR LUG

A. Long-barrel compression lugs with copper alloy body shall be used on all ground wire.

1. Provide lug size to match conductor being terminated.
2. Provide 2-hole pattern lugs to match PBB & SBB.
3. Provide each lug with hardware, including 2 bolts, 2 split lock washers and 2 nuts.
4. Compression connector lugs shall be UL listed.

B. Manufacturer:

1. Panduit.
2. Harger Lightning & Grounding GECLBxxx (xxx depending on cable Size).
3. Or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Comply with the execution requirements of Section 27 05 00.

3.2 EXAMINATION

- A. Prior to commencing work under this section, inspect the existing Telecommunications Grounding Backbone system. The Telecommunications Contractor shall be solely responsible for ensuring that the proposed work is fully compatible with the existing Telecommunications Grounding Backbone system, as determined by the Engineer.

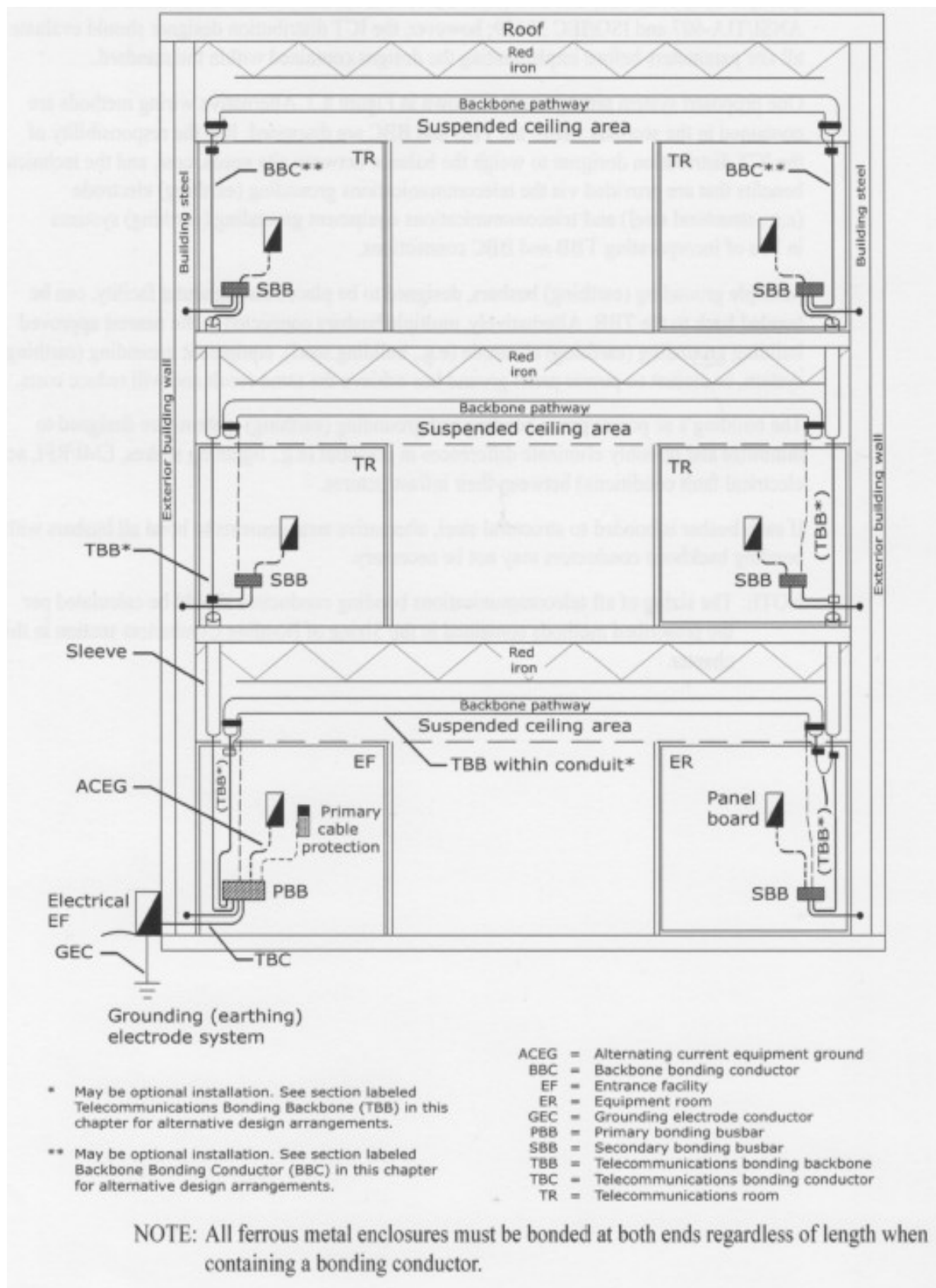
3.3 CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS, OR SPLICES

- A. Where specified, grounding conductors shall be spliced, connected to ground rods, or bonded to structural steel using exothermic welds or high-pressure compression connectors.
- B. Exothermic welds shall be used for cable-to-cable, cable-to-ground rod, and cable-to-structural steel connections. Exothermic weld kits shall be manufactured by Harger Lightning & Grounding, Cadweld, Thermoweld, or an approved equivalent. Each type of weld shall utilize a kit specifically designed for that weld application.
- C. High-pressure compression connectors shall be used for cable-to-cable connections. Acceptable connectors include Thomas & Betts #53000 series, Burndy "Hy-Ground," or an approved equivalent.

3.4 GENERAL EXECUTION

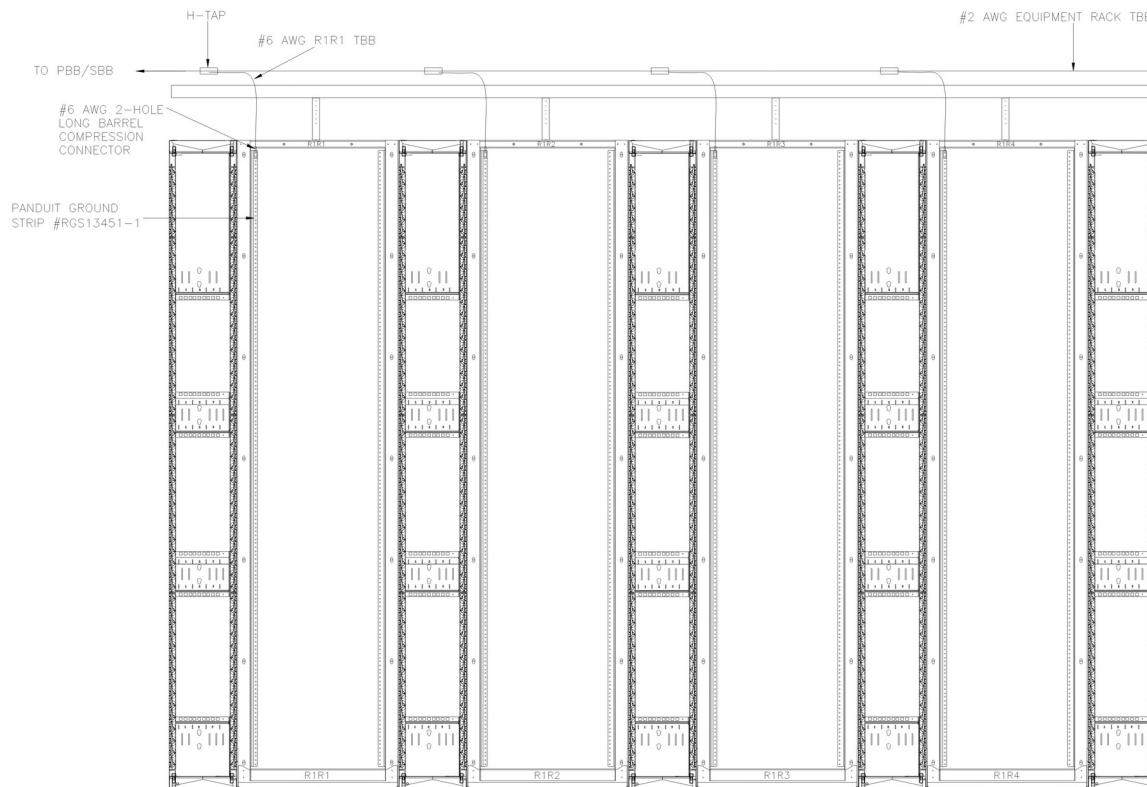
- A. Provide Grounding & Bonding according to the most restrictive requirements of ANSI-J-STD-607-E, California Electrical Code Article 250 and references therein and California Electrical Code Article 800.
 - 1. In the event of conflicting requirements, California Electrical Code requirements shall prevail.
- B. Contractor shall supply all materials required to furnish and install a complete functional telecommunications grounding system.
- C. The grounding system shall be installed in accordance with the manufacturer's instructions and as indicated on Contractor's submittal documentation, prior to final acceptance/approval by the University.
- D. Point of connection:
 - 1. Under Work of this Section, install a complete Telecommunications Grounding System, leaving only the physical connection between the PBB and Building Service Entrance Ground for work under Division 26 Electrical.
- E. Ground bar installation
 - 1. The Contractor shall install a ground bar in each Telecom Room to which all ground wires, grounding terminal points within the room, and Telecommunications Bonding Backbone conductors will terminate.
- F. Telecommunications Bonding Conductor:
 - 1. A TBB riser shall be installed from the PBB to the furthest SBB
 - a. In each TR the TBB riser shall be spliced via H-TAP to an appropriately sized TBB to bond the SBB. (reference diagram below)
 - b. PBB and/or SBB shall not be "daisy chained".
 - 2. Install TBBs in a manner that will protect them from physical and mechanical damage.
 - 3. Routing:
 - a. Route TBBs in the shortest possible path.
 - b. Minimum bend radius shall be 6 times the cable diameter.
 - 4. At PBB/SBBs:

- a. Thoroughly clean non-electro-plated busbar prior to fastening the conductors, bolts, or connectors to the busbar.
 - b. Apply anti-oxidant to the bonding point.
 - c. Attach lugs to busbar with appropriate size bolt, flat washer and Belleville washer.
5. Torque connections.



G. Rack Bay & Overhead Cable Support Bonding

1. Rack Bay: Bond equipment racks, frames, frame bays, cabinets, server racks, and other similar support systems located within the same room or space as the PBB/SBB to the busbar.
2. Equipment rack grounding (reference diagram below)
 - a. A #2 AWG TBB shall be placed from the PBB/SBB in the TR to a point above the furthest rack from the PBB/SBB.
 - b. A #6 AWG TBB shall be spliced via H-TAP to bond each rack.
 - c. #6 AWG TBB shall be bonded to a Panduit ground strip (#RGS13451-1) installed on the equipment rack via 1 #6 AWG 2-hole long barrel compression connector.



TYPICAL TELECOMMUNICATIONS RACK GROUNDING

NO SCALE

3. Overhead Cable Support:
 - a. Bond overhead runway located within the same room or space as the PBB/SBB to the busbar.
 - b. Provide "grounding kit" (straps & connectors) to bond sections of cable runway for ground continuity. This requirement shall apply to sections of cable runway within a single communication room.
4. Cable Tray Bonding
 - a. A #6 AWG TBB from the cable tray into the TR, via a Series-22 EZ-Path, shall be bonded to the PBB/SBB.
 - b. The cable tray TBB shall not share pathway with telecommunications cabling.

H. Bonding to Building Steel

1. A bond shall be made in each TR from building steel (where available) to the PBB/SBB.

3.5 LABELING

A. General Requirements

1. Labeling, identifier assignment, and label colors shall conform to ANSI/TIA-606-D Administration Standard and as approved by Owner's Representative before installation.
2. The Primary Bonding Busbar / Secondary Bonding Busbar shall be labeled as follows:
 - a. PBB/SBB – TR ROOM #
 - b. Examples: PBB-1011, SBB-3011
3. The Telecommunications Bonding Conductor (TBC) shall be labeled as follows:
 - a. TBC-TR ROOM #
 - b. Example: TBC-1011
4. The Telecommunications Bonding Backbone (TBB) shall be labeled as follows:
 - a. Riser TBB: TBB- ORIGINATING TR ROOM # - DESTINATION TR ROOM #
 - 1) Example: TBB-1011-3011
 - b. TR TBBs: TBB – ITEM BEING GROUNDED
 - 1) Examples: TBB-EQUIPMENT RACK, TBB-LADDER RACK, TBB-R1R1, TBB-CABLE TRAY, TBB-ENTRANCE PROTECTOR, TBB-CONDUIT
5. Permanently label TBCs. Affix label within 12" of termination.
6. Labels shall be permanent with machine-generated text, white background with black print minimum 12-point font; handwritten labels will not be accepted.
 - a. Wrap around labels shall be a minimum of 1" wide.
 - b. PBB/SBC labels shall be ½" (12mm) placed in the upper left-hand corner of the busbar.
 - c. Wrap around labels shall fully wrap around conductors 1.5 times with a self-laminating feature to provide permanent marking.

3.6 RECORDS

- A. Communication Bonding System records shall conform to ANSI/TIA-606-D Administration Standards. Each component shall have as a minimum, the information as outlined in ANSI/TIA-606-D.

3.7 ACCEPTANCE

- A. Review bonding configuration after all cabling and equipment is installed for approval by project IOR and UCDH IT representative.

END OF SECTION

SECTION 27 05 29
HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes the provision of all necessary labor, supervision, materials, equipment, and services required to fully execute the installation of communications supports and cable hook systems as described in this specification. This work includes, but is 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
 - 9. Poke-through device

1.2 SYSTEM DESCRIPTION

- A. Provide devices specified in this Section and related Sections for support of communications 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 SEISMIC REQUIREMENTS

- A. Seismic design requirements, as detailed in all project-related drawings—including architectural and structural—shall apply to all work specified in the following sections of this specification, as outlined below:
 - 1. SECTION 27 05 00 COMMUNICATIONS HORIZONTAL CABLING
 - 2. SECTION 27 05 26 GROUNDING AND BONDING OF COMMUNICATIONS SYSTEMS
 - 3. SECTION 27 05 36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS
 - 4. SECTION 27 11 16 COMMUNICATIONS CABINETS RACKS FRAMES AND ENCLOSURES
 - 5. All support systems and termination apparatus associated with the telecommunications system.
- B. The contractor shall install seismic restraints for all telecommunications racks and UPS systems in accordance with the construction documents. This includes floor-mounted items weighing over 400 pounds and wall-mounted or suspended items weighing over 20 pounds.

- C. All installations shall comply with engineered drawings and anchorage calculations provided by the structural engineer, in accordance with the California Code of Regulations, Title 24, and the 2022 California Building Code.
- D. Supports for items such as racks, conduit, cable trays, and similar equipment shall include proper support, bracing, and anchorage, designed by the structural engineer in accordance with CBC Chapter 16A.
- E. Supports to be sized to suit load and selected to match mounting conditions

1.4 REFERENCES

- A. Comply with requirements of Section 27 05 00
- B. In addition to those codes, standards, etc., listed in Section 27 05 00, comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:
 - 1. ASTM A 510 Specifications for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel.
 - 2. ASTM B 633 Specifications for Electrodepositing Coatings of Zinc on Iron and Steel, Sections SC2 and SC3.
 - 3. ASTM A 653 Specifications for Steel Sheet, Zinc-Coated (Galvanized) by Hot Dip Process.
 - 4. ASTM A 591 Specifications for Electrodepositing Coatings of Zinc on steel wire or sheets.
 - 5. ASTM A 123 Specifications for Zinc (Hot Galvanized) Coatings on Iron and Steel.

1.5 RELATED SECTIONS

- A. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS
- B. 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS
- C. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS
- D. 27 05 36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS
- E. 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
- F. 27 11 16 COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES
- G. 27 11 19 COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS
- H. 27 11 23 COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK
- I. 27 11 26 COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS
- J. 27 13 00 COMMUNICATIONS BACKBONE CABLING
- K. 27 13 43 COMMUNICATIONS SERVICES CABLING
- L. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

- M. 27 41 33 MASTER ANTENNA TELEVISION SYSTEMS
- N. 27 51 16 PUBLIC ADDRESS SYSTEMS
- O. 27 52 13 PATIENT MONITORING AND TELEMETRY SYSTEMS
- P. 27 52 23 NURSE CALL/CODE BLUE SYSTEMS
- Q. 27 53 13 CLOCK SYSTEMS
- R. 27 53 19 INTERNAL CELLULAR, PAGING, AND ANTENNA SYSTEMS

1.6 DEFINITIONS

- A. Definitions as described in Section 27 05 00 shall apply to this section.
- B. "Cable Hanger": A metal, most often steel, cable support device shaped (section view) similar to the letter J. The device is available in different sizes, supporting different quantities of cables, and is also available with different attachment hardware to be supported by different methods (e.g., wire support, beam flange clip, etc.).
- C. Cable Runway or Ladder Rack: Overhead means to get cabling from point to point whether it be vertical or horizontal within Telecommunications Spaces such as TR's and the TER.
- D. "J-Hook": Another name for cable hangers.

1.7 SUBMITTALS:

- A. Submittals shall conform with Division 1 33 00 requirements Submittal Procedures.
- B. Submittals shall conform with Division-27 Section 27 05 00 Common Work Results for Communications.
 - 1. Submit shop drawings and product data with the following information:
 - a. Provide manufacturer's data sheets for each piece of material incorporated into the hanger and support design.
 - b. Provide shop drawings indicating the size, location, and routing of j-hook and hanger pathways. Include penetrations through rated and non-rated barriers and the systems to be installed for each.

PART 2 - PRODUCTS

2.1 FASTENERS, STRAPS, AND BEAM CLAMPS

- A. Equal products by the following manufacturers will be considered providing that all features of the specified product are provided:
 - 1. Concrete fasteners
 - a. Hilti.
 - b. Phillips "Red-Head."

- c. Remington.
 - d. Ramset.
 - e. Simpson Strong-Tie.
 - f. Or approved equal.
2. Concrete inserts and construction channel:
- a. Unistrut Corp.
 - b. GS Metals "Globe Strut."
 - c. Thomas & Betts.
 - d. "Kindorf" Corp.
 - e. Or approved equal.

3. Conduit straps:
 - a. 0-Z/Gedney.
 - b. Erico "caddy" Fastening Products.
 - c. Thomas & Betts.
 - d. "Kindorf" Corp.
 - e. Or approved equal.
4. Beam Clamps
 - a. Cooper B-line.
 - b. SuperStrut.
 - c. Unistrut.
 - d. Or approved equal.

2.2 CABLE HANGERS

A. Ceiling Hung J-Hooks

1. Specifically intended to carry the load of up to 74 communications cables without applying excess forces to cables at bottom of bundle.
2. Integral broad bottom edge to spread cable load with flat bottom and provide a minimum of 1-5/8" cable bearing surface.
3. Integral hanger rod attachment hardware at top. Load rated for application.
4. Incorporates smooth 90-degree radius edges to prevent snagging cable jackets on installation.
5. Designed so the mounting hardware is recessed to prevent cable damage.
6. Integral mechanical cable latch retainer to provide containment of cables within the hook. The retainer shall be removable and reusable.
7. Suitable for direct attachment to walls, hanger rods, beam flanges, purlins, strut, floor posts, etc. to meet job conditions.
8. Multi-tiered cable hooks to be used where required to provide separate cabling compartments, or where additional capacity is needed.
9. Finishes: 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.
10. Cable hooks for corrosive areas shall be stainless steel, AISI Type 304.
11. Manufacturer:
 - a. Cooper B-Line series BCH21 (max 32 CAT-6A cables), BCH32 (max 50 CAT-6A cables), BCH64 (max 74 CAT-6A cables).
 - b. Caddy/Erico cablecat.
 - c. Or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Comply with the Executive requirements of Section 27 05 00.

3.2 EXAMINATION

- A. Thoroughly examine site conditions to ensure the supporting devices can be installed in accordance with manufacturer specifications and tolerance requirements. Notify the University's Representative of any conditions that could adversely affect the installation or future use of the system. Do not proceed with installation until any unsatisfactory conditions have been corrected.
- B. The installer is responsible for ensuring the integrity of the structures to which the system is attached, including verifying their ability to safely support the imposed loads, as evaluated by a qualified engineer.
- C. The University's Representative reserves the right to request additional supports if, in their sole opinion, such supports are necessary. Any additional supports required shall be installed at no extra cost to the University.

3.3 PREPARATION

- A. Prepare and maintain the following clearances from EMI sources (per BICSI Standards).
 - 1. Power cable (in grounded conduit) = 6 inches
 - 2. Power cable (unshielded) = 24 inches
 - 3. Fluorescent lights = 5 inches
 - 4. Transformers = 48 inches
- B. Provide all low voltage Communications Systems Pathways and Electronic Security and Safety System Pathways.

3.4 DISTRIBUTION PATHWAY VIA CEILING HUNG CABLE HOOKS (J-HOOKS)

- A. The cabling support system shall be installed in accordance with the manufacturer's instructions and as indicated on Contractor's submittal documentation, prior to final acceptance/approval by the University.
- B. Provide dedicated supports with a maximum separation of 60 inches along each route. Suspend wire or rod using components suitable for the structure, such as powder-actuated clip fasteners for wire, beam flange clips or angled flange clips for wire or rod, or embedded anchors for threaded rod. Do not share supports (wire/rod) with other trades. Do not attach hangers to ceiling grid support wires, ductwork, piping, or other equipment hangers.
- C. Provide independent dedicated pathways for each low voltage system (network, 800MHZ Radio, access control, DAS, BMS, etc.), including transitions through walls and fire barriers.
- D. Maintain minimum 6" clearance above suspended ceilings.
- E. J-hook pathways shall be designed not to exceed 25% of manufacturer's fill capacity when the project is complete.

END OF SECTION

SECTION 27 05 33
CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide telecommunications pathways in accordance with ANSI/TIA-569-E, per project plans and specifications.
- B. Provide conduits as required by fire code and where wall cavities are obstructed.
- C. Provide minimum 1 ¼" conduit to all Work Area Outlets (WAO), Wireless Access Point Outlets (WAP), Camera Locations, Building Monitoring System (BMS) locations, Emergency Phones, and all other user end telecommunications outlet locations. Conduit shall be stubbed out to within 2' of an accessible cable tray or j-hook pathway.
- D. All telecommunications WAOs shall consist of a 5" square by 2-7/8" deep junction box fed via a minimum 1-1/4" conduit unless otherwise specified.

1.2 RELATED SECTIONS

- A. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS
- B. 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS
- C. 27 05 29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS
- D. 27 05 36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS
- E. 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
- F. 27 11 16 COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES
- G. 27 11 19 COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS
- H. 27 11 23 COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK
- I. 27 11 26 COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS
- J. 27 13 00 COMMUNICATIONS BACKBONE CABLING
- K. 27 13 43 COMMUNICATIONS SERVICES CABLING
- L. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING
- M. 27 41 33 MASTER ANTENNA TELEVISION SYSTEMS
- N. 27 51 16 PUBLIC ADDRESS SYSTEMS
- O. 27 52 13 PATIENT MONITORING AND TELEMETRY SYSTEMS

- P. 27 52 23 NURSE CALL/CODE BLUE SYSTEMS
- Q. 27 53 13 CLOCK SYSTEMS
- R. 27 53 19 INTERNAL CELLULAR, PAGING, AND ANTENNA SYSTEMS

1.3 SUBMITTALS

- A. Submittals shall conform with Division 1 33 00 requirements Submittal Procedures.
- B. Submittals shall conform with Division-27 Section 27 05 00 Common Work Results for Communications.
- C. Submit shop drawings and product data with the following information:
 - 1. Submit conduit shop drawings for cable path other than wall drops.
 - 2. Confirm low voltage pathway quantity and fill ratio expected.
 - 3. Include junction box locations and sizes.

PART 2 - PRODUCTS

2.1 WORK AREA OUTLET BOX

- A. All telecommunications WAOs shall consist of a 5" square by 2-7/8" deep junction box fed via a minimum 1-1/4" conduit unless otherwise specified. Conduit shall be stubbed out to within 2' of an accessible cable tray or j-hook pathway.

2.2 WIRELESS ACCESS POINT (WAP) OUTLET BOX

- A. Provide 5" square by 2-7/8" deep junction box at WAP locations.
 - 1. For hard lid or inaccessible locations provide backbox finished with a double gang mud ring flush with the finish surface.
 - a. Provide 1 1/4" conduit from backbox to within 2' of an accessible cable tray or j-hook cable pathway.
 - 2. For suspended ceiling locations provide backbox finished with a double gang mud ring flush with the suspended ceiling.
 - a. Backbox shall be seismically braced per project requirements.

2.3 FLOOR BOXES, POKE-THROUGHS AND MONUMENTS

- A. All Floor boxes shall be sized and approved by UCDH IT and FD&C's furniture group.
 - 1. Provide 1-1/4" conduit for data at floor box and poke through locations. If a floor box / poke through is to be shared with AV, provide an additional 1-1/2" conduit.
 - 2. Wiremold RC9AM2TCBK flush poke -thru with accessories as required shall be provided to feed modular furniture.
 - 3. Wiremold Evolution 8" poke through assembly, # EWS-WM-8ATCFFBK shall be provided at poke through floor box locations.

4. Wiremold Evolution Series Floor Box, # EFB45BTCBK shall be provided at floor box locations.
5. Or approved equal.

2.4 SECURITY AND OTHER PERIPHERAL CABLING INSTALLATIONS

- A. Provide 2ea. CAT-6A cables, terminated with Panduit CAT-6A, housed within a Panduit 2-port surface mount box at each security panel, access control panel, lighting control panel, and BMS panel.
- B. Consider the device being installed when calling out conduit and housings for security and peripheral devices due to differing requirements.

2.5 FIRE RATED PENETRATIONS

- A. STI EZ-Path fire rated pathways shall be provided for penetrations at fire rated walls and barriers.
 1. Provide STI EZ-Path Series 44+ or approved equal.
 - a. STI EZ-Path Series 33 and/or Series 22 fire rated pathways shall be permitted where physical constraints prevent the installation of a STI EZ-Path Series 44+.
- B. Where conduit pathways are provided through fire rated walls and barriers, a STI EZ-Path retrofit device shall be installed.
 1. Provide EZDR200, or approved equal, for 2" conduit.
 2. Provide EZDR400, or approved equal, for 4" conduit.

2.6 NPON- FIRE RATED PENETRATIONS

- A. For penetrations through non-fire rated walls and barriers, STI EZ-Path Series 44NEZ Smoke and Acoustical Pathways shall be provided.
 1. STI EZ-Path Series 33NEZ Smoke and Acoustical Pathways shall be permitted where physical constraints prevent the installation of a STI EZ-Path Series 44NEZ.
- B. Provide conduit penetrations per electrical Specifications.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Distribution Pathway via EMT Raceway:
 1. Structured cabling installation is to meet BICSI cable distance limitations. Remaining parallel to the building structure is not a requirement.
 2. Conduit pathways shall have no single bend greater than 90 degrees or an aggregate of bends greater than 180 degrees between pull points.
 3. Conduit pathways shall not contain continuous sections longer than 100'. For runs that total more than 100' in length, pull points or pull boxes shall be incorporated so that no segment between pull points or boxes exceeds the 100' limitation.

4. Minimum bend radius for telecommunications conduits 2" or less shall be 6 times the internal diameter of the conduit.
5. Minimum bend radius for telecommunications conduits larger than 2" shall be 10 times the internal diameter of the conduit.
6. Conduit bodies and/or LB's shall not be used when constructing telecommunications pathways.
7. All ends of conduits shall be cut square, reamed, and fitted with insulated bushing.
8. All box connectors shall have throated collars or have screw on busing installed.
9. All conduit which passes through firewalls shall adhere to applicable fire code.

3.2 PREPARATION

- A. Fill ratios are to be calculated by the designer and installer during their respective design and installation phases of the project.
- B. Conduit used for pathway is to be designed with a maximum 40% fill.

3.3 MOUNTING AND INSTALLATION – WORK AREA OUTLET BOX

- A. Provide back boxes at all WAOs unless otherwise noted.
- B. Support and fasten pathway and pull boxes as defined in the electrical specifications.
- C. Conduit purposed for floor box(es) must have the respective conduit turn up in an adjacent or nearby wall or column that is stubbed to nearest accessible ceiling.
- D. Manufacturer's instructions:
 1. Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation.
 2. Maintain jobsite file of Material Safety Data Sheets (MSDS) for each product delivered to jobsite packaged with an MSDS.

3.4 STATION CABLE PATHWAY INSTALLATION

- A. Work Area Outlet Boxes:
 1. Unless otherwise noted on the plans, all cut in boxes and surface station outlet boxes are to be installed at a height of 18" A.F.F. (above finished floor) to center, except for those otherwise called out.
 2. Those plates or boxes that are to be used for telephone wall jacks shall be installed according to ADA requirements.
 3. All cabling outlets shall be installed so that their edges are parallel to the vertical and horizontal edges of the surface on which they are mounted.

3.5 FINAL INSPECTION AND CERTIFICATION

- A. Punch Walks and Punch Lists
 1. Punching the Work of individual Sections of Division 27 may be combined.
 2. Execute a punch walk with the Consultant to observe work.

3. Develop a punch list for items needing correction. Issue this punch list to Consultant.
4. Correct the Work as noted on punch list.
5. Execute follow up punch walk with the Engineer and the Owner or Owner's Representative to verify punch list items have been corrected.

END OF SECTION

SECTION 27 05 36
CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section outlines the requirements for the design, installation, and management of cable trays used in communications systems. It specifies the standards, materials, and practices necessary to ensure efficient and secure cable routing within a building.

1.2 RELATED SECTIONS

- A. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS
- B. 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS
- C. 27 05 29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS
- D. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS
- E. 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
- F. 27 11 16 COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES
- G. 27 11 19 COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS
- H. 27 11 23 COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK
- I. 27 11 26 COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS
- J. 27 13 00 COMMUNICATIONS BACKBONE CABLING
- K. 27 13 43 COMMUNICATIONS SERVICES CABLING
- L. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING
- M. 27 41 33 MASTER ANTENNA TELEVISION SYSTEMS
- N. 27 51 16 PUBLIC ADDRESS SYSTEMS
- O. 27 52 13 PATIENT MONITORING AND TELEMETRY SYSTEMS
- P. 27 52 23 NURSE CALL/CODE BLUE SYSTEMS
- Q. 27 53 13 CLOCK SYSTEMS
- R. 27 53 19 INTERNAL CELLULAR, PAGING, AND ANTENNA SYSTEMS

1.3 SUBMITTALS

- A. Submittals shall conform with Division 1 33 00 requirements Submittal Procedures.
- B. Submittals shall conform with Division-27 Section 27 05 00 Common Work Results for Communications.
- C. Shop drawings shall be provided demonstrating that the cable tray will not exceed 25% of the manufacturer's maximum fill upon project completion.
- D. Submit shop drawings and product data with the following information:
 - 1. Cable tray sizing, location, and routing. Include penetrations through rated and non-rated barriers and the systems to be installed for each.
 - 2. Connectors, 3-way intersections (T-sections), 90-degree sweeps
 - 3. Support bracketry and accessories
 - 4. Grounding materials

1.4 QUALITY ASSURANCE

- A. All cable and equipment shall be installed in a neat and workmanlike manner. Construction methods not explicitly described or indicated in the contract documents shall be subject to review and approval by the owner or the owner's representative.
- B. Equipment and materials shall be of the quality and manufacture specified. The specified equipment is based on the acceptable manufacturers listed. Where "approved equal" is stated, or a substitution is requested, the equipment must be equivalent in every way to the specified equipment. All substitutions are subject to review and approval by the owner or the owner's representative.
- C. Strictly adhere to all BICSI, Telecommunications Industry Association (TIA) recommended installation practices when installing communications and data cabling.
- D. Material and work specified herein shall comply with the applicable requirements of:
 - 1. ANSI/TIA/EIA-569-E (2019) Commercial Building Standard for Telecommunications Pathways and Spaces.
 - 2. ANSI/TIA/EIA-606-D (2021) Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
 - 3. ANSI/J-STD-607-E (2024) Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
 - 4. BICSI – Telecommunications Distribution Methods Manual (TDMM) 15th edition
 - 5. NEMA – VE-1 – Metal Cable Tray Systems (2017)
 - 6. NEMA – VE-2 – Metal Cable Tray Installation Guidelines (2018)

PART 2 - PRODUCTS

2.1 CABLE TRAY

- A. Cable Tray
 - 1. Open Wire Frame Construction.
 - 2. Welded wire mesh with continuous safety edge wire lip.

3. Mesh forms grid at nominally 2" by 4"
4. Electroplated zinc galvanized carbon steel.
5. UL listed.
6. Accessories: Provide a complete UL listed system of accessories, including bonding and grounding connections, conduit connectors, to terminate conduits extended to basket edge, radius shields to protect cabling at inside corners, and waterfall drop-outs at each end of cabling racks and cabinets or where needed to terminate open wiring systems.
7. Manufacturers:
 - a. Cablofil.
 - b. PW Industries.
 - c. Or approved equal.

2.2 CABLE TRAY TRANSITIONS (CONTRACTOR FURNISHED AND INSTALLED)

- A. All turns, bends, and direction changes shall utilize the manufacturer's 90-degree, 3-way, and 4-way radius transitions. Field-constructed 90-degree, 3-way, and 4-way transitions may only be used if it is demonstrated that the manufacturer's solution is not feasible for the specific application.

PART 3 - EXECUTION

3.1 CABLE TRAY APPLICATION

- A. Communications cable tray installations shall conform to the following:
 1. Cable trays shall be used for horizontal station cabling outside of Telecommunications Rooms (TRs) when the pathway contains more than 50 cables.
- B. Size and Fill Ratio:
 1. Minimum size cable tray shall be 18 inches wide by 4 inches deep.
 2. Cable trays shall not exceed 25% of the manufacturer's maximum fill upon project completion.

3.2 INSTALLATION

- A. The cable tray system shall be installed and supported in accordance with the manufacturer's instructions and the Contractor's approved submittal documentation. Installation shall be reviewed and approved by a UCDH IT representative prior to final acceptance.
- B. Installation shall be performed and accomplished in a professional manner, by qualified personnel.
- C. A minimum vertical clearance of 12 inches shall be maintained above the cable tray system to ensure adequate access.
- D. Maintain a 24-inch-wide access pathway along one side of the cable tray system. Any deviations must be approved by IT prior to installation. Installations not approved by IT shall be corrected or replaced at no cost to the University.

- E. A minimum vertical clearance of 12 inches shall be maintained between the top of the finished ceiling and the bottom of the cable tray.
- F. A maximum cable distance of 275 feet shall be maintained when designing horizontal cable infrastructure.
- G. The contractor is responsible for ensuring the separation of IT systems. Provide independent, dedicated pathways for each low-voltage system (e.g., network, 800MHz radio, access control, DAS, BMS, etc.), including transitions through walls and fire barriers.
- H. All cable trays shall terminate before firewalls and transition to E-Z paths, ensuring equal capacity at the point of penetration.
- I. In inaccessible areas, transition to an equivalent size conduit pathway. If fire stopping is required, an EZ Path retrofit EZDR shall be provided on all conduits.
- J. Center mount "T" style cable tray supports shall not be permitted.\

3.3 GROUNDING AND BONDING FOR CABLE TRAYS

- A. Cable trays shall be grounded to the PBB / SBB located in the TR they serve via a bonding conductor per section 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

END OF SECTION

SECTION 27 05 41
FIRE-STOPPING SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This section includes firestopping for the following:
1. Penetrations through fire-resistance-rated floor and roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
 2. Penetrations through fire-resistance-rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
 3. Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.

1.2 SYSTEM PERFORMANCE REQUIREMENTS

- A. Comply with California Code of Regulations - Title 24, CBC - Chapter 7, Fire Resistance Ratings and Fire Tests.
- B. Test Requirements:
1. ANSI/UL 2079 Tests for Fire Resistance of Building Joint Systems, 2020
 2. ASTM E-814-24 Standard Test Method for Fire Tests of Penetration Firestop Systems, 2024
 3. ANSI/UL 1479 Standard for Fire Tests of Penetration Firestops, 2015

1.3 RELATED SECTIONS

- A. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS
- B. 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS
- C. 27 05 29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS
- D. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS
- E. 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
- F. 27 11 16 COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES
- G. 27 11 19 COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS
- H. 27 11 23 COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK
- I. 27 11 26 COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS
- J. 27 13 00 COMMUNICATIONS BACKBONE CABLING

- K. 27 13 43 COMMUNICATIONS SERVICES CABLING
- L. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING
- M. 27 41 33 MASTER ANTENNA TELEVISION SYSTEMS
- N. 27 51 16 PUBLIC ADDRESS SYSTEMS
- O. 27 52 13 PATIENT MONITORING AND TELEMETRY SYSTEMS
- P. 27 52 23 NURSE CALL/CODE BLUE SYSTEMS
- Q. 27 53 13 CLOCK SYSTEMS
- R. 27 53 19 INTERNAL CELLULAR, PAGING, AND ANTENNA SYSTEMS

1.4 SUBMITTALS

- A. Submittals shall conform with Division 1 33 00 requirements Submittal Procedures.
- B. Submittals shall conform with Division-27 Section 27 05 00 Common Work Results for Communications.
- C. All manufacturer product data, including UL Listing, for all materials, prefabricated devices, and installation instructions shall be submitted. The material and installation instructions must receive approval from the Campus Fire Marshal prior to installation.
- D. Shop drawings shall be submitted that detail the locations of all planned through-penetration devices.

1.5 QUALITY ASSURANCE

- A. Compatibility:
 - a. Provide firestop systems that are compatible with one another and with the substrates, ensuring performance under both application and service conditions.
- B. Firestop system installation must meet requirements of ASTM E-814, UL 1479, or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.
- C. All materials shall be new.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Specified Technologies, Inc.
 - a. EZ-Path Series 44+ fire-rated pathway
 - b. EZ-Path Series 33 fire-rated pathway
 - c. EZ-Path Series 22 fire-rated pathway
 - d. EZ-Path Retrofit Device
- B. Or approved equal.

2.2 MATERIALS

- A. All through-penetrations shall be labeled on both sides of the wall to include the following information: the applicable UL system number, product used, installation date, hourly fire resistance rating, installer's details, location number, and the manufacturer's contact telephone number. The materials installed must meet the required conditions for installation to achieve the specified fire resistance rating.
- B. Use only firestop products that have been UL 1479, ASTM E-814, or UL 2079 tested for specific fire rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire rating involved for each separate instance.
- C. For penetrations by non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following materials are acceptable:
 - 1. EZ-Path retrofit device sized for the conduit being installed.
- D. For penetrations by combustible items (penetrants consumed by high heat aflame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe (closed piping systems) the following materials are acceptable:
 - 1. EZ-Path Fire Rated Pathway
- E. For large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways the following materials are acceptable:
 - 1. EZ-Path Fire Rated Pathway
- F. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E-814 which is equal to the time rating of construction being penetrated.
- G. Provide a firestop system with an Assembly Rating as determined by UL 2079 which is equal to the time rating of construction being penetrated.
- H. For workstation conduits from accessible ceiling to outlet.
 - 1. STI SpecSeal putty.
- I. For pipe penetrations of cast in place concrete floors and concrete over metal decking the following material is acceptable:
 - a. EZ-path

PART 3 – EXECUTION

3.1 PREPARATION

- A. Inspect and verify site conditions and measurements that may affect the work specified in this Section. Address and correct any detrimental conditions prior to commencing installation

3.2 INSTALLATION

- A. Install materials in strict accordance with the manufacturer's instructions and the guidelines provided in the UL Fire Resistance Directory.

- B. Install re-enterable, non-hardening, intumescent putty in workstation conduits where required.
Do not use fire caulk.

3.3 IDENTIFICATION

- A. Clearly identify firestopping using manufacturer's provided self-adhesive preprinted labels. Securely attach labels to the surfaces of the penetrated construction on both sides of each firestopping installation, ensuring they are permanently affixed and clearly visible to anyone who may remove penetrating items or firestopping.

END OF SECTION

SECTION 27 05 43
UNDERGROUND DUCTS AND RACEWAY FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. The work specified in this section includes the provision of all necessary labor, supervision, materials, equipment, and services required for the complete installation of exterior telecommunications pathways, as detailed in these specifications and related drawings. The scope includes, but is not limited to:
1. Cutting and Patching Asphalt and Concrete
 2. Trenching and Excavation
 3. Underground Conduit Systems
 4. Cable Routing Hardware
 5. Horizontal Directional Drilling – Also commonly referred to as Directional Boring or Guided Horizontal Boring

1.2 SYSTEM DESCRIPTION

- A. Provide devices specified in this Section and related Sections for support of communications equipment specified for this project.
- B. Maintenance Holes (MH)
1. All MH lids shall be AASHTO H-25 rated.
 2. Minimum size MH shall be 6' x 8' x 6' deep.
 3. All MHs shall be labeled as TELECOMMUNICATIONS. In addition, each MH shall be labeled with a UCDH provided nomenclature.
 - a. Labels shall be incorporated into the design of the MH and be permanent with minimum ¾" lettering.
- C. Pull Boxes:
1. All Pull Box lids shall be AASHTO H-25 rated.
 2. Minimum size pull box:
 - a. A 4' x 6' x 4' deep pull box shall be used for conduit banks exceeding 4ea. 4" PVC schedule 40 conduits.
 - b. A 3' x 5' x 3' deep pull box may be used to accommodate duct banks of up to 4ea. 4" PVC schedule 40 conduits.
 3. All pull boxes shall be labeled as TELECOMMUNICATIONS. In addition, each MH shall be labeled with a UCDH provided nomenclature.
 - a. Labels shall be incorporated into the design of the MH / Pull Box and be permanent with minimum ¾" lettering.
- D. OSP Conduit Bank: The typical conduit bank between Pull Boxes shall be 8ea. 4" PVC schedule 40 conduits.

- E. Entrance Conduit Bank: Each building shall be fed via redundant diverse pathways from the nearest telecommunications maintenance hole via four (4) 4" PVC Schedule 40 conduits. Each PVC conduit shall include pull- rope. (Refer to the Telecom Site Plan for details).
- F. Innerduct: Install three (3) – 3" 3-cell flexible innerduct into each of the 4" conduits. All pull cords shall be secured at each end to prevent accidental removal.

1.3 RELATED SECTIONS

- A. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS
- B. 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS
- C. 27 05 29 HANGERS AND SUPPORTS OR COMMUNICATIONS SYSTEMS
- D. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS
- E. 27 05 36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS
- F. 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
- G. 27 11 16 COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES
- H. 27 11 19 COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS
- I. 27 11 23 COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK
- J. 27 11 26 COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS
- K. 27 13 00 COMMUNICATIONS BACKBONE CABLING
- L. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING
- M. 27 41 33 MASTER ANTENNA TELEVISION SYSTEMS
- N. 27 51 16 PUBLIC ADDRESS SYSTEMS
- O. 27 52 13 PATIENT MONITORING AND TELEMETRY SYSTEMS
- P. 27 52 23 NURSE CALL/CODE BLUE SYSTEMS
- Q. 27 53 13 CLOCK SYSTEMS
- R. 27 53 19 INTERNAL CELLULAR, PAGING, AND ANTENNA SYSTEMS

1.4 SUBMITTALS

- A. Submittals shall conform with Division 1 33 00 requirements Submittal Procedures.
- B. Submittals shall conform with Division-27 Section 27 05 00 Common Work Results for Communications.

- C. Submit shop drawings and product data with the following information:
 - 1. Provide manufacturer's data sheets for each piece of material incorporated into the underground ducts and raceways design.
 - 2. Provide drawings showing the size, number, location, routing and labeling for all conduits, maintenance holes, and pull boxes incorporated into the underground ducts and raceways design.

1.5 QUALITY ASSURANCE

- A. All installation work for the new outside plant telecommunications pathways shall be performed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated shall be subject to the control of Owner.
- B. Equipment and materials shall conform to the quality and specifications indicated. The specified equipment is based on the acceptable manufacturers listed. Where the term 'approved equal' is used, proposed equipment must be equivalent in all respects to the specified equipment and is subject to approval upon review of submitted documentation.
- C. Materials and work specified herein shall comply with the applicable requirements of:
 - 1. California Electrical Code (CEC) (2022).
 - 2. IEEE/NESC – National Electrical Safety Code
 - 3. NEMA Standards including, but not limited to:
 - a. NEMA, RN1 (2018), PVC Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 - b. NEMA, TC3 (2021), PVC Fittings for use with Rigid PVC Conduit and Tubing.
 - c. NEMA, TC6 (2020), PVC and ABS Plastic Utilities Duct for Underground Installation.
 - d. NEMA, TC8 (2020), Extra Strength PVC Plastic Utilities Duct for Underground Installation.
 - e. NEMA, TC9 (2020), Fitting for ABS and OVC Plastic Utilities Duct and Fittings for Underground Installation.
 - f. NEMA, TC10 (2020), PVC and ABS Plastic Communications Duct and Fittings for Underground Installation.
 - 4. UL Standards including, but not limited to:
 - a. UL 6 (2022), Rigid Metal Electrical Conduit
 - b. UL 651 (2022) Schedule 40 and 80 PVC Conduit
 - 5. ANSI-C80.2 (2020), Specification for Rigid Steel Conduit, Enameled
 - 6. ANSI/TIA/EIA-569-E (2019) – Commercial Building Standard for Telecommunications Pathways and Spaces.
 - 7. ANSI/TIA/EIA-607-E (2021) – Commercial Building Grounding and Bonding Requirements for Telecommunications
 - 8. ANSI/TIA/EIA-758-C (2024) – Customer Owned Outside Plant Telecommunications Cabling Standard
 - 9. BICSI Telecommunications Distribution Methods Manual 15th Edition
 - 10. BICSI Customer-Owned Outside Plant Manual 6th Edition

- D. For horizontal directional drilling, the Contractor shall adhere to all necessary procedural precautions to ensure that key aspects of the directional bore installation are properly managed and controlled throughout the process.
- E. Personnel involved in horizontal directional drilling shall be fully trained in safety protocols and in their specific responsibilities as part of the drilling crew.

1.6 WARRANTY

- A. See Section 27 05 00 – Common Work Results for Communications, for warranty requirements.

PART 2 - PRODUCTS

2.1 CONDUIT SYSTEM

- A. Non-Metallic Conduit:
 - 1. PVC plastic pipe, ASTM D1785, Schedule 40, Type PVC 1120.
 - 2. Tone Tape, Arnco DL WP12LC Tone Tape, or equivalent.
- B. Conduit:
 - 1. Conduit joint coupling:
 - a. PVC non-metallic fittings must be installed with solvent applied couplings.
 - b. An approved transition coupling shall be used to connect metal to plastic (PVC) conduits.
 - c. Couplings may be threaded and / or glued to provide watertight seal at conduit junctions.
 - 2. Conduit sweeps:
 - a. Minimum 6 times the internal diameter of the conduit for conduits 2" or smaller.
 - b. Minimum 10 times the internal diameter of the conduit for conduits larger than 2".
 - 3. Conduit pathways shall have no single bend greater than 90 degrees or an aggregate of bends greater than 180 degrees between pull points.
 - 4. Conduit pathways shall not contain continuous sections longer than 600 feet. For runs that exceed 600 feet in total length, pull points or pull boxes must be installed so that no segment between pull points or boxes exceeds the 600-foot maximum.
 - 5. Include all necessary conduit straps and hangers, constructed of heavy-duty malleable iron or steel. Perforated pipe straps or wire hangers are not acceptable.
- C. All conduits shall be provided with mule tape installed, minimum 1250lb pulling tension.
- D. Core Drill Seals for Outside Building Walls:
 - 1. Provide Link-Seal waterproof assembly or equal. Manufactured by PSI/Thunderline/Link-Seal.
- E. Conduit Caulking Compound: Compounds for sealing conduit ducts shall have putty-like consistency workable with the hands at temperatures as low as 35 degrees Fahrenheit, shall not slump at a temperature of 300 degrees Fahrenheit, and shall not harden materially when exposed to the air. Compounds shall readily caulk or adhere to clean surfaces of plastic conduit, metallic

conduits, or conduit coatings; concrete, masonry; any cable sheaths, jackets, covers, or insulation material, and the common metals. Compounds shall form a seal without dissolving, noticeable changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect on the hands of workers or upon materials.

F. Underground Plastic Line marker:

1. Manufacturer's standard permanent, continuous-printed polyethylene film tape with metallic core, intended for direct burial service; not less than 3" wide x 4 mils thick. Provide orange tape with black printing reading, "CAUTION TELEPHONE/DATA CABLE BELOW," or similar.

G. Ground Wire: Bare Copper # 6

H. Tracer Box: NEMA-3 4" x 4" weatherproof box

I. Spacers for 4" Conduit: Carlon S289NJN Intermediate Spacer and S288NJN Base Spacer or approved equal.

J. Precast Concrete Vault:

1. General: Provide precast concrete communications vault as detailed on the Drawings and as required for installation of new duct-bank systems and connection to existing duct-bank systems at locations shown on the Drawings. Provide 4'W x 6'L x 4'D precast.
 - a. Design: Vaults shall be steel reinforced, and the complete vault assembly shall be designed for H-25 bridge loading. Submittals shall clearly indicate all dimensions and reinforcing steel.
2. Concrete: Vaults shall be constructed using concrete with a 4500 psi 28-day strength. Concrete mix shall be designed in accordance with ASTM standards.
 - a. Reinforcing Steel: Steel shall be intermediate or hard grade billet steel conforming to ASTM A15, deformed in accordance with ASTM A305.
3. Vaults: Vault and pull box covers shall be AASHTO H-25 traffic rated. The frame and neck shall be doweled into the vault to prevent movement away from the opening. Voice and Data communications vaults and pull box covers shall be marked "TELECOMMUNICATIONS".
4. Conduit Entry: Plastic conduits shall include a bell end inside the vault or pull box, mounted flush and grouted to seal openings. Precast fiber type terminators shall be provided for each duct-bank entry.
 - a. Grounding: A #4/0 bare copper ground wire shall penetrate the side wall in the bottom section of each vault and pull box and extend 48" inside and outside of the vault pull box.
5. Accessories: Knockouts, cable racks, sumps, steps, joint seals and other accessories shown on the Drawings or required for a complete installation shall be provided.

K. Duct Plug 4": General Machine Products (GMP) 6668R16.

L. End Bell 4": Carlon E297N

M. Multi-cell Fabric Mesh Duct:

1. 3ea. 3" x 3-cell mesh innerducts shall be placed in each 4" underground pathway.
2. All fabric mesh duct shall be installed per manufacturer's requirements.

3. Only manufacturer's fittings, transition adapters, terminators, accessories and installation kits shall be used.
4. All fabric mesh duct shall be populated with a measured pull tape.
5. Manufacturer: MaxCell or approved equal.

2.2 CABLE ROUTING HARDWARE

- A. Cable Rack with Support Hardware as Required (or comparable):
 1. 18 Hole: Condux 08380200, Chance C203-1126
 2. Other Sizes as Required: Condux, Chance
- B. Cable Rack Steps/Hooks:
 1. 4": Condux 08380600, Chance C203-1131
 2. Other Sizes as Required: Condux, Chance
- C. "S" Rack Supports: Condux, Chance
- D. Step Lock Wedge: Panduit CHW-C20

PART 3 - EXECUTION

3.1 EXAMINATION

- A. be installed. Provide written notification of any conditions that may hinder the proper completion of the work.
- B. Verify that field measurements and pathway routing conditions align with those shown in the drawings. Provide written notification of any deviations from the drawings.
- C. The commencement of telecommunications pathway installation shall signify the Contractor's acceptance of the existing conditions.

3.2 EXCAVATING, TRENCHING AND BACKFILLING

- A. Examine the areas and conditions where the new exterior telecommunications pathways are to
- B. General:
 1. The scope of work includes all necessary excavation and backfilling required to install the voice and data communications infrastructure. The Contractor shall coordinate the communications work with other activities in the same area, including excavation and backfilling, dewatering, floor protection, temporary facilities, existing and new underground services, landscape development, paving, structural foundations, and floor slabs on grade. The Contractor shall also consider weather conditions and provide any temporary facilities necessary to protect and ensure the proper execution of excavation and backfilling operations
- C. Standards:

1. Unless otherwise specified, comply with the applicable provisions for excavation and backfilling related to voice and data communications work. If there are any uncertainties, refer them to the Architect/Engineer for clarification before proceeding with the work.
- D. Coordinate excavating, trenching, and backfilling with Landscaping, Civil, Mechanical, Plumbing and Electrical drawings. Voice and Data Communications duct-banks shall be independent of any other systems.
- E. Refer to the Civil contract documents for information regarding required depths, slopes, grades, and additional details concerning trenches. If discrepancies between these documents and the civil plans arise, notify the Engineer before proceeding with construction. The trench bottom must be accurately excavated to provide a firm, uniform base for the raceways and duct banks. If unstable soil or mud is encountered at the trench bottom, it must be removed to reach a firm bearing, and the trench should be backfilled with bedding sand to the proper grade, then tamped to ensure uniform, firm support.
- F. The bottom of trenches shall be accurately graded to ensure proper fall and provide uniform bearing and support for each section of conduit, resting on undisturbed soil or a minimum of 2 inches of sand fill along the entire length. Generally, grading for voice and data communications duct-banks and conduits shall slope from the building to the vault, and from a high point between vaults to each individual vault.
- G. Exercise care not to excavate below the required depth, ensuring a flat bed of undisturbed, firm, and secure earth before laying the conduit. If rock is encountered, excavate 6 inches below the required depth, backfill with bedding sand to the required depth, and compact to a minimum of 95% compaction.
- H. All grading around the excavation area shall be managed to prevent surface groundwater from flowing into the excavations. Any accumulated water shall be removed using pumping or other acceptable methods. During excavation, material suitable for backfilling should be stacked in an orderly fashion, a sufficient distance from the trench edges, to prevent overloading and avoid slides or cave-ins. Material deemed unsuitable for backfilling shall be discarded, removed from the site, and properly disposed of
- I. The Contractor shall be fully responsible for the safety of personnel, materials, and equipment in or near trenches or other excavations, and shall implement all necessary sloping, shoring, railings, and other protective measures. The Contractor is required to submit a trench shoring plan and design, sealed by a registered professional engineer. Additional requirements can be found in Divisions 1 and 2.
- J. If any unknown or uncharted utilities are encountered during excavation, promptly notify the Architect/Engineer and await their instructions before proceeding with the work.
 1. If unknown utilities are encountered and work continues without notifying the Architect/Engineer for instructions, resulting in damage to the utilities, the Contractor shall repair the damage at their own expense to the satisfaction of the Owner or the affected utility company.
- K. Trenches shall not be backfilled until all required tests have been made by the Contractor and approved by the Architect/Engineer and any local authorities having jurisdiction.
- L. Backfill shall be cement stabilized sand up to 6" above the top of conduit or duct-bank as required by code. Backfill up to grade shall be in maximum 6" lifts with minimum 95% compaction of lifts. Refer to Division 2 or elsewhere in Contract Documents for additional trenching and backfill requirements.

M. Opening and Re-closing Pavement, Landscape Areas and Lawns:

1. Where excavation requires the opening of existing sidewalks, streets, driveways, or other pavements and lawns, the surfaces shall be cut as necessary to install new conduit and make connections to existing conduits. The size of the cuts shall be minimized, consistent with the work to be performed. After completing the installation and backfilling the excavation, the area shall be patched or replaced with materials matching the original surfaces. The patches must bond securely with the existing surfaces, be level with them, and meet all requirements set by the authorities having jurisdiction. All removed work shall be replaced by craftsmen experienced in installing the type of work being replaced.

N. Excavation in Vicinity of Trees:

1. All trees, including low-hanging limbs, within the immediate construction area shall be adequately protected to a height of at least 5 feet to prevent damage from construction operations and equipment. Excavation within the outermost limb radius of any tree shall be carried out with extreme care. Any roots within this radius shall be brought to the attention of the Architect before being cut or damaged, and the Architect will provide instructions for their proper handling. Stumps and roots encountered outside the outermost limb radius shall be cut back at least 18 inches from any concrete structure or pipeline. No chips, parts of stumps, or loose rock shall be left in the excavation. Where stumps and roots are removed, the excavation shall be backfilled with clean, compacted dry bank sand and tamped.

O. Perform all trenching and backfill for new underground conduit system placement as shown on the project drawings.

P. Perform pavement marking as required. All utilities to be located by contractor and exposed, if necessary, prior to construction.

3.3 CONDUIT SYSTEM PLACEMENT

A. Place new conduit system including maintenance holes as shown on the project drawings.

B. Twelve-inch (12") clearance from all utilities to be maintained. If not possible, conduit to be encased in concrete slurry (flow fill) where proper distance cannot be obtained.

C. The minimum trench depth shall provide at least 24 inches of cover from the top of the conduit to the final grade.

D. Warning Tape containing metallic tracings shall be placed a minimum of 18" above the conduit structure to minimize chances of an accidental dig up. Concrete encasement shall comply with the State of California, Department of Transportation standard specification.

E. Conduit shall be encased in concrete or cement slurry when the following conditions exist:

1. Minimum conduit depth cannot be attained.
2. Conduits pass under sidewalks, roadways, driveways, railroad tracks, and at bends and sweeps.

F. Coordinate with IT Facilities to approve all conduits prior to encasement.

G. All conduits shall be thoroughly cleaned before laying or using.

- H. During construction, the ends of conduits shall be securely plugged to prevent water, mud, or debris from entering the conduits, vaults, or buildings. Care shall be taken to keep the conduits free of concrete, dirt, or any other substances throughout the construction process.
- I. New and reopened trenches under asphalt roadways and parking lots must have concrete cap or be encased in concrete as required.
- J. Support multiple conduits on preformed nonmetallic separators to provide not less than 1" spacing between exterior surfaces of conduit (Type 5). Spacing between separators shall be close enough to prevent sagging of conduits or breaking of couplings and watertight seals.
- K. Squeegee is to be placed in the trench for 20' on each side of the vaults (Type 4).
- L. Conduits shall be securely anchored in place with nylon tie-downs to prevent movement during the placement of concrete slurry (flow fill), squeegee, and other backfill materials. Wire tie-downs are prohibited.
- M. Seal all conduit junctions and fittings to be watertight prior to pouring the concrete slurry (flow fill). Conduit couplings shall be installed in accordance with the manufacturer's recommendations for the specific type of conduit and coupling selected, and as approved.
- N. Transition to PVC coated GRC conduit five feet (5') from building outside wall penetrations.
- O. For all offsets and sweep bends, provide fiberglass or PVC coated GRC.
- P. All conduit bends shall have a minimum radius of 6 times the internal diameter of the conduit for conduits 2 inches and smaller, and 10 times the inside diameter of the conduit for conduits larger than 2 inches.
- Q. Conduit pathways shall have no single bend greater than 90 degrees or an aggregate of bends greater than 180 degrees between pull points.
 - 1. Conduit pathways shall not contain continuous sections longer than 600 feet. For runs that exceed 600 feet in total length, pull points or pull boxes must be installed so that no segment between pull points or boxes exceeds the 600-foot maximum.
- R. Cast into concrete a #6 bare copper ground wire directly above the telecommunications conduit and extend 4" into each vault space. Extend 6" of tracer wire into tracer box on outside wall of building directly above conduit entry point.
- S. Provide plastic conduit bell ends at each PVC conduit termination and for all conduit entering vaults.
- T. Do not bore under concrete sidewalks, remove and replace sidewalks as necessary.
- U. The new conduit shall extend through the wall into the building, tunnel, or crawl space a minimum of 4 inches.
- V. Building, tunnel, and vault core drills must be sealed around conduits with approved waterproof plugging compound.
 - 1. Seal openings around conduits that pass through inside building wall core drills with UL listed foamed silicone elastomeric compound.
 - 2. Seal openings around conduits that pass through outside building walls with a complete Link-Seal assembly or equal for a waterproof seal. Slope conduit away from building.

3. Seal openings around conduits that pass through vault walls with foundation foam on the interior of the core and silicone sealer on the inside and outside of the core for a waterproof seal.
- W. Maintenance Holes (MH) shall be installed with the long dimension aligned with the main conduit run. The conduits shall enter through opposite ends on the short sides of the MH, ensuring that the MH is not used as a 90-degree bend for cable installations.
- X. The ends of the metallic conduit shall be reamed and bushed using:
1. Insulated metallic bushings for 1-1/4" conduit and larger.
 2. Insulated metallic bushings with grounding lugs for conduit entering TRs and ERs
- Y. After the conduit duct installation is complete and the concrete has set, a mandrel pull test shall be conducted through all new conduit ducts to verify duct integrity and ensure the interior surfaces are smooth, free from burrs or obstructions that could damage cable sheaths.
1. Test mandrel shall be 1/4" smaller than inside conduit diameter and not less than 12 inches long.
 2. Following mandrel testing, draw cylindrical wire brush with stiff bristles through each conduit to clean the conduit and remove any concrete, dirt, or other obstructions.
- Z. Stub out conduits into ERs, TRs, and cabinets only enough to attach connector and bushings with grounding lugs.
- AA. All conduits shall be provided with mule tape installed, minimum 200lb pulling tension.
- BB. Plug ends of the new conduit with watertight rubber conduit plugs, conduit caulking compound, or conduit caps to ensure foreign matter does not enter the buildings.
- CC. Refer to Owner prior to cutting or drilling any surface.
- 3.4 CABLE ROUTING HARDWARE
- A. Place new cable routing hardware in the tunnels and in crawl spaces beneath the building as required for the project and as shown on the drawings.
 - B. Perform installation of routing hardware as specified in Section 270526 including anchoring and supports, grounding and bonding, etc.
 - C. Place new ladder, pulling-in irons, cable racks, "S" rack supports, steps in new and existing vaults as required for backbone cable routing.
- 3.5 HORIZONTAL DIRECTIONAL DRILLING
- A. The Owner shall be notified 48 hours in advance of the commencement of horizontal directional drilling work. Drilling shall not begin until the Owner confirms that the necessary preparations for the operation have been completed.
 - B. No work shall commence until Traffic Control and Construction Permits from Owner and/or the City are in place as applicable for the specific project.
 - C. Site Preparation
 1. Prior to any alterations to work site, the entry and exit points shall be marked.

2. No alterations to the work site beyond what are required for operations shall be made.
3. All activities shall be confined to designated work areas.

D. Drill Path Survey

1. The entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations within the areas indicated on drawings.
2. If a magnetic guidance system is being used, the drill path will be surveyed for any surface geomagnetic variations or anomalies.

E. All applicable environmental regulations shall be adhered to.

F. Following drilling operations, the equipment will be de-mobilized, and the worksite restored to its original condition. All excavations will be backfilled and compacted to 95% of original density. Landscaping will be restored to original site conditions.

3.6 SAFETY

A. The contractor must comply with Owner regulations for asbestos, lead, and confined spaces.

B. All applicable state, federal and local safety regulations shall be adhered to, and all operations shall be conducted in a safe manner.

C. Guard vault openings per NESC C-2-2017, 423.A:

1. When covers of maintenance holes are removed, the opening shall be promptly protected with a barrier, temporary cover, or other suitable guard.

D. Test for gas in vaults and unventilated vaults per NESC C2-2017, 423.B and C, including, but not limited to:

1. The atmosphere shall be tested for combustible or flammable gases before entry.
2. Where combustible or flammable gases are detected, the work area shall be ventilated and made safe before entry.
3. Unless forced continuous ventilation is provided, a test shall also be made for oxygen deficiency.
4. Provision shall be made for adequate continuous supply of air. Note: The term adequate includes evaluation of both the quantity and quality of the air.
5. Employees shall not smoke in vaults.
6. Where open flames must be used in maintenance holes or vaults, extra precautions shall be taken to ensure adequate ventilation.

3.7 AS-BUILT DRAWINGS

A. Mark the project drawings to reflect any variations from the base specifications and drawings, including as-built conduit routing.

END OF SECTION

SECTION 27 05 53
IDENTIFICATION AND LABELING OF COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide all labor, materials, tools, and equipment required for permanent intelligible labeling for items including but not limited to communications cabling (structured and non-structured) innerduct, connectors, faceplates, jacks, receptacles, patch panels, and racks.
- B. All labels shall be printed. Handwritten labels are not acceptable.
- C. This section includes minimum labeling requirements for the following:
 - 1. Room designations
 - 2. Communications cabling
 - 3. Closet Hardware including patch panels, terminal blocks, protectors, and racks.
 - 4. Work Area Outlets
 - 5. Wireless Access Points
 - 6. Pathways and Spaces
 - 7. Grounding and Bonding
 - 8. Overhead Paging Speakers

1.2 VISUAL APPEARANCE

- A. Clear plastic covers over faceplate labels are not permitted.
- B. Labels shall be black print on white background with a minimum 12-point font.

1.3 LABELING STANDARDS AND REQUIREMENTS

- A. All new labeling shall reflect UCD labeling standards.
- B. Contact the University's Representative for a copy of the current standards prior to proceeding.
- C. Notify the University Representative of any project conditions not covered by these specifications or the University's current standards, and follow the direction provided.
- D. Identification and administration work specified herein shall comply with the applicable requirements of:
 - 1. ANSI/TIA/EIA-606-D (2014) Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.

1.4 RELATED SECTIONS

- A. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS
- B. 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

- C. 27 05 29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS
 - D. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS
 - E. 27 05 36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS
 - F. 27 11 16 COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES
 - G. 27 11 19 COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS
 - H. 27 11 23 COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK
 - I. 27 11 26 COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS
 - J. 27 13 00 COMMUNICATIONS BACKBONE CABLING
 - K. 27 13 43 COMMUNICATIONS SERVICES CABLING
 - L. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING
 - M. 27 41 33 MASTER ANTENNA TELEVISION SYSTEMS
 - N. 27 51 16 PUBLIC ADDRESS SYSTEMS
 - O. 27 52 13 PATIENT MONITORING AND TELEMETRY SYSTEMS
 - P. 27 52 23 NURSE CALL/CODE BLUE SYSTEMS
 - Q. 27 53 13 CLOCK SYSTEMS
 - R. 27 53 19 INTERNAL CELLULAR, PAGING, AND ANTENNA SYSTEMS
- 1.5 SUBMITTALS:
- A. Submittals shall conform with Division 1 33 00 requirements Submittal Procedures.
 - B. Submittals shall conform with Division-27 Section 27 05 00 Common Work Results for Communications.

PART 2 - PRODUCTS

- 2.1 COMMUNICATION CABLE LABELS, GENERAL
- A. Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.
 - B. Provide vinyl substrate with a white printing area and black print.
 - C. Shall be flexible vinyl or other substrates to apply easy and flex as cables are bent.
 - D. Shall use aggressive adhesives that stay attached even to the most difficult to adhere to jacketing.

- E. Manufacturers:
 - 1. Brother, Brady, Panduit, or approved equal.

2.2 COMMUNICATION CABLING LABELS, OUTSIDE PLANT

- A. Maintenance Hole (MH) and Pull Box labeling
 - 1. Maintenance holes and pull boxes shall have a permanently affixed label that reads "Telecom". This label shall also include a unique UCDH nomenclature.
 - 2. The labeling standard for maintenance holes and pull boxes is as follows:
 - a. TELECOM: MH/PB-#
 - b. Example: TELECOM: MH-24
- B. Cable Tags in Manholes, Handholes, and Vaults
 - 1. Provide tags for communications cable or wire located in manholes, handholes, and vaults.
 - a. The tags shall be polyethylene.
 - b. Machine printed - Do not provide handwritten letters.
 - 2. Polyethylene Cable Tags
 - a. Provide tags of polyethylene that have an average tensile strength of 22.4 MPa (3250 pounds per square inch) 3250 pounds per square inch; and that are two millimeter (0.08 inch) 0.08 inch thick (minimum), non-corrosive non-conductive; resistive to acids, alkalis, organic solvents, and salt water; and distortion resistant to 77 degrees C 170 degrees F. For fiber optic cables provide Panduit PST-FO or equal. For Copper cables provide Panduit PST-1028 or equal.
 - b. Provide a one-piece nylon, self-locking tie for cable tags.
 - c. Ties shall have a minimum loop tensile strength of 778.75 N (175 pounds) 175 pounds. The cable tags shall have black block letters, numbers, and symbols 25 mm (one inch) one inch high on a yellow background.
 - d. Letters, numbers, and symbols shall not fall off or change positions regardless of the cable tags' orientation.
 - 3. Manufacturers:
 - a. Panduit
 - b. Brady
 - c. Or equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Verify all room numbers, racks, conduits, cable tray, cables, faceplates, patch panels equipment housing, vaults and items within this document have been labeled.
- B. Contractor applied labeling shall reflect final space and Telecommunications structure designations.
- C. Accurate labeling shall be provided on the as-built shop drawing submittals.

3.2 IDENTIFICATION AND LABELING

A. Telecommunications Rooms

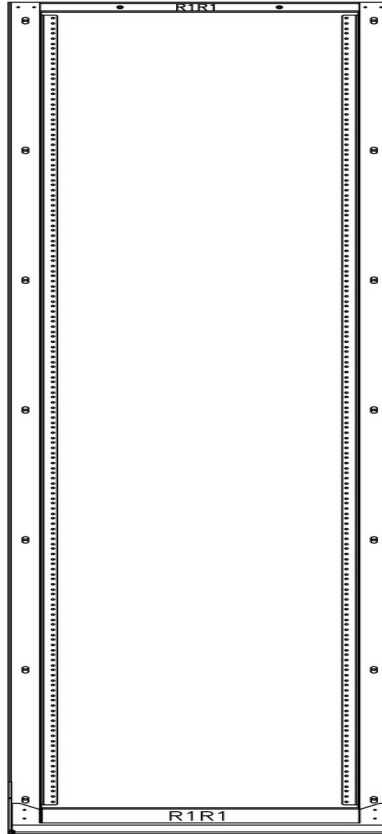
1. The Telecommunication Room labeling convention is as follows:
 - a. TR-(TR room #)
 - b. Example: TR-1101
2. TR labeling shall be affixed at the entry to all telecommunications rooms and spaces (Includes entrance facilities, telecommunications equipment rooms, communication equipment spaces and work areas).

B. Cable Tray and Conduits

1. Cable tray structured versus AV or analog systems pathway labeling and designations are the responsibility of the installer to designate the services that are to use the pathway or what portion of the pathway.
2. Any permanent label that is clearly visible is acceptable.

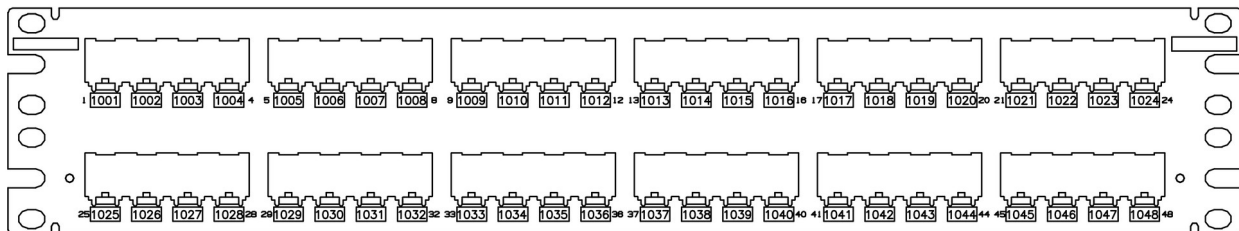
C. Rack and Cabinet Labeling

1. Rack labeling convention is as follows:
 - a. R(ROW#)R(RACK#)
 - b. Example: Row-1 Rack-1 would be labeled as R1R1.
2. Provide minimum 1" high label with black lettering on a white background. Use the largest font that will fit on a 1" high label.
3. Labels shall be placed centered on the bottom and top of each rack or cabinet.
 - a. If labels at the top of the racks or cabinets are obstructed, they may be placed on the ladder rack above the center of the rack.



D. Copper Patch Panels – Horizontal Cabling

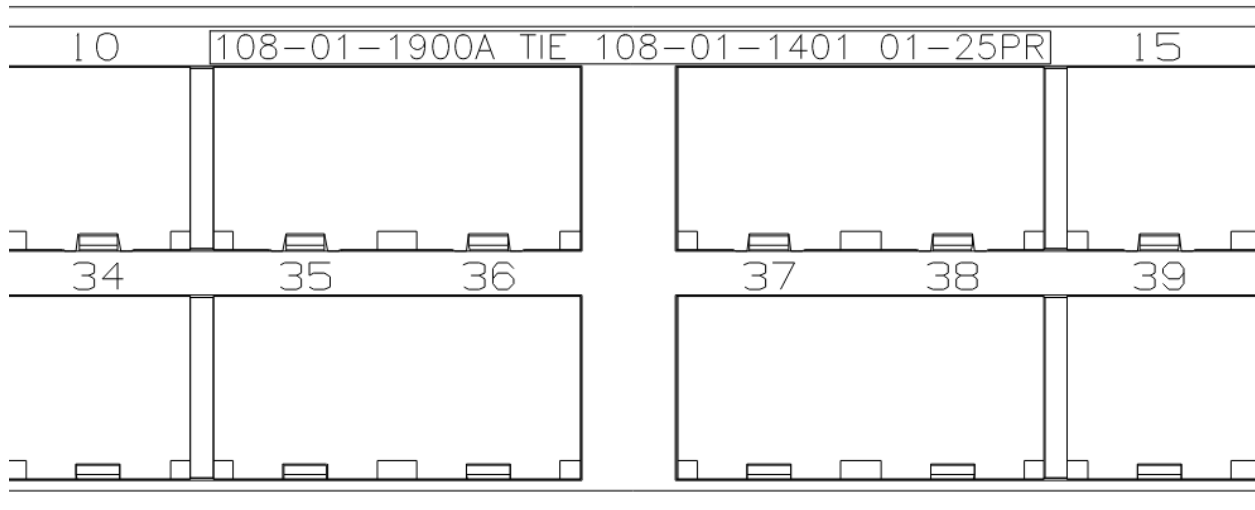
1. Provide 3/8" high label with black lettering on a white background, minimum 12-point font.
2. Labels shall be placed so that the jack number is centered on the labeling area.
3. Patch panel labeling convention is as follows:
 - a. (Floor #)(3-DIGIT JACK #)
 - b. Example: First Floor Jack # 5 would be labeled as 1005.



E. Tie Cable Patch Panels

1. Tie Cable Patch Panel labels shall be centered at the top of the patch panel.
2. Provide 1/4" high label with black lettering on a white background, minimum 12-point font.
3. Labeling convention for Tie Cable Patch Panels is as follows:
 - a. (BUILDING NUMBER)-(CABLE NUMBER)-(ORIGINATING TR ROOM #) TIE
(BUILDING NUMBER)-(CABLE NUMBER)-(DESTINATION TR ROOM NUMBER)
(CABLE PAIR COUNT)

- b. Example: A 25pr. tie cable from Building 108 TR-1900A to building 108 TR-1401 shall be labeled as 108-01-1900A TIE 108-01-1401 01-25PR

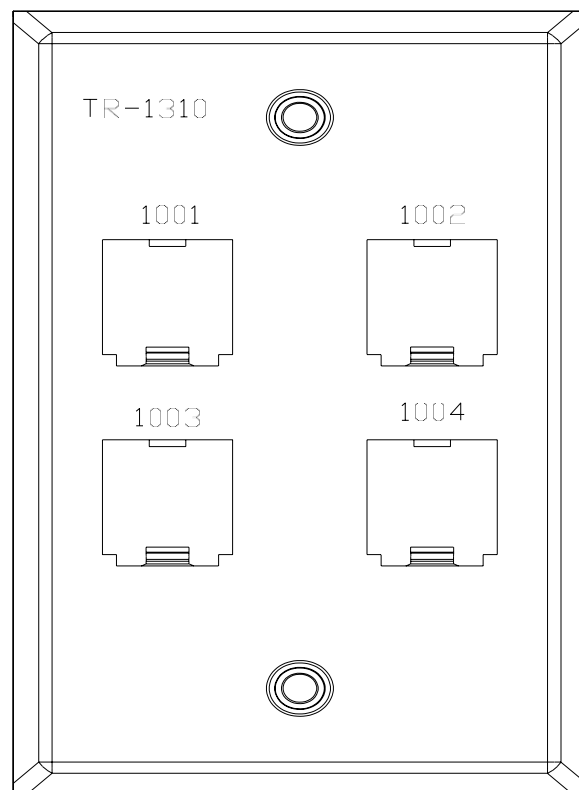
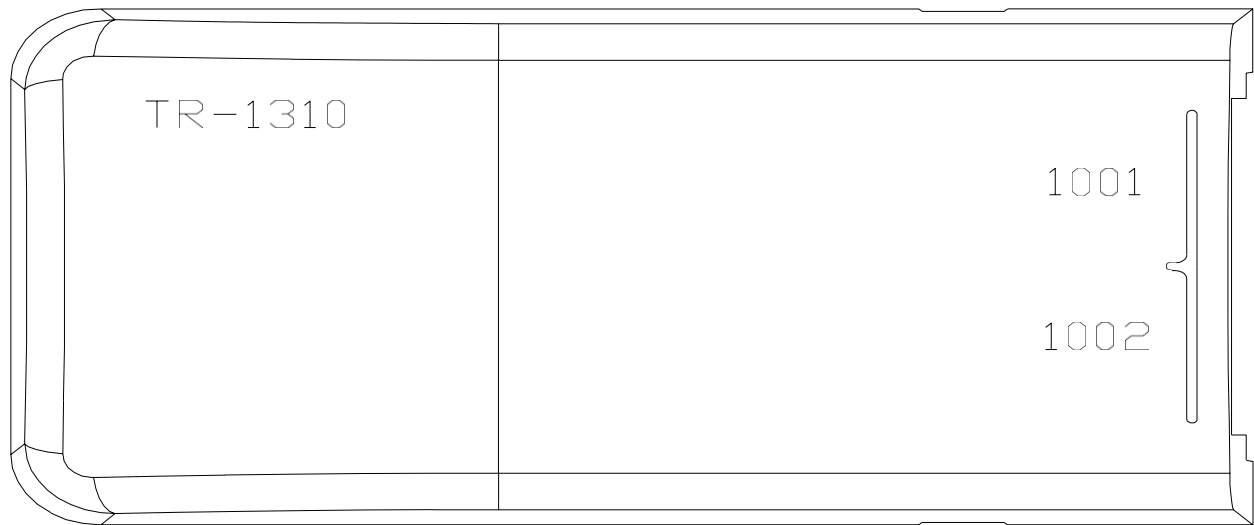


F. 110 Blocks

1. Not used other than MPOE, OSP installation.
2. Label with University provided designation.

G. Work Area Outlets (WAO):

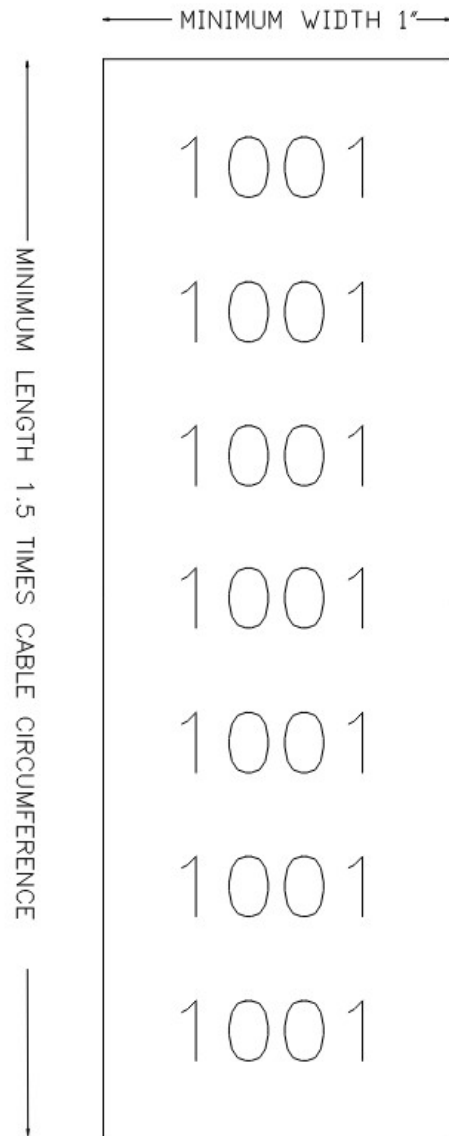
1. Use adhesive type labels and affix labels to faceplate per diagram provided.
2. Work Area Outlets shall have the TR designation label placed in the upper left corner of the faceplate or surface mount box.
 - a. Provide 3/8" high labels with black lettering on a white background, minimum 12-point font.
 - b. Work Area Outlet TR designation labeling convention is as follows:
 - 1) TR-(TR ROOM #)
 - 2) Example: A WAO that is fed from TR room number 1310 shall be labeled as TR-1310.
3. Work Area Outlets shall have the jack number labels placed above the jacks on a faceplate. WAOs placed in a surface mount box shall have jack number labels placed centered in the labeling area.
 - a. Provide 3/8" high labels with black lettering on a white background, minimum 12-point font.
 - b. Labeling convention for WAO jack numbers is as follows:
 - c. (Floor #)(3-DIGIT JACK #)
 - d. Example: First Floor Jack #1 would be labeled as 1001.
4. Under no circumstances are jacks to be installed with a drop/name or location number as a label or a matrix identifier.



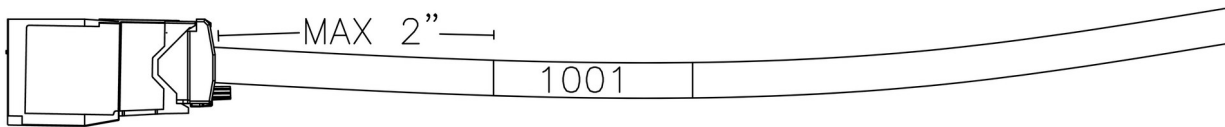
H. Cable Labels

1. All cables shall be labeled at both ends with a wraparound type label.
2. Provide a label with a minimum width of 1 inch, featuring black lettering on a white background in a font size of at least 12 points. The label length shall be sufficient to wrap around the cable at least 1.5 times.
3. Label shall be placed within 2" of the cable termination.
4. Wrap around cable labels shall be created as follows:

- a. Enter cable designation.
- b. Press the return button on the label maker to enter a blank line.
- c. Enter the cable designation again.
- d. Select the repeat function on the label maker.
- e. Print the label.
- f. The label should resemble the drawing below. This makes the cable ID easily viewable from all angles.

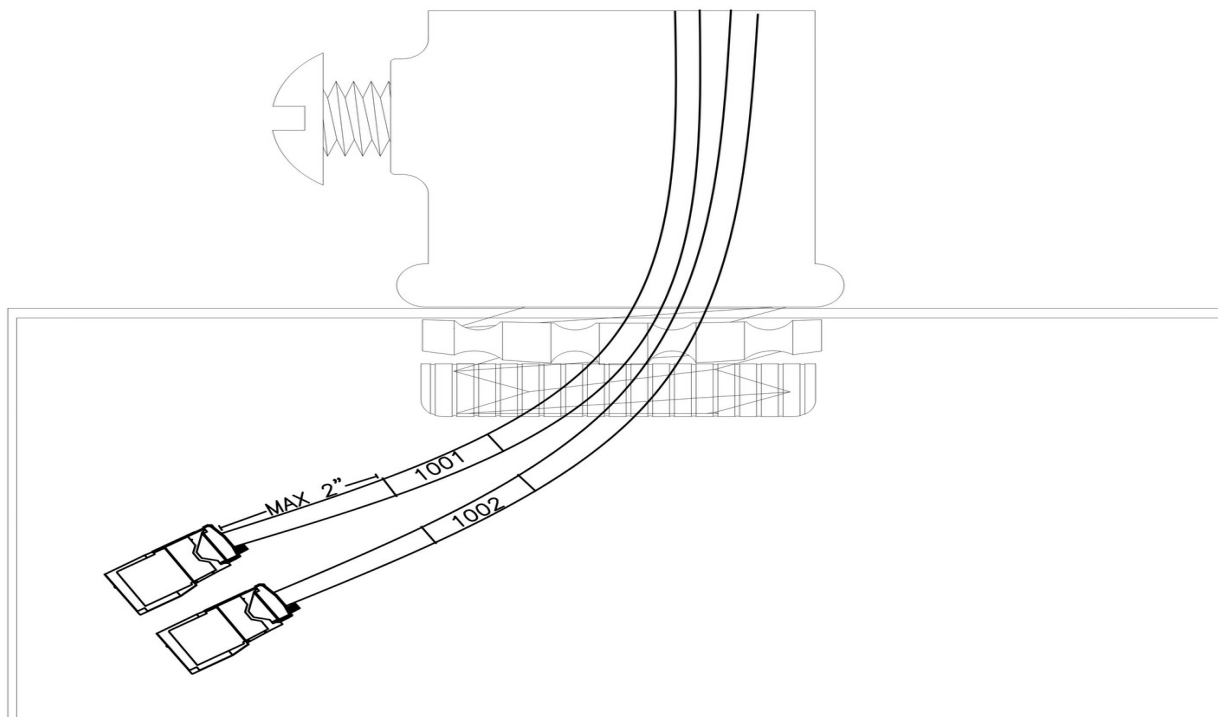


5. The labeling convention for cable labels is as follows:
 - 1) Labeling convention for WAO jack numbers is as follows:
 - 2) (Floor #)(3-DIGIT JACK #)
6. Example: First Floor Jack #1 would be labeled as 1001



I. Wireless Access Point (WAP) Cable Labeling

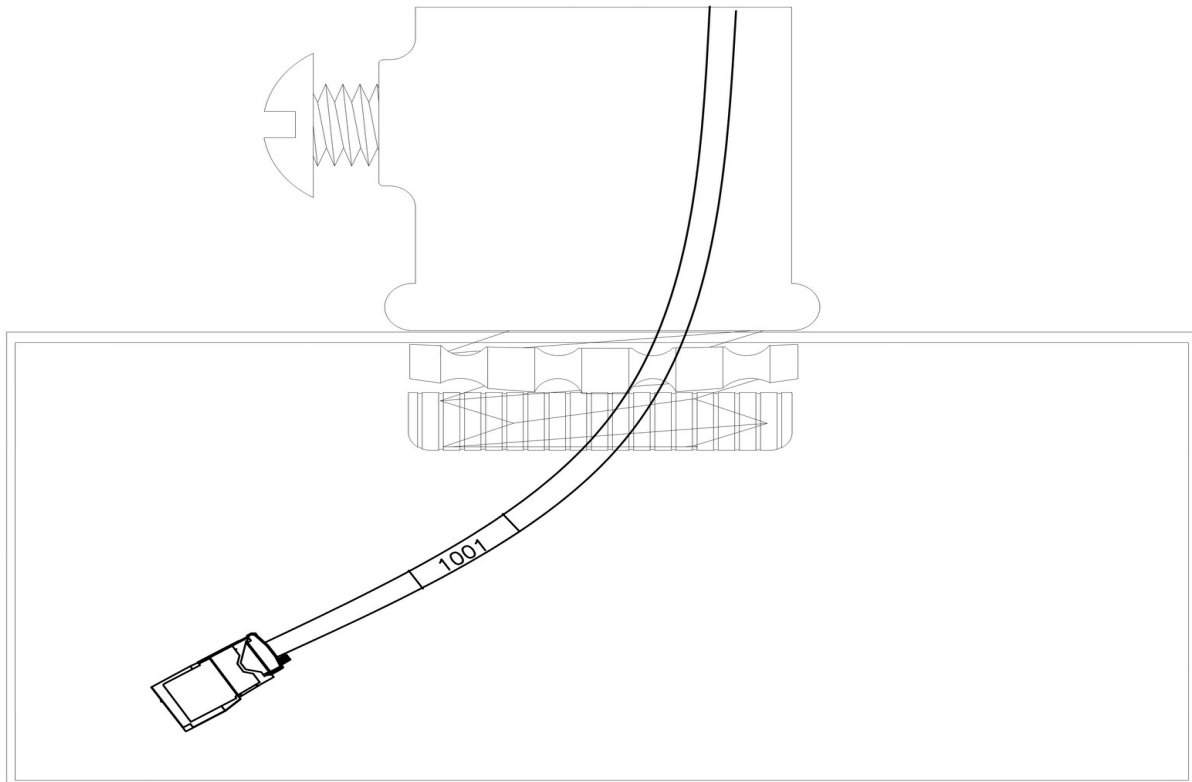
1. All cables shall be labeled at both ends with a wraparound type label.
 - a. Provide a label with a minimum width of 1 inch, featuring black lettering on a white background in a font size of at least 12 points. The label length shall be sufficient to wrap around the cable at least 1.5 times.
 - b. Label shall be placed within 2" of the cable termination.
 - c. The labeling convention for cable labels is as follows:
 - 1) Labeling convention for WAO jack numbers is as follows:
 - 2) (Floor #)(3-DIGIT JACK #)
 - 3) Example: First Floor Jack #1 would be labeled as 1001.
2. The University's Representative will provide locations for Wireless Access Point installations with the University's assigned designated identifiers adhered to the Access Point itself.



J. Camera Cable Labeling

1. All cables shall be labeled at both ends with a wraparound type label.
 - a. Provide a label with a minimum width of 1 inch, featuring black lettering on a white background in a font size of at least 12 points. The label length shall be sufficient to wrap around the cable at least 1.5 times.

- b. Label shall be placed within 2" of the cable termination.
- c. The labeling convention for cable labels is as follows:
 - 1) Labeling convention for WAO jack numbers is as follows:
 - 2) (Floor #)(3-DIGIT JACK #)
 - 3) Example: First Floor Jack #1 would be labeled as 1001.



K. Grounding and Bonding

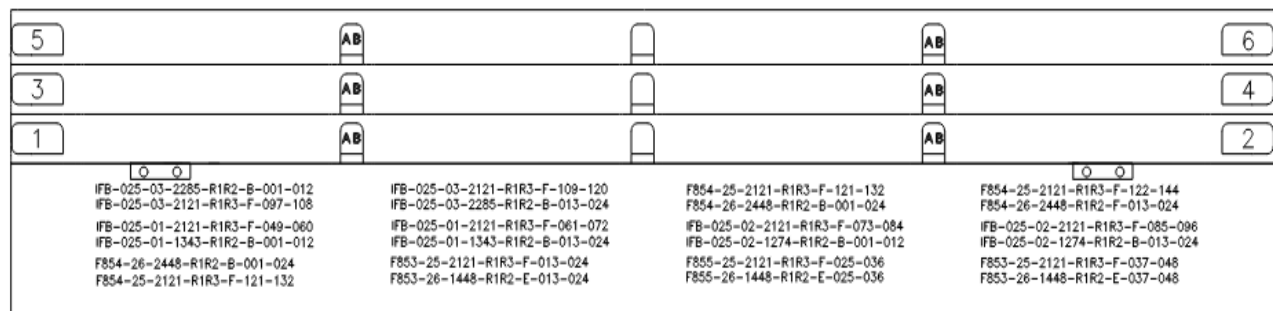
- 1. Label the PBB (Primary Bonding Busbar) and SBB(s) (Secondary Bonding Busbar) in the upper left corner.
 - a. Provide 3/8" high labels with black lettering on a white background, minimum 12-point font.
 - b. Labeling convention for PBB & SBB is as follows:
 - c. PBB or SBB-(TR ROOM NUMBER)
 - d. PBB-1011, SBB-2011
- 2. Label the Telecommunications Bonding Conductors for all equipment at both ends.
 - a. Provide a label with a minimum width of 1 inch, featuring black lettering on a white background in a font size of at least 12 points. The label length shall be sufficient to wrap around the cable at least 1.5 times.
 - b. Label shall be placed within 2" of the cable termination.
 - c. The label shall indicate the piece of equipment being bonded.

L. Other Cable Numbering

1. Other cabling types, such as Coax installed in a TR shall be numbered uniquely, such as C=Coax.
2. Point to point Data Cables require independent numbering such as A1001 for items such as in room video distribution equipment.
3. Sound Masking System:
 - a. Label cables with wrap around labels designating to / from locations.
 - b. Provide a label with a minimum width of 1 inch, featuring black lettering on a white background in a font size of at least 12 points. The label length shall be sufficient to wrap around the cable at least 1.5 times.
 - c. Label shall be placed within 2" of the cable termination.
 - d. Label speakers with channel, zone, and address.

M. Fiber Termination Units

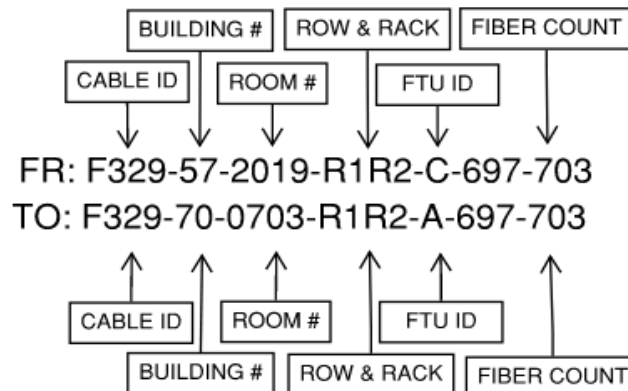
1. Fiber patch panels shall be labeled using adhesive labels indicating the cable installed to it. All fiber optic cable patch panels shall be labeled with the pair count of every fiber cable, the cable's assigned identifier, and the patch panel's assigned identifier.
2. Provide 3/8" label tape with minimum 12-point font.
3. Coordinate with IT before applying any labels.
4. The Fiber Terminating Unit (FTU) labeling convention is as follows:
 - a. FTU designation labels shall be placed in the upper left-hand corner of the front of the door as shown below. FTU designations shall be alpha numeric starting with the letter "A".
 - b. FTU fiber designations labels shall be placed on the inside of the FTU door as shown below.



FTU (Fiber Terminating Unit) LABELING CONVENTION

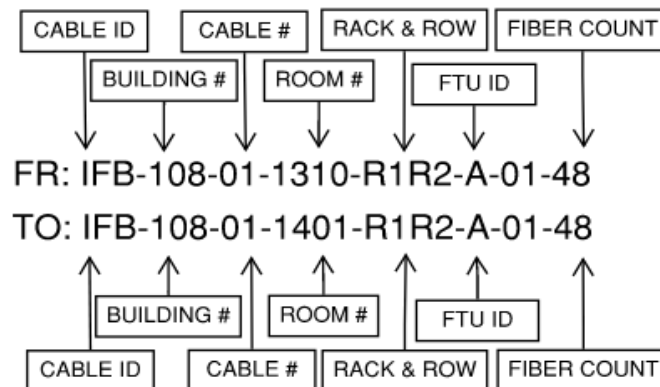


FIBER OPTIC INTERBUILDING (between buildings) LABELING CONVENTION



Example: Origination (from): Label begins with fiber cable designation (fiber identifier such as F329) - followed by the building number (57) - room number (2019) - row & rack locations (R1R2) - fiber termination unit ID (A) - fiber count (697-708) Destination (to): Label begins with fiber cable designation (fiber identifier such as F329) - followed by the building number (57) - room number (2019) - row & rack locations (R1R2) - fiber termination unit ID (A) - fiber count (697-708) "From" and "To" will be reversed at the destination end.

FIBER OPTIC INTRABUILDING (within building) LABELING CONVENTION



Example:

Origination (from): Label begins with fiber cable designation (IFA=Fiber within the hospital: Davis Tower, University tower, North/ South Addition, East Wing, Pavilion. IFB=Fiber within buildings other than the hospital) - followed by the building number (108) - intra-building cable number (01) - room number (1310) row & rack locations (R1R2) - fiber termination unit ID (A) - fiber count (01-48) Destination (to): Label begins with fiber cable designation (IFA=UCDH campus-LAN buildings, IFB=off campus location-WAN buildings) - followed by the building number (108) - intra-building cable number (01) - room number (1401) - row & rack locations (R1R2) - fiber termination unit ID (A) - fiber count (01-48) "From" and "To" will be reversed at the destination end.

N. Backbone/Riser Cable Labeling

1. In indoor environments, wrap-around type cable labels shall be provided at each end of the cable and installed within 12" of the point where the cable is broken out in the Telecommunications Room (TR). Additionally, backbone/riser cabling shall be labeled as it enters a TR, regardless of whether it terminates in that TR or routes through. Labels shall also be affixed at all Maintenance Holes (MH), Vaults, pull boxes, junction boxes, and other access points.
 - a. Provide a label with a minimum width of 1 inch, featuring black lettering on a white background in a font size of at least 12 points. The label length shall be sufficient to wrap around the cable at least 1.5 times.
2. In outdoor environments a self-laminating cable tag shall be provided at each end of the cable, installed using two appropriately sized UV resistant cable ties within 12" of where is cable is broken out. Labels shall also be affixed at all Maintenance Holes (MH), Vaults, pull boxes, junction boxes, and other access points.
 - a. Provide Panduit # PST-FOBLNK or approved equal.
3. The labeling convention for backbone/riser copper cable is as follows:
 - a. Copper OSP backbone building feeder cable:
 - 1) CABLE#-BUILDING#-CABLE PAIR COUNT
 - 2) Example: CA17-102-1601-1700
 - b. Copper OSP backbone riser cable:
 - 1) BUILDING# - CABLE# - ORIGINATING TR# - TIE – BUILDING# - CABLE # - DESTINATION TR#-CABLE PAIR COUNT.
 - 2) Example: 108-01-1900A TIE 108-01-1401 01-25PR.

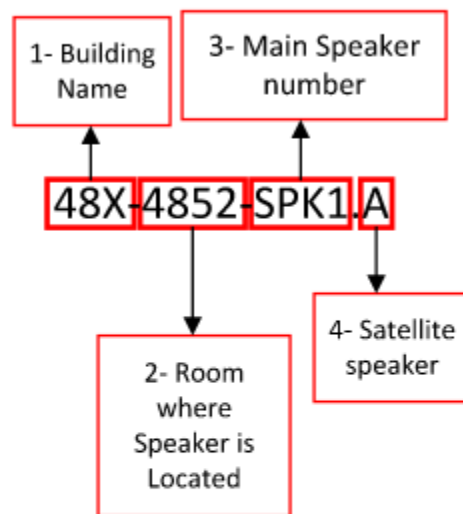
O. Fire stopping

1. Each fire stopping location shall be labeled at each location where fire stopping is installed, on each side of the penetrated fire barrier, within 12 in. of the fire stopping assembly.
2. Labels shall adhere to the requirements set forth by the authority having jurisdiction (AHJ).

P. VOIP Speaker Labeling:

1. VOIP speakers shall be labeled such that it can be viewed easily from the ground.
2. The VOIP labeling convention is as follows:

IP Speaker Labeling Convention



- 1- Building Name:** The name of the building where the speaker is located.
- 2- Room Location:** The number of the room where the speaker is located.
- 3- Main Speaker Number:** The number assigned to the main speaker (if there are multiple main speakers using the same value in Section 2, use numbers like SPK1, SPK2, SPK3, SPK4, etc.).
- 4- Satellite Speaker:** Assign satellite speakers according to daisy chain preferences. The first satellite connected to the main speaker will be labeled "A," the next one "B," and so forth.

END OF SECTION

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

PART 1 - GENERAL

1.1 SUMMARY

- A. Equipment racks shall be Contractor furnished; Contractor installed.
- B. UCDH standard requires a minimum of 3 feet of clearance between all racks, rack hardware, and any adjacent hard surfaces. This clearance is in addition to meeting all applicable code requirements for electrical power within the room. In certain cases, deviations may be necessary due to room dimensions or architectural constraints. Racks must be installed in accordance with the construction documents. Any conflicts or deviations encountered during installation must be reported to UCDH IT prior to proceeding.

1.2 PREPARATION

- A. Verify that no mechanical, electrical or other systems and piping systems, (e.g. water sources) run through the TR Rooms or IT spaces
- B. Receive approved layout from UCDH IT.
- C. Validate the package for IT installation, e.g. power for equipment, pathway for cabling air conditioning and incidentals for proper operation of each TR.

1.3 EQUIPMENT MOUNTING

- A. All floor supported equipment racks shall be bolted to the structure in accordance with the requirements of the CBC.
- B. The contractor shall install all components in accordance with the approved structural engineering design, ensuring that the materials used comply with these requirements.

1.4 RELATED SECTIONS

- A. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS
- B. 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS
- C. 27 05 29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS
- D. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS
- E. 27 05 36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS
- F. 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
- G. 27 11 19 COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS
- H. 27 11 23 COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK

- I. 27 11 26 COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS
- J. 27 13 00 COMMUNICATIONS BACKBONE CABLING
- K. 27 13 43 COMMUNICATIONS SERVICES CABLING
- L. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING
- M. 27 41 33 MASTER ANTENNA TELEVISION SYSTEMS
- N. 27 51 16 PUBLIC ADDRESS SYSTEMS
- O. 27 52 13 PATIENT MONITORING AND TELEMETRY SYSTEMS
- P. 27 52 23 NURSE CALL/CODE BLUE SYSTEMS
- Q. 27 53 13 CLOCK SYSTEMS
- R. 27 53 19 INTERNAL CELLULAR, PAGING, AND ANTENNA SYSTEMS

1.5 SUBMITTALS:

- A. Submittals shall conform with Division 1 33 00 requirements Submittal Procedures.
- B. Submittals shall conform with Division-27 Section 27 05 00 Common Work Results for Communications.
- C. Submit shop drawings and product data with the following information:
 - 1. Provide manufacturer's data sheets for each cabinet, rack, frame and/or enclosure incorporated into the design.
 - 2. Provide shop drawings showing the manufacturer, model, location, and labeling for each cabinet, rack, frame and/or enclosure incorporated into the design.

PART 2 - PRODUCTS

2.1 PRODUCTS

- A. Seismic Racks
 - 1. Seismic racks shall be used for all new construction and project with full TR remodels.
 - 2. RXL-2823-BK8019 heavy duty double sided seismic 2-post rack, or equal.
 - a. Eight-foot for new builds and remodels with open TR ceilings or ceilings of 12' AFF or higher.
 - b. Seven-foot racks will be used as an alternate where ceilings are lower than 12' AFF. Coordinate rack requirements with the owner.
- B. Standard Racks
 - 1. Standard equipment racks shall only be use where specifically approved by UCDH IT.
 - 2. RXL-2200-BK80T, RXL-2020-BK80T two post rack, or equal.

- a. Eight-foot for new builds and remodels with open TR ceilings or ceilings of 12' AFF or higher.
- b. Seven-foot racks will be used as an alternate where ceilings are lower than 12' AFF. Coordinate rack requirements with the owner.

C. Outdoor Enclosures:

- 1. An outdoor telecommunications enclosure is a protective housing designed to safeguard telecommunications equipment and infrastructure in outdoor environments. These enclosures provide physical security, environmental protection, and proper ventilation or climate control to ensure the reliable operation of sensitive electronic components.
- 2. Outdoor telecommunications enclosures are used for housing fiber-optic and copper backbone cabling, Horizontal cabling, switches, power supplies, uninterruptable power supplies, and other critical telecommunications components in outdoor applications.
- 1. Key Features Include:
 - a. Minimum dimensions of 51"H X 28"W X 47"D with minimum 26-RU
 - b. Material and Construction: Made from durable materials such as steel, aluminum, or composite plastics to withstand weather conditions, UV exposure, and potential vandalism.
 - c. Environmental Protection: Rated NEMA 4X to resist rain, snow, dust, extreme temperatures, and provide corrosion protection.
 - d. Security: Equipped with locks, tamper-proof hardware, and alarms to prevent unauthorized access.
 - e. Cable Management: Designed with ports, seals, and pathways for efficient cable entry and organization.
 - f. Climate Control: Air conditioning, minimum 6,000BTU, to maintain optimal operating temperatures for the equipment inside.
 - g. 2-position wind lock doors.
 - h. Minimum ½" insulation kit installed.
 - i. Provide 3" pedestal base for entrance conduit termination.
 - j. Environmental Protection: Rated NEMA 4X to resist rain, snow, dust, extreme temperatures, and provide corrosion protection.
 - k. Security: Equipped with locks, tamper-proof hardware, and alarms to prevent unauthorized access.
 - l. Cable Management: Designed with ports, seals, and pathways for efficient cable entry and organization.
 - m. Climate Control: Minimum 6,000BTU air conditioner and 1300 watts of heat, to maintain optimal operating temperatures for the equipment inside.
- 2. Manufacturer
 - a. Enclosure: DDB Unlimited, # OD-50DDXC or approved equal.
 - b. HVAC: APC-6000-N36-110 or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Equipment Racks

1. Equipment racks shall be assembled and installed per manufacturer's instructions.
2. Racks and cabinets shall be grounded to the PBB and/or SBB per section 27 05 26 Grounding and Bonding for Communications Systems. The ground will meet local code requirements and will be approved by the Authority Having Jurisdiction (AHJ).
3. In seismic areas, the rack should have additional bracing as required by building codes and the recommendations of a licensed structural engineer.
4. Ladder rack shall be attached to the top of the rack via a rack-to-runway transition plate and 6" elevation kit.

END OF SECTION

SECTION 27 11 19
COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install copper termination assemblies, including patch panels, modular jacks, 110 blocks, and all associated termination hardware.
- B. Furnish and install fiber termination assemblies, including rack mount fiber termination units, fiber cassettes, and all associated termination hardware.

1.2 RELATED SECTIONS

- A. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS
- B. 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS
- C. 27 05 29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS
- D. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS
- E. 27 05 36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS
- F. 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
- G. 27 11 16 COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES
- H. 27 11 23 COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK
- I. 27 11 26 COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS
- J. 27 13 00 COMMUNICATIONS BACKBONE CABLING
- K. 27 13 43 COMMUNICATIONS SERVICES CABLING
- L. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING
- M. 27 41 33 MASTER ANTENNA TELEVISION SYSTEMS
- N. 27 51 16 PUBLIC ADDRESS SYSTEMS
- O. 27 52 13 PATIENT MONITORING AND TELEMETRY SYSTEMS
- P. 27 52 23 NURSE CALL/CODE BLUE SYSTEMS
- Q. 27 53 13 CLOCK SYSTEMS
- R. 27 53 19 INTERNAL CELLULAR, PAGING, AND ANTENNA SYSTEMS

1.3 SUBMITTALS

- A. Submittals shall conform with Division 1 33 00 requirements Submittal Procedures.
- B. Submittals shall conform with Division-27 Section 27 05 00 Common Work Results for Communications.
- C. Provide manufacturer's data sheets, product drawings/specifications, and installation instructions for copper patch panels, modular jacks, 110 blocks, fiber termination units, fiber cassettes, and all associated termination hardware.

1.4 QUALITY ASSURANCE

- A. All cables and equipment shall be installed in a neat and professional manner. Any construction methods not specifically described or indicated in the contract documents must be approved by the owner or the owner's representative.
- B. Equipment and materials shall meet the quality and specifications indicated. The specified equipment is based on the manufacturers listed as acceptable. Where "approved equal" is noted or a substitution is requested, the proposed equipment must be equivalent in every respect to the specified equipment. All substitutions are subject to approval by the owner or the owner's representative.
- C. Strictly adhere to all BICSI and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.

1.5 WARRANTY

- A. The horizontal communications cabling system installed shall be eligible for coverage by a Limited Lifetime Warranty to the end user.
- B. The Authorized Installer/Authorized Integrator shall provide labor, materials, and documentation in accordance with Panduit requirements to ensure that the Owner receives a Limited Lifetime Warranty.
- C. Necessary documentation for warranty registration shall be provided to the manufacturer by the installer (within 10 days) following 100 percent testing of cables.

PART 2 - PRODUCTS

2.1 COPPER CABLE TERMINATION EQUIPMENT

- A. Copper patch panels
 - 1. Rack mount modular 48-port patch panel for horizontal cable terminations:
 - a. Panduit CP48BLY or approved equal.
 - 2. Rack mount modular high density patch panel for copper backbone termination at equipment racks:
 - a. Panduit CPP48HDWBLY or approved equal.
- B. COPPER 110 TERMINATION HARDWARE

1. Wall mount 100-pair and 300-pair 110 block termination kits shall be provided as necessary to terminate copper backbone cabling at the backboard.
 - a. Panduit 100-Pair 110 termination kit, P110KB1005Y or approved equal.
 - b. Panduit 300-Pair 110 termination kit, P110KB3005Y or approved equal.

2.2 FIBER CABLE TERMINATION EQUIPMENT

A. Fiber Termination Unit

1. Fiber Termination Units (FTU) shall be capable of accommodating 144 fiber strands per rack unit.
2. FTU shall be equipped with front-access drawers that are capable of being divided, left and right, and operated independently.
3. FTU shall be capable of cassette installation / removal from both the front and rear.
4. 1-RU FTU:
 - a. Provide Panduit HD Flex, FLEX1U06 or approved equal.
5. 2-RU FTU:
 - a. Provide Panduit HD Flex, FLEX2U06 or approved equal.
6. 4-RU FTU:
 - a. Provide Panduit HD Flex, FLEX4U06 or approved equal.

B. Fiber Termination Cassettes

1. Provide SM OS-2 12-Strand LC UPC splice cassettes (6-Duplex Ports) pre-loaded with factor terminated 250um pigtails and splice sleeves. Cassettes shall have a maximum standard insertion loss of .35db, and a maximum splice loss of .06db is allowable.
 - a. Panduit HD Flex Splice Cassette LC UPC, FHS9N-12-10P or approved equal.

C. For legacy installations:

1. The installation contractor shall ensure that the existing fiber type, FTU, and connector/cassette type are identified and matched appropriately.

PART 3 - EXECUTION

3.1 GENERAL

- A. The contractor selected to provide the installation of this system shall be certified by the manufacturing company in all aspects of design, installation and testing of the products described herein.
- B. Contractor shall have a minimum of five (5) years of recent experience on structured cabling systems of similar type, size and quantities.
- C. Cable termination:
 1. Route cables in Telecom Rooms to patch panels in racks by routing across cable runway to top of rack and then down vertical cable management sections to back of patch panels or termination locations.

2. Route cables in Telecom Rooms to wall mount cabinets and down through openings of top and/or bottom of cabinets to patch panels. Cabinet standoffs may be used to create additional and necessary pathway.
3. Cables and Termination Hardware: Test 100 percent for defects in installation and verify cabling system performance under installed conditions.
 - a. Verify all pairs of each installed cable before system acceptance.
 - b. Defects in cabling system installation, including but not limited to cables, connectors, patch panels, and connector blocks shall be repaired or replaced to ensure 100 percent useable conductors in all cables installed.
4. Cables, Jacks, Connecting Blocks, and Patch Panels:
 - a. Verify all pairs of each installed cable before system acceptance.
 - b. Defects in cabling system installation, including but not limited to cables, connectors, patch panels, and connector blocks shall be repaired or replaced to ensure 100 percent useable conductors in all cables installed.

END OF SECTION

SECTION 27 11 23
COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes provision of cable management for cabling installed under the work of this Project.
- B. Walls shall be covered with A/C fire-resistant treated plywood from 6" AFF to 12'6" AFF, and all surfaces sealed to mitigate airborne dust. Plywood shall be installed with the A-side exposed and stamp visible.
- C. 18" wide ladder rack shall be installed around the perimeter of the room. 24" adjustable runway shall be installed over equipment racks.
- D. Install CFCI racks, elevation kits, and vertical wire managers to support cable management and supporting systems within the room.
- E. Contractor shall furnish and install patch panels.
- F. Contractor shall furnish and horizontal cable management.
- G. Install conduit, fire penetrations, and cable pathway suitable to support and manage the installation of fiber and copper data infrastructure per BICSI standards.
- H. Design cable pathways to accommodate project cabling at a maximum of 40% fill.
- I. Ensure proper EMI separation.

1.2 RELATED SECTIONS

- A. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS
- B. 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS
- C. 27 05 29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS
- D. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS
- E. 27 05 36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS
- F. 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
- G. 27 11 16 COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES
- H. 27 11 19 COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS
- I. 27 11 26 COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS

- J. 27 13 00 COMMUNICATIONS BACKBONE CABLING
- K. 27 13 43 COMMUNICATIONS SERVICES CABLING
- L. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING
- M. 27 41 33 MASTER ANTENNA TELEVISION SYSTEMS
- N. 27 51 16 PUBLIC ADDRESS SYSTEMS
- O. 27 52 13 PATIENT MONITORING AND TELEMETRY SYSTEMS
- P. 27 52 23 NURSE CALL/CODE BLUE SYSTEMS
- Q. 27 53 13 CLOCK SYSTEMS
- R. 27 53 19 INTERNAL CELLULAR, PAGING, AND ANTENNA SYSTEMS

1.3 SUBMITTALS:

- A. Submittals shall conform with Division 1 33 00 requirements Submittal Procedures.
- B. Submittals shall conform with Division-27 Section 27 05 00 Common Work Results for Communications
- C. Provide manufacturer's data sheets for each piece of material incorporated into the design.

PART 2 - PRODUCTS

2.1 LADDER RACK

- A. Cable Runway (Ladder Rack)
 - 1. Construction:
 - a. Welded tubular steel construction.
 - b. Stringers shall be 1.5"H x .375"W.
 - c. Cross members shall be 1"H x .5"W welded at 9" intervals.
 - d. UL classified
 - 2. Accessories: Provide with a complete system of accessories including elevation kits and waterfall dropouts.
 - 3. Finish: Black powder coat
 - 4. Perimeter runway shall be black in color minimum 18" wide.
 - 5. Runway over racks shall be 24" wide adjustable runway. Adjustable runway shall only be used over equipment racks.
 - 6. Provide 6" runway elevation kit.
 - 7. Provide protective end caps on all unfinished ends of ladder rack.

2.2 LADDER RACK APPLICATION

1. Ladder Rack - Wraps and traverses within communications rooms, as shown on construction drawings.
2. Ladder Rack size is typically 18" wide unless the room size prohibits access when installed. Install ladder rack as sized on the drawings.
3. For legacy installations the installation contractor shall ensure the existing type, size, and color of ladder rack is identified and matched appropriately.
4. Provide an 18-inch vertical section of ladder rack from each conduit stub-up at the floor to the overhead horizontal ladder rack.
5. Provide a vertical section of ladder rack from any entrance pathway located more than 10'-6" above finished floor (AFF) down to the horizontal ladder rack below.

2.3 BACKBOARD CABLE MANAGEMENT (CONTRACTOR FURNISHED AND INSTALLED)

- A. $\frac{3}{4}$ inch x 48" x 84 " A/C grade, fire rated, painted plywood installed on perimeter of the room from 6" to 12'6" AFF.
 1. Plywood will be painted white with an approved fire-retardant paint compliant with APWA and CSFM/CBC standards.
 2. Fire rating labels on plywood will be covered with masking tape before painting and later removed to allow for inspection before turnover.

2.4 LADDER RACK WATERFALL (CONTRACTOR FURNISHED AND INSTALLED)

- A. Provide ladder rack water falls at vertical wire management.

2.5 HORIZONTAL WIRE MANAGER (CONTRACTOR FURNISHED AND INSTALLED)

- A. Install 2RU or 4 RU assembly as indicated in Owner provided rack elevations.
- B. Panduit PR2HF2 or PR2HF4 as shown on IT rack elevation drawings.

2.6 VERTICAL WIRE MANAGEMENT (CONTRACTOR FURNISHED AND INSTALLED)

- A. A high-density vertical wire manager shall be provided to accommodate both fiber and copper cross-connect patching cables, as well as to support power distribution, power strip mounting, and additional space requirements.
- B. Contractor installed; refer to Owner provided rack elevation drawings for placement.
 1. Install according to construction documents and manufacturer's instructions.
 2. Do not put large sweeps or service loops in vertical cable managers.
- C. Provide Panduit PE2VD1096 or equal for TRs with 8' equipment racks.
- D. Provide Panduit PE2VD10 or equal for TRs with 7' Equipment racks.

PART 3 - EXECUTION

3.1 GENERAL EXECUTION - PREPARATION

- A. UCDH IT is responsible for the preliminary layout of the telecommunications room and shall provide the necessary requirements to the Construction Team for the preparation of shop drawings.
- B. The cabling contractor, in conjunction with the engineer, is responsible for managing cable quantities and validating the pathways to ensure proper fill ratios and placement. This includes verifying that cable lengths and capacities meet the Owner's requirements. If the pathways are found to be insufficient, the contractor shall construct additional pathways as needed.
- C. Install products, components, accessories, hardware, etc., according to the manufacturer's instructions. Do not put service loops in vertical wire managers.
- D. The contractor selected to provide the installation of this system shall be certified by the manufacturing company in all aspects of design, installation and testing of the products described herein.

3.2 INSTALLATION

- A. Do not Tie Wrap cables to ladder rack.
- B. Ladder rack shall be installed at an elevation of 6" above Data Racks.
- C. The ladder rack shall be securely bonded to the Primary Bonding Busbar (PBB) or Secondary Bonding Busbar (SBB). A bonding conductor, sized according to J-STD-607-D and local code or the authority having jurisdiction (AHJ), shall be installed between the PBB/SBB and the ladder rack. The bonding conductor shall be attached to the ladder rack using the appropriate hardware, in accordance with the manufacturer's installation instructions. The installer is responsible for providing the bonding conductor and any other necessary hardware required to complete the connections between the ladder rack and the PBB/SBB.
- D. Install end caps for all exposed ends. File and deburr ladder rack then place end caps on all exposed ends.

3.3 EXAMINATION AND ACCEPTANCE

- A. Perform walk thru with Owner representative to validate cable separation, cable routes and fill ratios before and after installation.

END OF SECTION

SECTION 27 11 26
COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Centralized Building IT UPS:
 - 1. All IT equipment in the IT room shall be serviced (unless prohibited by code) by a centralized UPS used exclusively for IT. A single efficient building UPS is the goal of IT to minimize UPS size and optimize maintenance.
 - 2. The centralized Building IT UPS shall be contractor provided, and contractor installed.
 - 3. The centralized unit shall provide 3-phase 208 power to all TRs. The unit shall be sized for 10.0KVA at each TR.
 - 4. Final size and placement shall be coordinated with UCDH IT Facilities.
 - a. Each TR shall have a dedicated UPS panel located within the room.
 - 5. Testing and commissioning shall be performed by installation contractor.
- B. Power Distribution from the three phase IT UPS power distribution panel to each outlet, Contractor Furnished and Contractor Installed.
- C. Single phase IT UPS systems up to 10 KVA (Owner Furnished, Owner Installed)
- D. 208 Volt power provided to the IT UPS systems, 10 KVA or 6 KVA. Contractor Furnished Contractor Installed.
 - 1. For a 10KVA UPS, provide a 60 AMP service disconnect switch, located on the wall behind the equipment racks, fed from the emergency power/generator/back-up electrical panel in the telecommunications room (TR). Install four (4) 6 AWG conductors from the service disconnect to a 5" square x 2-7/8" deep junction box, positioned above the racks in accordance with the project elevation diagram.
 - 2. For a 6KVA UPS, provide a L14-30 receptacle fed from the emergency power/generator/back-up electrical panel in the telecommunications room (TR) positioned above the racks in accordance with the project elevation diagram.
- E. 120 Volt power provided to the IT UPS system 3 KVA, contractor furnished, and contractor installed.
 - 1. Provide a L5-30 receptacle fed from the emergency power/generator/back-up electrical panel in the telecommunications room (TR) positioned above the racks in accordance with the project elevation diagram.
- F. Power Distribution from the three phase IT UPS power distribution panel to each outlet, Contractor Furnished and Contractor Installed.
- G. Turn up, test and certification provided by Owner.
- H. Installation of Power Strips in Cabinets and Racks are Owner Furnished Owner Installed.

1.2 REFERENCES

- A. ANSI/TIA-569-E Telecommunications Pathways and Spaces, 2019
- B. ANSI/TIA-568.0-D Generic Telecommunications Cabling for Customer Premises, 2020
- C. ANSI/TIA – 568.1-E Commercial Building Telecommunications Cabling Standard, 2023.
- D. ANSI/TIA-942-B Telecommunications Infrastructure Standard for Data Centers, 2017.
- E. ANSI/TIA – 606-D Administration Standard for Telecommunications Infrastructure, 2021.
- F. ANSI/TIA – 607-E Generic Telecommunications Bonding and Grounding (Earthing) For Customer Premises, 2024.
- G. ANSI/TIA-862-B Structured Cabling Infrastructure Standard for Intelligent Building Systems, 2019
- H. California Electrical Code (CEC).

1.3 SUBMITTALS

- A. Submittals shall conform with Division 1 33 00 requirements Submittal Procedures.
- B. Submittals shall conform with Division-27 Section 27 05 00 Common Work Results for Communications.
- C. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for rack-mounted power protection.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- D. Shop Drawings: For communications equipment room fittings. 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. Include workspace requirements and access for cable connections.
 - 3. Grounding: Indicate any chassis bonding requirements.
 - 4. Network Connection and Programming: Indicate networking and configuration requirements and connections.

1.4 QUALITY ASSURANCE

- A. Product Certifications: UL & CUL 62368; IEC 62368; CE; FCC Part 15, Class A; EN 55022 and RoHS Compliant

1.5 RELATED SECTIONS

- A. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS

- B. 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS
 - C. 27 05 29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS
 - D. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS
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 - P. 27 52 23 NURSE CALL/CODE BLUE SYSTEMS
 - Q. 27 53 13 CLOCK SYSTEMS
 - R. 27 53 19 INTERNAL CELLULAR, PAGING, AND ANTENNA SYSTEMS
- 1.6 SEQUENCING
- A. Coordinate with Construction management and Owner representative. A 30-Day burn in is required for electronic equipment.
- 1.7 PREPARATION
- A. Verify that no piping systems, (e.g., water sources) run through or above the UPS location.
 - B. Provide shop drawings indicating locations and sizes of UPS systems to receive approval of IT Facilities.
- 1.8 EMERGENCY POWER
- A. Provide two (2) separate emergency distribution systems from two (2) ATS designed "Life Safety System" and "Equipment System" where available.
- 1.9 POWER NON-HOSPITAL (LEASED ADMIN)

- A. Provide two (2) separate distribution systems from two diverse panels.
- B. Where available backup generator service shall provide service to UPS equipment.
- C. Owner required emergency power loads such as IT systems shall be placed on the "Equipment System" (Load shedding provisions).

PART 2 - PRODUCTS

2.1 UNINTERRUPTABLE POWER SUPPLIES

- A. Liebert UPS

2.2 GENERAL

- A. A bypass circuit shall be provided as an integral part of the UPS. The bypass control logic shall contain an automatic transfer control circuit that senses the status of the inverter logic signals and operating and alarms conditions. This control circuit shall provide a transfer of the load to the bypass source if available and if the inverter is capable of powering the load (i.e., if there is an overload condition, if the unit is in Manual Bypass Mode or if the voltage or frequency is out of tolerance).
 - 1. Automatic Transfers

2.3 BYPASS

- A. The transfer control logic shall activate the bypass automatically, transferring the critical AC load to the bypass source, shall be provided when applicable.
- B. COMMUNICATION OPTIONS
 - 1. Liebert IntelliSlot Communications
- C. The UPS shall include one Liebert IntelliSlot communication port to allow the operator to field-install an optional Liebert IntelliSlot communication card. A Liebert IntelliSlot card may be installed during any state of UPS operation (On, Standby or Off states). Available Liebert IntelliSlot options are described below.
- D. Liebert IntelliSlot Web Card RDU101 for GXT5 10KVA and smaller IS-UNITY-DP for 3 phase units.
- E. The optional Liebert IntelliSlot Web Card shall deliver SNMP and Web management to the UPS when connected to any 10 or 100 Mbit Ethernet network. The card shall support 10 and 100 Mbit Ethernet and shall provide for in-the-field upgrade of SNMP firmware. The kit shall include the Liebert IntelliSlot card, MIB, configuration cable and user manual.
- F. Liebert IntelliSlot Relay Interface Card (RELAYCARD-INT)
- G. The optional Liebert IntelliSlot Relay Interface Card shall provide contact closure for remote monitoring of alarm conditions in the UPS, delivering signals for On Battery, On Bypass, Low Battery, Summary Alarm, UPS Fault and On UPS. The contacts shall be rated for 24VAC or 24VDC at 1A. Connections shall be to a DB25F connector with cable provided by the end user.

2.4 LIEBERT REMOTE SYSTEMS MONITORING

- A. All UPS systems must integrate into the existing UPS remote monitoring system to be approved for installation.
- B. On battery signal shall be a normally open (NO) dry contact. When the UPS is supplying output power from the battery and has reached the Low Battery Warning time selected in the configuration program, this contact shall be closed.

2.5 WARRANTIES

- A. Provide a 1-year minimum warranty on the centralized UPS and all components.
- B. Advanced replacement of defective equipment shall be offered as a standard service.

PART 3 - EXECUTION

3.1 GENERAL

- A. Confirm the exact power output distribution requirements with the Owner's Representative.
- B. Estimated runtime of 30 minutes is required. Provide Quantity (2) Two Optional External Battery Cabinets in base bid. Check with Owner's Representative for additional requirements.
- C. Secure approval of UPS locations with IT Facilities.
- D. Input disconnect: No Emergency Power Off (EPO) shall be provided as part of the UPS design and installation.
- E. Demonstration
 - 1. Full functionality of UPS by:
 - a. Coordinate with UCDH Data Center Services (DCS) for start-up and commissioning procedures.
 - b. Disconnecting power to the UPS and demonstrating ability of UPS to carry load consistent with the manufacturers' runtime for the attached load.
 - c. Demonstrate that the UPS passes the manufacturers diagnostic software with no errors.

END OF SECTION

SECTION 27 13 00
COMMUNICATIONS BACKBONE CABLING

PART 1 - GENERAL

1.1 SUMMARY

- A. This section covers the installation of backbone telecommunications cabling that links equipment rooms, telecommunications rooms, entrance facilities and other key network areas within a building or campus. It includes copper and optical fiber backbone cabling plus associated terminations, cross-connects, labeling and documentation.
- B. The work covered under this section includes the installation of indoor, outdoor, and riser copper and fiber backbone cabling between Telecommunications Rooms (TRs) and the Main Point of Entry (MPOE).

1.2 SYSTEM DESCRIPTION

- A. The Communications Backbone Cabling System provides the structured cabling infrastructure that interconnects all Telecommunications Rooms (TRs), the Main Point of Entry (MPOE), and associated network equipment within the building or campus. The system consists of copper and optical fiber backbone cabling installed via indoor, outdoor, and riser pathways. It is designed to support all voice, data, video, security, and building systems, providing a high-performance, scalable, and reliable network backbone.
- B. The backbone cabling system includes:
 - 1. Copper Backbone Cabling: Multi-pair, twisted-pair copper cable rated for backbone applications, terminated in designated cross-connect panels in each TR. Supports voice, low-speed data, and building system connectivity.
 - 2. Optical Fiber Backbone Cabling: Single-mode and multi-mode fiber optic cabling installed in riser and plenum pathways, terminated in fiber distribution panels to support high-speed data, video, and long-distance campus connectivity.
- C. This section outlines cabling configurations for the UCDH Campus. Offsite configurations may require circuit extensions. Report any conflicts between the construction drawings and IT standards to the Owner's representative before purchasing materials or proceeding with installation.

1.3 RELATED SECTIONS

- A. All related sections indicated in Section 27 05 00, "Common Work Results for Communications," shall apply as appropriate to this section.

1.4 REFERENCES AND STANDARDS

- A. All references and standards indicated in Section 27 05 00, "Common Work Results for Communications," shall apply as appropriate to this section.

1.5 ABBREVIATIONS

- A. Reference section 27 05 00.1.6 for abbreviations.

1.6 DEFINITIONS

- A. Definitions provided under section 27 05 00 shall apply to this section.

1.7 QUALITY ASSURANCE

- A. Comply with Quality Assurance requirements of Section 27 05 00.

1.8 SUBMITTALS

- A. Submittals shall conform with Division 1 33 00 requirements Submittal Procedures.
- B. Submittals shall conform with Division-27 Section 27 05 00 Common Work Results for Communications.
- C. Submit shop drawings and product data with the following information:
 - 1. Provide manufacturer's data sheets for each piece of material incorporated into the communications backbone cabling design.
 - 2. Provide shop drawings showing the type, size, routing, length and labeling for all communications backbone cabling.

1.9 WARRANTY

- A. Warranty shall conform with Division-27 Section 27 05 00.

PART 2 – MATERIAL

1.1 CATEGORY-3 COPPER BACKBONE CABLING.

- A. OSP, indoor/outdoor, riser (CMR), and plenum-rated (CMP) communications backbone cabling shall be ANSI/TIA Category 3, minimum 24 AWG solid conductor, 100-ohm, multipair UTP (unshielded twisted pair), with conductors formed into 25-pair binder groups.
- B. Copper backbone cabling shall be imprinted at regular intervals, not to exceed 2 ft, with the manufacturer's name or identifier, flammability rating, conductor gauge, transmission performance rating (Category designation), and footage marking, including the word "FEET" or the abbreviation "FT."
- C. Copper communications backbone cabling shall be suitable for direct connection to the public switched network and shall comply with FCC Part 68, California Public Utilities Commission requirements, and all other authorities having jurisdiction.
- D. Provide telecommunications plenum-rated (CMP) cabling for horizontal copper backbone runs and for any cables designated as riser cabling.
- E. Manufacturer:

1. General Cable
2. Superior Essex
3. Or approved equal.

1.2 CATEGORY-3 COPPER TERMINATION EQUIPMENT

- A. For rack mount applications provide an angled, 1-RU, 48-port modular patch panel at each end.
 1. Manufacturer:
 - a. Panduit CPPA48HDWBLY
 2. Flat 1-RU, 48-port modular patch panels shall only be permitted with prior approval from UCDH IT.
 - a. Manufacturer:
 - 1) Panduit CPP48HDWBLY
- B. For wall mount applications provide an appropriately sized, field-terminable 110 termination kit for Category 3 copper backbone cabling.
 1. Manufacturer:
 - a. Panduit P110KB***5Y.
 - b. Or approved equal.
- C. For applications requiring entrance protection, provide an appropriately sized 110/110 entrance terminal without cover or splice.
 1. Manufacturer:
 - a. Circa 1880ENA1/NSC-**
 - b. Or approved equal.

1.3 FIBER OPTIC COMMUNICATIONS BACKBONE CABLE

- A. Provide a minimum 24-strand, SM-OS2, loose-tube, dry-core, 250 µm fiber optic cable with 12 strands per buffer tube and a maximum outside diameter of 0.5 in.
- B. Communications fiber optic backbone cable shall have a maximum loss of .40db/km at the 1310nm wavelength and .30db/km at the 1550nm wavelength.
- C. Fiber Optic Cable, indoor/outdoor/riser distribution
 1. Manufacturer:
 - a. Panduit # FSNR924Y
 - b. Or approved equal.
- D. Fiber Optic Cable, indoor/outdoor/plenum distribution
 1. Manufacturer:
 - a. Panduit # FSNP924Y
 - b. Or approved equal.
- E. Fiber Optic Cable, Indoor/Plenum
 1. Manufacturer:

- a. Panduit # FS1P924Y/N
- b. Or approved equal.

1.4 FIBER OPTIC BACKBONE CABLE TERMINATION EQUIPMENT

A. Fiber Termination Unit (FTU)

1. The FTU shall house, organize, manage, and protect fiber optic cables, splices, and splice cassettes. The FTU shall provide full front access with trays designed to slide out and lock in the extended position. Each tray shall be capable of being split, allowing half of the tray to operate independently for improved access during maintenance and splicing.
2. The FTU shall be rack-mountable in a standard 19-inch equipment rack and shall be field-configurable for varying fiber capacities. The unit shall include cable management features to protect bend radius, support incoming and outgoing cables, and secure buffer tubes and strength members.
3. The FTU shall be capable of cassette installation from both the front and rear and have a minimum density of 144 strands per rack unit.
4. Manufacturer:
 - a. 1-RU FTU:
 - 1) Provide Panduit HD Flex, FLEX1U06.
 - 2) Or approved equal.
 - b. 2-RU FTU:
 - 1) Provide Panduit HD Flex, FLEX2U06.
 - 2) Or approved equal.
 - c. 4-RU FTU:
 - 1) Provide Panduit HD Flex, FLEX4U06.
 - 2) Or approved equal.
 - d. All FTUs shall be provided with a slack plate and rear cover.
 - 1) 1-RU FTU:
 - a) Provide Panduit FLEX-PLATE1UR.
 - 2) 2-RU FTU
 - a) Provide Panduit FLEX-PLATE2UR.
 - 3) 4-RU FTU:
 - a) Provide Panduit FLEXPLATE-4UR.

B. Fiber Optic Splice Cassettes.

1. Fiber optic splice cassettes shall provide a secure and organized way to permanently splice fiber optic cables.
2. Manufacturer:
 - a. Ribbon Fiber Cassette:
 - 1) Panduit HD Flex Splice Cassette LC UPC, FHS9N-12-10R.
 - 2) Or approved equal.
 - b. Loose Tuber Fiber Cassette:
 - 1) Panduit HD Flex Splice Cassette LC UPC, FHS9N-12-10P.
 - 2) Or approved equal.

C. For legacy installations:

1. The installation contractor shall ensure that the existing fiber type, FTU, and connector/cassette type are identified and matched appropriately.

PART 2 - EXECUTION

2.1 GENERAL

- A. All communications backbone cabling and splices shall be performed in accordance with the manufacturer's written instructions and the approved Contractor submittals, subject to final inspection and acceptance by the Owner.

2.2 PERFORMANCE STANDARDS

- A. Telephone (Voice) Copper Cabling Plant
 - 1. Category-3 as defined in TIA-568.2-E Balanced Twisted-Pair Telecommunications Cabling and Components.
- B. Fiber Optic Cabling
 - 1. The optical loss budget for any end-to-end link not to exceed the sum of (optical fiber loss + splice loss + connector loss).
 - a. Single-mode fiber attenuation shall not exceed 0.40dB/km at 1310nm and shall not exceed 0.30dB/km at 1550nm.
 - 1) Optical fiber loss shall be the optical fiber specified cable performance, prorated for total link distance.
 - b. The maximum acceptable splice loss shall be .05db per fusion splice.
 - c. Connector loss, single mode not to exceed 0.50 dB for each mated pair of type LC, ultra polish connector or 0.30 dB for each mated pair of type LC, angle polished connector
 - 2. Example: Maximum acceptable loss for a single mode fiber 1-kilometer in length terminated with a LC ultra polished cassettes on each end at the 1310nm wavelength would be as follows:
 - a. $(\text{optical fiber loss @1310}).40\text{db} + (\text{splice loss} \times 2).10 + (\text{connector loss} \times 2).1.0\text{db}$
 $= (\text{link loss budget})1.50\text{db}.$

2.3 EXAMINATION

- A. Examination shall conform to the requirements of Section 27 05 00.
- B. The Contractor shall provide written notification to the Owner or Owner's representative of any existing or encountered conditions that may adversely affect or hinder the proper completion of the work. Such notification shall be provided promptly upon discovery to allow for timely resolution.
- C. The Contractor shall verify that all field measurements and pathway routing conditions are consistent with the Drawings. Any deviations from the Drawings shall be documented and submitted in writing to the Owner or Owner's representative prior to proceeding with the work.
- D. The commencement of telecommunications pathway installation by the Contractor shall constitute acknowledgment and acceptance of the existing site conditions. Any discrepancies or issues that have not been reported prior to the start of work shall be considered the responsibility of the Contractor.

2.4 INSTALLATION

A. CAT3 COPPER BACKBONE CABLE

1. Application for Telecommunications Rooms (TR), Minimum Point of Entry (MPOE), and Entrance Facility (EF) Category-3 interconnectivity copper backbone cabling.
2. The minimum Category-3 interconnectivity configuration between the MPOE and all Telecommunications Rooms shall be one 25-pair cable to each TR.

B. FIBER OPTIC CABLING

1. The minimum interconnectivity between the MPOE and all Telecommunications Rooms (TRs) shall be one (1) 24-strand single-mode (SM) fiber optic cable to each TR.
2. The minimum interconnectivity between the secondary EF and all Telecommunications Rooms (TRs) shall be one (1) 24-strand single-mode (SM) fiber optic cable to each TR.
3. Diverse, redundant physical pathways shall be provided between both the MPOE and the secondary EF to each TR to ensure that backbone cabling does not utilize a single pathway.
4. At each TR, MPOE, and EF, provide a minimum 15-foot service loop secured with cable rings, Leviton 48900-OFR or approved equal.
5. Splice-free cabling between Telecommunications Rooms (TRs), and between TRs and all locations indicated for fiber cabling media, shall be provided; splicing shall be permitted only at designated splice points or Fiber Termination Units (FTUs).
6. The proposed fiber optic breakout procedure shall be reviewed with the Owner's Representative before beginning fiber splicing.
7. Refer to owner provided IT elevations and distribution drawings for further details.

2.5 TESTING

A. GENERAL

1. Test and provide certification reports for every strand of each cabling segment separately.
2. Machine-generated documentation and raw data of all test results in both PDF and native test format shall be provided for review by UCDH IT. Any deficiencies shall be corrected, retests performed, and new documentation shall be provided to acceptance.

2.6 TEST PROCEDURES – COPPER

A. Backbone Copper Cable Testing.

1. A new copper backbone cable shall be tested only after all conductors within the cable have been terminated and labeled at both ends.
2. All new copper backbone cable shall be tested for continuity, polarity, and shorts. (wire map)
3. All new copper backbone cable shall be tested for resistance.
4. All new copper backbone cable shall be tested for length.
5. The Contractor shall correct all defects.
6. Test results shall be submitted in native test software format.

2.7 TEST PROCEDURES – FIBER

- A. UCDH IT shall be notified a minimum of three (3) working days in advance of fiber optic cable testing. A pre-test inspection shall be scheduled between UCDH IT and the low-voltage installation contractor to approve the test equipment and set-up.
- B. All test equipment shall have been calibrated within 1 year of the test date.
- C. All test cables shall be reference-grade, with reference-grade connectors, to minimize measurement errors.
- D. Test cables shall be of appropriate length for the fiber being tested to ensure accurate measurements.
- E. Tier 1 Fiber Testing
 - 1. Tier-1 testing shall be performed bidirectionally at both the 1310nm and 1550nm wavelength.
 - 2. Maximum attenuation for Tier-1 testing is defined in section 27 13 00.3.2.B of this document.
- F. Tier 2 Fiber Testing
 - 1. Tier 2 testing shall be performed at both the 1310nm and 1550nm wavelength in both directions.
 - 2. Maximum loss factors are defined in section 27 13 00.3.2.B of this document.
 - 3. Tier 2 testing shall be performed using both a “launch” and a “tail” test cable.
 - 4. Test cables shall be appropriate length for the fiber being tested (minimum 1km).
- G. Test results shall be submitted in PDF and native test software format.
- H. Test results shall be submitted with the following information:
 - 1. Date of test
 - 2. Name of test personnel
 - 3. Test wavelength
 - 4. Pulse duration(s) and scale range(s)
 - 5. Index of refraction
 - 6. Fiber cable type and part number
 - 7. Fiber tube and/or fiber strand number
 - 8. Direction of test
 - 9. Overall distance
 - 10. Attenuation in dB
 - 11. Localized attenuation shall not exceed 0.5 dB at any point

2.8 TEST EQUIPMENT

- A. Contractor shall provide all test equipment as required to perform the scope of work.
- B. Copper Backbone Cable Test Equipment

1. Outside Plant Voice Cabling Plant tester - capable of detecting shorts, opens, reversals, mis-wiring and cross twists.
 - a. Fluke Versive or equal.

C. Tier 1 Fiber Test Equipment / Optical Power Meter

1. Minimum Performance - Single Mode Power Meter 1300nm and 1500nm +/- 20 nm wavelength laser light sources.
2. Output Stability +/- 0.40 dB from 0 to 50 degrees C
3. Long Term output stability +/- 0.10dB at 25 degrees C Measurement range shall be from 10 to -60 dBm
4. Accuracy shall be +/- 5% at 0 to -50dBm and +/- 10% 10 to 0dBm and -50 to -60 dBm.
5. Resolution shall be 0.1 dB
6. Manufacturer: Fluke Versive Mainframe with Certifiber Pro Singlemode OLTS modules CFP2-100-S or equal.

D. Tier 2 Fiber Test Equipment / Optical Time Domain Reflectometer (OTDR).

1. Tier 2 test equipment shall be capable of performing a real-time fiber trace.
2. Tier 2 test equipment shall be capable of testing at 1310nm with a minimum dynamic range of 42db and 1550nm with a minimum dynamic range of 41db.
3. Tier 2 test equipment shall be capable of producing a 3ns-20,000ns pulse width.
4. Tier 2 test equipment shall have a Fresnel dead zone less than or equal to 1-meter, and a backscatter dead zone less than or equal to 5.5-meters.
5. Tier 2 test equipment shall be capable of deriving a graphical representation of fiber characteristics and loss events within a fiber link: a fiber trace.
 - a. Each fiber trace shall show launch test fiber, connector attenuation losses, fiber link attenuation, splice attenuation losses, and tail test fiber.
 - b. Each fiber trace shall indicate the reflectance value of the fiber being tested.
 - c. Cursors shall be set immediately before the first connector and after the last connector in the link being tested.
 - d. Launch and tail test cable shall be appropriate length (minimum 1-KM) for the fiber link being tested.
6. Manufacturer: Anritsu MT9085B or equal.

2.9 LABELING

- A. Communications backbone cabling, enclosures, and termination equipment shall be labeled in accordance with section 27 05 53 Identification and Labeling of Communications Systems.

2.10 RECORDS

- A. The installation contractor shall maintain records of all installed communications backbone cabling, including routing and labeling, for closeout as-built documentation in accordance with Section 27 05 00.

2.11 ACCEPTANCE

A. Testing Results Review and Verification by the Owner

1. Contractor shall submit (1) copy of software capable of viewing the electronic test result files.
2. Data found to be altered from the manufacturers recommended settings may result in retention by the Owner of a 3rd party test company to retest the installed cabling at the expense of the Contractor.
3. Data found to be incomplete may result in retention by the Owner of a 3rd Party Test Company to retest the installed cabling at the expense of the Contractor.
4. After all cabling and equipment installation is complete, the Contractor shall review the communications backbone cabling configuration with the project Inspector of Record (IOR) and UCDH IT representative. Any deviations or deficiencies identified shall be corrected prior to final acceptance.

END OF SECTION

SECTION 27 13 43
COMMUNICATIONS SERVICES CABLING

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Outdoor (Outside Plant) Communications Cabling placed underground in existing communications ducts, maintenance holes, and pull boxes.
 - 1. High pair count OSP copper cabling
 - 2. High strand count OSP Fiber Optic Cabling
 - 3. Service Entrance / Building Lateral Fiber
 - 4. All copper service entrance cabling shall be terminated on entrance protectors, equipped with modules capable of eliminating sneak current.
 - 5. Two diverse physical communications entrance pathways shall be provided to the two Building Distribution Facilities.
 - a. A minimum of 48-strands of SM fiber and 50pr. of copper shall be provided at each BDF.
 - 6. At TR / MPOE and EFs, at both ends of cables, provide 15' service loops secured with cable rings, Leviton 48900-OFR or approved equal.
- B. For all cabling:
 - 1. Test cabling to demonstrate performance to specified standards or better using test equipment and methods as specified in Section 27 13 00.
 - 2. Label cables, jacks, plates, and patch panels as specified in Section 27 05 53.
 - 3. Document on Record Documents as described in Section 27 05 00.

1.2 RELATED SECTIONS

- A. All related sections indicated in Section 27 05 00, "Common Work Results for Communications," shall apply as appropriate to this section.

1.3 REFERENCES

- A. In addition to the requirements of Section 27 05 00 - Common Work Results for Communications, conform to the applicable portions of the following standards agencies:
 - 1. BICSI TDMM 15th edition.
 - 2. Customer Owned Outside Plant Design Manual, 5th edition.

1.4 SUBMITTALS

- A. Submittals shall conform with Division 1 33 00 requirements Submittal Procedures.
- B. Submittals shall conform with Division-27 Section 27 05 00 Common Work Results for Communications.
- C. Product Data:

1. Provide product data for all materials required to install a fully functional system, including fiber, termination materials, consumables, racking, splice cases, and all necessary hardware.
- D. Shop Drawings:
 1. Provide shop drawings clearly indicating cable routes, including maintenance holes (MHs), pull boxes, hand holes, conduit banks, aerial pathways, and service entrance pathways.
 2.
 - a. Shop drawings shall specify the type and size (pair/strand count) of the cable being installed.
 - b. Shop drawings shall identify the specific conduit(s) within a conduit bank, pull box, or maintenance hole to be used for cable placement.
 - c. Shop drawings shall show the locations of splice cases, cable slack, and racking.
 - d. Shop drawings shall include detailed elevation diagrams and placement information for the cable and equipment along the cable route and at termination points.
 3. Contact Owner Representative for underground plant MAP.
- E. Standard Operating Procedure (SOP):
 1. Provide a Standard Operating Procedure (SOP) that outlines the sequencing of activities and the estimated time allocated for each task required by the project scope.
 - a. Include all safety procedures and contingencies.

1.5 SEQUENCING

- A. Complete entrance facilities prior to need for communications to fire life safety.
- B. Complete Section 27 13 00 to facilitate need for communications to fire life safety.

PART 2 - PRODUCTS

2.1 FIBER OPTIC COMMUNICATIONS SERVICE CABLING

- A. Single mode OS2 OSP gel free ribbon fiber cable from 48-1728 strands designed for lashed aerial, underground duct, or direct buried applications.
 1. 12-strand fiber ribbons shall be provided.
- B. Performance:
 1. The optical loss budget for any end-to-end link not to exceed the sum of (optical fiber loss + splice loss + connector loss).
 2. Optical fiber loss shall be the optical fiber specified cable performance, pro-rated for total link distance.
 3. Single Mode fiber loss shall not exceed:
 - a. At 1310 nanometers, .40 dB per kilometer; at 1550 nanometers, .30 dB per kilometer.
 4. Splice loss, single mode not to exceed 0.05 dB for each fusion splice.
 5. Connector loss, single mode not to exceed 0.50 dB for each mated pair of type LC, ultra polish connector or 0.30 dB for each mated pair of type LC, angle polished connector.

6. Example: Maximum acceptable loss for a single mode fiber 1-kilometer in length terminated with a LC ultra polished cassettes on each end at the 1310nm wavelength would be as follows:
 - a. $(\text{optical fiber loss @1310}).40\text{db} + (\text{splice loss} \times 2).10 + (\text{connector loss} \times 2).1.0\text{db}$
 $= (\text{link loss budget})1.50\text{db}.$

C. Minimum required bend radius:

1. At installation: 20x's diameter
2. Long term application: 10x's diameter
3. Zero water entry per FOTP-82, 24 hours immersion
4. Crush resistance: 600N/cm min per EIA-455-41
5. Impact Resistance: 25 impacts, per FOTP-25
6. Flex, Twist/Bend: 25 cycles, per FOTP-104 and FOTP-85

A. Manufacturer:

1. 12-144 Strand Count: Prysmian # RRIODK-12-AA-***-BB (***) indicates the number of strands)
2. Greater than 144 strands: Prysmian # RRIODK-24-AA-***-BB (***) indicates the number of strands)

2.2 OPTICAL FIBER SPLICE CLOSURE

A. Functions/Features

1. Provide re-enterable underground or inside plant splice closure as shown on the Drawings.
2. Metal Stainless Steel or plastic construction – no corrodible materials.
3. Waterproof, suitable for direct burial.
4. Fusion splice protection chamber.
5. Grommet cable entrance and exits.

B. Manufacturers

1. Preformed Line Products Coyote Series.
2. Or approved equal.

2.1 FIBER OPTIC COMMUNICATIONS SERVICE CABLING FIBER TERMINATION

A. Fiber Termination Unit

1. Fiber Termination Units (FTU) shall be capable of accommodating 144 fiber strands per rack unit.
2. FTU shall be equipped with front-access drawers that are capable of being divided, left and right, and operated independently.
3. FTU shall be capable of cassette installation / removal from both the front and rear.
4. 1-RU FTU:
 - a. Provide Panduit HD Flex, FLEX1U06 or approved equal.
5. 2-RU FTU:

- a. Provide Panduit HD Flex, FLEX2U06 or approved equal.
- 6. 4-RU FTU:
 - a. Provide Panduit HD Flex, FLEX4U06 or approved equal.
- B. Fiber Termination Cassettes
 - 1. Provide SM OS-2 12-Strand ribbon LC UPC splice cassettes (6-Duplex Ports) pre-loaded with factor terminated 250um pigtails and splice sleeves. Cassettes shall have a maximum standard insertion loss of .35db, and a maximum splice loss of .06db is allowable.
 - a. Panduit HD Flex Splice Cassette LC UPC, FHS9N-12-10R or approved equal.
- C. For legacy installations:
 - 1. The installation contractor shall ensure that the existing fiber type, FTU, and connector/cassette type are identified and matched appropriately.
- D. Review proposed breakout procedure with the Owner's Representative before beginning this work.
- E. Refer to OWNER IT elevations and distribution drawings for further details.

2.2 TEST PROCEDURES – FIBER

- A. UCDH IT shall be notified a minimum of 3 working days in advance of horizontal cable testing. A Pre-test inspection shall be scheduled between UCDH IT and the low voltage installation contractor to approve the test equipment and set-up.
- B. All test equipment shall have been calibrated within 1 year of the test date.
- C. All test cables shall be reference grade with reference grade connectors to minimize measurement errors.
- D. Test cables shall be appropriate length for the fiber being tested.
- E. Tier 1 and Tier 2 testing shall be performed on all fiber, bi-directionally at both the 1310nm and 1550nm wavelengths.
- F. Tier 1 Fiber Testing
 - 1. Tier-1 testing shall be performed bidirectionally at both the 1310nm and 1550nm wavelength.
 - 2. Maximum attenuation for Tier-1 testing is defined in section 27 13 43.2.1 of this document.
- G. Tier 2 Fiber Testing
 - 1. Tier 2 testing shall be performed using both a "launch" and a "tail" test cable.
 - 2. Test cables shall be appropriate length for the fiber being tested (minimum 1km).
 - 3. Tier 2 testing shall be performed at both the 1310nm and 1550nm wavelength in both directions.
 - 4. Maximum loss factors are defined in section 27 13 43.2.1 of this document.
- H. Test results shall be submitted in native test software format.

- I. Submit test report no later than five days after the cables are tested.
- J. Test results shall be submitted with the following information:
 - 1. Date of test
 - 2. Name of test personnel
 - 3. Test wavelength
 - 4. Pulse duration(s) and scale range(s)
 - 5. Index of refraction
 - 6. Fiber cable type and part number
 - 7. Fiber tube and/or fiber strand number
 - 8. Direction of test
 - 9. Overall distance
 - 10. Attenuation in dB
 - 11. Localized attenuation shall not exceed 0.5 dB at any point

2.3

2.4 TELEPHONE, OUTSIDE PLANT, UNDERGROUND IN DUCTBANK

- A. OSP 22-24AWG dry-block type copper cable suitable for lashed aerial, underground duct, or direct buried applications.
 - 1. Solid round copper wire individually bound per BICSI color code.
 - 2. Solid aluminum tape overall shield.
 - 3. Dry-block
 - 4. Polyethylene Overall Jacket.
 - 5. Available in pair counts from 6 to 300
- B. Manufacturer
 - 1. General Cable
 - 2. Superior-Essex
 - 3. Or approved equal.
- A. OSP Copper Service Cable Testing.
 - 1. A new copper backbone cable shall be tested only after all conductors within the cable have been terminated and labeled at both ends.
 - 2. All new copper backbone cable shall be tested for continuity, polarity, and shorts. (wire map)
 - 3. All new copper backbone cable shall be tested for resistance.
 - 4. All new copper backbone cable shall be tested for length.
 - 5. The Contractor shall correct all defects.
 - 6. Test results shall be submitted in native test software format.

2.5 TEST EQUIPMENT

- A. Contractor shall provide all test equipment as required to perform the scope of work.
- B. OSP Copper Service Cable Test Equipment
 - 1. Outside Plant Voice Cabling Plant tester - capable of detecting shorts, opens, reversals, mis-wiring and cross twists.
 - a. Siemon STM-8, Fluke or equal.
- C. Tier 1 Fiber Test Equipment / Optical Power Meter
 - 1. Corning Cable Systems, Fluke or equal
 - 2. Minimum Performance - Single Mode Power Meter 1300nm and 1500nm +/- 20 nm wavelength laser light sources.
 - 3. Output Stability +/- 0.40 dB from 0 to 50 degrees C
 - 4. Long Term output stability +/- 0.10dB at 25 degrees C Measurement range shall be from 10 to -60 dBm
 - 5. Accuracy shall be +/- 5% at 0 to -50dBm and +/- 10% 10 to 0dBm and -50 to -60 dBm.
 - 6. Resolution shall be 0.1 dB
 - 7. Connector types shall include LC only.
 - 8. Manufacturer: Fluke Versive Mainframe with Certifiber Pro Singlemode OLTS modules CFP2-100-S or equal.
- D. Teir 2 Fiber Test Equipment / Optical Time Domain Reflectometer (OTDR).
 - 1. Teir 2 test equipment shall be capable of performing a real-time fiber trace.
 - 2. Teir 2 test equipment shall be capable of testing at 1310nm with a minimum dynamic range of 42db and 1550nm with a minimum dynamic range of 41db.
 - 3. Tier 2 test equipment shall be capable of producing a 3ns-20,000ns pulse width.
 - 4. Teir 2 test equipment shall have a Fresnel dead zone less than or equal to 1-meter, and a backscatter dead zone less than or equal to 5.5-meters.
 - 5. Tier 2 test equipment shall be capable of deriving a graphical representation of fiber characteristics and loss events within a fiber link: a fiber trace.
 - a. Each fiber trace shall show launch test fiber, connector attenuation losses, fiber link attenuation, splice attenuation losses, and tail test fiber.
 - b. Each fiber trace shall indicate the reflectance value of the fiber being tested.
 - c. Cursors shall be set immediately before the first connector and after the last connector in the link being tested.
 - d. Launch and tail test cable shall be appropriate length (minimum 1-KM) for the fiber link being tested.
 - 6. Manufacturer: Anritsu MT9085B or equal.

2.6 EXAMINATION & ACCEPTANCE

- A. Testing Results Review and Verification by the Owner
 - 1. Contractor shall submit (1) copy of software capable of viewing the electronic test result files.

2. Data found to be altered from the manufacturers recommended settings may result in retention by the Owner of a 3rd party test company to retest the installed cabling at the expense of the Contractor.
3. Events exceeding loss standards above will cause the test result to be rejected.
4. Data found to be incomplete may result in retention by the Owner of a 3rd Party Test Company to retest the installed cabling at the expense of the Contractor.

2.7 SHIELD CONNECTORS

- A. Shield connectors shall make a stable, low-impedance electrical connection between the shield of the communications cable and a conductor such as a strap, bar, or wire.
- B. The connector shall be made of tin-plated tempered brass.
- C. Shield bond connectors shall comply with REA PE-33.

2.8 GROUNDING BRAID

- A. Grounding braid shall provide low electrical impedance connections for dependable shield bonding.
- B. The braid shall be made from flat tin-plated copper.

2.9 OUTSIDE PLANT TELEPHONE CABLING CLOSURES

- A. In Building Telephone Closure:
- B. Drawing Reference: IBTC
- C. Features and Functions:
 1. Provides transition point from unlisted, gel-filled Outside Plant Cabling to Interior (CU) cabling.
 2. Can house a straight, butt, and branch splice in a protective housing.
 3. Not pressurized or encapsulated.
 4. Fire-retardant Plastic construction, meeting PUB55006 for interior (in-building) installation.
- D. End Caps
 1. Multiple End caps shall be sized precisely to fit the diameter of the tip cables entering the closure.
 2. Number of openings in the multiple end caps shall be determined by dividing the number pairs in the feed cable by 100 and doubling that number. (ie. 1200 pair cable would have 24 openings for tip cables.
 3. Collared Cap opening can be up to 6.35mm (1/4") larger than the feed cable diameter.
 4. Actual end cap to be provided shall be based on the diameter of the feed cable to be spliced.
- E. Plugs
 1. Use tapered or collared plugs as required to fill extra opening in end caps.

2. Seal if inside diameter of hole is less than 6.35mm (.25").

F. Bushings

1. Use rubber or variable bushings as required to reduce standard opening in end caps to accommodate custom diameters.
2. Seal if inside diameter of hole is less than 6.35mm (.25").

G. Manufacturer

1. UraSeal 2000FR Type.
2. 3M K&B Series.
3. Tyco Electronics.
4. Or approved equal.

2.10 OUTSIDE PLANT TELEPHONE CLOSURE, VAULT

A. Drawing Reference: OTC, TOSC

B. Features/Functions

1. Stainless Steel outer jacket housing
2. Can house a straight, butt, and branch splice in a protective housing.
3. Rigid outer protective body
4. Suitable for periodic water immersion - air and watertight.
5. Renter able.
6. Gel Filled, Injected encapsulant using precision means.
7. Minimum inside diameter shall be 5" (127mm).
8. Minimum inside length shall be 26" (660mm).

C. Manufacturer

1. Preformed Line Products Armadillo Stainless.
2. UraSeal
3. 3M
4. Emerson Network Power
5. Or approved equal.

2.11 MULTIPAIR SPLICING CONNECTORS

A. Drawing Reference: None. Provide at all IBTC, TOSC, OTC and similar locations where shown on the plans or required in the field.

B. Function

1. Can provide gas tight termination for large pair counts of copper cabling to connectorized ends and reliable mate ends in compact area.
2. Industry standard termination means.
3. All modules shall have test entry ports on the front side of the module.

4. All straight splicing modules shall be tap modules.

C. Manufacturer

1. 710 25-pr bridge splice connector (Industry standard item).
 - a. 3M, corning, or approved equal as required to match the standard in use at the facility.

2.12 MISCELLANEOUS UNDERGROUND PRODUCTS

A. Encapsulant

1. Encapsulates shall be transparent.
2. Splice case and Encapsulant must be re-enterable.
3. Shall be compatible with the cable insulation.
4. Shall not be corrosive to copper and must not support fungi or mold growth.

2.13 WATER IMPERMEABLE CONDUIT PLUGS

1. Tyco RDSS Duct seal / E7512-160 / E7512-160.
2. Jack moon compression plugs.
3. Or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install safety barriers and deploy flag persons for all open manholes and pull boxes located in areas accessible to the public, ensuring adequate visibility and protection to prevent unauthorized access and ensure public safety.
- B. Implement traffic control measures in compliance with Campus policies and standards. Adhere to OSHA guidelines for accessing manholes and handholes, including the mandatory requirement for air sampling. Ensure continuous air quality measurements during the process. Maintain logs of air samples, recorded at intervals no greater than two hours, and provide these logs to the Owner's Representative for review
- C. Ensure sufficient personnel are available to maintain at least one individual above the surface at all times, in continuous visual contact with those working in manholes or similar confined spaces. The observer must be equipped with an appropriate means of communication to obtain immediate assistance if needed.
- D. Provide ladders for access to manholes. Do not permit workers to use cables or splice cases as ladders.
- E. Install a $\frac{3}{4}$ ", 2500lb rated, mule tape with detectable tracer wire and sequential footage markers.

3.2 CABLE PULLING

- A. Test existing duct lines with a mandrel and thoroughly swab out to remove foreign material before pulling cables.

- B. A Kellum grip cable-pulling device with a swivel shall be used to pull cable in place, cut off the section of cable under the grip before splicing and terminating.
- C. OSP Copper Cabling Special Procedures
 - 1. Contractor shall provide notice 3 days in advance notice prior to pulling any cable greater than 400 pairs in size or when a winch is planned for use.
 - 2. Owner's representative shall have the option to be present to observe all pulling activities of cable greater than 400 pair or when a winch is planned for use.
 - 3. Contractor shall be responsible for verifying that ducts are ready for occupancy prior to cable placement.
 - 4. Contractor shall assume responsibility for any difficulties or damage to the cable during placement.
 - 5. Adhere to all manufacturers requirements regarding pulling tension allowable lubricants and bending radius.
 - 6. All un-terminated cable pair ends must be cleared (not shorted or crossed) and binder tagged.
 - 7. All open-ended cables must be watertight sealed using temporary end caps or encapsulation.

3.3 CABLES IN MANHOLES, PULL BOXES AND HANDHOLES

- A. Support cable splices in underground structures by racks on each side of the splice.
- B. All OSP service cables shall make one complete wrap around each vault, maintenance hole, and pull box they pass through, or provide a service loop equal to one complete wrap.
- C. Install cables starting at the bottom of cable racks, leaving top space opening for future cables and splice cases, except as otherwise indicated for existing installations.

3.4 BUILDING ENTRANCE CONDUIT WATER BARRIER

- A. Conduits entering a structure are to penetrate the last vault at the highest elevation possible to prevent water penetration.
- B. All Conduits entering a structure are to be sealed and watertight from the last vault to the MPOE, TR or ER.
- C. No conduits shall be sealed (other than fire stopping materials required by the AHJ) inside the structure.

3.5 SERVICE LOOP AND GROUNDING AT BUILDING ENTRY

- A. In Telecommunications Rooms, provide at least 15 feet of excess cable at both ends of each cable, beyond the length required to terminate. Form the excess cable into a storage loop and mount it to the wall using a loop ring, as directed by the Owner's Representative.
 - 1. Manufacturer: Leviton 48900-OFR or approved equal.
- B. Bonding Harnesses shall be used to ground the shields of the spliced cables to the PBB/SBB or building service ground. Bonding harness shall be 14 AWG and sized according to closure.

END OF SECTION

SECTION 27 15 00
COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

- A. This section covers the provisioning, installation, termination, and testing of twisted-pair horizontal cabling within modular furniture and hard-wall workstations across the project area. Work under this section will include:
 - 1. Wireless Access Point cabling
 - 2. Printer Stations
 - 3. IP Camera Cabling
 - 4. Monitor and MATV cabling
 - 5. All workstation cabling as defined on the construction documents

1.2 TYPICAL WORK AREA OUTLETS (WAO)

- A. A typical work area outlet (WAO) shall consist of two Category-6A Data cables, unless otherwise indicated.
 - 1. Cables shall be terminated on CAT-6A modular jacks in a 2-port stainless steel faceplate.
 - 2. Cables shall be labeled per section 27 05 53 Identification for Communications Systems.
- B. When re-cabling a building or office, consideration must be given to adding data cables to support devices that will remain operational after transitioning to a VoIP network, such as fax machines, fire alarms, elevator phones, pay phones, etc.
- C. A typical work area outlet shall have a slack loop of 10 feet at the field end of the run.

1.3 OTHER OUTLET CONFIGURATIONS

- A. Monitor / TV location
 - 1. A typical Monitor / TV Outlet shall consist of two Category-6A Data cables, unless otherwise indicated.
 - 2. Cables shall be terminated on CAT-6A modular jacks in a 2-port stainless steel faceplate.
 - 3. Cables shall be labeled per section 27 05 53 Identification for Communications Systems.
 - 4. Elevation shall be coordinated with power and the monitor mount.
- B. Wireless Access Points
 - 1. A typical wireless access point (WAP) Outlet shall consist of two Category-6A Data cables, unless otherwise indicated.
 - a. Cables shall be terminated on CAT-6A modular jacks in a double gang j-box finished with a double gang mud ring.
- C. Timeclock Outlet

1. A typical time clock outlet shall consist of one Category-6A Data cable, unless otherwise indicated.
 - a. Cable shall be terminated on a CAT-6A modular jack in 2-port stainless steel faceplate.
- D. IP Camera Outlet
 1. A typical camera outlet shall consist of one Category-6A Data cable, unless otherwise indicated.
 - a. Cable shall be terminated on CAT-6A modular jack in a double gang j-box finished with a double gang mud ring.
- E. BMS / Equipment Service Panel / Controls D-marc.
 1. A typical equipment service panel outlet shall consist of two Category-6A Data cables, unless otherwise indicated.
 - a. When the equipment service panel is located in the TR, cables shall be terminated on CAT-6A modular jacks in a 2-port surface mount box located within the panel.
 - b. In rooms other than the TR, provide a minimum 1-1/4" conduit from the nearest cable pathway to a 8" x 6" x 4" junction box with a hinged door (Hoffman AHE8X6X4, OR EQUAL). Cables shall be terminated on CAT-6A modular jacks in an appropriately sized surface mount box inside of the junction box. Provide a 1" conduit from the 8" x 6" x 4" junction box for a patch cable to the equipment Network Interface Card. A separate 1" pathway shall be provided for each piece of networked equipment within the room.
 - 1) Note: The contractor shall provide the patch cable on the equipment side of all BMS / Equipment Service Panel / Controls D-marc.



- F. Modular Furniture Work Area Outlet
 - 1. A typical modular furniture work area outlet shall consist of two Category-6A Data cables, unless otherwise indicated.
 - a. Cables shall be terminated on CAT-6A modular jacks in a 4-port modular furniture faceplate.
- G. Cables shall be labeled per section 27 05 53 Identification for Communications Systems.
- H. Other outlet configurations as defined by and coordinated with Owner IT.

1.4 RELATED SECTIONS

- A. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS
- B. 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS
- C. 27 05 29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS
- D. 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS
- E. 27 05 36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS
- F. 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
- G. 27 11 16 COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES
- H. 27 11 19 COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS
- I. 27 11 23 COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK
- J. 27 11 26 COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS
- K. 27 13 00 COMMUNICATIONS BACKBONE CABLING
- L. 27 13 43 COMMUNICATIONS SERVICES CABLING
- M. 27 41 33 MASTER ANTENNA TELEVISION SYSTEMS
- N. 27 51 16 PUBLIC ADDRESS SYSTEMS
- O. 27 52 13 PATIENT MONITORING AND TELEMETRY SYSTEMS
- P. 27 52 23 NURSE CALL/CODE BLUE SYSTEMS
- Q. 27 53 13 CLOCK SYSTEMS
- R. 27 53 19 INTERNAL CELLULAR, PAGING, AND ANTENNA SYSTEMS

1.5 SUBMITTALS:

- A. Submittals shall conform with Division 1 33 00 requirements Submittal Procedures.

- B. Submittals shall conform with Division-27 Section 27 05 00 Common Work Results for Communications.
- C. Submit shop drawings and product data with the following information:
 - 1. Provide manufacturer's data sheets for each piece of material incorporated into the horizontal cabling design.
 - 2. Provide shop drawings showing the routing for the horizontal cabling.

PART 2 - PRODUCTS

2.1 MODULAR JACK COMPONENTS, GENERAL

- A. Modular Jacks rated Category-6A
 - 1. Panduit Mini-Com CJ6X88TGVL.

2.2 HORIZONTAL COPPER CABLING, CATEGORY 6A

- A. High Speed CAT-6A 23AWG .23"OD Plenum Rated cable, UL certified for 100W power over HDBaseT.
 - 1. General Cable GenSpeed 10 MTP CAT-6A, Part No. 7151855 Purple, or approved equal.

2.3 HORIZONTAL COPPER CABLING, INDOOR / OUTDOOR & OSP

- A. High Speed, CAT-6A 23AWG .30"OD Indoor-Outdoor Plenum Rated cable suited for installation in below grade conduit, slab-on-grade conduit, duct, and other wet environments.
 - 1. General Cable GenSpeed 10 UTP Indoor/Outdoor Plenum CAT-6A cable, Part No. 7141007, or approved equal.

2.4 TELECOMMUNICATIONS OUTLET COMPONENTS

- A. Modular Furniture Faceplate, Black
 - 1. Panduit CFFPL4BL, or approved equal.
 - 2. Modular Surface Mount Box Blank Insert Panduit CMBBL-X
- B. Faceplate
 - 1. Panduit- Mini-Com Faceplates, CFP(2,4,6)SY (single gang), CFP(4,8,10)S-2GY (double gang)
 - 2. Modular Blank Insert, Panduit CMBIG-X
 - 3. Coordinate finish with Architect prior to submittals
- C. Black Loom
 - 1. Panduit loom CLT100F/CLT150F (choose size appropriate for cable installation quantity)
 - 2. Thomas & Betts black liquid tight EFC150
- D. Duplex In-Line Jack frame, one to four jacks (only where required, NOT standard installation)
 - 1. Panduit Mini-Com 106 Duplex Module Frame, # CF1064IWY or approved equal.

PART 3 - EXECUTION

3.1 CABLING RUN LENGTHS

- A. The distance limitation for in-wall cabling shall be carefully reviewed and calculated to ensure it does not exceed 275 feet.
- B. The contractor shall field verify the performance, including cable length, of the proposed installation by conducting a mockup using the specified cabling, jacks, raceway, and test equipment before proceeding with the full installation.
 - 1. Locate proposed cable pathway drawing for the upcoming cable run.
 - 2. Contractor to install One (1) typical copper work area outlet complete with jacks at both ends.
 - 3. Use the proposed pathway and cabling to the furthest location from the TR.
 - 4. Install a cable simulating the cable length of the Plug Pack configuration.
 - 5. The cabling contractor is to perform testing of these cables patched together to determine the true length of this mockup.
 - 6. Test Results are to be inspected and reviewed by the University's Representative prior to proceeding with the rest of the installation.
 - 7. Any deficiencies in the installation of the mockup are to be corrected by the Contractor and re-inspected by the University's Representative prior to proceeding with the rest of the installation.

3.2 TELECOMMUNICATIONS OUTLET EXECUTION

- A. All data and voice station cable shall be terminated at the individual receptacle modules in accordance with ANSI/TIA-568-C, assignment T568B.
- B. Typical Work Area Outlet
 - 1. Provide 2ea. CAT-6A modular jacks terminated 568-B in a 4-port stainless steel faceplate, labeled per Section 27 05 53 Identification and labeling of Communications Systems.
 - a. Provide blanks in unused faceplate ports.
- C. Monitor Location
 - 1. Provide 2ea. CAT-6A modular jacks terminated 568-B in a 4-port stainless steel faceplate, labeled per Section 27 05 53 Identification and labeling of Communications Systems.
 - a. Provide blanks in unused faceplate ports.
 - 2. Coordinate outlet height with power and monitor mount.
- D. Wireless Access Point (WAP)
 - 1. Provide 2ea. CAT-6A modular jacks terminated 568-B in a 5" square x 2-7/8" deep j-box, finished with a double gang mud ring, labeled per Section 27 05 53 Identification and labeling of Communications Systems.
- E. Timeclock Outlet
 - 1. Provide 1ea. CAT-6A modular jack terminated 568-B in a 2-port stainless steel faceplate, labeled per Section 27 05 53 Identification and labeling of Communications Systems.

- a. Provide blanks in unused faceplate ports.

F. IP Camera Outlet

1. Provide 1ea. CAT-6A modular jack terminated 568-B in a 5" square x 2-7/8" deep j-box, finished with a double gang mud ring, labeled per Section 27 05 53 Identification and labeling of Communications Systems.

G. BMS / Equipment Service Panel / Controls D-marc

1. A typical equipment service panel outlet shall consist of two Category-6A Data cables, unless otherwise indicated.
2. When the equipment service panel is located in the TR, cables shall be terminated on CAT-6A modular jacks terminated 568-B in a 2-port surface mount box located within the panel.
3. In rooms other than the TR, provide a minimum 1-1/4" conduit from the nearest cable pathway to a 8" x 6" x 4" junction box with a hinged door (Hoffman AHE8X6X4, OR EQUAL). Cables shall be terminated on CAT-6A modular jacks terminated 568-B in an appropriately sized surface mount box inside of the junction box. Provide a 1" conduit from the 8" x 6" x 4" junction box for a patch cable to the equipment Network Interface Card. A separate 1" pathway shall be provided for each piece of networked equipment within the room.
4. Provide the patch cable on the equipment side of all BMS / Equipment Service Panel / Controls D-marc.
5. Provide blanks in unused faceplate ports.

H. Modular Furniture Work Area Outlet

1. Provide 2ea. CAT-6A modular jacks terminated 568-B in a 4-port furniture faceplate, labeled per Section 27 05 53 Identification and labeling of Communications Systems.
 - a. Provide blanks in unused faceplate ports.

3.3 COPPER CABLING DATA VOICE/DISTRIBUTION

A. Maintain the following clearances from EMI sources (Per BICSI Standards)

1. Power cable – 6 in.
2. Fluorescent Lights - 12 in.
3. Transformers- 48 in.

B. Monitor cable length limitations.

1. All cable installations shall be continuous, un-spliced runs
2. All wiring above ceilings shall be installed in cable tray or cable hangers.
3. Cable in accessible ceilings shall be supported 5' on center (min) attached to building structure.
4. Cable shall have no physical defects such as cuts, tears or bulges in the outer jacket.
5. Cables jackets that are chaffed or burned exposing internal conductor insulation or have any bare copper ("shiners") shall be replaced.
6. Limit cable bends to a minimum radius of 4 times cable diameter except where otherwise noted herein.
7. Refrain from exceeding fill ratio on horizontal cabling installations

8. Do not put large sweeps or service loops in vertical wire managers.
9. Provide slack, which is to be no less than 2.5" and no greater than 5.0", in the station cable at the station outlet end. The Work Area Outlet shall provide enough slack to be serviceable without excess.
10. Service loop at outlet locations: Provide a (10') Ten Foot Slack Loop for all horizontal cabling, supported on J-hook with wire above all drop locations.

3.4 HORIZONTAL COPPER TESTING

- A. UCDH IT shall be notified a minimum of 3 working days in advance of horizontal cable testing. A Pre-test inspection shall be scheduled between UCDH IT and the low voltage installation contractor to approve the test equipment and set-up.
 1. Tests shall be performed using Level-IIIe test equipment capable of certification of to 500MHz.
 2. All test equipment shall have been calibrated within 1 year of the test date.
 3. All horizontal copper cables shall be certified as a Permanent link. Permanent link adaptors shall be serviceable and in working order.
 4. Horizontal cable shall be tested using the manufacturer specific test profile for General Cable CAT-6A #7158155 or #7141007 from the test equipment library.
 5. Cable test results shall be saved using UCDH horizontal cable labeling convention per contractor provided shop drawings.
 6. Failed test results (FAIL) shall not be accepted by UCDH IT.
 7. Marginal test result (*PASS) shall not be accepted by UCDH IT.
 8. Re-certified test results (RC) shall not be accepted by UCDH IT.
 9. Test results shall be submitted to UCDH IT in native test platform software format.
 10. Test results shall be submitted to Panduit for warranty.

3.5 PERFORMANCE STANDARDS

- A. Horizontal (Station) category 6A Copper cabling - Permanent Link
 1. In accordance with the field test specifications defined in TIA-568-C.2 "Commercial Balanced Twisted-Pair Telecommunications Cabling and Components Standard", every horizontal station cabling link in the project shall be tested for:
 - a. Wire Map Length Insertion Loss NEXT Loss
 - b. PS NEXT Loss
 - c. ACR-F Loss
 - d. PS ACR-F Loss
 - e. Return Loss
 - f. Propagation Delay
 - g. Delay Skew
- B. Using the listed category 6A cable test set, test installed cabling using Permanent Link procedure and submit report demonstrating that the link meets the following:
 1. Each permanent link shall demonstrate a positive PSACR beyond 350 MHz to meet and exceed the bandwidth requirements of TIA-568-C.2 Category 6A standards.

2. Report whether tested link passes or fails.
3. Test and report on each intermediate cabling segment separately, including station cabling, horizontal distribution (each segment, if multiple) and telecommunications room wiring.
4. Test each end-to-end cable link
5. Submit machine-generated documentation and raw data of all test results on Contractor provided, and University's Representative approved, forms; and in electronic format approved by the University's Representative.
6. Test stations wire only after all pairs of station wire in a work area have been terminated at both ends, and no work of this Section or other Sections may cause physical disturbance to the wiring.
7. Correct any and all transpositions found. Retest.
8. If any conductor in a station wire tests either open or short, then the entire station wire is to be removed, replaced, and re-tested.
9. Data found to be altered from the manufacturers recommended settings may result in retention by the University of a 3rd Party Test Company to retest the installed cabling at the expense of the Contractor.
10. Events exceeding industry standards will cause the test result to be rejected. Direct review by UCD IT will be required to allow for an exception of a test result.
11. Data found to be incomplete may result in retention by the University of a 3rd Party Test Company to retest the installed cabling at the expense of the Contractor.
12. Contractor shall submit (1) copy of software capable of viewing the electronic test result files. Testing Results shall be reviewed and verified by the University before payments are remitted.

C. Test Equipment

1. The Contractor shall provide all test equipment as required to perform the scope of work.
2. Test the communication systems cabling using at least one (1) each of the following test measurement devices or their functional equivalents:
3. Level IIIe field testers as defined in TIA-1152-A. Test equipment shall have been calibrated within 1 year of test date.
4. The tester including the appropriate interface adapter must meet the specified accuracy requirements.
5. The accuracy requirements for the permanent link test configuration (baseline accuracy plus adapter contribution) are specified in TIA-1152-A.
6. The RJ45 test plug shall fall within the values specified in TIA-568-C Annex C for NEXT, FEXT and Return Loss.
7. The tester interface adapters must be of high quality and the cable shall not show any twisting or kinking resulting from coiling and storing of the tester interface adapters.
8. To deliver optimum accuracy, permanent link interface adapters for the tester shall be used.
9. Manufacturer: Fluke Versive Mainframe with DSX-8000 CableAnalyzer modules, or equal.

END OF SECTION

SECTION 27 41 16 - INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Audiovisual systems – presentation systems, conference systems, distributed audio systems distributed video systems, control systems, and interface with other systems. Refer to article 1.4 “System Description” for more information.
- B. Base Bid Work
 - 1. Provide equipment and materials, whether specifically mentioned herein or not, needed for a complete and operating audiovisual systems to satisfy the requirements of this section and related drawings. This specification lists major equipment but not every wire, connector, extender, converter, fastener, etc., needed to complete the work.
 - 2. Refer to responsibility matrix for scope delineation.
 - 3. Equipment Racks:
 - a. Floor-standing racks: Provide floor-standing equipment racks as shown on the drawings, including frame, side panels, top panels, and front and back doors, anchorage and seismic bracing as required.
 - b. Pedestal Racks: Provide pedestal-type equipment racks as shown on the drawings, including anchorage and seismic bracing as required. For floor-standing equipment racks, include side and top panels, and front and back doors, unless otherwise noted. For slide-out equipment racks, include base/slide assembly and rack rail assembly.
 - c. Slide-out Racks: Provide slide-out equipment racks as shown on the drawings, including base/slide assembly, attachment, rack rail assembly, and seismic bracing as required.
 - d. Provide standard or custom rack shelves and mount adapters for equipment installed in equipment racks as needed to properly mount equipment, power supplies, accessories, components, and the like. Provide cable management to properly route and mind wires, cables, and cords.
 - e. Provide power receptacle strips in quantities needed to supply power to the equipment within the rack.
 - f. Within racks greater than 18 RUs, provide one work light in the front and one in the back of each rack.

- g. Provide spare rack mounting screws. Determine based on rack mount units (RUs) – one spare screw per 2 RU installed, minimum.
- h. Provide bonding for racks, cabinets, equipment, equipment support and cable/wire management to an approved grounding point.

4. Cooling Provisions

- a. Provide cooling provisions (means to move heat out of enclosed spaces to prevent temperatures from exceeding equipment manufacturers' specified maximums). Ensure equipment operates within manufacturer's cooling guidelines. Provide only code-compliant cooling provisions (e.g., exhausting from one space to another).
- b. In racks, enclosures, millwork, cabinets, and other spaces where equipment will be installed and prone to heat buildup, provide thermostatically controlled active cooling devices to create adequate airflow through the enclosed space. Examples of active cooling devices include vent fans. At a minimum, ensure airflow by installing active cooling devices or systems such as fans.

- 5. Provide power controllers (such as an IP power strip connected to the network or controllable through the room control system) to devices that cannot inherently be remotely controlled for power cycling. Verify functional operation for specified control operations.
- 6. Provide audio transformers, whether or not explicitly shown on the drawings, with appropriate impedance ratios and power handling capacities as required for the intended function of the System.
- 7. Provide networks and pads, whether or not explicitly shown on the drawings, as required to achieve proper impedance matching and levels. Provide networks and pads that are balanced and constructed from 0.5 watt, 5% resistors, soldered to fixed connection points at each end.
- 8. Labeling: Provide labeling for audiovisual system components. The components include, but are not limited to, the following:
 - a. Equipment racks and equipment enclosures
 - b. Rack-mounted equipment and devices: Provide a label on the back of each piece of equipment. If a serial number (of a given piece of equipment) is not visible in a final installed condition, provide a label on the equipment on a visible location duplicating the serial number.
 - c. Wall-mounted equipment and devices: Provide an equipment label on the back of each piece of equipment. If a serial number (of a given piece of

equipment) is not visible in a final installed condition, provide a label on the equipment on a visible location duplicating the serial number.

- d. Provide an equipment plate for each piece of equipment.
- e. Provide a label for each control that is not inherently labeled, such as those in racks and user spaces.
- f. Wires and cables: Provide a cable label at each end of each piece of wire, cable and cord.
- g. Terminal blocks, patch panels, and other termination apparatus: Provide a label on each termination block, piece of termination apparatus and termination position on patch panels.
- h. Handheld, lavalier, wireless, and other microphones and associated equipment (such as receivers)
- i. User interface devices/plates

9. Coordination Requirements

- a. Coordinate with the construction team at large to ensure that equipment and other system components will be installed properly, and that there will be no compromises due to, among other aspects, spatial conflicts or power service incompatibilities.
- b. Coordinate with the electrical contractor for power requirements and service connection to the System's equipment.
- c. Coordinate with the telecom contractor and other trades/contractors (as needed) placement of cables and wires when sharing pathways (such as cable tray) with other low voltage systems. Do not place cables and wires into pathways provided by others without permission.
- d. Coordinate with the telecom contractor (or Owner) for locations within racks for installing equipment.
- e. Coordinate with the Owner (or Owner's network provider) for network configurations and/or settings required for the System's proper or correct operation.
- f. Coordinate conference system connections to phone system.

C. Related Divisions and Sections: Consult other divisions, determine the extent and character of related work. Coordinate the work of this section with, at least, but not limited to, the following divisions and sections:

- 1. Division 0 (for Bidding Requirements, Contract Forms, and Conditions of Contract) and Division 1 (for General Requirements) – provisions listed or specified therein apply to work under this section.
- 2. Section 270000, "Communications Basic Requirements"

3. Section 270009, "Technology System Demolition"
 4. Division 26, "Electrical Systems"
 5. Division 23, "Heating, Ventilating, and Air Conditioning Systems"
 6. Section 271513, "Communications Horizontal Cabling"
 7. Section 270811, "Communications Twisted Pair Testing"
 8. Section 270821, "Communications Fiber Optic Testing"
- D. Products Furnished but not Installed Under this Section
1. None
- E. Products Installed but not Furnished Under this Section
1. Network patch cords
 2. Computers: in-room, signage players, Epic
 3. Cisco Webex video conferencing equipment
 4. Refer to project-specific procurement plan for additional OFE requirements
- F. Products Specified but not Installed Under this Section
1. None
- G. Products Furnished and Installed Under Another Section
1. Rough-in (device boxes, conduits, and related accessories)
 2. Electrical service (e.g., 120 VAC); refer to division 26
 3. Telecommunication cabling; refer to section 271513
 4. Telecommunication pathways; refer to section 270528
 5. Network switches, with Power over Ethernet (PoE)
 6. Operating Room audiovisual equipment
- H. It is possible that certain portions of the system described herein will be ready for use prior to the completion of the entire scope of this specification. The Owner reserves the right to use substantially completed systems without obligation to the Contractor and without implying final acceptance of the systems or equipment so used.

1.2 REFERENCES

- A. Comply with the References requirements of section 270000.
- B. In addition to the references listed in section 270000, perform work in accordance with applicable requirements of governing codes, rules and regulations including the following minimum standards, whether statutory or not:
 - 1. National Fire Protection Agency (NFPA)
 - a. NFPA 262, “Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces”
 - 2. Underwriters Laboratories (UL)
 - a. UL 969, “Marking and Labeling Systems”
 - b. UL 1419, “Professional Video and Audio Equipment”
 - c. UL 60065, “Audio, Video and Similar Electronic Apparatus – Safety Requirements”
 - 3. AVIXA
 - a. A102.01, “Audio Coverage Uniformity in Listener Areas”
 - b. ANSI/AVIXA D401.01:201X “Standard Guide for AV Systems Design and Coordination Processes”
 - c. V201.01:2018, “Projected Image System Contrast Ratio”
 - d. F501 01, “Cable Labeling for Audiovisual Systems”
 - 4. “Sound Systems Engineering”, 3rd Ed., Davis and Davis
 - 5. Electronic Components Industry Association (ECIA)
 - a. EIA/ECA-310, “Cabinets, Racks, Panels, and Associated Equipment”

1.3 DEFINITIONS

- A. Refer to section 270000 for definitions. The definitions of section 270000 apply to this section.
- B. In addition to those definitions of section 270000 and Division 01, the following terms used in this specification are defined as follows:
 - 1. “ACEG”: alternating current equipment ground (an example of this is a ground bus within an electrical panel)
 - 2. “Approved Grounding Point”: an approved grounding point is one that satisfies the applicable electrical code and provides a low impedance path to earth. Examples include the following though may manifest in different means: a

telecommunications grounding busbar (such as for bonding an equipment rack within a telecom room), the ACEG of the electrical panel serving the equipment requiring bonding to ground (such as for bonding a credenza rack within a conference room), or the ground conductor of a branch circuit (such as for bonding a single piece of equipment).

3. "A/R": Indicates that the quantity of an item is as required to meet the design criteria indicated in the audiovisual drawings and specifications.
4. "A/S": Indicates that the quantity of an item is as shown on the drawings.
5. "Audience Area": the portion of a presentation space intended to be occupied by an audience. An audience area includes the primary seating and standing spaces and may include the adjacent circulation spaces. An audience area generally excludes spaces reserved for presenters.
6. "Custom" indicates systems or components the Contractor fabricates based on these specifications and drawings
7. "EDID": Extended display identification data
8. "HDCP": High-bandwidth digital content protection
9. "HDMI": High-definition multimedia interface
10. "OFE": Owner Furnished Equipment
11. "Or equal" indicates an item that is equal in function and performance to the specified device or system
12. "RU": rack unit, as defined in EIA/ECA-310
13. "Shall" denotes a mandatory requirement
14. "Should" denotes an advisory statement
15. "SPL": sound pressure level
16. "THD": total harmonic distortion
17. "Will" denotes an informative statement
18. "Project": The scope of work defined by this specification and its related drawings
19. "Provide": Procurement, delivery, installation, configuration, testing, commissioning, and training of the particular item, equipment, task, or scope of work used in conjunction with the term "provide".

20. “Software”: Any executable programs, parameter files, user interfaces, or other coded content that are required to operate, control, or maintain the audiovisual systems in this Project
21. “Custom Created Software”: Any software, parameter files, user interfaces, or other coded content created for the control or operation of the audiovisual systems in this Project
22. “Third-party software:” Any programming developed by a party other than the AV Contractor and the Owner to be used to operate, control, or maintain the audiovisual systems in this Project
23. “System”: The audiovisual components, cabling, and programming incorporated in the descriptions and equipment lists herein

1.4 SYSTEM DESCRIPTION AND PERFORMANCE REQUIREMENTS

A. General

1. In circumstances where the specifications and drawings conflict, the drawings govern quantity and the specifications govern quality.
2. The contract drawings and specifications convey design intent. They are not intended to be used in lieu of shop drawings.

B. ADA Compliance: Provide the following:

1. Display of closed captioning content
2. Accessible control systems
3. Assistive listening systems

C. Audio System Performance Criteria

1. Provide echo cancellation for microphones in audio and video conferencing systems.
2. Frequency Response:
 - a. Program audio system: 100 Hz to 12,000 Hz. 3 dB per octave roll off below 100Hz and above 12 kHz.
 - b. Distributed audio system: 125 Hz to 10,000 Hz. 3 dB per octave roll-off below 125 Hz and above 10 kHz.
3. Total Acoustical Harmonic Distortion:

- a. Audio system: 1% maximum from 30 Hz to 15 kHz at four feet (1,220 mm) above finished floor in the middle of the room.
- 4. Signal to noise ratio (mixer input to amplifier output), including crosstalk: 55 dB minimum.
- 5. Frequency response with equalizers bypassed: less than ± 1 dB from 20 Hz to 20 kHz.
- 6. Distortion: less than 0.5% at 1 kHz at the equipment's rated input signal level.
- 7. Output levels (in audience areas without objectionable distortion, rattles, or buzzes, employing as test signals several different samples of recorded music and microphones applied at each system input):
 - a. Program audio: not less than 95 dB in the seating area without objectionable distortion, rattle, or buzz. Employ several different samples, such as recorded music and microphones as test signals.
 - b. Speech reinforcement: not less than 85 dB
- 8. Hum and Noise: inaudible (below the background noise level of the space) under normal operation observed in audience areas.
- D. Video Signals
 - 1. Signal-to-noise Ratio (peak to RMS) un-weighted DC to 4.2 MHz: 55 dB minimum
 - 2. Cross talk: Cross talk (un-weighted DC to 4.2 MHz): 45 dB minimum
 - 3. Frequency Response: ± 0.5 dB to 4.2 MHz
 - 4. Line and Field Tilt: 2% minimum
 - 5. Differential Gain: 3% maximum
 - 6. Differential Phase: 2-degree maximum
- E. Video Timing:
 - 1. System Timing: Synchronize coincidence within 50 nanoseconds
 - 2. Color Timing: Within 2 degrees at 3.58 MHz
- F. Video System Resolutions
 - 1. System component minimum resolution: capability of 3840 X 2160.
 - 2. Supported resolutions: 1,280 x 720, 1,920 x 1,080, 1,920 x 1,200, 3840 X 2160, and 4096 x 2160.

G. Control Systems

1. Provide user interfaces, such as control panels, that respect ergonomics and varying levels of technical ability among users. Follow these guidelines:
 - a. Avoid abbreviations
 - b. Size lettering at 1/8" minimum
 - c. Maintain background to lettering contrast
 - d. Correct functional operation for all specified controls
 - e. Positive logic: Avoid conditions which may cause command synchronization conflicts (i.e., alternate action (toggling) on/off without power reset or feedback. Provide power sensors or other devices where necessary to ensure that positive logic conditions are maintained.
 - f. Timing: Prevent two or more commands being sent simultaneously to the same piece of equipment.
 - g. Linking: Provide linking of functions to require the fewest number of user actions to effectively control the equipment.
 - h. Clearing: Ensure that each media selection clears the previous audio and visual selection (e.g., selecting COMPUTER clears the audio and video section of the previous Blu-ray disk selection).
 - i. Defaults: Establish default power-up conditions for the system including device audio levels, warmup routine, power conditions, switcher status and other default conditions as required by the Owner or the Owner's representative.
 - j. Volume Memory: Provide easy-to-use memory for volume settings associated with each source device. Unless directed otherwise in this document, provide programming that maintains these settings between alternate selections during each use – through power-on and power-off.
 - k. Status indication: Program buttons for both touch panels and pushbutton panels to provide clear status indication using illumination when back-lighting is available or by changing color.
 - l. Failsafe: Provide program that ensures that no operation or sequence of operations causes the control system to become inoperable or interferes with further processing, correct operations or execution of commands.
 - m. Wireless systems neither shall be the source of, nor be affected by, radio-frequency interference to and from any external signal devices.

1.5 ROOM TYPES

A. General

1. Where possible, all proposed audiovisual design elements for room-based audiovisual systems shall conform to standard room types.

2. Each room to receive audiovisual systems is shown on the drawings with a type designation.
 3. For each room, adapt the audiovisual system to best suit the architectural layout such that each room of a certain type is similar to others of its type, with minor layout differences to accommodate architecture.
 4. Refer to drawings for room types included in each phase.
 5. Refer to the drawings for the quantities of each type of room and for specific audiovisual interface information per room.
 6. Refer to responsibility matrix for scope delineation.
- B. Large Conference Room example (design elements may vary per project)
1. Provide wall-mounted displays
 2. Provide an integrated audio system with DSP, amplifier, ceiling-mounted microphones, and loudspeakers
 3. Provide infrastructure to support a portable ADA-compliant assistive listening system including a female-to-female 3.5mm coupler.
 - a. Refer to section 3.3/P for installation instructions
 4. Provide a table input for laptop content including the following components:
 - a. A table box with HDMI and power. Route the cables under the table to the retractors. Dress cables in a manner that conceals them, protects them from knees and legs under the table, and are accessible for servicing. If no cable management accessories or system is provided by furniture, provide a cable management solution.
 5. Provide a videoconferencing system including the following:
 - a. Camera mounted above the designated display(s)
 - b. Codec locally mounted behind the display(s)
 - c. Wall-mounted or tabletop control panel
 - d. Wireless presentation capability
 6. Provide an HDMI distribution system consisting of a switcher, transmitters, and receivers
 - a. Any proposed digital video distribution via AV-over-IP solutions must be approved by UCDH IT prior to implementation, whether employed in isolation or within an enterprise network segment (e.g., VLAN or VRF).
 7. Provide scheduling panel(s) outside the room, connected to the network

8. Stage AV equipment locally within a dedicated AV rack or ventilated cabinet enclosure

C. Medium Conference Room example (design elements may vary per project)

1. Provide a wall-mounted display
2. Provide an integrated audio system with DSP, amplifier, ceiling-mounted microphones, and loudspeakers
3. Provide infrastructure to support a portable ADA-compliant assistive listening system including a female-to-female 3.5mm coupler.
 - a. Refer to section 3.3/P for installation instructions.
4. Provide a table input for laptop content including the following components:
 - a. A table box with HDMI and power. Route the cables under the table to the retractors. Dress cables in a manner that conceals them, protects them from knees and legs under the table, and are accessible for servicing. If no cable management accessories or system is provided by furniture, provide a cable management solution.
5. Provide a videoconferencing system including the following:
 - a. Camera mounted above the designated display(s)
 - b. Codec locally mounted behind the display(s)
 - c. Wall-mounted or tabletop control panel
 - d. Wireless presentation capability
6. Provide an HDMI extension system between the table and the videoconferencing codec.
7. Provide scheduling panel outside the room, connected to the network
8. Stage AV equipment locally within cabinet or credenza

D. Small Conference Room example (design elements may vary per project)

1. Provide an all-in-one video conferencing solution. This may consist of an integrated touch screen collaboration device, or a wall-mounted display connected to a soundbar-style video conferencing system with wireless presentation capability
2. Provide a tabletop control panel

3. Provide infrastructure to support a portable ADA-compliant assistive listening system including a female-to-female 3.5mm coupler.
 - a. Refer to section 3.3/P for installation instructions.
5. Provide a scheduling display outside the room, connected to the network.
- E. Huddle Room example (design elements may vary per project)
 1. Provide wall-mounted display for basic use-cases (presentation only)
- F. Consult Room example (design elements may vary per project)
 1. Install wall-mounted display.
 2. Install Owner-furnished computer behind display.
- G. Training Room example (design elements may vary per project)

ADD TRAINING ROOM DESCRIPTION AND SUMMARY

- H. Displays – Digital Signage Installations and Waiting Room TVs
 1. Provide displays for marketing, wayfinding, and digital signage.
 2. Displays may be in portrait or landscape. Confirm final orientation prior to shop drawing creation.
 3. Displays may require touch capabilities. Confirm requirement prior to product submittals.
 4. Install an Owner-Furnished player behind each display.
 5. Provide connections to existing CATV system where television service is required.

1.6 SUBMITTALS

- A. Comply with the Submittal requirements of section 270000.
- B. Bid Submittal: Submit bids in accordance with the project's overall bidding requirements, and include the following requirements of this section.
 1. Site visit: As possible, visit the site before submitting your bid. Coordinate site visit arrangements with the General Contractor. Include date of site visit in the bid submittal.

2. Firm information and qualifications: Include detailed information about the firm, including but not limited to the following, in the bid:
 - a. Firm's history – how long the firm has been in business, how long the firm has offered audiovisual systems integration services, etc.
 - b. Annual revenue for the three most current years
 - c. Bonding capacity and bonding insurance agent contact information
 - d. Three successfully completed projects of similar scope within the past 24 months. For each project, include the owner/client name, contact information (person's name, position, and telephone number or email address), project location, type of systems installed, total contract amount, date completed, and services included (e.g., engineering, installation, integration, maintenance, etc.).
 - e. Industry affiliations
 - f. Advanced certifications (CTS-I/D, DMC-D/E, ACE-D/I/P/RMS, XTP, etc.)
 - g. Manufacturer certifications
 - h. Contractor license number for the state where the work will take place
 - i. Union affiliation(s)
3. Personnel and Certifications: Include information on key personnel in the bid.
 - a. Include résumés and certifications for personnel who will be assigned to the project including but not limited to the Project Manager, Systems Engineer, Field Installation Supervisor, Lead Control System Programmer, and other key personnel.
 - b. Include résumé(s) of CTS-I (Certified Technology Specialist – Installation) certified personnel
 - c. Include résumé(s) of DMC-E (DigitalMedia Certified Engineer) certified personnel.
 - d. Include résumé(s) of Q-Sys Level 2 (QSC Certification) certified personnel.
 - e. Include other relevant company-held industry, manufacturer, and educational certifications and designations for involved personnel
4. Subcontract Information: Indicate in the bid, all subcontractors and their responsibilities and qualifications.
5. Schedule of Values: Include a schedule of values in the bid. Break out the schedule of values into three areas – equipment costs, non-equipment costs, and service contract.
 - a. Equipment Costs: List equipment costs (each piece of equipment), including required modifications and accessories.
 - b. Non-equipment Costs: List non-equipment costs, such as the following:
 - 1) General and Administrative: shipping, insurance, and guarantees, etc.

- 2) Fees: e-Waste/disposal, permits, etc.
 - 3) Engineering: design, drawings, run sheets, instruction manuals, etc.
 - 4) Pre-installation: fabrication, modification, assembly, rack wiring, etc.
 - 5) Installation: installation, coordination, supervision, testing, etc.
 - 6) Owner training: training session(s), manuals, etc.
6. Alternates/Substitutions: Refer to section 270000 for alternate and substitution requirements. Submit bids based on the specified equipment. If the bid includes proposed alternates and/or substitutes, separate these from the costs of the equipment as specified and include for alternate equipment full technical information and cut sheets. Proposed alternate equipment will receive consideration if the differences between the specified and alternate/substituted equipment do not depart from the design intent and function of the system and are in the best interests of the Owner. If the inclusion of substituted equipment will result in a different connection configuration than that in the bid documents, include drawings that illustrate how the proposed system would be connected.
 7. System Enhancements: Include in the bid recommendations, if any, that will enhance the performance and/or functionality of the system or will reduce costs without loss of performance/functionality. Recommendations that are of value to the Owner will be taken into consideration in the evaluation of the bids. Make such proposed recommendations as “alternates”, with the appropriate cost modifications shown separate and apart from the costs of the system “as specified”.
 8. Exceptions: In the bid, explain exceptions, if any, to these specifications and related drawings. In the absence of exceptions, these specifications and related drawings are binding in letter and intent.
 9. Guarantee compliance with requirements and regulations in effect on the job site. Explicitly state any such non-compliances or conflicts in the bid submittal. The bidder has the responsibility to investigate potential contract, union, and scheduling issues, and to notify the general contractor of such.
- C. Pre-construction Submittals
1. Last Responsible Moment Product and Design Validation Report
 - a. Due to the length of duration between design and installation, audiovisual equipment models will have changed, and technologies being used will have developed or sunset. Because of these potential changes, prior to the submittals process, the Integrator shall perform a review of current products as compared to what is included in the design documents.

- b. For products which have direct replacements, indicate the direct replacement. A direct replacement is defined to have identical form factors, sizes, dimensions, mounting requirements, weights, control protocols, feature sets, etc.
 - c. For products which do not have direct replacement, provide two closest alternatives giving priority to size, weight, mounting, I/O, network compatibilities, and 24/7 performance.
 - d. For products which will be an older generation and which a newer product or technology will serve the installation better – better defined as: for the same price point, the product is simpler to install, provides the Owner with a better experience, is a more durable product, is simpler to maintain, or is a lower price point.
- 2. Product Data: Prior to purchase and installation, submit as a PDF file information (such as cut sheets, etc.) for equipment, components, products, etc., that will be installed as part of the work of this section.
 - a. Include in the submittal, a Table of Contents, listing equipment, components, products, etc., by room, by system, and/or by other logical designation. A continuous list of all products with no reference to where the products will be installed will be rejected. Incomplete lists will be rejected.
 - b. Indicate (arrow, highlight or other designator) on each product's cut sheet the manufacturer, model/part number, accessories (as applicable), options (as applicable), color (as applicable), and other information to indicate the exact item to be installed. Where this information is not already provided on the cut sheet, manually input this information and a brief description (as applicable).
- 3. Substitutions [refer to section 270000 for substitution requirements]: Submit substitution requests based on the specified equipment and including associated equipment costs separate from the cost of the equipment as specified.
 - a. Proposals for alternate equipment will receive consideration if the differences between the specified and alternate/substituted equipment do not depart from the overall intent of the design and operation of the system and are in the best interests of the Owner.
 - b. Include full technical information and cut sheets for the proposed substitutions.
 - c. If the inclusion of substituted equipment will result in a different connection configuration than that in the bid documents, produce drawings that illustrate how the proposed system would be connected.

4. Shop Drawings [refer to section 270000 for additional shop drawing requirements]: Submit shop drawings prior to installation and in accordance with the Conditions of Contract and Division 1, including the following.
 - a. Functional line diagrams for all systems – clearly tag each item with name, manufacturer, and manufacturer’s model number (e.g., “Program Amplifier LabGruppen LUCIA 60/2M”) and show the terminal number or input/output designation (e.g., “Mic 1-In”, or “Record Out-Left”).
 - b. Provide schematic diagrams of custom circuitry such as receptacle pin numbers and component callouts; show details of custom resistive attenuation and/or combining networks, filters, or pads which may be required in the assembly; show point to point wiring drawings for control system modules and interfaces, and for switches and relays in audio, video, or control systems
 - c. Equipment rack elevations and patch panel assignments – clearly and consistently label rack elevations, patch panels, and on equipment controls.
 - d. Provide pushbutton and handheld remote control panel layouts –tag each button with function and ID matching installed labels
 - e. Factory and custom panels, plates, and designation strips, showing material, finish, color and engraving (exact lettering)
 - f. Custom designed consoles, tables, carts, support bases, and shelves
 - g. Equipment modifications (if any), including details of modifications that change or void manufacturers’ warranties.
 - h. Cable run lists – clearly show at each terminal point the type of connector to be used; include typical wiring details of each connector; note where shields are connected and where they will float to ensure the integrity of the shielding system; indicate cable types and, where appropriate, color codes; assign wire numbers and patch bay locations to every wire and patch point in the drawing
 - i. Wattage tap setting per loudspeaker.
5. User Interface Menu Submittal:
 - a. Provide a PDF per system containing a page for each menu, submenu, and popup in that system’s user interfaces. Include menus that are manually triggered and those that automatically appear as the result of events such as the connection of a source device. Ensure that the PDF is unlocked so that the Engineer may annotate it.
 - b. If the development environment allows, provide an executable menu simulation file or web link for control systems in addition to a PDF-based submittal.

6. Network Coordination: Submit as an Excel file or cloud-based collaborative spreadsheet (such as Google Sheets) a list of equipment that will be connected to the network, including but not limited to the following (e.g., spreadsheet column headers):
 - a. Item number
 - b. Description
 - c. Manufacturer
 - d. Model/part number
 - e. MAC address
 - f. IP address type (DHCP or static)
 - g. Power-over-Ethernet (PoE) requirements (yes or no)
 - h. Specific network and/or subnet configuration requirements
 - i. Specific QOS requirements
 - j. Anticipated network traffic
 7. Samples: Submit sample panels, plates, and designation strips, including details relating to terminology, engraving, finish and color.
 8. Testing Equipment and Procedures:
 - a. Submit a list of test equipment, including manufacturer, model number, and description that will be used for testing and adjustment of the installed systems.
 - b. Submit testing procedures to be performed during pre-functional testing and acceptance testing, including the minimum acceptable outcome for each test.
- D. At the Completion of the Installation
1. Initial Testing and Tuning Report: After completing initial testing and tuning, checkout, settings, as built drawings, and operational documentation, submit written notification to the Owner and Architect that initial checkout is complete. Include in this notification a completed Initial Testing and Tuning Report that satisfies the requirements of Part 3. In the Report, document the results for tests performed during initial testing and tuning. Organize the report per room, per system, and per test. Include the testing tools/equipment, manual and automated tests, testing procedures, and expected result per test. If the test equipment stores test results and has the capability to produce reports, also include these reports.
 2. Wireless Microphone Frequencies: Submit a list of wireless microphone frequencies and associated channels used for each microphone and system.
- E. Closeout Submittals

1. **Acceptance Testing Report:** After completing final acceptance testing, final tuning and settings, submit an Acceptance Testing Report that documents the results for tests performed during final testing and tuning. Organize the report per room, per system, and per test. Include the testing tools/equipment, manual and automated tests, testing procedures, and expected result per test. If the test equipment stores test results and has the capability to produce reports, also include these reports. Include the system's normal settings.
2. **As-built Drawings** [refer to section 270000 for additional as-built drawing requirements]: Submit as built drawings in accordance with the Conditions of Contract and Division 1, including the following.
 - a. System functional line drawings for all systems; clearly tag each item with name, manufacturer, and manufacturer's model number (e.g., "Program Amplifier LabGruppen LUCIA 60/2M") and show the terminal number or input/output designation (e.g., "Mic 1-In", or "Record Out-Left").
 - b. Point-to-point wiring diagrams for switches and relays in audio, video, and control systems; point-to-point wiring diagram for control system modules and interfaces
 - c. Schematic diagrams of custom circuitry such as receptacle pin numbers and component callouts; show details of custom resistive attenuation and/or combining networks, filters, or pads which may be required in the assembly
 - d. Equipment rack elevations and patch panel assignment drawings. Clearly label the rack elevations, patch panels, and equipment controls.
 - e. Cable run lists – clearly show at each terminal point the type of connector to be used; include typical wiring details of each connector; note where shields are connected and where they will float to ensure the integrity of the shielding system; indicate cable types and, where appropriate, color codes; assign wire numbers and patch bay locations to every wire and patch point in the drawing
 - f. Pushbutton and handheld remote-control panel layouts, including tagging each button with function and ID that matches installed labels
 - g. Factory and custom panels, plates, and designation strips, showing material, finish, color and engraving (exact lettering)
 - h. Wattage tap setting per loudspeaker.
3. **System Operation and Maintenance (O&M) Manual:**
 - a. Describe typical procedures necessary to activate each system for full functionality as required under the System Description.

- b. Describe normal settings for equalizer, amplifier, signal processing, and user operated controls (as established during system check out) in tabular or pictorial form.
 - c. Outline a recommended maintenance schedule with reference to the applicable pages in the manufacturer's maintenance manuals. Where inadequate maintenance information is provided by the manufacturer, provide the information necessary for proper maintenance.
 - d. Outline a recommended plan for a normal maintenance period of at least one year, including a list of necessary and recommended replacement parts.
 - e. Assume the reader of this manual to be technically competent, but unfamiliar with this particular facility.
 - f. Submit equipment manufacturer's operation and maintenance manuals for each piece of equipment.
4. Programming/Software:
- a. Submit the project's control system programming and audio processor configuration files – refer to "Software License" below.

1.7 Quality Assurance

- A. Audiovisual Contractor Requirements: Demonstrate that your firm meets or exceeds the following requirements:
- 1. Five years' experience, minimum, with the design, engineering, assembly, installation, start-up and maintenance of audiovisual systems of similar or greater complexity to those identified in this specification
 - 2. Provide the necessary professional design, engineering, fabrication, installation, and project management personnel to execute the work of this section, and to guarantee a complete, functional system in compliance with the design intent
 - 3. Successfully completed in the past 24 months a minimum of three projects of similar scope
 - 4. Current state contracting license, as required to perform the work under this section
 - 5. Bondable to 100% of contract value
 - 6. Be an authorized supplier and installer for equipment listed in this section
 - 7. Maintain permanent fabrication, service and support facilities within 100 miles of the Project site.

- B. Audiovisual Contractor Certifications: Demonstrate that your firm has the following certifications:
 - 1. An InfoComm CTS-I (Certified Technology Specialist-Installation) certified employee to actively manage this project – the Engineer will verify CTS credentials at the InfoComm website.
 - 2. A Crestron DMC-E (DigitalMedia Certified Engineer) certified employee to be actively involved in the design, implementation and commissioning of systems in this project – the Engineer will verify DMCE credentials at the Crestron website.
 - 3. An Extron Control Specialist-certified employee to be actively involved in the design, implementation and commissioning of systems in this project – the Engineer will verify Control Specialist with Extron.
 - 4. A QSC Q-Sys Level 2-certified employee to be actively involved in the design, implementation and commissioning of systems in this project – the Engineer will verify Q-Sys credentials with QSC.
- C. Manufacturer/equipment Supplier Requirements: Demonstrate that your firm meets or exceeds the following:
 - 1. Operate their business for not less than five years
- D. Subcontractor Quality:
 - 1. Specifically identify in the bid submission, for Owner, Architect, or Engineer's approval, all subcontractors that will be used.
 - 2. Regardless of any subcontract arrangement, your firm will have sole responsibility for the successful implementation of the work in this section.

1.8 PROJECT MANAGEMENT AND COORDINATION

- A. Comply with the Project Management requirements of section 270000.
- B. Assign a project manager to this project for the entire duration. They shall oversee the design, submittals, implementation, testing, and close out – the entire process from start to finish. The project manager shall also coordinate this work of this section with other trades.
- C. Report to the Engineer any conditions that would prevent the correct installation of the system as designed.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Delivery, Storage, and Handling requirements of section 270000.

1.10 WARRANTY

- A. Warrant the System for a minimum of one year from the date of system acceptance by the Owner. Honor component warranties per manufacturers' terms if greater than one year.
 - 1. Include service as described in 3.14 "Maintenance and Extended Service" in the warranty.
- B. Activate manufacturers' equipment warranties in the Owner's name. The warranty period shall commence on the date of System Acceptance by the Owner.
 - 1. In the case of contractor-modified equipment (where the manufacturer's warranty could be voided), warrant such equipment equivalent to that of the original manufacturer.
- C. Warrant the Software and version updates – see "Software" below.

1.11 SOFTWARE LICENSE

Revision needed for this section. Change has been requested to reflect full ownership of AV system source code and other AV related software.

PART 2 PRODUCTS

2.1 GENERAL

- A. Comply with the Products requirements in section 270000.
- B. Provide products, equipment and software that are the latest version of the specified model or type available at the time of procurement, providing the updated devices provide the same or better capabilities and performance required by the system design.
- C. Mounts must have OSP documentation where required by regulatory code.

- D. Only where denoted “or equal”, equal products will be considered. The manufacturers, product numbers, and types listed at those instances establish minimum performance.
- E. Substitutions: The Engineer may consider substitutions for certain equipment if the Contractor demonstrates that the substitution meets or exceeds the functional requirements described in the System Description and Performance Standards. Follow the requirements of section 012500 “Substitutions” for substitution requests.

2.2 STANDARD EQUIPMENT

Add equipment tables from standards doc here?

2.3 CABLES AND WIRES

- A. Provide cables and wires that are continuous - without splices.
- B. For CATEGORY-type UTP cabling (cables, termination apparatus and installation requirements), refer to section 271513.
- C. Cable Selection:
 - 1. Refer to functional diagrams for signal type between equipment.
 - 2. Select a cable with the appropriate rating and configuration required by the applicable building code, electrical code, AHJ, and applicable codes and regulations governing the installation.
 - 3. For cables that will be installed in conduit within on-grade concrete, select a cable rated for underground construction.
 - 4. For cables that will be installed outdoors in underground conduit, aerial, and/or corrosive environments, select a cable rated for outdoor construction.
 - 5. For signal extenders, use extender the manufacturer’s recommended cable type. Ensure cabling length does not exceed maximum specified distance limits, per manufacturer recommendation.
- D. Unless otherwise called for in these specifications and drawings, the following cables are approved for the associated application or signal type. Ensure the chosen cable is appropriate for the signal type, available pathway capacity, and run length.

Application	Non-Plenum Product, or equal	Plenum Product, or equal
Ethernet	Refer to section 271513	Refer to section 271513
HDBaseT	Belden 2183R West Penn 4246F Extron XTP DTP 24 Superior Essex 6H-246-xA Windy City Wire CAT6S	Belden 2183P West Penn 254246F Extron XTP DTP 24P Superior Essex 6H-246-xB Windy City Wire CAT6SP
Control cable (AMX AXLink, Crestron Cresnet)	Belden 1502R West Penn 77350, C4215 Liberty LLINX-U Windy City Wire CRESCOM	Belden 1502P West Penn D25350 Liberty LLINX-U-P Windy City Wire CRESCOMP
Microphone and line-level audio cable	Belden 9451 West Penn 454 Liberty 20-2C-SH-GRY Windy City Wire 22-1PREZ-BLK	Belden 9451P West Penn 25291B Liberty 20-2C-PSH-GRY Windy City Wire 22-1PREZP-BLK
Program loudspeaker cable	Belden 5000UE West Penn 227 Liberty 12-2C-GRY Windy City Wire 12-02-GRY	Belden 6000UE West Penn 25227B Liberty 12-2C-P-BLK Windy City Wire 12-02P-BLK
Distributed loudspeaker cable	Belden 5300UE West Penn 224 Liberty 18-2C-GRY Windy City Wire 18-02-BLK	Belden 6300UE West Penn 25224B Liberty 18-2C-P-BLK Windy City Wire 18-02P-BLK
ALS emitter	See Antenna cable (wireless microphone) – 50-ohm, below	
Antenna cable (wireless microphone) – 50-Ohm	West Penn 813 Liberty RG8-CMR-BLK RG8-BLK Or equal by Belden	West Penn 2598G8 Liberty RG8-CMP-BLK RG8P-BLK Or equal by Belden
Antenna cable (wireless microphone) – 75-Ohm	See CATV trunk and drop cables, below	
Analog video coaxial cable, RG59-type	Extron 815 Liberty RG59-CCTV-CM-BLK Windy City Wire RG59-BLK	Extron 25815 Liberty RG59-CCTV-PL-BLK Windy City Wire RG59P-BLK
Serial digital coaxial cable	West Penn 819 Liberty 20-CMR-VIDEO-BLK Windy City Wire RG59HD-BLK	West Penn 25825 Liberty 20-CMP-VID-COAX-BLK Windy City Wire RG59HDP-

		BLK
CATV trunk cable	West Penn 811 Liberty RG11-CATV-BLK Windy City Wire RG11-BLK	West Penn 25821 Liberty RG11-CCTV-PL-WHT Windy City Wire RG11P-BLK
CATV drop cable	West Penn 806 Liberty 18-CMR-SD-BLK Windy City Wire RG6-BLK	West Penn 25841 Liberty 18-CMP-VID-COAX-BLK Windy City Wire RG6P-BLK

2.4 CUSTOM REMOTE-CONTROL PANELS AND INTERFACE PLATES

- A. For custom remote-control panels and interface plates, use 1/8 inch (3mm) thick #6061 T6 aluminum, with a brushed, anodized, black finish (or as approved by the Architect via submittals).

2.5 EQUIPMENT PLATES

- A. For equipment plates, utilize 1/32" to 1/16" thick by 1/4" high aluminum with a brushed anodized black finish.
- B. Provide engraved lettering 1/8" to 3/16" high.

2.6 LABELS

- A. General: Labels shall meet UL 969 product requirements.
- B. Equipment Labels:
 1. Equipment labels shall be machine printable, shall be polyester (or similar) adhesive-back type, and shall be permanent.
 2. Face stock (print area) shall be white.
 3. Size: as needed.
 4. Manufacturer, or equal:
 - a. Brady
 - b. Brother
 - c. DYMO XTL or Rhino
 - d. Panduit

- 1) #C150X075YJJ; component label, laser/inkjet print, white face stock 1.5"W x 0.75"H
 - e. Thomas and Betts
- C. Cable and Wire Labels:
1. Cable and wire labels shall be machine printable, shall be permanent, and shall be either of the following types:
 - a. Tape – machine-printable, wrap-around, self-laminating, permanent adhesive-backed tape
 - b. Machine-printable, shrink-wrapped labels
 2. Face stock (print area) shall be white.
 3. Size: as needed per wire/cable size (approximately 1" wide).
 4. Manufacturer, or equal:
 - a. Brady
 - b. Brother
 - c. DYMO XTL or Rhino
 - d. Panduit
 - 1) #S100X075YAJ; self-laminating cable label, white face stock 1"W, for cable diameters 0.08"-0.16"C150X075YJJ
 - 2) #S100X125YAJ; self-laminating cable label, white face stock 1"W, for cable diameters 0.12"-0.28"
 - 3) #S100X150YAJ; self-laminating cable label, white face stock 1"W, for cable diameters 0.16"-0.32"
 - 4) #S100X225YAJ; self-laminating cable label, white face stock 1"W, for cable diameters 0.24"-0.48"
- D. Loudspeaker Labels:
1. Loudspeaker labels shall be polyester (or similar) adhesive-back type, shall be permanent, and shall be machine printable with a printer.
 2. Face stock (print area) shall be white.
 3. Size: as needed.
 4. Manufacturer, or equal:
 - a. Brady
 - b. Brother
 - c. DYMO XTL or Rhino
 - d. Panduit
 - 1) # C075X050YJJ; component label, laser/inkjet print, white face stock

0.75"W x 0.5"H

2.7 RACK BONDING

- A. Refer to section 270526 for approved bonding products.

PART 3 EXECUTION

3.1 GENERAL

- A. Comply with the Execution requirements of section 270000.
- B. Perform work in accordance with the standards and best practices defined by the AVIXA coursework for Installation 1: System Fabrication and Installation 2: Setup and Verification.
- C. Install products per manufacturers' instructions.
- D. Install panels, equipment, boxes, etc., plumb and square.
- E. Seismic Safety:
 - 1. Mount, anchor and/or brace permanently installed equipment to the building structure using anchors, fastenings, supports, and methods approved by structural engineer with a safety load factor of at least 1.5. Provide installations that meet the most stringent of applicable codes and regulations to minimize potential damage to personnel and equipment from foreseeable seismic events.
 - 2. Brace hanging audiovisual and associated equipment both to minimize sway and to prevent detachment from the overhead structure in accordance with applicable codes.
 - 3. Firmly secure equipment in place unless requirements of portability dictate otherwise.

3.2 EXAMINATION

- A. Prior to starting the work of this section, examine areas to receive system components and pathways to receive cabling to verify conditions are ready for work of this section and to verify conformance with manufacturer and specification tolerances.

1. Verify that pathways, including conduit, junction boxes, cable trays, ceiling enclosures, etc., are in place prior to placing cables into pathways and as required by applicable codes.
 2. Verify that rough-in (including conduit, device boxes, floor boxes, and the like) is ready to receive wiring, cabling, devices, equipment, and the like prior to installing into the rough-in.
 3. Verify that electrical power service is ready and stable prior to connecting equipment.
 4. Check ceiling types, ceiling heights, and clearances above ceilings to ensure conditions are appropriate per manufacturer's installation requirements.
- B. Verify that the network is operational and ready to receive connection from and configuration for the System. "Ready" includes settings on the network required for the System to function properly. Coordinate with the network contractor as needed to ensure the network settings have been adjusted to support full functionality of the System.
- C. Proceed with installation work only after unsatisfactory conditions are corrected.

3.3 INSTALLATION

- A. Pedestal and Credenza-Type Equipment Racks
1. Completely assemble equipment racks. Include parts and accessories, such as electrical power distribution devices, cable dressing accessories, and blank and vent panels, required for a complete result.
 2. Anchoring/bracing: Anchor racks to the floor at four points per approved structural details using anchors and methods approved by a structural engineer.
 3. Bonding/Grounding: Connect the equipment rack frame to an approved ground point using a bonding conductor (12 AWG up to 6 AWG) and approved connectors. (Here, an approved ground point may be the ground of the branch circuit serving the rack or an approved conductor to the ground bus of the electrical panel serving the rack.)
 4. Cooling provisions: Coordinate cooling provisions (means to prevent equipment from overheating) within rack/credenza/etc., such as inlet and exhaust openings, exhaust fans, etc. All installed equipment must be capable of working continuously with the enclosure closed normally while staying within

manufacturers' operating temperature specifications. Acceptance testing will include temperature verification.

B. Slide-out Equipment Racks

1. Coordinate installation with millwork, casework, and other trades. Ensure that the construction that will receive the rack is properly prepared (framed, finished, braced, backed, etc.).
2. Completely assemble slide-out equipment racks. Include parts and accessories, such as electrical power distribution devices, cable dressing accessories, and blank and vent panels, required for a complete result.
3. Attach racks to receiving surfaces (such as millwork) using fasteners approved for the application.
4. Where power strips are required, install them onto the back-side of the slide-out rack's base.
5. Bonding/Grounding
 - a. Connect the equipment rack frame to an approved ground point using approved connectors and 12 AWG (or larger up to 6 AWG) bonding conductor. (Here, an approved ground point may be the ground of the branch circuit serving the rack.)
6. Cooling Provisions
 - a. Coordinate cooling provisions (means to prevent equipment from overheating) within millwork/casework/cabinets, such as inlet holes/openings, exhaust fan openings, power service, etc. At a minimum, ensure airflow by installing active cooling devices or systems such as fans.
 - b. Adapt cooling provisions to suit the configuration of each instance.

C. Displays and Mounts

1. Wall-Mounted Displays: Install mounts using fasteners approved for the mounting substrate. For framed walls, firmly engage fasteners into backing or, if no backing is present, into framing studs.
2. Ceiling-Mounted Displays: Install mounts to structure using fasteners and mounting accessories approved for the mount and mounting substrate. Install seismic restraints as appropriate for the installation location. Conceal cabling within mounting columns where feasible.

3. Securely install displays onto mounts. Complete final connections (power, signal, control, etc.).
4. Install accessories onto mounts or displays using approved attachment methods that guarantee the longevity of the installation. Accessories may be attached mechanically, if allowed by the display/mount manufacturer, or by using 3M TB3571/3572 hook and loop fastener tape or an approved equal.
5. Dress cables; ensure they are maximally concealed yet serviceable.
6. Adjust each display and mount to attain a true, square, and level installed result.

D. Ceiling Microphones

1. Review field conditions, and coordinate with the Architect or Engineer to resolve conflicts with other trades' devices conflicting with microphone locations.
2. Route analog microphone cabling away from other cabling types. Where this cabling must cross other cabling types, install it at a 90° angle.
3. Install microphone preamplifiers, conversion devices, and other back boxes using safety wires attached to the building structure.
4. Prior to acceptance testing, confirm microphones do not produce audible buzz and/or noise.

E. Table Microphones

1. Review table drawings, and coordinate with the Architect and Engineer to resolve conflicts with other tabletop or through-table devices conflicting with microphone locations.
2. Coordinate microphone locations and installation activities with the Architect and Engineer prior to installing through-tabletop microphones and microphone receptacles.
3. Route analog microphone cabling separated from other cabling types to prevent signal interference. Where this cabling must cross other cabling types, cross it at a 90° angle.
4. Install microphone preamplifiers and other microphone-related conversion devices neatly, square to the table, and as hidden from view as possible. Coordinate the locations of these devices with the Architect and Engineer.
5. Label and dress all cables neatly and with approved cable management products.

6. Prior to acceptance testing, confirm microphones produce no audible buzz and/or noise.

F. Antennas

1. Use antennas designed specifically for the frequency bands they will carry.
2. For antennas extended from the attached equipment, use cabling appropriate for the frequency and distance.
3. Use extender devices (preamplifiers) and distribution amplifiers per cabling lengths and manufacturers' recommendations.
4. Install cabling per manufacturers' bend radius guidelines.
5. Locate and orient antennas to ensure coverage throughout the room(s). Verify this by walk-testing systems.

G. Loudspeaker Tap Settings

1. Where loudspeaker tap wattages are specified in the design documents, set transformers per these. Otherwise, set taps per best practices.
2. Set taps such that the total wattage of a series of loudspeakers will not exceed 75 percent of the associated amplifier's rated wattage.
3. Record tap settings per loudspeaker for inclusion on the as-built drawings.

H. Loudspeakers, Acoustical Tile, Ceiling-Mounted

1. Coordinate ceiling tile work (such as cutting holes) with the ceiling contractor.
2. Unless directed otherwise, center ceiling loudspeakers to ceiling tiles and evenly space loudspeakers.
3. Cut ceiling tiles to fit loudspeaker such that no gaps are visible after the loudspeaker cover/grille is installed.
4. Install ceiling loudspeakers with safety wires attached to the building structure per applicable codes and best practices.
5. Use tile rails and other support components to ensure loudspeakers do not sag.
6. Where manufacturer labels are visible on loudspeaker grills and are rotatable, align these consistently.
7. Replace ceiling tiles damaged during loudspeaker installation work.

I. Room Scheduling Displays

1. Coordinate with the general contractor and specialty contractors to conceal cabling in glazing system frame members.
2. Mount devices as directed by the manufacturer.
3. For consumer tablets, such as iPads, provide specified mounting frames.
4. Mount any specified Ethernet/USB power extractors per code and conceal them.
5. Conceal the tablet power cable. If necessary to conceal connection points at tablets, use cables with right-angle connectors.
6. Provide service loops to allow displays to be removed prior to disconnection.

J. Digital Signage

1. Make digital signage accessible and controllable via the network and via web access.
2. Coordinate with the Owner to determine configuration and/or initialization files are required by players/receivers to be managed by the Owner's local or cloud-hosted management platform.
3. Coordinate with the Owner's Representative to ensure a successful implementation of this requirement.

K. Cabling and Wiring at Racks

1. Do not use electrical tape for bonding, splicing, joining, or any other purpose.
2. As a general practice, run power cables, control cables, and other cables with higher voltage levels on the left side of an equipment rack as viewed from the back; run other cables with lower voltage levels on the opposite side. Where wiring issues or wire routing facilities preclude this configuration, it is acceptable to deviate from the directions above, if separation is maintained between signal and electrical power cables.
3. To reduce signal contamination, group cables per the signals being carried. Maintain appropriate distances between cable groups, especially between high-current (power; loudspeaker) and low current (microphone) groups. Form separate groups for the following cables/signal types:
 - a. Power
 - b. Control
 - c. Analog video
 - d. Digital audio and video
 - e. Analog microphone audio

- f. Analog line audio
 - g. Loudspeaker audio
 - h. Radio frequency
- 4. Within racks, install wires and cables with service loops. Provide sufficient cable to allow each piece of equipment to be removed from the front of the rack for servicing.
- 5. At boxes or points of termination, install wires and cables with service loops. Provide sufficient cable to allow each piece of equipment to be removed and laid flat on a surface for servicing.
- 6. At slide-out equipment racks, dress cables to allow racks to be extended to the maximum length of the rack slides. For slide-out rotating racks, provide sufficient cable to allow full extension and rotation.
- 7. For cables that interface with racks, cabinets, consoles, or equipment modules, use screw-type terminal blocks, terminal strips, or connectors. Telephone-style punch-down blocks (e.g., 110 blocks) are not acceptable.
- 8. Do not bend any cable or wire tighter than the manufacturer's minimum bend radius.
- 9. Install wires and cables such that the cable exerts no strain on its termination.
- 10. Label wires and cables, regardless of length, using a cable label with a unique number or letter per the instructions below under "Labeling".
- 11. Cable Shield Bonding: For cables with shields, connect them using approved connectors per an approved grounding topology.
- 12. Encase umbilicals (groups of bundled cables) connecting moveable racks and cabinets to walls and other fixed locations in braided sleeving. Where racks and cabinets are installed in view of nontechnical people, coordinate sleeving colors with the Architect.
- L. Cabling and Wiring – Overhead Distribution
 - 1. Use cabling appropriate to loudspeaker impedance, cabling distance, and installation conditions (such as plenum versus non-plenum).
 - 2. The use of electrical tape for bonding, splicing, joining, or any other purpose is prohibited.
 - 3. Provide cable runs between termination points that are continuous, with sheath continuity. Splices are not permitted anywhere.

4. Place cables within designated pathways, such as cable tray, cable hangers, etc. Do not fasten cables to other building infrastructure (such as ducts, pipes, etc.), other systems (such as ceiling support wires, wall studs, etc.), or to the outside of conduits, cable trays, or other non-approved pathway systems.
5. Protect cables from physical interference and damage during installation and termination. Install cables with no kinks or twists.
6. Install HDBaseT cables within manufacturers' length recommendations.
7. Comply with manufacturers' limits for pulling tension.
8. Do not use cable-pulling compounds for indoor installations.
9. Install cables within manufacturers' bend radius limits. If no minimum bend radius is given, then maintain a minimum bend radius of six times the cable diameter during and after installation.
10. Route cables under building infrastructure (such as ducts, pipes, conduits, etc.); do not route cables over building infrastructure. Install cables to provide accessibility for future service.
11. Place cables 6", minimum, away from power sources to reduce interference from EMI.
12. Connectors: Use the following connectors:

CHECK TABLE CONTENTS FOR CONSISTENCY ACROSS PROJECTS

Add Eric's preferred connector options

- M. Terminations and Cords at Floor Boxes
1. Provide strain relief for cables. Use appropriate cable management products (such as hook and loop straps for UTP and STP cabling, and nylon cable ties for other cables) to group similar cable types.
 2. Provide permanent labels on cables within 6" of terminations.
 3. Provide permanent labels on receptacles within floor boxes to clearly identify terminations and services.
 4. Encase umbilicals connecting moveable racks, cabinets, etc., to floor boxes in braided sleeving. Where racks and cabinets are installed in view of non-technical people, coordinate sleeving colors with the Architect.

- N. Blank Panels: Provide blank trim plates in floor, wall and furniture-mounted boxes at unused termination positions. Fill each module opening filled, either with a receptacle, a receptacle plate, or a module of the type the opening is intended to house.
- O. Patch Panels
 - 1. Assignments: Wire patch panels so that signal sources appear on the upper row of a row pair; and destinations appear on the lower row of a row pair. Submit variations from this approach per the requirements in Submittals.
 - 2. Designation strips: Utilize alphanumeric identifications and descriptive information on audio and video patch panel designation strips. Number the jack positions in each row sequentially from left to right. Letter the jack rows sequentially from top to bottom. Include the alphanumeric identification of each jack on the functional block drawings. Mount reproductions of these drawings in an appropriate location near the patch bays.
- P. Portable Assistive Listening
 - 1. Provide six feet of audio cable from DSP or videoconferencing device for transmitter.
 - 2. Neatly coil the cable behind the audience-facing left side of the display so the cable is not visible.

3.4 EDID MANAGEMENT

- A. For each system, determine the maximum pixel resolution, frame rate, and color depth supported by all content displays, and designate this as the target resolution for the system. Omit digital signage displays from this process.
 - 1. Scalers: Configure video scalers as follows:
 - a. Input: Emulate the EDID configuration of the native resolution of the connected display or projector for both analog and digital inputs.
 - b. Output: Configure to match the native resolution of the display system and at the highest supported scan rate.
- B. Determine the system's maximum audio parameters – output channel count, LFE capabilities, etc.
- C. Configure the system's EDID management to ensure that these audio and video parameters are sent to source devices.

3.5 HDCP MANAGEMENT

- A. Include HDCP support in all equipment that incorporates copy protection for the transport of copyrighted media.
 - 1. Installation Requirements
 - a. Equipment capable of passing HDCP included in this project must support the same HDCP version (i.e. HDCP 1.4 or HDCP 2.2).
 - 2. Exceptions
 - a. HDCP may be defeated for educational institution projects per 'fair use' copyright terms.

3.6 NETWORK SECURITY

- A. Leave no network-connected device operating with its factory-default password.
- B. Obtain Owner-defined password changes for all network-connected devices. Program these passwords into the devices.
- C. Where available, enable two-factor authentication.

3.7 PROGRAMMING AND EQUIPMENT CONFIGURATION

- A. General Programming
 - 1. Install the most current version of manufacturers' firmware on devices.
- B. Audio Processor Programming
 - 1. The following instructions apply to all systems including programmable audio processors and microphones.
 - 2. Set input devices (wireless microphones, ceiling microphones, video device audio, etc.) to unity gain.
 - 3. Set output devices to unity gain.
 - 4. Set amplifiers to maximum gain.
 - 5. Set gains from microphones on analog and Dante/AES67 input blocks in audio processors to achieve input gains on meters around -15 to -20dBFS.

6. Set gains on analog and Dante/AES67 output components in audio processors to achieve required output gain from the loudspeakers.
 7. Adjust gating auto-mixer settings so that room participants can be heard clearly with minimal room noise and echo, with no noticeable delay nor cutoff words when talkers begin to speak, and with minimal breathing and other artifacts after talkers stop speaking.
 8. Adjust AEC settings so that no echo can be heard by far-end callers.
 9. Balance program levels between HDMI program audio and USB bridge program audio to within 3 dB.
 10. Coordinate AEC among all processing devices and software in the system so that only one processor in the audio chain, whether physical, such as a hardware DSP, or virtual, such as a software processor in collaboration software, has AEC enabled.
 11. Make equalization and other room tuning adjustments to obtain the flattest and least colored result the system is capable of.
 12. Make additional equalization and other room tuning adjustments to eliminate feedback when the microphones are at maximum system gain. Do not use feedback suppression components.
- C. Control System and Touch Panels
1. Owner's Requirements
 - a. Meet with the Owner and document their functional and user interface requirements (backgrounds, color scheme, screens, menus, functions, etc.).
 - b. Develop programming and user interfaces based on the user requirements.
 - c. Submit touch panel layouts and menu flow documentation to the Owner and Engineer per submittal schedule.
 - d. Meet with the Owner and Engineer and present the control system programming and user interfaces. Obtain the Owner's approval on these items.
 2. Programming Guidelines
 - a. Create initial screens (splash screens) that use a version of the Owner's logo, generated without visible scaling artifacts.
 - b. Only use red for alarm indicators and other screen elements of special significance.

- c. Avoid use of technical terms, rather, use clear, everyday language. For example, instead of “System On”, use “Turn System On”; instead of “Power Down”, use “Turn Power Off”, etc.
 - d. Ensure soft buttons are sized consistently and spaced evenly.
 - e. Ensure spelling, punctuation, and grammar are 100% correct.
 - f. Provide menus on both touch panels and control system web pages that appear and function consistently throughout the project.
 - g. Ensure items with similar functions appear consistently in all menus.
 - h. Provide soft button presses that display visual feedback, and if required by the Owner, audible feedback.
 - 3. Tech Menu: Provide a “tech” (Technician-level) menu for each touch panel. Include in tech menus:
 - a. Volume control for button audible feedback
 - b. Screen brightness
 - c. A means to change the tech screen password; obtain from the Owner’s Representative a default password for all touch panel tech menus or an alternative method for password management, such as the use of Active Directory.
 - d. Other technician-specific functions required for each system
 - 4. Make IP control system devices (touch panels, controllers, processors, etc.) accessible and controllable via the network and via web access. For example, users and/or technicians shall be able to operate touch and pushbutton panel functions remotely. Coordinate with the Owner’s Representative to ensure a successful implementation of this requirement.
 - 5. In AV-equipped rooms with an operable partition, program the AV system to use signals from the rooms’ partition sensors to automate audiovisual system combine/divide functions.
- D. Power Control and Sequencing
- 1. Whether explicitly listed in this specification or not, provide power control interfaces, e.g., remotely controllable PDUs, for equipment and devices that are not equipped with integrated power control. Provide power control interfaces that are fully compatible with the specified control system. Follow this directive for devices, such as audio power amplifiers, which would not be adversely affected by external power controls. Omit such power controls for devices, such as transmitters and receivers, that should not be externally power controlled.

2. Configure non-controlling items to power off or go into a standby/low power-consumption mode when systems are powered off. At minimum, program the AV system to power off the following types of devices when not in use.
 - a. Audio processors
 - b. Audio amplifiers
 - c. Displays
 - d. Projectors
3. Configure devices that detect connection to user devices to stay in standby/low power-consumption mode when audiovisual systems are turned off.
 - a. Video switchers and processors
4. When turning systems on, use the following sequence for audio components.
 - a. Turn on source devices.
 - b. Turn on processing and routing devices.
 - c. Turn on amplifiers.
5. When turning systems off, use the following sequence for audio components.
 - a. Turn off amplifiers.
 - b. Turn off processing and routing devices.
 - c. Turn off source devices.

E. Network Connection

1. Connect all network-connectable equipment and devices to the network. Program them to electronically issue notifications for preventative maintenance (e.g., replace a projector lamp).
2. Coordinate with the Owner's Representative which devices are to provide notification (e.g., email notification) immediately at the time of a fault and which devices will provide notifications on a daily or weekly report.
3. Coordinate with the Owner's Representative to obtain the default notification means (e.g., the email address for maintenance messages).
4. Ensure the Owner's Representative can revise the maintenance email address via a simple method– using a single address for all networked AV devices. Document this procedure in the Operations Manual.

F. Lighting and Window covering control

1. Program the control system to control room lighting and window covering systems:
 - a. When a user pushes a button to set the audiovisual system in presentation mode, the system will lower mesh shades.

- b. When a user pushes a button to set the audiovisual system in video conference mode, the system will lower blackout shades and set lighting to a videoconference scene/preset.

G. Lighting System Programming and Interface Coordination

1. Lighting Designer Responsibilities:

- a. Via coordination with the Owner and the project lighting designer, determine lighting scenes for each area with an IP or low voltage-controlled lighting system.
- b. For rooms with projection systems, provide a presentation scene that minimizes lighting spill onto projection screens.
- c. Assign a short name for each lighting scene. Coordinate with the AV control system programmer to determine maximum scene name length based on hard and soft button text capacities.
- d. Provide these names to the design team.

2. Lighting System Installer and Programmer Responsibilities

- a. Program lighting scenes per the lighting designer's list into rooms' lighting systems.
- b. Provide appropriate control protocol/preset information to the AV control system programmer.
- c. Coordinate with the AV control system programmer for hardware interface requirements between AV control systems and lighting systems.
- d. Coordinate with the GC to determine where lighting control cabling will run and who will run it.
- e. Coordinate with the AV control system programmer for lighting system testing and fine-tuning.

3. AV Control System Programmer Responsibilities

- a. Program lighting scenes provided by the lighting designer into the appropriate control system menus. Use the provided scene names.
- b. Coordinate with the lighting system designer and GC for control cabling and termination, etc.
- c. Coordinate with the lighting system designer for testing and fine-tuning.
- d. Train users in the use of appropriate lighting scenes ("Presentation" during projection, etc.).

H. Equipment Configuration:

1. Blu-ray Disk Players: Set color space to RGB.

2. Computer Interfaces, Signal Extenders and Transmitters with Integral Input Switching: Program devices and related system components so analog audio inputs are active regardless of which video input is selected.

3.8 LABELING

- A. Provide labeling identifiers that match closeout documentation (e.g., as-built drawings, O&M Manual, etc.).
- B. Clean and degrease surfaces receiving nameplates and labels prior to affixing labels.
- C. When creating labels for user-facing equipment and cables, use colored labels where possible. Example uses are floor boxes, table boxes, cameras, displays, and user-facing cables. Use color coding to relate labels to related components, i.e., match the text and color on each user-facing cable, its corresponding button on the button panel, and its corresponding input on the display. Example: HDMI 2 cable has a yellow label printed with “HDMI 2”, the button panel at the table box has a yellow “HDMI 2” label and the input on the display has a yellow label printed with “HDMI 2”.
- D. Interface Plate Designation:
 1. Provide wall-mounted interface plates with clearly engraved alphanumeric identification of input type (e.g., “MIC-1”, “LINE IN”, “SPEAKER”, “VIDEO”, etc.) and corresponding patch field designation.
- E. Equipment Racks and Cabinets:
 1. Install the label on the top of the rack or cabinet, centered horizontally.
 2. Example: line 1: “AV-01”, line 2: “Audiovisual Devices”.
- F. Equipment
 1. Rack-mounted equipment: Install labels in visible locations on equipment and devices on the front and back of the equipment.
 2. Field equipment: Install labels in visible locations on miscellaneous field equipment and devices.
- G. Wireless Transmitters and Receivers: Label wireless transmitters and receivers so users can clearly identify a given transmitter associated with its receiver.

1. Use an identifier, such as a room number, that associates each transmitter with a given room or system.
2. Example: RM.230–MIC.3–RCVR.1

H. Wire and Cable:

1. Comply with the Owner's labeling requirements. If the Owner does not have labeling requirements, conform with AVIXA F501.01.
2. Provide labels with machine-generated text; hand-written labels will not be accepted.
3. Use a numbering system with a consistent number of characters for each cable's unique identifier.
4. Generate a unique identifier for each cable and wire using either the Owner's system or AVIXA F501.01. Include primary level data elements per F501.01; secondary level data elements are optional.
5. Label Installation:
 - a. Install labels on both ends of cables at least 1" (25mm) and no more than 12" (300mm) from the connector strain relief or the heat shrink tube from which individual wires exit the cable jacket.
 - b. Labels must be visible; they may not be concealed by strain relief elements or within bundles.
 - c. Install labels such that they are visible by a technician from a normal stance.
 - d. Install labels according to label manufacturers' guidelines.
6. Label Legibility:
 - a. Text margins shall be a minimum of 1mm in the printable area.
 - b. Text shall not be obscured by any part of the label.
 - c. Primary text shall be all capitals, no less than 2.5mm tall. Bold is permitted; italics are not.
 - d. Secondary text shall be all capitals, no less than 2.1mm tall. Neither bold nor italics are permitted.
7. Label Consistency:
 - a. All primary labels shall have the same width. All secondary labels shall also be the same width, but that width may differ from that of the primary labels.
 - b. All labels shall be of sufficient height for the outer dimensions to meet the manufacturer's installation.

- c. In environments and applications where additional physical protection is required to preserve label integrity and legibility for the specified design life, apply additional protective materials. In such cases, apply the additional materials to all labels in the system. If a specific design life is not otherwise specified, assume 10 years will be required.
- d. Primary labels shall utilize the same font type, font size, font spacing, and margin spacing except in the case of user-accessible cable labeling. Secondary labels shall utilize the same font type, font size, font spacing, and margin spacing. The properties of the primary labels may differ from the secondary labels, but they shall be consistent within each label type.
- e. Unless defined otherwise within the labeling schema, text shall be the same color. Text color shall present high contrast to the background color of the label. Black text on a white background is preferable, but where any other color scheme is used, a contrast of no less than 3:1 shall be achieved.

3.9 FIELD QUALITY CONTROL

- A. Initial Tests and Measurements: Prior to final adjustment and scheduling acceptance testing, perform initial tests and measurements. At minimum, include the following initial tests and measurements:
 - 1. Adjust, balance, and align equipment for optimum quality and to meet manufacturers' published specifications.
 - 2. Perform the test procedure provided at the end of this specification and return the completed form no less than one week prior to the initial punch walk.
 - 3. For rack-mounted equipment with user-accessible controls, install 1/8" diameter vinyl "map dots" as indicators for nominal operating positions of rotary, slider, and other accessible controls. Provide multiple dots, adequately distinguished, for controls having more than one nominal operating position.
- B. Twisted-pair Cable Testing: Follow the following procedures to test CATEGORY-type twisted pair cabling.
 - 1. Equipment, or equal:
 - a. Fluke DSX CableAnalyzer
 - 2. Test Procedure:

- a. Configure the cabling and test set up as a permanent link.
 - b. Test each cable under a TIA-568 Permanent Link test script to match the category of the installed cabling.
- C. Digital Video Cabling: Follow the following procedure to test each provided digital video cable.
 1. HDMI: Quantum Data 780, or equal
 2. DVI/SDI/HD-SDI: Quantum Data 882D, or equal
 3. DisplayPort: Quantum Data 882E-DP, or equal
 4. Test Procedure:
 - a. Test each cable.
 - b. Replace all cables that fail.
- D. CATV/Satellite Cabling:
 1. Follow the following procedure to test the coaxial cabling infrastructure
 2. Equipment, or equal:
 - a. Anritsu S332E
 - b. Agilent N9330B
 3. Test procedure:
 - a. Test each cable.
 - b. Test the complete cabling system.
 - c. Replace all cables and devices that fail
- E. Audio System Testing:
 1. Loudspeaker Line Impedance: Measure the impedance at 63 Hz, 250 Hz, and 1 kHz and the resistance of each loudspeaker line leaving the sound equipment rack with the line disconnected from its normal driving source. For lines to full range distributed loudspeaker systems, measure impedance at 1 kHz.
 2. Hum and Noise Level:
 - a. Measure the hum and noise levels of the overall system for each microphone input channel and line level input channel.
 - b. Adjust gain controls for optimum signal to noise ratio so that full amplifier output is achieved with 0 dBm at a line level input.
 - c. Terminate line level inputs with resistors of 150 and 600 ohms, respectively, for these measurements.
 - d. Disconnect the loudspeaker lines and terminate the power amplifier outputs with power resistors for these measurements. Use load

resistors within 5% of the nominal load impedance of the amplifier under test. Use resistors with power ratings equal to or greater than the power rating of the amplifiers.

3. System Frequency Response: Measure audio system frequency response for the AV systems described in Part 1. Adjust systems to provide specified performance.
4. Uniformity of Coverage: Using a calibrated testing device, measure octave bands using a pink noise test signal played through the loudspeaker system(s).
5. System Power Output and Signal Level Adjustment:
 - a. Measure the electrical distortion of the overall system for each line level input channel.
 - b. Adjust gain control as for the tests specified herein.
 - c. Apply a 1 kHz sine wave signal from a test signal generator having less than 0.5% total harmonic distortion at the input tested, at a level required to produce full amplifier output. Note that a pad with 150-ohm output impedance is required for driving the microphone level input in accordance with the EIA standard.
 - d. Use a distortion analyzer to measure the output level and total harmonic distortion of the audio equipment. In the absence of a distortion analyzer, a high input-impedance measuring device such as a DMM may be used to measure the output level.
6. Loudspeaker Polarity:
 - a. Perform loudspeaker line polarity checks using a polarity tester or use DC source at one end of each line and a voltmeter at the other end. Confirm that loudspeaker lines are correctly polarized with respect to color coding.
 - b. Confirm loudspeaker polarity using a polarity tester.
7. Freedom from Parasitic Oscillation and Radio Frequency Interference:
 - a. With systems set up for each mode of operation specified in the Part 1, confirm that systems are free from spurious oscillation and radio frequency pickup, in the absence of audio input signal and when the system is driven to full output at 100 Hz.
 - b. Confirm these tests audibly and by using an oscilloscope having at least 5 MHz bandwidth.
 - c. Apply a slow sine wave sweep from 50 Hz to 5 kHz at a level of 6 dB below rated power amplifier output to each system. Listen carefully for buzzes, rattles and objectionable distortion.

- d. Correct causes of these defects unless the cause is clearly from other than the sound amplification system's equipment and installation, in which case bring the cause to the attention of the Owner and Architect.
- 8. Audio Test Signal Paths: Verify operation from source inputs through system components to signal destinations.
- F. Projection Systems:
 - 1. For each projection system, measure light intensity at the screen's center and four corners. Take corner measurements 5% of the image area width and height in from image edges.
 - 2. Use a properly calibrated foot-candle (or lux) meter with cosine correction for the above measurements.
- G. Control Systems:
 - 1. Verify all operational functions at each fixed control interface position.
 - 2. Verify all operational functions of provided wireless control devices.
 - 3. Verify all operational functions of the control system and interfaced devices.
- H. Radio Frequency (RF) Systems:
 - 1. Connect an analog-capable TV to each system outlet. Make a subjective evaluation of picture quality and verify that no visible components of cross modulation, ghosting, or beat interference appear when the receiver is tuned to each of the desired channels.
 - 2. Using an RF signal strength meter, record the signal levels in dBmV of modulated carriers transmitted through the system at representative outlets.
 - 3. RF Test Signal Paths: Verify proper system operation from source inputs to the head end, including antennas, CATV feeds and modulators, through line amplifiers, splitters, and directional couplers, to system outlets.

3.10 CLEANING, PROTECTION AND REPAIR

- A. Comply with the cleaning requirements of section 270000.

- B. During the installation and up to the date of final acceptance, protect finished and unfinished work against damage and loss. In the event of such damage or loss, replace or repair such damaged work.

3.11 SUBCONTRACTOR MANAGEMENT

- A. Continuously supervise subcontractors during the installation; intermittent supervision is not acceptable.

3.12 SYSTEM ACCEPTANCE TESTS

- A. Perform system acceptance tests after completion of initial system checkout and after submitting the Initial Testing and Tuning Report.
- B. Prior to setting up a demonstration and/or punch walk with the Engineer, ensure that the System/Systems are complete, operational, and fully functioning, and that pre-functional and functional testing have been completed. Fees for any additional punch walks resulting from incomplete and/or non-functioning Systems may be assessed.
- C. System acceptance tests consist of the following:
 - 1. Take a physical inventory of equipment on site and compare it to equipment lists in the contract documents.
 - 2. Demonstrate the operation of system equipment.
 - 3. Perform both subjective and objective tests to determine compliance with the specifications. Provide test equipment specified for these tests.
 - 4. Provide final, "as built" drawings, run sheets, manuals, and other required documents, as detailed in Part 1.
 - 5. Provide complete testing reports generated by subsystems that provide self-testing.
 - 6. Perform power on/off cycles to ensure these take place with no audible and only minimally visible artifacts, pops, etc.
- D. Initial Testing and Tuning Report
 - 1. Perform the following tests for each system unless otherwise noted in Part 1.
 - 2. Use additional pages as necessary to allow complete comments.

3. Where blanks are provided in the checklist below, observe the associated value in parenthesis.

Test	Description	Result	Comment
1	Record equipment that was specified but is not present. Provide a reason why this equipment is not present.		
2	Confirm no sharp or jagged surfaces are accessible to users and technicians.		
3	Confirm that each active device's external temperature, measured using a non-contact thermometer, is within manufacturer's guidelines.		
4	Perform and log cable inspection. Confirm each cable is labeled, dressed, included in a bundle with cables with like signals, not under stress, is serviceable, is correctly strain-relieved, is not bent beyond manufacturer's recommended bend radius, does not have tie wraps tensioned excessively or used inappropriately. Confirm labels are positioned and oriented consistently and are legible and unambiguous.		
5	Demonstrate that the full inventory is new equipment, in full compliance with the specification, or as modified by approved submission. Record test results as pass/fail, and list exceptions.		
6	Confirm rack elevation and single-line drawings, cable and other labels and engravings are an accurate model of the furnished system, and comply with latest revised specifications. Record test results as pass/fail.		
7	Confirm switcher inputs and outputs are labeled (wherever possible), so that users can easily make manual routes quickly without having to refer to the system drawings.		
8	Confirm amplifier channels are properly labeled, so technicians can make quick adjustments without having to refer to the system drawings.		
9	Confirm rack mounted equipment is labeled and that the labels match those on the drawings (equipment symbols and/or description), control system, field plates, patch panels, and any labels associated with the system.		

10	Confirm modular terminations are solid in their connectors.		
11	Confirm each coax cable respects the manufacturer's minimum bend radius or at least 5x the cable's diameter.		
12	Record ambient noise, A-weighted, slow.		
13	Confirm power amplifiers are working within rated load. <i>Record the impedance (and at what frequency) of each loudspeaker line on each power amplifier at 63, 250, and 1,000 Hz.</i>		
14	Using appropriate test signals, have the sound system produce a nominal operating level of __(65) dB SPL for conference speech, __(60) dB SPL for program material, "A" weighted at all listeners' ears $\pm$ __(2) dB ("Uniformity of Coverage") (or at least __(15) dB above the ambient noise, A-weighted, whichever is greater), with the control system volume control indicating "normal" or default setting. <i>Record results for each channel and source.</i>		
15	Confirm the system is capable of producing an additional __(15) dB above this level (__(80) dB SPL) for each audio source, with less than 0.5% THD (Total Harmonic Distortion) plus noise. <i>Measure THD plus noise when source is at __(15) dB above nominal operating level at each "destination", for all sources selected.</i>		
16	Confirm the system develops a noise level that is electrically __(55) dB below the normal operating level for all audio sources. "Noise" refers to the aggregate of hum, electrostatic noise, RF interference, etc. <i>Measure and record Signal to Noise ("signal" measured electrically at nominal operating level at each destination, for all sources selected.</i>		
17	Confirm program loudspeakers are connected in the same polarity, and speech reinforcement systems are polarized such that a positive acoustic pressure on a microphone results in a positive acoustic pressure at the loudspeaker ("Polarity Test").		
18	Confirm the system produces no more than a __(1) dB variance in program source levels when each program source is playing audio from a calibrated medium (CD, test signal generator, etc.)		

19	Confirm there is no audible vibration caused by improper mechanical installation. <i>Use a continuous sweep signal at headroom level (from an audio test signal generator or test CD.) Provide a pass/fail result and document which device fails and the frequency of these artifacts. ("Buzzes and Rattles Test").</i>		
20	Confirm speech reinforcement systems are stable, with no ringing nor feedback.		
21	For audio conference systems, adjust microphone input gain to demonstrate that a "standard talker" (60 dB SPL at 1 m), positioned at each talker position in the room, produces a 0 dB level at the input of the mixer bus of the audio conference DSP device. If there is local voice reinforcement ("mix-minus"), AGC and ALC may need to be restricted when performing this test. <i>Record test results as pass/fail. Record level across analog telephone line, if one is used. Inspect DSP mixer telephone line levels, both transmit and receive, when normal speech is encountered in the room.</i>		
22	For conferencing mode, at the __ (65) dB SPL listening level, confirm full duplex operation, with no reports of echo or "speech trails" as detected from the far end.		
23	Confirm equalizers, whether hardware or virtual, are adjusted for best intelligibility, and in accordance with any preferred acoustic level response curves. <i>Record the "house curve" before equalization, as well as after the equalizers have been tuned, with and without microphone input filters. If requested by the Consultant, produce this documentation for systems without equalizers, as this test may apply to the preamp filter settings in cases where intelligibility can be improved.</i>		
24	If required, confirm system intelligibility, with a RSTI (Rapid Speech Transmission Index) greater than 0.85.		
25	For wireless microphone systems, with all wireless microphones turned on, confirm that throughout the specified operating area for the transmitter, there are no dropouts, intermodulation interactions between		

	wireless systems, nor RF-caused artifacts.		
26	If required, for composite video sources, connect a test generator at each input and confirm 1 volt peak-to-peak to each destination $\pm 10\%$ (or 1dB). <i>Record results at each destination using NTSC/PAL bars, peak white, and five-step multiburst (0.5, 1.0, 2.0, 3.0, 3.58, and 4.2 MHz).</i>		
27	For NTSC sources, confirm optimum brightness, contrast, and color in displays using a SMPTE source with PLUGE display.		
28	Where several displays are visible in the same space, confirm picture tonal consistency across all of them. For composite video signals, use NTSC color bars with PLUGE signal to all. For digital video signals use a colorimeter and test color signal software to confirm consistent images		
29	Confirm projectors are focused, centered, and evenly illuminated. <i>If requested, confirm using a calibrated light meter that the brightest measurement locations are no more than +10% above average, and the dimmest locations no less than -5% below average measurement. If requested, document that geometric distortion is within 2% tolerance. Take actual measurements if necessary (top, bottom, left, right dimensions of white portion of screen) and photograph if necessary.</i>		
30	Confirm that the system displays with stability, and with no scaling-related visual artifacts when switching between, at a minimum, the resolutions specified in 1.04 D. Record test results.		
31	Where HDMI, DVI, or DisplayPort signals are included in the system, confirm that an acceptable signal is being displayed on the monitor from each source position. Use the Alt Pixel test image (pixel-on, pixel-off) for each resolution included in the design intent: 1,920x1,200@60, 1,920x1,080@60, 1,280x720@60, as required. Inspect each, leaving the signal on for three minutes. Confirm that no artifacts are visible. For systems including 4k displays, test also at 3,840 x 2,160 and 4,096 x 2,160. Note: If the signal is going to a		

	codec, disable HDCP. If the signal is going to a display, enable HDCP unless specified otherwise in Part 1.		
32	Using a signal generator, confirm scaler and display/projector configurations by successfully passing video at the resolutions defined in 1.04 D.		
33	Confirm HDCP is maintained from sources to destinations except as excluded above. Confirm EDID is managed correctly and that devices output at resolutions supported by the system.		
34	Confirm the control system controls all of the required equipment as specified. Confirm system performs with stability and in sync with the equipment being controlled without the need to reset any item of equipment. Confirm that user interface requirements dictated in Part 3 of the audiovisual specifications have been met.		
35	Confirm system is serviceable: all devices must be easily removable for repair by one person; all cables must be dressed neatly and be provided with adequate services looks, must be bundled in forms (refer to "Sound System Engineering", Davis and Davis, 1987 and "Audio Systems Design and Installation", Giddings, 1990) having no excessive pressure on cables at termination points and connectors, and each cable number must agree with the shop drawings and cabling run list.		
36	Confirm switches and receptacles are logically and permanently labeled.		
37	Confirm nomenclature for consistency: drawings, touch screen, wall plates, floor boxes, patch panels, equipment, etc.		
38	Confirm patch cables have cable numbers.		
39	Where cameras are included in system, confirm each operates correctly and provides correct image quality.		
40	Confirm camera presets are programmed as specified by the user. In the absence of Owner direction, create and document presets that are logical for the room's layout.		
41	Confirm TV reception from all sources (OTA, CATV, etc.) and that all channel presets are accurate.		
42	Confirm that all specified codec options have been		

	installed.		
43	Confirm and document the IP configuration information provided by the Owner is loaded into the equipment, including IP and MAC addresses, Dante device names, subnet masks, gateways, time server, gatekeeper, etc. Confirm that all network functions specified by the customer function properly on the customer's LAN.		
44	Confirm all web-based system control and monitoring features, and other IP system functionality (time servers, system-generated email, etc.) are completely functional.		
45	Confirm that display devices have On-Screen Displays/ Menus disabled. If the customer has directed otherwise, document from which person this direction came.		
46	Confirm that video projectors have blue screens or other images or colors displayed in the absence of an input signal disabled. If the customer has directed otherwise, document from which person this direction came.		
47	Log test conference calls (audio and video). Include in the log start time, line used, number called, status of connection (completed/failed, etc.) who was spoken with at the far end, success of full duplex, success of auto-disconnect, dB SPL in the room. Note static, jitter/packet loss, or any other artifacts, distortion, etc. Note if auto-disconnect functions as specified.		
48	Using a full-screen white test signal, confirm no direct view display nor projector has more defective pixels than specified in Part 1. Note number and location of lost pixels, if any. Provide photos of defects. Include room numbers and any other distinguishing information in photo file names.		
49	Check for excessive vibration on VC camera(s) at full telephoto position.		
50	Provide video recordings of all non-conformances and anomalies.		
51	Confirm all visible devices are installed square and plumb.		
52	Confirm no dust, grease, scratches, or any other signs of handling are visible on any devices.		

53	Confirm assistive listening systems work throughout intended listening areas		
54	Confirm closed captioning is functional on all displays		
55	Confirm control system user interfaces provide a means to enable and disable display of closed captions		

- E. If further adjustment is required, or defective equipment must be repaired or replaced, tests may be suspended or continued at the option of the Owner or Owner's representative.
1. If the need for further adjustments becomes evident during the demonstration and testing, continue work until the installation operates properly. Included in the continued work, changes to or installation of resistive pads, adjustment of loudspeaker aiming, adjustment of system processing, programming changes to the control system, convergence and/or alignment of the video projector, if these adjustments are required.
 2. If acceptance of the system is delayed because of defective equipment or because the equipment does not fulfill this specification, reimburse the Owner for time and expenses for these tests during extensions of the acceptance testing period.

3.13 OWNER TRAINING

- A. Provide a minimum of 4 hours of training on the audiovisual systems specified herein at the project site (or other location designated by the Owner) by a qualified instructor (equipment manufacturer as needed) covering operation and maintenance of the systems.

3.14 MAINTENANCE AND EXTENDED SERVICE

- A. Warranty Maintenance
1. Provide maintenance calls with same-day issue response – less than 12 hours.
 2. On a quarterly basis during the warranty period, execute a service visit to check and adjust equipment and systems such that they maintain the original performance. Coordinate visits directly with the Owner.
 3. Pre-emptive Maintenance Minimum Requirements:

- a. Clean filters, vents, and lenses, and dust the equipment.
 - b. Test and verify that all system controls operate as labelled and that the controlled devices respond accordingly.
 - c. Document and photograph any conditions that may affect the continued function and long-term operation of the audiovisual system and report to owner.
- B. Provide cost for additional service levels beyond the warranty period (as defined in this section) as follows:
 - 1. One year, two-year, and three-year service with quarterly pre-emptive maintenance calls and same-day issue response
 - 2. One year, two-year, and three-year service with quarterly pre-emptive maintenance calls and 24-hour issue response
 - 3. One year, two-year, and three-year service with quarterly pre-emptive maintenance calls and 48-hour issue response
- C. Touch Panel Programming Updates
 - 1. At a date determined by the Owner within six months following Substantial Completion, attend a single meeting with them regarding alterations or updates to the touch panel layouts or function. At a time approved by the Owner, implement those alterations or updates.
 - 2. Provide any training necessitated by these revisions.
 - 3. Provide documentation of these revisions to the Engineer.
 - 4. Provide the source code documentation according to "Software License" in this section.

END OF SECTION

SECTION 27 41 33
MASTER ANTENNA TELEVISION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- 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 the distribution of the TV signal to patient rooms, lobbies, conference rooms, and the display devices used as described in this Section, including but not limited to:
 - 1. All MATV Video Distribution Equipment and Cabling including but not limited to:
 - a. Coax
 - b. Fiber
 - c. Terminations
 - d. Wall plates
- B. Related Work: Equipment and materials provided and installed by others, and require coordination with the work of this Section, shall include the following:
 - 1. Conduits and back-boxes
 - 2. 120v, 60Hz AV Outlets

1.2 RELATED SECTIONS

- A. 01 00 00 GENERAL REQUIREMENTS
- B. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS
- C. 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
- D. 27 11 16 COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES
- E. 27 52 23 NURSE CALL/CODE BLUE SYSTEMS

1.3 SYSTEM DESCRIPTION

- A. Provide a MATV system including all active equipment to support various MATV and patient entertainment, engagement, and/or experience systems. The system shall support various methods of video encoding depending on the service provider requirements
- B. Provide a system that supports minimum UHD resolution at all in-room devices.
- C. Provide all necessary encoders, interfaces, converters, TVs, set-top boxes, servers, cables, connectors, and other components to complete a MATV system.
- D. Provide a MATV system including all active equipment to support various MATV and patient entertainment, engagement, and/or experience systems. The system shall support various methods of video encoding depending on the service provider requirements

- E. The Video Cabling System will be used for distribution of local MATV (Master Antenna TV system), satellite, and on demand, pre-recorded programming.
- F. Each end device will be fed with a single quad-shielded coaxial cable with appropriate code compliant outer jacketing, one per outlet. ("Home Run")
- G. The Video Cabling System will be able to achieve bi-directional signals, two-way communication over a single coaxial cable, using different frequency bands carrying signals in opposite directions.
- H. An electronic receiving device (End Device) will provide a video for display.

1.4 REFERENCES

- A. American National Standards Institute (ANSI)
 - 1. ANSI/TIA-568-C.3, Optical Fiber Cabling Components Standard, published 2008, plus errata issued in October 2008.
- B. National Fire Protection Association
 - 1. NFPA 101, Chapter 8 for firestopping in healthcare facilities
- C. National Electrical Manufacturer's Association (NEMA)
- D. BICSI Telecommunications Distribution Methods Manual, 14th Edition (2020)
- E. American National Standards Institute (ANSI)
- F. California Electrical Code (CEC), 2019
- G. California Building Code Title 22 (Accessibility) and Title 24, Part 6 – California Energy Code

1.5 SUBMITTALS

- A. Conform with Division 1 Submittal Procedures.
- B. Submittals shall conform with Division-27 Section 27 05 00 Common Work Results for Communications.
- C. Shop Drawings: Submit in accordance with Division 1 requirements. Including the following:
 - 1. Provide functional block diagrams for all systems – clearly tag each item with name, manufacturer, model number, and show the terminal number or input/output designation.
 - 2. Provide schematic diagrams of all systems. These drawings shall contain outlet designations and any changes made to the system during installation. The as-built drawings shall be provided as required by Division 1.
 - 3. Complete riser diagrams showing all devices, tap values, calculated dBmv levels and cabling as installed.
 - 4. Descriptions of all equipment and normal operating procedures and channel assignments
- D. Warranty Documentation: Provide one (1) copy containing all warranty information required by manufacturers for submission of warranty claims for all equipment installed. Comply with Division 1 requirements.

- E. Technical Documentation: Furnish one (1) complete copy technical service manual.

1.6 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of the current manufacturer.
- B. Installer shall have at least three (3) years' experience in the installation of similar systems.
- C. Licensed to install low voltage electronic cabling systems in the State of California where applicable (C7).
- D. Provide a 1-year warranty on materials and installation.
- E. Provide a 1-year warranty on all electronics provided.

PART 2 - PRODUCTS

2.1 DEVICES

- A. General
 - 1. The contractor shall be prepared to receive and deliver materials listed below from 7301 14th Ave. Supports to be sized to suit load and selected to match mounting conditions.
 - 2. Owner Provided Contractor Installed (OFCI):
 - a. Optical Amplifier
 - b. Optical Receiver
 - c. TV
 - d. TV bracket mount
 - e. CommScope Coax or approved equal
- B. Manufacturers
 - 1. CommScope Coax or approved equal
 - 2. CommScope Multimode Fiber or approved equal
- C. Spare Parts
 - 1. Installation packages should include one TV per 15 installed as a spare, or as determined by UCDH representative.
 - 2. Installation packages should include one TV bracket mount per project as a spare, as determined by UCDH representative.
 - 3. Installation packages should include one Optical Receiver per project as a spare, as determined by UCDH representative.
 - 4. Installation packages should include one Optical Amplifier as a spare, as determined by UCDH representative.
 - 5. Deliver Spare parts and obtain a receipt for spare parts from UCDH representative.
 - 6. Additional spare parts shall be determined by project and by UCDH representative.

PART 3 - EXECUTION

3.1 GENERAL

- A. Backboards: Telecommunications Room (TR) used for TV distribution will have a fire-resistant backing board provided and used to mount video system equipment. This area of installation will include a designated 20-amp, 120 Volt AC quad circuit minimally.
- B. All fiber connectors shall be SC/APC polished connector. Fiber requires both a transmitter and receiver to replace a hardline ½" RG-11 trunk feed.
- C. Cable Connectors: Furnish and install RF connectors for RG6 and RG11 cable for use with radiation proof passives or as directed by UCDH standards. Quantities as required. Holland Electronics SLEV or Beldon PPC style compression fittings.
- D. RG6 to RG11 Transitions: Provide sufficient adaptors for all transitions from RG6 to RG11 cable runs.
- E. Furnish grommets in wire mold, outlet boxes, and communications pathways as required to prevent damage to insulation or conductors.
- F. Secure all cabling to avoid damage to cabling and shielding. Manufacturer's recommended pulling tensions and bend radius shall not be exceeded.
- G. In the Telecommunications Room (TR) furnish Cable Distribution Rings (D-Rings) as necessary to route and support cables no greater than 18" apart. Provide vertical support as necessary to prevent cable sheering.
- H. Provide slack in cable to prevent cable system wear and to allow for access and service of the Video Cabling System and other building systems. Wrap the room when terminating in a Telecommunications Room (TR) or distribution location.
- I. A minimum 3' slack loop shall be provided at the device end of the cable.
- J. Wall mount Optical Amplifier.
- K. Adjust Video Cabling System to meet the following parameters and test with one of these or other approved test equipment with 2-gigabit bandwidth range: Manufacturer: HP; Model: Lanalizer or equal; Manufacturer: Scope; Model: Current handheld version by this manufacturer or equal.
 - 1. For RG11: Sweep testing and attenuation readings (plus manufacturers recommended allowances for connector loss) pass at:
 - a. 5 MHz < .7 dB
 - b. 300 MHz < 3.7 dB
 - c. 450 MHz < 4.5 dB
 - d. 900 MHz < 6.3 dB
 - e. 1200 MHz < 7.5 dB
 - f. 1500 MHz < 8.5 dB
 - 2. For RG6: Sweep testing and attenuation readings (plus manufacturers recommended allowances for connector loss) pass at these reading or better dB per 100 ft:
 - a. 5 MHz < .4 dB

- | | | |
|----|----------|----------|
| b. | 50 MHz | < 1.0 dB |
| c. | 100 MHz | < 1.4 dB |
| d. | 300 MHz | < 3.0 dB |
| e. | 450 MHz | < 4.5 dB |
| f. | 900 MHz | < 4.2 dB |
| g. | 1000 MHz | < 4.5 dB |
| h. | 1450 MHz | < 6.2 dB |

L. Labeling

1. Conform to requirements of Section 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.
2. Update room numbers to final room numbers on all documentation.
3. As-built drawings will be placed in each Telecommunications Room (TR) next to TV distribution placement location.
4. Copies of as-built drawings shall be securely mounted in Telecommunications Room (TR) to be used as references for on-going Video Cabling System management.

M. Preparation

1. Evaluate DB load
2. Evaluate MATV capability
3. Evaluate designated installation site
4. Investigate and validate cabling pathway
5. Provide for MATV required outputs on desired formats such coax or SMAP fiber and correct where necessary on shop drawings.
6. Coordinate with project management schedules and installation.

N. Installation

1. Install Horizontal Video Cabling: Furnish, install, and test RG6 for runs 100' or less and RG11 for runs in excess of 100', rated at 2-gigabit bandwidth, quad shielded, solid conductor, UL listed and code compliant cable. All RG-11 runs will be "pigtailed" with RG-6 from the hallway into the patient's/room homerun TV outlet box. Quantity as required. CommScope or equal.
2. 75-ohm Terminators shall be installed on all unused ports.
3. Install Video Trunk Line Cabling (Project dependent) : Furnish, install, and test ½" RG11 (as per design) rated at 2-gigabit bandwidth minimally, quad shielded, solid conductor, UL listed and code compliant cable.
4. Install SMAP fiber feed, in a redundant terminated secondary feed. (as per design)
5. Install Directional Couplers: Furnish and install Directional Couplers with -100 dB radiation shielding, isolation values as required for proper dBmv levels and port as specified. Coupler outlet dB value calculated to obtain a 10-dB power output at TV outlet. Quantities as required. Blonder-Tongue SRT Series or equal.
6. Install Splitters: Furnish and install Splitters with -80 dB radiation shielding, ports as required. Quantities as required. Blonder-Tongue SDS Series or equal.
7. Install Cable Connectors: Furnish and install RF connectors for RG6 and RG11 cable for use with radiation proof passives or as directed by UCDH standards. Quantities as

required. Holland Electronics SLEV or Beldon PPC style compression fittings. Install infrastructure for connectivity to nurse call TV connectivity as required.

8. Install all equipment and components in accordance with manufacturer's written instructions, in compliance with CEC, and with recognized industry practices, to ensure that all items comply with specifications and serve intended purposes.
9. All fiber connections shall be SC/APC style connectors
10. All cable to be swept to 2 GIGHZ

O. Examination/Acceptance

1. Thoroughly examine site conditions for acceptance of supporting device installation to verify conformance with manufacturer and specification tolerances.
2. As-built drawings updates:
 - a. Provide documentation on moves, adds and changes to the Video Cabling System.
 - b. Updating distribution values and transfer to as-built drawings and provide update to UCDH representative.
3. Run Lengths:
 - a. Confirm with test results that the total length does not to exceed limitation expressed herein.
4. Provide room location of all cables
5. Provide documentation of all tests as specified by this and other Sections in the following formats. Submit in CAD and in hard copy form (2 copies).
6. Submit interim test reports to the UCDH representative and 'final' acceptance test reports (where only one test iteration is required consider it be the 'final').
7. Complete walk thru with UCDH representative.
8. Provide overview of operation and maintenance on equipment that has adjustable settings.
9. Complete punch lists as necessary.

3.2 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Tests and Inspections:
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 2. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.
 3. Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements.
 4. Replace malfunctioning or damaged items.
 5. Retest until satisfactory performance and conditions are achieved.
 6. Prepare television equipment for acceptance and operational testing.
 7. Use an agile receiver and signal strength meter or spectrum analyzer for testing.

8. CCTV Sources: Connect receiver to the output of each CCTV signal source or the distribution amplifier associated with it.
- C. Test Schedule: Schedule tests after pretesting has successfully been completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
1. Operational Tests: Perform tests of operational system to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.
 2. Distribution System Acceptance Tests:
 - a. Field-Strength Instrument: Rated for minus 40-dBmV measuring sensitivity and a frequency range of 54 to 812 MHz, minimum. Provide documentation of recent calibration against recognized standards.
 - b. Signal Level and Picture Quality: Use a field-strength meter or spectrum analyzer, and a standard television receiver to measure signal levels and check picture quality at all user-interface outlets.
 - c. Test the signal strength in dBmV at 55, 151, 547, and 750 MHz.
 - d. Minimum acceptable signal level is 10 dBmV (1000 mV).
 - e. Maximum acceptable signal level over the entire bandwidth is 17 dBmV.
 - f. Television receiver shall show no evidence of cross-channel intermodulation, ghost images, or beat interference.
 3. Signal-to-Noise-Ratio Test: Use a field-strength meter to make a sequence of measurements at the output of the last distribution amplifier or of another agreed- on location in system. With system operating at normal levels, tune meter to the picture carrier frequency of each of the designated channels in turn and record the level. With signal removed and input to corresponding headend amplifier terminated at 75 ohms, measure the level of noise at same tuning settings. With meter correction factor added to last readings, differences from first set must not be less than 45 dB.
- D. Headend and distribution system will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.
- F. Cap all unused connectors and seal weather tight.
- 3.3 DEMONSTRATION
- A. Train UCDH maintenance personnel to adjust, operate, and maintain MATV equipment.
1. Train UCDH maintenance personnel on procedures and schedules for troubleshooting, servicing, and maintaining equipment.
 2. Demonstrate methods of determining optimum alignment and adjustment of components and settings for system controls.
 3. Demonstrate programming and tuning of satellite receivers.
- 3.4 CLEAN UP
1. Clean up per 01 00 00 General Requirements

END OF SECTION

SECTION 27 51 16
PUBLIC ADDRESS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section covers the requirements for the design, equipment, installation, and integration of IP-based Public Address (PA) Systems within UDH facilities. These systems are used for the distribution of voice announcements, alerts, and background music over an IP network infrastructure.
- B. Related Work: Equipment and materials provided and installed by others, and require coordination with the work of this Section, shall include the following:
 - 1. Conduits and back-boxes
 - 2. 120v, 60Hz Outlets

1.2 RELATED SECTIONS

- A. 01 00 00 GENERAL REQUIREMENTS
- B. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS
- C. 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
- D. 27 11 16 COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES
- E. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

1.3 SYSTEM DESCRIPTION

- A. Provide and install all equipment to provide a VoIP overhead paging system including, but not limited to, outlet boxes, cabling, speakers, and all other necessary equipment to provide a complete operating system.
- B. The design of the overhead paging system shall be centered on the Informacast platform that integrates the UCHD Cisco Call Manager through a SIP (Session Initiation Protocol) trunk.
- C. Provide system design and illustrate on the T drawings.
- D. Provide overhead Public Address System covering all corridors, general work areas, public areas and other areas as required by the customer and reviewed by UCDH.
- E. Overhead Public Address System shall be constructed to provide audible overhead paging to any one / all of the UCDH provided zones.
- F. The PA system shall be capable of playing pre-recorded messages and broadcasting live announcements.
- G. Zoning:

1. The PA system shall incorporate an emergency override function and priority-based paging. Coordinate and provide interfaces to the fire alarm and life safety systems. In the event of a fire, program the PA to mute for the duration of the FA announcement.
 2. Each department or floor will be covered by a dedicated audio zone with control to allow for volume and content selection for each zone. Additional coordination will be required to confirm specific zoning requirements. Provide the ability for the IUCDH IT team to reconfigure paging zones.
- H. Components installed outdoors shall meet minimum IP54 standard for exterior damp locations.
- I. Ceiling speaker placement shall be designed using the industry standard paging system speaker spacing formula of twice the distance from the floor to ceiling for speaker placement. For example, a 9 foot ceiling would require speakers be spaced 18 feet apart on center.
- J. High quality speakers designed for IP PoE operation shall be strategically placed throughout the facility to ensure even coverage and optimal audio quality. Speakers shall have ambient noise detection and talkback capabilities.
- K. Designer and installer are required to designate and use colors to create a customer expected aesthetically and visually appealing environment.
- L. Coordination:
1. Coordinate with the construction team to ensure that speakers, equipment, and other system components are installed properly, and mitigate compromises due to, among other aspects, spatial conflicts.
 2. Coordinate with the electrical contractor for power requirements and service connection to the system's equipment.
 3. Coordinate with UCDH for locations within racks for installing equipment.
 4. Coordinate with UCDH to confirm functionality, zoning, configurations/settings, and other owner-driven aspects of the system.
- M. Network:
1. Provide a fully IP-based paging system running on the UCDH network.
 2. Coordinate network requirements with UCDH Unified Communications team including network segregation, traffic management, required protocols, and accessibility to other networks (E.g., internet).
 3. Coordinate adherence to the PA system manufacturer's network guidelines.
- 1.4 SEISMIC DESIGN REQUIREMENTS
- A. Items requiring adherence to CBC Chapter 16A - OSHPD:
1. Ceiling Speaker
 2. Grill
 3. Back Box
 4. External Speaker
- 1.5 SUBMITTALS
- A. Submittals shall conform with Division 1 33 00 requirements Submittal Procedures.

- B. Submittals shall conform with Division-27 Section 27 05 00 Common Work Results for Communications.
- C. Submit shop drawings and product data with the following information.
 - 1. Floor plans showing the entire project area illustrating all audible overhead paging devices
 - 2. Floor plans showing the entire project area cable paths
 - 3. Floor plans showing speaker zone designation
 - 4. Speaker hardware cut sheets
 - 5. Single line diagram for the system indicating the manufacturer, model number, and location of each piece of equipment.

1.6 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new and unused.
- B. All materials shall be warranted for a period of one year from the date of installation.
- C. Paging system integrators shall be certified by the equipment manufacturer as an authorized supplier and installer and shall have an AVIXA CTS-I certified employee to actively manage the project. The project manager shall oversee the design submittals, implementation, testing, and close out – the entire process from start to finish. The project manager shall also coordinate the work of this section with other trades.

PART 2 - PRODUCTS

2.1 PUBLIC ADDRESS PRODUCTS

- A. Speakers:
 - 1. IP speakers (ceiling, wall mounted, horn, etc.) with built in amplifiers and network interfaces.
 - a. Algo #8188-IC Informacast IP (ceiling), or approved equal.
 - b. Algo #8198-IC Informacast IP PoE+ (ceiling master speaker), or approved equal.
 - c. Algo #1189 (ceiling remote speaker)
 - d. Algo 8196 (IP PoE+ outdoor horn), or approved equal.
- B. IP paging controllers for managing audio routing, scheduling, and zone control.
 - 1. Algo # 8300 IP Controller, or approved equal.
 - 2. Algo # 8301 Paging Adapter, or approved equal.
- C. Cabling: CAT-6A Plenum Twisted Pair.
 - 1. GenSpeed #7151855, or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install paging system and accessories in compliance with Manufacturer's instructions.
- B. All paging speakers shall be labeled per UCDH Division-27 Section 27 05 53 Identification and Labeling of Communications Systems.

3.2 PREPARATION

- A. Prior to starting the work of this section, examine areas to receive system components and pathways to receive cabling to verify conditions and verify conformance with manufacturer and specification tolerances.
 - 1. Verify pathways including conduit, junction boxes, cable trays, ceiling enclosures, etc., are in place prior to placing cables.
 - 2. Check ceiling types, ceiling heights, and clearances above ceilings to ensure conditions are appropriate per manufacturer's installation requirements.
- B. Registered Communications System Designer shall provide design drawings for OSHPD and/or building permit.
 - 1. Drawings shall indicate speaker cable pathway
 - 2. Drawings shall indicate firewall penetrations
 - 3. Drawings shall indicate zone assignment exceptions

3.3 INSTALLATION

- A. Install cabling per fire code. Install wiring in conduit only where applicable by fire code.
- B. Install cabling and speaker locations as indicated on the drawings.
- C. Install speakers using home run 4 Pair Plenum CAT-6A cables.
- D. Adjust speaker volume so that speaker dB level is no less than 10 dB and no more than 15 dB above ambient noise level in area.
- E. All equipment shall be grounded per UCDH Division-27 Section 27 05 26 Grounding and Bonding for Communications Systems.
- F. Loudspeaker Installation:
 - 1. Install loudspeaker plumb and square.
 - 2. Install loudspeakers flush with architecture.
 - 3. Install loudspeakers so they align with adjacent architectural elements to the extent that the performance of the system is not jeopardized.
- G. Acoustic Ceiling Mounted:
 - 1. Coordinate work with ceiling contractor.
 - 2. Unless otherwise noted, center ceiling loudspeakers in ceiling tiles and evenly space.

3. Cutouts for loudspeakers shall have no visible gaps after the cover/grill is installed.
4. Loudspeakers shall be installed with safety wires attached to the building structure per applicable codes and AHJ.
5. Where manufacturer labels are visible on the covers/grills, align these consistently.

H. Gypsum (hard-lid) Ceiling Mounted:

1. Coordinate work with framing contractor.
2. Cutouts for loudspeakers shall have no visible gaps after the cover/grill is installed.
3. Loudspeakers shall be installed with safety wires attached to the building structure per applicable codes and AHJ.
4. Where manufacturer labels are visible on the covers/grills, align these consistently.

3.4 EXAMINATION

- A. Contractor shall adjust zones and volume settings during acceptance testing as recommended by UCDH representative.
- B. Contractor shall demonstrate proper operation of all system components and functions during the acceptance tests.
 1. Contractor shall provide all test equipment necessary to test systems, including but not limited to an impedance meter and sound pressure level meter.
 2. Contractor shall pretest all Overhead Public Address System devices and functions and shall document the results of this pretest before calling for final acceptance test.

3.5 FIELD TESTS

- A. Contractor shall test all systems and devices and submit a report certifying that the installation is in full compliance with the contract documents. Testing of the system shall be performed with test instruments and procedures recommended by the manufacturer, and in full conformance with NEC guidelines. Upon review of these documents by UCDH representative, final acceptance tests shall be scheduled for all concerned parties. The test reports shall include the following:
 1. A complete list of all equipment installed.
 2. Certification by the Contractor and manufacturer's representative that all equipment is properly installed, functional, and conforms to the requirements of this Section.
 3. Certification by the Contractor that all systems and devices have been tested for proper operation.
 4. As-built floor plans with required port count for the system.

3.6 COMMISSIONING AND ACCEPTANCE

1. Contractor shall demonstrate proper operation of all system components and functions.
2. The final acceptance test shall be performed in the presence of UCDH representative. The final acceptance test shall include a complete test of all system devices and functions, and any additional testing requested by UCDH representative. Contractor shall provide all personnel and equipment necessary to accomplish the test. A copy of the test result shall be provided to the UCDH representative.

3.7 RECORD DRAWINGS

- A. Maintain a complete set of prints and shop drawings of the work forming a part of the Public Address Systems. As work is installed, carefully draw on prints, in colored pencil, actual location of work including depth of underground runs, if any, with dimensions from permanent walls, walks, etc. Wiring diagrams and details shall be included.
- B. Upon completion of the project, transfer this information to reproducible Drawings and updated CAD (AutoCAD DWG files), submit to UCDH.
- C. One additional complete set shall remain on the job site in folders secured inside the electronic racks.
- D. Record Drawings shall include:
 - 1. Complete wiring diagrams for all components, including cable types and quantities, conduit routings, cable routing, floor plans indicating device locations, conduit sizes, riser diagrams, etc.
 - 2. Complete elevation, mounting, point-to-point and termination drawings for all devices. Partial or "Typical" drawings will not be accepted.
 - 3. Dimensioned drawings of all racks and any fabricated equipment showing locations of all major components.
 - 4. A Master Legend/Spreadsheet on the drawings that identifies all devices, device location on the drawings, wire label verbiage, and termination points.
 - 5. A complete list of all equipment installed, including serial numbers of major components.

END OF SECTION

SECTION 27 51 19.11 - SOUND MASKING SYSTEMS

1.1 SUMMARY

A. Section Includes:

1. Networked sound-masking system.
2. Non-networked sound-masking system.
3. Wire and cable.

B. Related Requirements:

1. Section 095123 "Acoustical Tile Ceilings."
2. Section 270528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, enclosures, and cabinets serving communications systems.
3. Section 284621.11 "Addressable Fire-Alarm Systems" for mute sound masking in the event of a fire emergency.
4. Section 284621.13 "Conventional Fire-Alarm Systems" for mute sound masking in the event of a fire emergency.

1.2 REFERENCES

- A. ANSI S1.4, "Specification for Sound Level Meters."
- B. ANSI S1.6, "Preferred Frequencies and Filter Band Center Frequencies for Acoustical Measurements."
- C. ANSI S1.11, "Octave-Band and Fractional-Octave-Band Analog and Digital Filters."
- D. ANSI 709.1, "Control Network Protocol Specification" for standards related to open platforms.
- E. ASTM E1374-06, "Standard Guide for Open Office Acoustics and Applicable ASTM Standards."
- F. ASTM E1573-18, "Standard Test Method for Measurement and Reporting of Masking Sound Levels Using A-Weighted and One-Third-Octave-Band Sound Pressure Levels."
- G. NFPA 72, "National Fire Alarm and Signaling Code."
- H. UL 1310, "Standard for Class 2 Power Units."
- I. UL 1480, "Standard for Speakers for Fire Alarm and Signaling Systems, Including Accessories."
- J. UL 2043, "Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces."
- K. UL 2572, "Standard for Mass Notification Systems."

- L. UL 60065, "Standard for Audio, Video and Similar Electronic Apparatus - Safety Requirements."
- M. UL 6500, "Standard for Audio/Video and Musical Instrument Apparatus for Household, Commercial, and Similar General Use."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions, profiles and finishes of individual components.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 - 3. Nationally recognized testing laboratory listing data for plenum-mounted and rack-mounted equipment.
- B. Shop Drawings: For sound-masking systems.
 - 1. Include plans, elevations, sections, and mounting details for all system components. Provide schematics of system design including floor plan indicating quantity, type, and location of components.
 - 2. Include details of equipment assemblies and installation instructions. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:
 - 1. Provide as-built drawings of the system including schematics and floor plans indicating quantity, type, and location of components, cabling, and accessories.
 - 2. Operation and maintenance manuals.
 - 3. Provide warranty documentation, with start date(s) and service contract(s).
- B. Software and Firmware Operational Documentation:
 - 1. Inventory of system components, with model and serial numbers for each.
 - 2. Software operating and upgrade manuals.
 - 3. Program Software and System Settings Backup: On digital media complete with data files. Provide electronic backup file of all system settings.
 - 4. Device address list.
 - 5. Printout of software application and graphic screens.
 - 6. Provide login ID and password(s) to access control functions on the graphical user interface, if applicable.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Factory qualified and certified to install products listed.
 - 1. Responsible for system specified and single contact point for Architect, Consultant, Fire Protection Engineer, and/or Owner with respect to sound-masking work specified.
 - 2. Experienced in design, fabrication, installation, checkout, and warranty contract management of sound-masking systems.
- B. Obtain required permits.
- C. Follow applicable codes, including regulatory testing and certifications.
- D. Equipment and associated hardware fabricated and installed in accordance with manufacturer's instructions.
- E. Configuration and commissioning by an authorized manufacturer representative or their approved agent.

1.6 COORDINATION

- A. Coordinate quantity and arrangement of sound-masking system components with ceiling space configuration and with components occupying ceiling space, including structural members, pipes, air-distribution components, raceways, cable trays, luminaires, and other items.
- B. Coordinate raceway system material, routing and locations with General Contractor.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver in manufacturer's original unopened and undamaged packages with manufacturer's labels legible and intact.
- B. Store and handle in strict compliance with manufacturer's written instructions and recommendations. Protect from moisture during shipping, storage, and handling.
- C. Inspect manufacturer's packages upon receipt.

1.8 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace sound-masking loudspeaker control units and loudspeakers that fail in materials, workmanship, or performance within one year (warranty period) from date of installation.
 - 1. At Closeout, provide to Owner an executed copy of manufacturer's standard limited warranty against manufacturing defects, outlining terms, conditions, and exclusions from coverage.
- B. System components for sound masking must carry a minimum 10-year warranty. Warranty statements must be submitted prior to notice to proceed.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Source Limitations: Obtain components for sound-masking system from a single source.
- B. 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.
- C. Compliance Standard: Fabricate and label electronic components to comply with UL 60065 or UL 1419.
- D. Compliance Standard: Fabricate and label components to comply with UL 2572, in order to interface with a Fire Alarm Control Unit (FACU).
- E. Wire, cable, devices, and assemblies installed in air-handling spaces to be plenum rated, complying with NFPA 70 requirements for rate of heat-release and smoke-release characteristics. Tests for these requirements to be in accordance with UL 2043.

2.2 NETWORKED SOUND-MASKING SYSTEMS

- A. Description: Networked decentralized architecture sound masking system with digital control of addressable system devices. Digital network controls at control panel include adjustments and monitoring and display of current settings for sound-masking loudspeaker controls, associated network devices, and control panel components.
- B. Basis-of-Design: Subject to compliance with requirements, provide Lencore; i.Net
- C. Standard: Comply with ASTM E1374.
- D. Network:
 1. Provide an Ethernet LAN to connect controller/gateways to a PC running a Microsoft Windows operating system, macOS, or iOS.
 2. Ethernet Protocols: Comply with and be compatible with 10BASE-T and networks.
 3. Network communications protocol to be IP.
 4. Network controls to be available at the control panel and or using a PC connected to the control network,
- E. Network Control Panel. Single, system control for entire building or buildings by providing operation of multiple system components from a single, central location.
 1. Connections.
 - a. Comply with UL 60065.
 - b. Power Supply: NFPA 70, Class 2.
 - c. Ethernet Connection: TIA 485.

- d. Serial Connection: RS-232 port.
 - e. Output to Loudspeaker Control Units: NFPA 70, Class 2.
2. Sound-Masking Performance: Digital signal processing (DSP) technology for masking sound generation and output adjustment of masking signals.
- a. Masking Sound: Generated via a truly random, non-deterministic digital process with no repeat cycle within a 24-hour period.
 - b. System Requirements:
 - 1) Single Control Unit: Capable of addressing entire system. Multiple control units not acceptable.
 - 2) Integrated Sound-Masking Digital Signal Processors (DSPs): Utilize an open platform network technology, meeting open control standards with web appliances, browser interfaces, infrared remote controls, and internet access capable.
 - 3) Capable of separately and independently configuring zones for sound masking via the network, zoned through its singular central control.
 - 4) Sound-Masking System Shutdown: Through interface with FACU as described in Section 283100 "Intrusion Detection."
 - a) Compliance: UL 2572.
 - 5) Control System: Capable of using TCP/IP for intelligent building integration.
 - 6) Standards for Open Platform: Comply with ANSI/CEA 709.1.
 - 7) US Army Corp.'s Unified Facilities Guide Specifications:
 - a) UFGS 25 10 10, "Utilities Monitoring and Control System."
 - b) UFGS 23 09 23, "Direct Digital Control for HVAC and Other Local Building Controls."
 - 8) Multi-drop network system; point-to-point systems are unacceptable.
 - 9) System Tuning: Through network port.
 - 10) Complete diagnostics capability of entire system functions including diagnostics of network, hubs, nodes, routers, DSP, relays, memory, circuitry, amplifiers, and power.
 - 11) Report entire settings for each zone, indicating at a minimum the volume, contour, equalization, diagnostics, and zones and channel groupings.
 - 12) Diagnostics and remote administration via a standard web browser.
 - 13) Capable of naming network nodes, channels, zones, and external audio sources via its integrated graphical user interface.
 - 14) Equalizer: 30-Band third octave.
3. Sound-masking adjustment for each loudspeaker control unit:
- a. Masking Sound: 20 Hz to 20 kHz, with equalizers for adjusting the masking-sound spectrum at third-octave resolution.
 - b. Masking-Sound Volume Adjustment: Digital control adjustable in .5 dBA increments over the range of 34-82.5 dBA or a continuous adjustment within that range.

- c. Twenty-eight (28) preset contour options. Adjust contour from minus 14 to plus 14.
- 4. Paging Inputs: **Advisory on paging functions:** While mic and line level inputs are provided as an overhead paging interface, the sound masking system is tuned to emit broad spectrum noise and is not optimized for intelligible reproduction of human speech. The manufacturer does not recommend utilizing the sound masking system as a primary paging solution. In a scenario where paging or other auxiliary sources must be distributed through the sound masking headend (MPI), please provision input devices per the following specifications.
 - a. Telephone.
 - 1) Input Impedance: 600 ohm.
 - 2) Operating Loop Current: 13 to 120 mA.
 - 3) Dynamic Range: 82 dB.
 - 4) Receive THD: Minus 82 dB.
 - b. Auxiliary.
 - 1) Input Impedance: 10 kilohms.
 - 2) Input Level: 3.5 V(rms) maximum.
 - 3) Gain, Max: 6 dB.
 - c. Microphone.
 - 1) Input Impedance: 600 ohm.
 - 2) Input Level: 70 mV maximum.
 - 3) Gain, Max: 60 dB.
- 5. Paging Performance:
 - a. Paging Volume Control: 34 to 83 dB in 1 dB steps with mute setting.
 - b. One-octave signal equalizer, with 10 bands, 31.25 Hz to 16 kHz.
- 6. Four channels per Operating Platform (OP).
 - a. Capable of digitally assigning any group of masking zones to a selected channel.
 - b. Volume Control: Selectable in 1 dB steps.
- 7. Enclosure: 1 RU rack enclosure for mounting in a rack unit or on a wall.
- F. Control Network Software: Microsoft, Windows, macOS, or iOS based.
 - 1. Description of Functions:
 - a. Communicate with network control panel(s) to assign device addresses and to configure network hardware.
 - b. Security: 128-bit AES encryption and user passwords.
 - c. Setup data to be saved in electronic and printed formats.

- G. Sound-Masking Loudspeaker Control Unit: Addressable, connected to the sound-masking system control network. Unit has no physical controls; all settings to be from the network control panel.
1. Masking-Sound Generator: Digital, solid-state, random sequence noise generator, stable in sound spectrum and output level, and containing the following:
 - a. Electronic sound amplifier and equalizers for shaping the masking-sound spectrum, complying with ASTM E1374.
 - b. Masking Sound: 20 Hz to 20 kHz with equalizers for adjusting the masking-sound spectrum at third-octave resolution.
 - c. Masking-Sound Volume Adjustment: At least 10 steps at 0.5 dB each, or a continuous adjustment within that range.
 - d. Independent zoning of sound masking, paging, and background audio when applicable.
 - e. Inline Speakers: Speakers with independent potentiometer allowing individual speaker adjustment control outside of networked zoned controls as necessary.
 2. Paging Performance:
 - a. Music-Page Interface (MPI): Device with direct microphone, second line-level microphone, or analog phone input.
 3. Diagnostic functions specified at the network control panel.
 4. Enclosure: One RU high, rack mounted, metal enclosure.
- H. Sound-Masking Loudspeakers: Connected to a loudspeaker control unit.
1. Cone Type: 4 inches (102 mm) in diameter with 1-inch (25-mm) voice coil and minimum 10-oz. (283-g) ceramic magnet, mounted in an acoustic enclosure ensuring delivery of a broad frequency spectrum.
 2. Rated Output Level: 10 W.
 3. Dispersion Angle: 120 degrees.
 4. Sensitivity: 88-dB sound-pressure level (SPL) at 1 W/m on the reference axis.
 5. Audio Output: 83 dB, maximum for both masking sound and paging/music.
 6. Frequency Response: Plus or minus 3 dB from 85 to 13,000 Hz.
 7. Enclosure: Metal acoustic enclosure, housing the loudspeaker, its connections, and controls.
 8. Mounting:
 - a. For plenum mounting, arrange units for upward dispersion, suspended from the building structure above the ceiling; adjustable, not less than 20 inches (510 mm) from finished ceiling.
 - b. For flush-with-ceiling mounting, arrange units for downward dispersion and equip with a perforated grill and accessories required for mounting in the suspended ceiling.
- I. Power Supplies: Comply with UL 1310, Class 2.

2.3 NON-NETWORKED SOUND-MASKING SYSTEM

- A. Description: Single, non-networked, self-contained, plenum-mounted loudspeaker with sound masking generator and associated controls. System includes electronic noise generators, amplifiers, wiring, loudspeakers, controls, and components to generate, amplify, distribute, and reproduce digitally synthesized and stabilized background sound masking to improve speech privacy in zones of coverage.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide Lencore; Classic
- C. Standard: Comply with ASTM E1374.
- D. Standalone Sound-Masking Loudspeakers:
 - 1. Power Supply: NFPA 70, Class 2.
 - 2. House loudspeaker and controls to be in a metal acoustic enclosure.
 - a. For plenum mounting, arrange units for upward dispersion, suspended from the building structure above the ceiling; adjustable, not less than 20 inches (510 mm) from finished ceiling.
 - b. For flush-with-ceiling mounting, arrange units for downward dispersion and equip with a perforated grill and accessories required for mounting in the suspended ceiling system.
 - 3. Masking Sound: Digital, random sequence, noise generator, electronic sound amplifier and filters for adjusting the sound spectrum.
 - a. Masking Sound: 125 Hz to 8 kHz.
 - b. Masking-Sound Volume Adjustment: At least 10 steps, plus a continuous adjustment.
 - 4. Loudspeaker:
 - a. Cone Type: 4 inches (102 mm) in diameter with 1-inch (25-mm) voice coil and minimum 10-oz. (280-g) ceramic magnet, mounted in an acoustic enclosure.
 - b. Impedance: 16 ohms.
 - c. Rated Output Level: 10 W rms.
 - d. Dispersion Angle: 120 degrees.
 - e. Sensitivity: 88-dB sound-pressure level (SPL) at 1 W/m on the reference axis.
 - f. Audio Output: 87 dBA, maximum for both masking sound and paging/music audio signals.
 - g. Frequency Response: 85 to 13,000 Hz.
 - 5. Remote Central Volume Control (RCVC):
 - a. Operates as central volume control from which universal volume adjustments can be made remotely for a minimum 50 main units and covering up to 33,000 sq. ft. (3065 sq. m).
 - b. Equipped with a 10-step volume control, an additional continuous volume control, and central volume remote adjustment control (as described above).

- c. Consists of individual self-contained noise generator, audio amplifier, and loudspeaker in damped aluminum enclosure.
- d. All solid-state components with CMOS/MSI digital random sequence noise generator, electronic amplifier, and filter for active spectrum shaping.
- e. Power Input: 16 to 18 V(ac).
- f. Capable of driving one secondary loudspeaker.
- g. Sound Output Range: 41 to 86 dBA.
- h. Independent and separate volume control for paging/music.

2.4 WIRE, CABLE, AND COMPONENTS

- A. Comply with Section 27 15 00 "Communications Horizontal Cabling" for balanced twisted pair cabling.
- B. Category 6A Twisted Pair Cable: Four-pair, balanced-twisted pair cable, certified to comply with transmission characteristics of Category 6A cable at frequencies of up to 500 MHz.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. General Cable GenSpeed, part # 7151855 purple.
 - b. Or approved equivalent
 - 2. 100-ohm, 23 AWG solid copper.
 - 3. Unshielded twisted pairs (UTP)
 - 4. Plenum rated regardless of environment.
 - 5. CAT-6A termination hardware:
 - a. Provide and install CAT-6A 8p-8c modular jacks, Panduit # CJ6X88TGVL.
 - b. Provide and install Panduit surface mount box at the speaker location, Panduit # CBX2BL-AY.
 - c. Provide and install the appropriate length Panduit purple CAT-6A patch cable at the speaker location.
 - d. Provide Panduit modular patch panel in the TR as necessary, Panduit # CP48BLY.
- C. Loudspeaker Wire and Cables:
 - 1. Plenum-Rated Paired Cable: NFPA 70, Type CMP.
 - a. One pair, twisted, No. 16 AWG tinned-copper conductors.
 - b. Unshielded.
 - c. Flame Resistance: Comply with NFPA 262.
- D. Control-Circuit Conductors:
 - 1. Class 2 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Install in accordance with manufacturer's instructions based upon approved system design and submittals. Follow manufacturer's installation manual.
- C. General Contractor: Responsible for supplying any conduit, which may be required to complete system installation in accordance with specifications and local building codes.
- D. Loudspeaker Assemblies: Suspend with chains from building structure above ceilings, so bottom of assembly is 6 to 8 inches (150 to 200 mm) above upper plane of finished ceiling material. Use eyebolts on speaker assemblies for attachment. Suspend independently from structure, not to supports for components of other building systems.
- E. Loudspeaker Connections: For two- or three-channel systems, connect loudspeaker assemblies alternatively, so masking sound is redundant throughout coverage zones.
- F. Wiring Method: Install cables in raceways and cable trays, except within consoles, cabinets, desks, and counters and unless otherwise indicated.
 - 1. Except raceways are not required in accessible indoor ceiling spaces and attics.
 - 2. Except raceways are not required in hollow gypsum board partitions.
 - 3. Conceal raceways and wiring, except in unfinished spaces.
- G. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements for raceways and boxes specified in Section 260533 "Raceway and Boxes for Electrical Systems."
 - 3. Comply with requirements in Section 27 15 00 "Communications Horizontal Cabling."
- H. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.
- I. Exposed Cable: Install parallel to building lines, follow surface contours, and support as recommended by manufacturer.
- J. Grounding: As recommended by manufacturers unless more stringent requirements are indicated. Ground equipment and conductors to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments with a maximum of 5 ohms to ground at main equipment location.
- K. Impedance Matching: For system components, including connecting cable, provide end-to-end level and impedance-matched signal paths. Use matching networks and balancing devices at connections where necessary to avoid mismatches.

- L. Splices, Taps, and Terminations: Make splices, taps, and terminations on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- M. Final connection to FACU will be completed by fire alarm system installer.
- N. Design Note:
 - 1. System shall be installed such that there are no overlapping zones in different types of spaces (i.e. no hallways grouped with enclosed offices or open work areas, etc.).
 - 2. Sound making shall not be installed in conference rooms.

3.2 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 27 05 53 "Identification and Labeling of Communications Systems."
- B. Use color-coded conductors and apply wrap around labels to designate wires and cables, so media are identified in coordination with system wiring diagrams.
- C. Label loudspeakers as to channel, zone, and address.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections with the assistance of a factory-authorized service representative.
- E. Tests and Inspections:
 - 1. Operational Test: Start system to confirm proper operation. Remove malfunctioning units, replace with new units, and retest. Make initial sound-spectrum and -level adjustments for each zone.
 - 2. Inspection: Verify that units and controls are properly labeled, and interconnecting wires and terminals are identified.
 - 3. Pretesting: Tune, align, and adjust system, and pretest components, wiring, and functions to verify compliance with specified material, installation, and performance requirements. Correct deficiencies and retest until satisfactory performance and conditions are achieved.
 - 4. Masking Sound-Power Level Adjustments: Adjust independently for each space to minimum level between 46 and 48 dBA that will provide speech privacy between adjacent workstations while complying with other system requirements.
- F. Final Acceptance Testing: Provide a minimum of 10 days' notice of acceptance test performance schedule. Schedule tests after pretesting has been successfully completed.

1. Perform sound-masking evaluation tests in accordance with ASTM E1130 with measurements and calculations in accordance with ANSI S3.5. Report test results in accordance with the requirements in ASTM E1130.
 2. Tests and Calibration Conditions: Spaces to be completely furnished but unoccupied; lights and HVAC systems to be on; HVAC system testing and balancing to be completed; and electronic ballasts, lighting relay panels, and low-voltage transformers to be in place.
 3. Test Conditions: Complying with ASTM E1130 and calculated in accordance with ANSI S3.5.
 4. Instrumentation: Use a professional-quality, sound-level meter with octave-band filters and documentation of recent calibration against recognized standards. Comply with ANSI S1.4-1.
 5. Record test observations, readings, and corrective actions.
 6. System Tests: Include the following for each system zone:
 - a. Ambient Sound-Level Tests: With system off, measure ambient sound level in one-third octave bands. Also measure ambient sound level as a single, wide-band, A-weighted reading.
 - b. System Noise Test: With masking-noise signal on and amplifiers adjusted at a working level 10 dB above ambient sound level, check for hum, buzz, rattle, or other operating deficiencies.
 - c. Spatial Uniformity Test: Measure sound level at locations no greater than 15 ft. (4.6 m) o.c. throughout covered spaces to determine compliance with specified performance level.
 - d. Frequency Response Adjustment and Test: Adjust one-third octave frequency bands and other unit filters to provide response. Adjust to meet requirement of space speech intelligibility and quality of background sound. Comply with ANSI S3.2, CTA 426, and ASTM E1110.
 7. Adjust level of masking sound that is appropriate for the area and the overall volume.
 8. Adjust level of masking sound for each space, so one-third octave band centered at 500 Hz has final selected sound-power level for that space. Measure deviation from listed values in one-third octave bands from 100 to 1000 Hz. Measured values must not deviate from those listed by more than four dB for open-plan areas and eight dB for enclosed offices. The total of individual band deviations in eight bands must not exceed 16 dB for open-plan areas and 30 dB for enclosed offices.
 9. Walk-Through Test: People in covered spaces cannot discern loudspeaker locations.
 10. Where required, space to comply with HIPPA (45 CFR, Parts 160 and 164) for privacy.
 11. Where required, space to comply with the Gramm-Leach Bliley Act to protect consumer personal and financial information in open office layouts.
- G. Retest: Correct deficiencies identified by tests and observations, and retest until compliance with specified requirements is achieved.
- H. Recording Control Settings and System Adjustments: Record final control settings and programming, and final tap setting of loudspeaker-matching transformers. Record final sound-level measurements and observations.

3.4 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to 2 visits to Project during other-than-normal occupancy hours for this purpose.

3.5 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning at Substantial Completion.
- B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within 2 years from date of Substantial Completion. Upgrading software to include operating system and new or revised licenses for using software.
 - 1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain services.

END OF SECTION 275119.11

SECTION 27 52 23
NURSE CALL CODE BLUE SYSTEMS

GENERAL

1.1 SUMMARY

- A. The work covered under this Section consists of the complete installation and integration of a Nurse Call system.
- B. The Nurse Call System (NCS) at UC Davis Health is operated and maintained by UC Davis Health Innovation Technologies, Facilities Technologies (ITFT), and programmed and configured by the Contractor. The following system, devices, and components shall be utilized at all UC Davis Health facilities, new and existing, owned and leased.
- C. The Owner is defined herein as "UCDH" which represents University of California Davis Health and specifically includes IT Facilities, IT Facilities Infrastructure, IT Facilities Engineering, Network Operations, Auxiliary Services, and other relevant UCDH departments and representatives.
- D. All work in OSHPD-1 Hospital and associated facilities shall be executed in accordance with the requirements of UCDH Infection Control Risk Assessment (ICRA) and Pre-Construction Risk Assessment (PCRA) requirements, standards, forms, policies, and procedures.

1.2 SYSTEM DESCRIPTION

- A. Each Nurse Call system shall be capable of operating as a stand-alone system, with the ability of interfacing to the existing Hospital-wide Nurse Call network.
 - 1. Nurse Call Master Stations
 - a. The Nurse Call Master Stations (NCMS) shall be at the caregiver stations and as indicated on the Drawings. The NCMS shall be the primary call annunciation point for the Nurse Call system. Each NCMS shall consist of a full color touchscreen monitor and an alphanumeric display microphone, keypad, and handset.
 - 2. Nurse Call Central Station
 - a. The Nurse Call Central Station shall be located in the Telecommunications Room (TR) as indicated on the Drawings. The Nurse Call Central Station shall be the primary processing point of the Nurse Call system.
 - 3. Patient Stations
 - a. Patient stations shall provide the interface between the patient and the NCMS. Each Patient Stations will display on its face plate a light indicating a call has been placed and a separate light indicating an open audio path. Each patient station shall be able to accept input from peripheral devices including emergency stations, staff presence stations, remote switches, and auxiliary devices. Patient stations shall be microcomputer based.
 - 4. Staff Stations
 - a. Staff stations shall provide an interface between the nursing staff and the nurse control station. Each Staff Stations will display on its face plate a light indicating a call has been placed and a separate light indicating an open audio path. Each staff station shall be able to accept input from peripheral devices including emergency

stations, staff presence stations, remote switches, and auxiliary devices. Staff stations shall be microcomputer based.

5. Emergency Stations

- a. Provide emergency pull cord stations in the toilets and in other locations as indicated on the Drawings. Stations shall meet UL waterproof requirements. The faceplate shall be electrically isolated from internal electrical components.

6. Corridor Lights

- a. Provide corridor lights at the entrance to the patient rooms (dome lights) and in the corridors to indicate the wing of a patient call (zone lights) as indicated on the Drawings.

7. Smart Dome Lights

- a. Provide smart dome lights at locations indicated.

8. Staff Presence Stations

- a. Provide wall mounted recessed manual staff presence stations at the locations indicated on the floor plans. These stations shall report back to the NCMS monitoring the patient room.

9. Entertainment and Environmental Interface Units

- a. Provide recessed mounted interface units for the patient entertainment system (television) and the patient-controlled lighting fixture for each bed. Interface units may not be shown on the Drawings but shall be installed in a location accessible from the patient room. These units shall provide control of the television set and lighting fixture through the patient control unit and patient station.

10. Vocera

- a. Provide Vocera paging capability for each of the caregiver stations. These systems shall operate in either a manual mode or an automatic mode, as selected from the NCMS.

1.3 RELATED SECTIONS

- A. Division 27 Communications Sections
- B. 27 05 41 FIRE-STOPPING SYSTEMS
- C. 28 10 00 ACCESS CONTROL
- D. 28 20 00 VIDEO SURVEILLANCE
- E. 28 31 00 INTRUSION DETECTION
- F. 28 49 00 ELECTRONIC PERSONAL PROTECTION SYSTEMS

1.4 REFERENCES

- A. American National Standards Institute (ANSI)
- B. American Society for Testing and Materials (ASTM)
- C. Building Industry Consulting Services International (BICSI)

- D. Institute of Electrical and Electronic Engineers (IEEE)
 - E. National Electrical Manufacturers Association (NEMA)
 - F. National Fire Protection Association (NFPA)
 - G. Telecommunications Industry Association (TIA)
 - H. Underwriters Laboratories, Inc. (UL)
 - I. California Building Standards Code (California Code Of Regulations, Title 24), 2019
 - J. Public Safety (California Code of Regulations, Title 19), 2021
 - K. Office of the California State Fire Marshal (CSFM) Building Materials Listing (BML) Program
 - L. NFPA 70 National Electrical Code (NEC), 2020
 - M. NFPA 70 National Electrical Code (NEC), Chapter 8 Communications Systems, Article 800 Communications Circuits, 2020
 - N. NFPA 99 Health Care Facilities Code, 2021
 - O. ANSI/TIA-568.0 Generic Telecommunications Cabling for Customer Premises, Rev. E, 2020
 - P. ANSI/TIA-568.1 Commercial Building Telecommunications Infrastructure Standard, Rev. E, 2020
 - Q. ANSI/TIA-568.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standard, Rev. D, 2018
 - R. ANSI/TIA-568.3 Optical Fiber Cabling and Components Standard, Rev. D, 2016
 - S. ANSI/TIA-568.4 Broadband Coaxial Cabling and Components Standard, Rev. D, 2017
 - T. ANSI/TIA-569 Telecommunications Pathways and Spaces, Rev. E, 2019
 - U. ANSI/UL 2900-1 Standard for Software Cybersecurity for Network-Connectable Products, General Requirements, 2020
 - V. ANSI/UL 2900-2-1 Software Cybersecurity for Network-Connectable Products, Particular Requirements for Network Connectable Components of Healthcare and Wellness Systems, 2020
 - W. ANSI/UL 2900-2-3 Standard for Software Cybersecurity for Network-Connectable Products, Particular Requirements for Security and Life Safety Signaling Systems, 2020
- 1.5 SUBMITTALS
- A. Submittals shall conform with Division 1 requirements Submittal Procedures.
 - B. Submittals shall conform with Division-27 Section 27 05 00 Common Work Results for Communications.
 - C. Procurement and installation shall not begin until product data, shop drawings, and loading schedule submittals have been approved by UCDH.

- D. Submit shop drawings submittals to UCDH for review and approval.
 - 1. Submit shop drawings submittals including device and equipment locations.
 - 2. Prepare floor plans including room names, room numbers, and door numbers indicating all device locations labeled with unique device name and number.
 - 3. Include point-to-point drawings of systems, wiring diagrams of individual devices, equipment elevations, and installation details.
 - 4. Indicate wall space and rack space requirements.
 - 5. Indicate IP addresses, Ethernet switch ports, and fiber connectivity requirements.
 - 6. Indicate and label access controlled zones and electronic personal protection system secure zones, where applicable.
 - 7. Indicate which devices are to be controlled, and which areas and rooms are to be monitored, by a designated nursing station, where applicable.
 - 8. Include user defined information per floor and per system component.
 - 9. Compile shop drawings in AutoCAD and submit an electronic copy in .pdf format.
- E. Submit Nurse Call System Loading Schedule for coordination of programming, configuration, and addressing of the ACS with UCDH ITFT.
- F. Submit Operation and Maintenance Manual (O&M) submittals to UCDH for review and approval.
 - 1. Provide a copy of the final approved acceptance testing reports and documentation.
 - 2. Reflect final UCDH occupancy room numbers in the O&M manuals, programming sheets, and system programming.
 - 3. Compile system, product, device, and equipment documentation (including graphics, tables, and diagrams) complete with a Table of Contents linked to the bookmarks within the manual and submit an electronic copy in Adobe Acrobat or Bluebeam Revu .pdf format.
- G. Submit as-built drawings submittals to UCDH for review and approval.
 - 1. As work progresses, maintain field redlines of actual installation conditions, including device, equipment, and cabling locations.
 - 2. At project close-out, transfer these redlines to as-built drawings in AutoCAD format.
 - 3. Reflect final UCDH occupancy room numbers on as-built drawings, programming sheets, and system programming.
 - 4. Include floor plans clearly indicating all device locations labeled with unique device name and number.
 - 5. Indicate and label access controlled zones and electronic personal protection system secure zones, where applicable.
 - 6. Indicate which devices are to be controlled, and which areas and rooms are to be monitored, by a designated nursing station, where applicable.
 - 7. Compile as-built drawings in AutoCAD and submit an electronic copy in AutoCAD .dwg and in Adobe Acrobat or Bluebeam Revu .pdf format.

1.6 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacturer.

- B. Units and components offered under this Section shall be covered by the manufacturer's warranty for a minimum of two years from date of UCDH acceptance of the project, a copy of which shall be included in the shop drawings submittals. Submitted system shall have been used on at least five projects of similar size and scope as this project. A reference of these similar systems shall be provided.
- C. Vendor shall provide 24×7×365 support to validate features and functionality for a period of 30 days following the opening of the unit.
- D. A factory-trained and authorized service representative shall perform the work of this Section.
- E. Provide documentation stating that spare parts will be continued to be manufactured or be stocked and available for a minimum of 5 years after the complete system acceptance by UCDH representative. Including equipment not manufactured by West Com.
- F. Provide spare parts minimum of 10% of each item or 1 whichever quantity is greater.

1.7 WARRANTY

- A. Contractor shall provide labor and hardware repairs and replacement for a period of one year following the acceptance of the installation.

PRODUCTS

2.1 NCS PLATFORM:

- A. West-Com Novus Connect

2.2 DEVICES

- A. General
 - 1. UCDH has a sole source agreement with West-Com Nurse Call Systems, Inc. for all Nurse Call systems.
 - 2. UCDH uses West-Com Novus in clinic environments and West-Com Novus Connect in Hospital environments.
- B. NCS Devices
 - 1. Nurse Call Master Stations
 - 2. Nurse Call Central Stations
 - 3. Patient Stations
 - 4. Staff Stations
 - 5. Emergency Stations
 - 6. Corridor Lights
 - 7. Smart Dome Lights
 - 8. Staff Presence Stations
 - 9. Entertainment And Environmental Interface Units

C. Integration Requirements

1. Vocera

2.3 GENERAL

A. System Operation and Description

1. The Nurse Call system shall provide a minimum but not limited to:
 - a. Enables a patient to alert a nurse of the need for any type of assistance
 - b. Provides a visual indication of where services are required
 - c. Must provide an audible signal indicating a call on the system
 - d. Must adhere to the state health department requirements
 - e. Must page or provide a wireless means of communicating to nursing staff
 - f. Must provide patient services from bed side, rest room or shower
 - g. Must be able to integrate with Patient bedside TV controls
 - h. Must be able to integrate with room lighting controls
 - i. Must be able to integrate with existing Nurse Call systems
 - j. Must be able to provide nursing statistics of responses
 - k. Must be able to provide manual locaters indicating a staff presence in a room
 - l. Must integrate with other devices, seizure alarm equipment, ventilators, and other auxiliary devices as required
 - m. Must be Ethernet network compatible
 - n. Must be able to be programmed to be supported from any nursing station on the floor or in the Hospital
2. Complete Vocera interface.
3. Complete Electronic Medical Records (EMR) integration.

 EXECUTION

3.1 GENERAL

- A. Coordinate with UCDH representatives the location, physical wall and rack space, power, and network connections required in designated Telecommunications Room (TR) for the installation of systems, products, devices, equipment, and enclosures in this Section.
- B. All materials and labor required to produce a completely operational and fully functional system shall be supplied by the Contractor. It will be the responsibility of the Contractor to conform to the requirements of this Section for system operation, final connection, testing, turnover, and warranty compliance.
- C. Network cable and patch cables shall be provided in accordance with the requirements of Division 27 Communications Sections.

3.2 PREPARATION

- A. Thoroughly examine site for acceptance of device installation to verify conformance with manufacturer and UCDH requirements.
- B. Validate that the system is meeting the customers' needs and feature set at UCDH.
 - 1. Coordinate with construction management on scheduling details.
 - 2. Coordinate with UCDH to provide IP addresses.
 - 3. Coordinate with UCDH for fiber connectivity.
 - 4. Verify antivirus software and security updates have been installed per UCDH Security Standards.
 - 5. Coordinate Nurse Call network cabling with the structured cabling package in accordance with Division 27 Communications requirements.

3.3 INSTALLATION

- A. Install a fully functional Nurse Call System as required and approved by UCDH for the project
 - 1. No electrical outlet splitters allowed. Hospital approved UPS or power strip is acceptable.

3.4 LABELING

- A. All system products, devices, equipment, power supplies, cabling, conduits, patch panels, and patch cables shall be labeled with their unique device name and number.
- B. Labeling shall match the text and nomenclature in the programming sheets, system programming, and on the as-built drawings.
- C. Labels shall be machine printed on adhesive labels, minimum 1" x 1.5" with minimum 12pt font.. Handwritten labels are not acceptable.
- D. The font shall be at least 1/8 inch in height, block characters, and legible. The text shall be black characters on a white background.

3.5 EXAMINATION / ACCEPTANCE

- A. Contractor shall conduct and document System Functional Testing and Onsite Acceptance Testing. System Functional Testing shall be performed by Contractor to ensure that the system is fully functional and completely operational in accordance with the requirements of this Section. Onsite Acceptance Testing shall be performed with UCDH representatives to demonstrate the operation of the completed system.
 - 1. Onsite Acceptance Testing shall only be performed after the System Functional Testing is approved and accepted.
 - 2. Contractor shall provide all personnel and equipment necessary to perform the System Functional Testing and the Onsite Acceptance Testing.
 - 3. Punch list items from the System Functional Testing and Onsite Acceptance Testing shall be satisfactorily resolved by the Contractor prior to UCDH issuing a written notice of acceptance.
- B. System Functional Testing:

1. At least ten working days (two weeks) prior to the scheduled Onsite Acceptance Testing date, Contractor shall provide printed System Functional Testing documentation indicating each device has been successfully tested and is in conformance with the operational intent outlined in the Contract Documents.
 2. Printed System Functional Testing documentation should clearly indicate any remaining outstanding items, issues, and punch list items.
 3. Failure to provide printed System Functional Testing documentation will prevent Onsite Acceptance Testing from being conducted.
- C. Onsite Acceptance Testing:
1. After approval and acceptance of the printed System Functional Testing documentation, Contractor shall perform Onsite Acceptance Testing in collaboration with the UCDH representative.
 2. Upon completion and resolution of all remaining outstanding punch list items, Contractor shall perform follow-up Onsite Acceptance Testing in collaboration with the UCDH representative.
 3. Upon successful completion of the follow-up Onsite Acceptance Testing, resolution of all punch list items, delivery and acceptance of the final printed System Functional Testing documentation, and delivery and acceptance of the O&M manuals and as-built drawings, UCDH shall issue a written notice of acceptance, the project shall be considered substantially complete, and the warranty period shall begin.

3.6 DEMONSTRATION AND TRAINING

- A. Provide the services of a factory-authorized service representative to demonstrate and train UCDH maintenance personnel as described below.
- B. Train personnel in the procedures and schedules involved in operating, troubleshooting servicing, and preventive maintenance of the systems. Provide a minimum of 16 hours training. Training shall be scheduled in more than one session, as agreed-upon by Contractor and UCDH.
- C. Train caregiver personnel in proper use of the systems. Periods of training shall be coordinated with the UCDH representative to assure all nursing shifts receive the required training.
- D. Schedule all training through the UCDH representative a minimum of 14 days in advance.
- E. Provide on-site assistance in adjusting sound levels and adjusting controls to suit actual occupied conditions on an as-requested basis for the first year of operation. Provide a minimum of six visits to the site for this function.
- F. Provide completed documentation of all tests as provided by the UCDH representative. Complete repairs at the time of inspections and review.
- G. Vendor shall provide 24×7×365 support to validate features and functionality for a period of 30 days following the opening of the unit. 2-hour response time required.
- H. Provide spare parts to UCDH at the time of building occupancy. The UCDH representative shall provide to the Contractor a list of spare parts to be purchased and shall notify the Project Manager of the required purchase of spare parts acceptable to all parties.
- I. Deliver and obtain a receipt for spare parts from the designated UCDH representative.

- J. Comply with AHJ to provide a fully functional system to comply with state and local codes and authorities to provide a compliant Nurse Call system.

END OF SECTION

SECTION 27 53 13
CLOCK SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- 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 a centrally controlled clock system as described in this Section, including but not limited to:
 - 1. Network controlled clocks
 - 2. Elapse time clocks
- B. Clock System cabling shall include ethernet network cabling as specification in Division 27.
- C. All Clock System clock installation details shall be shown on the project drawings and keyed to the programming and labeling standards provided by ITFT.
- D. Each clock location shall include all infrastructure, conduits, cabling, and mounts required by the project.
- E. Clock System design configuration shall be based on a distributed network model where all clocks terminate to the nearest PoE+ network switch in the TR room on the same floor as the device, unless specifically approved by ITFT.
- F. All CLOCK SYSTEM clocks terminating in a TR shall be on UPS power.

1.2 RELATED SECTIONS

- A. 01 00 00 GENERAL REQUIREMENTS
- B. 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS
- C. 27 15 00 COMMUNICATIONS HORIZONTAL CABLING

1.3 SYSTEM DESCRIPTION

- A. A wired master clock system consisting of master clocks and secondary clocks including analog and digital displays.

1.4 REFERENCES

- A. Most Recent California Building Code (CBC).
 - 1. California Energy Code, Title 24, Part 6 of the CBC
- B. NEMA ICS 6 enclosure for Industrial Control and Systems.

1.5 SUBMITTALS

- A. Conform with the Division 1 Submittal Procedures.

Project Name and Number
Architect or Consultant

27 53 13 – 1
Issuance and Date

B. Submittals shall conform with Division-27 Section 27 05 00 Common Work Results for Communications.

C. Submit the following with shop drawings:

1. Technical data showing exact types and quantity of all Simplex clock devices. Highlight or otherwise identify specific components on catalog cut sheets.
2. In addition, the legend must include the quantity and model numbers
3. Point to point details that indicate the interconnections between the items of equipment.
4. Provide single line riser diagram.
5. The title page of the shop drawings must include the following statements:
 - a. A set of approved clock shop drawings stamped by UCDH engineer of record shall be on the job site and used for installation. Any deviation from approved shop drawings, including substitution of devices, shall be approved by UCDH representative.
 - b. Any discrepancies between the shop drawings, applicable code or recognized standards shall be brought to the attention of the UCDH representative via the RFI process.
 - c. Stamp and signature of the design professional of record.
 - d. Submit simultaneously with shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s) including technical data sheets.
 - e. Submittals will be automatically rejected if complete product listing information does not accompany submittal.

D. Provide sequence of operations to show how the system will react to master clock corrections.

1.6 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacturer.

B. Provide documentation stating that spare parts will be continued to be manufactured or be stocked and available for a minimum of 5 years after the complete system acceptance by UCDH representative.

1. Provide 10% spares, minimum 1 additional clock, for replacement if a clock fails and while replacement is being shipped.

C. Manufacturer shall have local service organization in the Northern California area.

PART 2 - PRODUCTS

2.1 DEVICES

A. Clock Systems Platform:

1. Primex OneVue

B. Clocks:

1. PoE Analog Clock – Traditional Series

2. PoE Analog Clock – Slim Metal Series
3. Elapsed Time Clocks

C. Contractor support and installation requirements include providing and installing new clocks and conduit and cabling to support clock connectivity as defined by the project documents.

2.2 CENTRALLY CONTROLLED CLOCKS

- A. Clock system: Centrally controlled with master clock, secondary clocks, elapsed-time clocks, and wiring system.
- B. Connect via PoE Ethernet cabling per Division 27.
- C. All components: UL approved.
- D. Surface, semi surface and flush mount clocks are typical round, 12" surface mount, PoE, individually reset clocks.
- E. Provide clocks designed to operate fifteen years without servicing.
- F. Modern styled, satin white dials with black minute and hour hands, and red sweep-second hand.
- G. Bezels: Etched and black in color
- H. Including 4-wire polarized disconnect plug.
- I. Clock crystals: slightly convex to minimize glare and reflection.
- J. Primex OneVue Traditional or Slim Metal series to meet project architectural requirements and specifications.

2.3 ELAPSE TIME CLOCKS

- A. Surface mount with separate installed single gang push button, start/stop/reset control station.
- B. Rectangular digital clock with black face and 4" red numerals.
- C. 120v/ 60Hz AC with integral battery backup.
- D. All components: UL approved.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION

- A. Connect all clocks to network via PoE.
- B. Install and wire system in accordance with manufacturer's recommendations.
- C. Configure and program clocks to operate on the UCDH network. Coordinate address schema with UCDH prior to testing and commissioning.
- D. Test and prepare to commission system.

3.3 EXAMINATION/ACCEPTANCE

- A. The UCDH representative reserves the right to request additional validation of the system control equipment
- B. Upon completion of the installation of the clock system, Contractor shall coordinate an acceptance test. This must be performed in the presence of UCDH representative. The acceptance test must successfully demonstrate all functions required in the contract.
- C. Provide clear and concise operating instructions that gives, in detail, the information required to properly operate the equipment and system.

END OF SECTION

SECTION 27 53 19
DISTRIBUTED ANTENNA SYSTEM CELLULAR

PART 1 - GENERAL

1.1 SUMMARY

- A. This section defines the requirements for the design, furnishing, installation, testing, and commissioning of an in-building Distributed Antenna System (DAS) used to enhance wireless coverage within UCDH facilities. The section outlines the performance criteria, system architecture, equipment, and integration requirements with the Authority Having Jurisdiction (AHJ) and service providers.

1.2 SYSTEM DESCRIPTION

- A. The Distributed Antenna System (DAS) shall provide a scalable, high-reliability solution for enhancing in-building wireless coverage for commercial cellular carriers as required by the project. The system shall consist of a head-end, remote units, fiber and coax distribution, antennas, power systems, monitoring hardware, and all associated infrastructure necessary to deliver consistent and code-compliant RF coverage throughout the designated areas of the facility.
- B. The DAS shall collect, condition, transport, and distribute RF signals from external donor sources. These signals shall be routed through the head-end equipment, transmitted via optical fiber to remote units, and radiated through a coordinated network of indoor antennas. The system shall support multi-band and multi-technology operation, enabling simultaneous distribution of multiple frequencies and carriers where required.
- C. The system shall be designed to meet all RF performance criteria, including minimum signal strength, signal-to-noise ratios, latency requirements, and uplink/downlink balance.
- D. All DAS components shall be compatible with the host facility's telecommunications infrastructure and shall be integrated into the building's grounding and bonding system in accordance with applicable codes and standards. The system shall be expandable to accommodate future technology upgrades, additional carriers, increased capacity demands, or expanded coverage areas without significant system redesign.

1.3 DAS SYSTEM DESIGN

- A. The System, or "DAS", shall reliably distribute RF signals and/or wireless services throughout the specified frequency ranges and the specified coverage areas. The System shall be implemented based on proven technology that can seamlessly integrate with the rapid evolution of wireless technologies and business applications. The System shall be flexible and shall easily accommodate additional wireless services within the System's frequency bands without requiring significant upgrades or system modifications.
- B. The System shall include subsystems, equipment, components, transmission media, connection/ termination apparatus, etc., necessary for a complete operating system as described herein.

- C. The System's head-end and signal sources are existing and located in the North Admin building. UCDH is coordinating any modifications of the head-end with carriers. This project will provide fiber remote units to connect back to the existing head-end.
- D. In the future, the System's head-end will be relocated to the new RHT tower. This DAS system must be compatible with the planned RHT head-end. Migration of the head-end connection will be excluded from this scope of work.
- E. The System shall have lightning protection.
- F. Design Criteria
 - 1. Frequency Range: The System shall support frequencies between 700 MHz to 2600 MHz C band.
 - 2. The System shall distribute RF coverage at levels indicated below in the following areas of the building(s) — herein specified coverage areas:
 - a. Floor areas
 - b. Basement
 - c. General Use spaces (break rooms, staff rooms)
 - d. Mechanical / Electrical Rooms
 - e. Restrooms
 - f. Stairwells
 - g. Elevators
 - h. Patient Room
 - i. Operating Rooms
 - j. Procedure / Treatment Rooms
 - k. Penthouse
 - l. Sub-Floor and other ancillary spaces
 - 3. The System shall be able to simultaneously support the following wireless services, technologies, and associated frequencies — values in MHz:
 - a. Wireless Operators Verizon, T-Mobile, AT&T
 - b. C band should be considered for Future Deployment

Service	Uplink	Downlink
Cellular	824 - 849	869 - 894
PCS	1850 - 1915	1930 - 1995
AWS	1710 - 1755	2110 - 2155
700 LTE	698 – 716, 777-787	728 - 757
BRS/EBS	2496 - 2690	
CBRS	3400-4200	

4. The System shall have the capability for separate control over each service (or wireless operator) to allow adjustment and control of power levels without disturbing other services/operators.
5. The System shall support multiple services in a modular architecture so services can be added or removed without requiring new infrastructure, without readjustment of signal power levels, and disturbing existing services.
6. The System shall enable services to be added without requiring additional cabling or antennas.
7. The System shall not impede any management features or functionality of any attached network and/or device management system.
8. The System shall allow for proactive management and end-to-end alarming of active electronics.
9. The System shall be able to engage with 3rd party SNMP-based element management systems and provide fault management information.
10. The Owner prefers that the System's antennas be mounted below ceiling grids. Coordinate the RF design, antenna placement, and mounting with both the Architect and the Owner throughout the project.
11. E911: The System must support E911 and associated sectors.
12. Cellular Services:
 - a. The System shall support the latest advancement in mobile broadband and LTE, to support the growth of mobile computing, low-latency transmission, and the demand for higher throughput requirements as necessary for different applications.
 - b. The System shall provide RSSI cellular signal strength of -75 dBm or stronger for 3G (-85 dBm for LTE/ 4G) services throughout at least 95% of the required coverage areas, and the System shall provide a signal strength of -85 / -95 dBm, minimum, for the remaining 5% of the building.
 - c. The System shall provide RSRP signal strength of at least -104 dBm for LTE / 4G services.

- d. The System shall provide at least 8 dB higher (signal dominance) than the cellular carriers' macro signal based upon the current macro coverage.
 - e. The System shall provide RSRQ signal quality of at least -14 throughout at least 95% of the required coverage areas.
 - f. The System shall provide a SNIR signal-to-noise ratio of at least 10 dB or better throughout the coverage areas at least 95% of the required coverage areas.
 - g. The System shall provide a PIM level of 100 dBm / -143 dB or better on segments for the 850 MHz frequency band.
13. The System and the associated wireless devices shall comply with the FCC and regional regulatory authorities' emission rules for wireless devices.
- a. Refer to: FCC advisory: "A Local Government Official's Guide to Transmitting Antenna RF Emission Safety Rules, Procedures, and Practical Guidance", FCC's OET Bulletin 65, and FCC Rule 47-part 17 and (ANSI/IEEE C95.1-1992) Hazardous Emission document.

1.4 RELATED SECTIONS

- A. All related sections indicated in Section 27 05 00, "Common Work Results for Communications," shall apply as appropriate to this section.

1.5 REFERENCES AND STANDARDS

- A. All references and standards indicated in Section 27 05 00, "Common Work Results for Communications," shall apply as appropriate to this section.

1.6 ABBREVIATIONS

- A. Reference section 27 05 00.1.6 for abbreviations.

1.7 DEFINITIONS

- A. Definitions provided under section 27 05 00 shall apply to this section.

1.8 QUALITY ASSURANCE

- A. Comply with Quality Assurance requirements of Section 27 05 00.

1.9 SUBMITTALS

- A. Submittals shall conform with Division 1 Submittal Procedures.
- B. Submittals shall conform with Division-27 Section 27 05 00 Common Work Results for Communications.
- C. Submit shop drawings and product data with the following information:
- D. Provide manufacturer's data sheets for each piece of material incorporated into the DAS design.
- E. Provide single line drawings showing the manufacturer, model, location, and labeling for the DAS system.

- F. Pathway and cable support systems
- G. Wall and/or rack elevations, showing equipment layout, space requirements and integration with other systems (outside the scope of the DAS)
- H. Installation details for unique antenna mounting conditions, specialty cable hangers, and other components specific to the system not covered under the contract drawings.
- I. Compliance with permitting agency requirements.
- J. Test equipment to be used during commissioning that shows current calibrations and test data.
- K. Acceptance Test Plan (ATP):
 - 1. In this submittal, describe in detail the procedure for testing the System's performance and balancing the System's signal strength, including a description of the test data (or an example of the test report). The procedures and results shall demonstrate the desired services have been successfully deployed and tested. The DAS must be deployed with the WSP criteria and approval.

1.10 WARRANTY

- A. Warranty shall conform with Division-27 Section 27 05 00.
- B. Submit Contractor's System warranty, including procedures and contact information for service calls under warranty.
- C. Correct deficiencies within 24 hours of notification during the warranty period.
- D. Splitters, couplers, and Coverage Antennas: 5-Year limited Warranty from date of system acceptance.
- E. Coaxial Cable and Connectors: 10-year limited warranty from date of system acceptance.
- F. Fiber- Optic Cable: 25-year limited warranty from date of acceptance.
- G. Active Components: The earliest Of 1- year limited warranty from date of system installation.
- H. The installation contractor shall provide a completed Validation survey report to the owner.

PART 2 - MATERIAL

2.1 MANUFACTURERS

- A. UCDH has chosen CommScope Inc. as the required DAS manufacturer.

2.2 DATA COLLECTION TEST EQUIPMENT

- A. Specifications
 - 1. Accuracy: 1 dB (across basic RF input power range)
 - 2. Dynamic range: -120 dBm to -20 dBm at 30 kHz
 - 3. Frequency range: 10 MHz to 6GHz<, 26GHz to 40GHz>
 - 4. Technologies: 4G LTE,5G, C-Band &CBRS

5. Antenna configuration: Capable of 2x2 and 4x2 4X4 LTE MIMO measurements
6. Connection: Bluetooth or USB to Windows laptop or Android tablet
7. Power: Hot-swappable batteries

B. Manufacturers, or equal:

1. PCTEL — IBM/ex
2. Keysight — Nemo
3. FalconSmart — Falcon Kitt
4. Enhancell — Echo

C. Accuver — XCAL

D. Infovista — TEMS

2.3 CABLE

- A. Riser and feeder cables shall be plenum rated.

PART 3 - EXECUTION

3.1 GENERAL

- A. All materials and equipment shall be installed in accordance with the manufacturer's installation instructions and guidelines.
- B. The DAS installation contractor shall furnish materials, installation, and coordination through the General Contractor with other trades for a complete, operational, and balanced distributed antenna system. A complete turnkey system shall be provided that supports frequencies and services throughout the coverage spaces specified herein. The DAS installation contractor shall furnish materials, accessories, fasteners, etc., and the labor and associated services necessary for a complete and operational System, whether expressly stated or not.
- C. General execution requirements for the DAS system shall include, but are not limited to, the following:
1. The DAS installation contractor shall provide project management services for the installation of the DAS system.
 2. Antenna placement and mounting shall be coordinated with the General Contractor and all affected trades. Mounting locations shall be confirmed with both the Architect and the Owner.
 3. Installation shall include system functionality testing and carrier integration.
 4. The DAS installation contractor shall coordinate with the construction team regarding the use of pathways provided by others.
 5. The DAS installation contractor, in coordination with UCDH IT, shall manage and coordinate the wireless service providers' connections to the system.

6. E911 coordination and integration shall be managed and coordinated by the DAS installation contractor.
7. The DAS installation contractor, in coordination with UCDH IT, shall manage FCC registration, including Part 90 requirements and FCC licensing, perform system acceptance testing, and provide system turnover to the Owner.

D. Additional Coordination Requirements:

1. Ceiling Types: Understand every ceiling type and its interaction with the System. For example, some ceiling types may impede RF signals and, subsequently, performance.
2. Fiber Distribution System: Coordinate the System's fiber distribution requirements with the backbone fiber cabling contractor. Provide patch cords connect equipment to the fiber distribution system. Ensure compatibility with the cabling described in section 27 13 00, "Backbone Fiber Optic Cabling".

E. Power Service:

1. Coordinate with the electrical contractor the power provisions required for the System. The DAS contractor is solely responsible for ensuring proper electrical power service.

F. Work Covered Under Other Sections

1. Electrical power — raceways, junction boxes, circuits, branch wiring, and receptacles
2. Pathways — backbone conduits, primary pathways (such as cable trays), conduits, sleeves
3. Telecommunications Rooms — equipment support (racks/frames), power service, cooling, and grounding
4. Backbone Fiber Optic Cabling
5. Wired network

3.2 PROJECT MANAGEMENT SERVICES:

- A. The DAS installation contractor shall assign a project manager (PM), serving as a single point of contact, with overall responsibility for communications and the delivery of contracted materials, installation, performance criteria, and services. The PM shall interface with the Owner, telecommunications service providers, the General Contractor, and all subcontractors.
- B. The PM shall present the system design to the Owner and coordinate cable routes with the telecommunications engineer.
- C. The PM shall represent the Construction Team in coordinating on-site construction activities with the General Contractor and in managing the receipt of telecommunications services ordered by the Owner.
- D. The PM shall manage and coordinate the wireless operators' installation of equipment and provision of services within the facility.
- E. The PM shall be responsible for providing closeout documentation for the project to the Owner.

3.3 EXAMINATION

- A. Examination shall conform to the requirements of Section 27 05 00.
- B. Examine equipment rooms, pathways, power service, NFPA 72 and NFPA 1221 compliance, and other aspects for completeness, the compatibility with the work of this section, and the readiness for connections with the work of this section.
- C. Confirm the enterprise Ethernet network can accommodate connection to the System.

3.4 INSTALLATION

- A. Coordinate the installation and schedule with the owner, General Contractor, and electrical contractor prior to the start of installation activities. Once the owner and General Contractor have accepted the coordination and schedule, proceed with the installation.
- B. Indoor Antenna Installation
 - 1. Mount according to manufacturers' recommendations.
 - 2. Mount at locations identified within DAS design drawings. Avoid mounting locations as follows:
 - a. Adjacent to metal materials
 - b. Adjacent to RF signal sources
 - 3. Cable paths to antenna must match DAS design drawings.
 - 4. Deviation of installation details and/or locations must be coordinated with UCDH IT.
- C. Change default passwords in accordance with the Owner's direction.
- D. Install latest software versions, firmware, and security patches.
- E. Disable unused communication ports, protocols, and access accounts.
- F. Test the following during installation: Sweep Testing (SYS RL/DTF, Load RL/DTF + short), PIM testing (PIM vs Time, DTP +Loads), Fiber Testing (OTDR+ Scopes) & CW Testing when applicable.
- G. System Balancing: Balance system component (e.g., antenna) signal strength to device signal levels.

3.5 LABELING

- A. The labeling of the DAS system shall conform to the requirements of section 27 05 53 Identification for Communications Systems.
- B. Label equipment, components, and cables.
 - 1. Equipment Labeling:
 - a. Affix labels to equipment (such as fiber remote units) such that they will be clearly visible.
 - 2. Cable Labeling:

- a. Affix label as close as practical to each end of each cable.
 - b. Cable labels shall fully wrap around cable jackets resulting in a self-laminating result.
 - 3. Antenna Labeling:
 - a. Affix labels to antennas such that they will be clearly visible
 - C. Labeling, label colors, and identifier assignments shall conform to the TIA-606 standard. Coordinate labeling and identifier assignment with the Engineer or Owner.
 - D. Submit a labeling plan as part of the shop drawings, in compliance with the labeling requirements shown on the Technology drawings.
- 3.6 TESTING / VALIDATION SURVEY
- A. Acceptance testing shall be performed in accordance with the approved Acceptance Test Plan (ATP). Testing shall be conducted only by personnel qualified in DAS systems and proficient with cellular data-collection tools.
 - B. Perform an on-site survey to validate RF coverage (signal strength) throughout the coverage areas identified in Part 1 using approved test equipment.
 - C. Outdoor Perimeter Area:
 - 1. Survey the building perimeter at ground level within 5 to 10 meters of the exterior facade.
 - D. Testing Procedure:
 - 1. Verify that remote units for the area under test are on.
 - 2. Allow test equipment to stabilize in the test environment for a minimum of 30 minutes prior to testing. Temperature variations may invalidate calibration.
 - 3. Collect validation survey data at continuous intervals of two seconds or less for each frequency band identified in the "Wireless Operators' Frequencies" table in Part 1.
 - 4. Correlate validation survey data with the project floor plans during data collection.
 - 5. Use active signal sources from the wireless carriers to measure all required quality parameters. If carrier signals are not yet available, utilize a signal generator connected to the head-end downlink (TX) interface through tested and approved coaxial cabling and connectors.
 - 6. Record test frequencies and signal power with the date and time of each site walk.
 - 7. Save site walk screen shots with a frequency span of 20 MHz relative to the center / measured frequency.
 - E. Equipment Requirements:
 - 1. All testing equipment shall have been calibrated within 12 months prior to the test date.

2. The signal generator transmission frequency (MHz) and output power (dBm) shall be preapproved by the Project Engineer prior to testing. The control channel from the base station may also be used as an approved signal source.
3. Use a spectrum analyzer, preapproved by the Project Engineer, to capture and present. Verify the spectrum analyzer is set to unity gain (0dB, frequency specific) so that the combination of analyzer and its antenna do not artificially increase measurement results.
 - a. Verify the spectrum analyzer is set to unity gain (0dB, frequency specific) so that the combination of analyzer and its antenna do not artificially increase measurement results.
 - b. Present signal strength as a graphical "heatmap".
4. Use a Link Master LML Air Interface (or equivalent) tool to capture and present signal strength.

3.7 TURNOVER AND TRAINING

- A. Pre-emptive Maintenance Minimum Requirements: Perform the following just prior to closeout.
 1. Clean filters, vents, and equipment components that may accumulate dust and dirt.
 2. Organize and manage cables and cords that have been placed.
 3. Update firmware with latest versions.
 4. Document and photograph any conditions that may impact the ongoing functionality or long-term operation of the System, and report all such conditions to the Owner.
- B. Present the completed system and wireless services to the Owner, including functionality, features, ongoing maintenance, and warranty procedures. Demonstrate system operation, including signal strength at selected locations, to both the Owner and the Project Engineer.
- C. For this System, provide up to 8 hours of training for the Owner.

3.8 RECORDS

- A. The installation contractor shall maintain records of all installed DAS system including routing and labeling, for closeout as-built documentation in accordance with Section 27 05 00.
- B. The installation contractor shall provide As-Built Drawings, including:
 1. Cable routing, splitters, couplers, and coverage antenna locations
 2. Active component locations, layout, and configuration
 3. Test Reports
 4. Cable test results: include every cable segment.
- C. The installation contractor shall provide a completed Validation survey report to the owner.

3.9 ACCEPTANCE

- A. The installed system shall be fully tested, configured, and commissioned to verify performance across all designated areas. Final acceptance shall include complete documentation, including as-built drawings, labeling schedules, test results, and integration verification with carriers or AHJ representatives where applicable.
- B. The installation contractor shall participate in a punch walk with the engineer to demonstrate that the work complies with the requirements of this section.
- C. The installation contractor shall submit a Certificate of Compliance with manufacturers specifications to the project.
- D. The installation contractor shall submit final testing documentation to and obtain acceptance from the wireless carriers. Include these documents in the as-builts.

END OF SECTION

SECTION 27 53 29

EMERGENCY RESPONDER RADIO COMMUNICATION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. The purpose of this section is to define the requirements for the installation, testing, and acceptance of an in-building ERRCS. The system shall be installed in accordance with approved design drawings, specifications, and standards, with all components, cabling, antennas, and head-end equipment configured to provide reliable radio coverage for emergency responders throughout the project site.

1.2 SYSTEM DESCRIPTION

- A. The Emergency Responder Radio Coverage System (ERRCS) shall be designed to provide reliable, continuous radio communications coverage for emergency responders within the building, including all occupied areas, stairwells, elevators, and critical infrastructure spaces. The system shall consist of donor antennas, bidirectional amplifiers (BDAs), coaxial and fiber optic distribution cabling, in-building antennas, and associated monitoring and control equipment. The system shall support all frequencies and technologies required by first responders and UCDH mobile pagers.
- B. The system shall provide signal coverage sufficient to maintain uninterrupted communications for first responders under normal and emergency conditions. Monitoring and reporting features shall allow verification of signal strength, system status, and alarms. All components shall be compatible with one another, tested for interoperability, and designed to allow maintainability and future expandability. The system shall include documentation of as-built conditions, labeling of all components, and procedures for maintenance and troubleshooting.

1.3 ERRCS SYSTEM DESIGN

- A. The ERRCS system shall reliably distribute RF signals for multiple first responder/emergency response wireless services throughout the specified frequency ranges and the specified coverage areas. The System shall be implemented based on proven technology that can seamlessly integrate with the rapid evolution of wireless technologies and business applications. The System shall be flexible and shall easily accommodate additional wireless services within the System's frequency bands without requiring significant upgrades or system modifications.
- B. The System shall include subsystems, equipment, components, transmission media, connection/ termination apparatus, etc., necessary for a complete operating system as described herein.
- C. The System shall continuously distribute public safety radio signal throughout the building for 24 hours, minimum, during an event such as loss of utility power, as required per CFC and NFPA 1221. Therefore, the System requires continuous power with a runtime of 24 hours, minimum. The System requires dedicated circuit(s) to the equipment primary power source(s).

- D. The active equipment and battery systems shall be electronically supervised and monitored by a supervisory service, or when approved by the AHJ, shall sound an audible signal at a constantly attended location, as required per CFC 510.4.2.4 #3.
- E. The survivability of all ERRCS cables and components shall, at a minimum, meet or exceed the fire-resistance rating of the building.
- F. The System shall have lightning protection.
- G. Additional design criteria:
 - 1. Frequency Range: The System shall support all frequencies in the 800, 900 MHz bands.
 - 2. The System shall distribute RF coverage throughout interior spaces.
 - 3. The system shall be sized to support connectivity to the Davis Tower JMA head-end.
 - 4. The system shall be expandable to support connectivity to a future JMA head-end in RHT.
 - 5. The System shall support public safety (including "First Responder") wireless services and technologies, including the following:
 - a. Local police department
 - b. City police department
 - c. County sheriff
 - d. Fire department
 - 6. The System shall have the capability for separate control over each service to allow adjustment and of control power levels without disturbing other services/operators.
 - 7. The System shall support multiple services in a modular architecture so services can be added or removed without requiring new infrastructure, without readjustment of signal power levels, and disturbing existing services.
 - 8. The System shall not impede any management features or functionality of any attached network and/or device management system.
 - 9. The System shall allow for proactive management and end-to-end alarming of active electronics.
 - 10. The System shall provide fault management information.
 - 11. The System's electronic supervision shall monitor, at a minimum, the following:
 - a. Normal AC power
 - b. Loss of normal AC power
 - c. Battery charger failure
 - d. Low-battery capacity (i.e., to 70 percent depletion)
 - e. Donor antenna failure

- f. Active RF emitting device malfunction/failure.
 - g. Active system component malfunction
 - h. The System shall audibly annunciate alarms generated by the supervision.
 - i. The System shall have a separate dedicated supervision panel located near the building's fire alarm control panel.
- 12. The Owner prefers that the System's antennas be mounted below ceiling grids. Coordinate the RF design and the antenna placement and mounting with both the architect and the Owner throughout the project.
- 13. The System shall interface with the Fire Alarm System, compliant with NFPA 1221.
- 14. The System shall distribute public safety channels with -95 dBm (or stronger) signal strength (RSSI) throughout 95% of occupied building spaces and 99% in critical areas as defined in NFPA 1221 and IFC or as required by local ordinance and agencies, including local and city police, county sheriff, and fire departments. Confirm with the AHJ, Owner, and additional authorities' frequencies that will be in use at the time of facility opening.
- 15. The System shall have at a minimum 20 dB isolation between a donor antenna and all inside antenna as defined in NFPA 1221 or as required by local ordinance and agencies, including local and city police, county sheriff, and fire departments. Confirm with the AHJ, Owner, and additional authorities' frequencies that will be in use at the time of facility opening.
- 16. The sound quality shall meet or exceed DAQ 3.4 per SRRCS requirements ("Speech understandable with slight effort; requires occasional repetition due to noise or distortion") as defined in NFPA 1221.
- 17. The System and the associated wireless devices shall comply with the FCC and regional regulatory authorities' emission rules for wireless devices.
 - a. Refer to: FCC advisory: "A Local Government Official's Guide to Transmitting Antenna RF Emission Safety Rules, Procedures, and Practical Guidance", FCC's OET Bulletin 65, FCC Rule 47-part 17 and (ANSI/IEEE C95.1-1992) Hazardous Emission document.

1.4 RELATED SECTIONS

- A. All related sections indicated in Section 27 05 00, "Common Work Results for Communications," shall apply as appropriate to this section.

1.5 REFERENCES AND STANDARDS

- A. All references and standards indicated in Section 27 05 00, "Common Work Results for Communications," shall apply as appropriate to this section.

1.6 ABBREVIATIONS

- A. Reference section 27 05 00.1.6 for abbreviations.

1.7 DEFINITIONS

- A. Definitions provided under section 27 05 00 shall apply to this section.

1.8 QUALITY ASSURANCE

- A. Comply with Quality Assurance requirements of Section 27 05 00.

1.9 SUBMITTALS

- A. Submittals shall conform with Division 1 Submittal Procedures.
- B. Submittals shall conform with Division-27 Section 27 05 00 Common Work Results for Communications.
- C. The installation contractor shall provide a certificate from the ERRCS equipment manufacturer stating that the contractor is trained and qualified to install the equipment.
- D. The installation contractor shall have an FCC-issued GROL for the lead installation personnel and the testing personnel.
- E. Submit shop drawings and product data with the following information:
 - 1. Provide manufacturer's data sheets for each piece of material incorporated into the ERRCS design.
 - 2. Provide single line drawings showing the manufacturer, model, location, and labeling for the ERRCS system.
 - 3. Pathway and cable support systems
 - 4. Wall and/or rack elevations, showing equipment layout, space requirements and integration with other systems (outside the scope of the ERRCS)
 - 5. Installation details for unique antenna mounting conditions, specialty cable hangers, and other components specific to the system not covered under the contract drawings.
- F. Submittal Requirements Prior to Acceptance Testing:
 - 1. Test equipment to be used during commissioning that shows current calibrations and test data.
 - 2. Acceptance Test Plan (ATP): This submittal shall describe in detail the procedure for testing the System's performance and balancing the System's signal strength, including a description of the test data (or an example of the test report). The procedures and results shall demonstrate the desired services have been successfully deployed and tested. The ERRCS must be deployed with the FCC Licensee (SRRCS) AHJ criteria and approval.
- G. Letter from the FCC Licensee/AHJ accepting the ATP results.
- H. Operations and Maintenance Manual.

1.10 WARRANTY

- A. Warranty shall conform with Division-27 Section 27 05 00.
- B. Submit Contractor's System warranty, including procedures and contact information for service calls under warranty.
- C. Submit Manufacturer's warranty, including procedures and contact information for service calls under warranty.
- D. Splitters, couplers, and Coverage Antennas: 5-Year limited Warranty from date of system acceptance.
- E. Coaxial Cable and Connectors: 10-year limited warranty from date of system acceptance.
- F. Fiber- Optic Cable: 25-year limited warranty from date of acceptance.
- G. Active Components: 1- year limited warranty from date of system installation.
- H. Correct deficiencies within 24 hours of notification during the warranty period.

PART 2 - MATERIAL

2.1 MANUFACTURERS

- A. Comba
- B. JMA Wireless
- C. Westell

2.2 ANNUNCIATOR

- A. Displays status of BDA, Donor Antenna, AC Power, Battery Capacity, Battery Charger, and System Status.
- B. Includes a form C relay for interface with fire alarm system
- C. NEMA-4 enclosure
- D. Internal battery back-up
- E. Manufacturer:
 - 1. DASalert #1221
 - 2. Approved equal.

2.3 CABLE

- A. Riser and feeder cables shall be plenum rated.

PART 3 - EXECUTION

3.1 GENERAL

- A. Comply with the execution requirements of Section 27 05 00.

- B. All materials and equipment shall be installed in accordance with the manufacturer's installation instructions and guidelines.
- C. The ERRCS installation contractor shall furnish materials, installation, and coordination through the General Contractor with other trades for a complete, operational, and balanced distributed antenna system. A complete turnkey system shall be provided that supports frequencies and services throughout the coverage spaces specified herein. The ERRCS installation contractor shall furnish materials, accessories, fasteners, etc., and the labor and associated services necessary for a complete and operational System, whether expressly stated or not.

3.2 PRE-INSTALLATION COORDINATION

- A. Coordinate RF rebroadcasting agreements with AHJ.
- B. Represent the Owner during negotiations with the FCC Licensee/AHJ to obtain their approval.

3.3 PROJECT MANAGEMENT SERVICES:

- A. The DAS installation contractor shall assign a project manager (PM), serving as a single point of contact, with overall responsibility for communications and the delivery of contracted materials, installation, performance criteria, and services. The PM shall interface with the Owner, telecommunications service providers, the General Contractor, and all subcontractors.
- B. The PM shall present the system design to the Owner and coordinate cable routes with the telecommunications engineer.
- C. The PM shall represent the Construction Team in coordinating on-site construction activities with the General Contractor and in managing the receipt of telecommunications services ordered by the Owner.
- D. The PM shall manage and coordinate the wireless operators' installation of equipment and provision of services within the facility.
- E. The PM shall be responsible for providing closeout documentation for the project to the Owner.

3.4 EXAMINATION

- A. Examination shall conform to the requirements of Section 27 05 00.
- B. Examine equipment rooms, pathways, power service, NFPA 72 and NFPA 1221 compliance, and other aspects for completeness, the compatibility with the work of this section, and the readiness for connections with the work of this section.
- C. Confirm the enterprise Ethernet network can accommodate connection to the System.
- D. Confirm that the fire-alarm system's annunciator can accommodate connection to the System.

3.5 INSTALLATION

- A. Coordinate the installation and schedule with the Owner, General Contractor and electrical contractor prior to the start of installation activities. Once the Owner and General Contractor have accepted the coordination and schedule, proceed with installation.
- B. Coordinate the location of and power service to the NEMA 4-rated cabinet. Anchor the cabinet to the building structure in accordance with the project's approved installation details.

- C. Install active signal components and battery systems (used for emergency power) in a NEMA 4 type cabinet.
- D. Coordinate with the Owner regarding the monitoring requirements of the System. Configure the electronic supervisory system, including monitoring of signal booster components, emergency power, and battery systems, in accordance with the Owner's requirements.
- E. Indoor Antenna Installation:
 - 1. Mount according to manufacturers' recommendations.
 - 2. Mount at locations identified within ERRCS design drawings. Avoid mounting locations as follows:
 - 3. Adjacent to metal materials
 - 4. Adjacent to RF signal sources
 - 5. Cable paths to antennas shall match ERRCS design drawings.
 - 6. Deviation of installation details and/or locations must be coordinated with ERRCS design engineer.
- F. Change default passwords in accordance with the Owner's direction.
- G. Install latest software versions, firmware, and security patches.
- H. Disable unused communication ports, protocols and access accounts.
- I. Test the following during installation: Return Loss (RL) and Distance to Fault (DTF) Loads ,system
- J. System Balancing: Balance system component (e.g., antenna) signal strength to the device signal levels.
- K. Alert the FCC Licensee prior to bringing the system operational.
- L. Manage FCC License: Acting as a representative of the Owner, obtain required licenses for operation under FCC Regulations.
- M. Do not install amplification systems capable of operating on frequencies licensed to any public safety agency by the FCC without prior coordination and approval by the AHJ.

3.6 LABELING

- A. The labeling of the DAS system shall conform to the requirements of section 27 05 53 Identification for Communications Systems.
- B. Labeling, label colors, and identifier assignments shall conform to the TIA-606 standard. Coordinate labeling and identifier assignment with the Engineer or Owner.
- C. Submit a labeling plan as part of the shop drawings, in compliance with the labeling requirements shown on the Technology drawings.
- D. Label equipment, components, and cables:
 - 1. Equipment Labeling:

- a. Affix labels to equipment (such as fiber remote units) such that they will be clearly visible.
2. Cable Labeling:
 - a. Affix label as close as practical to each end of each cable.
 - b. Cable labels shall fully wrap around cable jackets resulting in a self-laminating result.
3. Antenna Labeling:
 - a. Affix labels to antennas such that they will be clearly visible

3.7 TESTING

- A. ERRCS testing shall be performed in accordance with the approved Acceptance Test Plan (ATP). Testing shall be conducted only by personnel qualified in ERRCS systems and proficient with cellular data-collection tools.
- B. Perform an on-site survey to validate RF coverage (signal strength) throughout coverage areas (listed in Part 1) using approved test equipment.
- C. Test equipment::
 1. All test equipment shall have been calibrated within 12 months prior to the test date.
 2. Specifications:
 - a. Accuracy: t1 dB (across basic RF input power range)
 - b. Dynamic range: -120 dBm to -20 dBm at 30 kHz
 - c. Frequency range: 150 MHz to 900MHz
 - d. Technologies: LMR, and P25
 - e. Connection: Bluetooth or USB to Windows laptop or Android tablet
 - f. Power: Hot-swappable batteries
 3. Manufacturers:
 - a. Anritsu MS2720T spectrum analyzer
 - b. PCTEL — IBflex
 - c. Keysight — Nemo
 - d. FalconSmart — Falcon Kitt
 - e. Enhancell — Echo
 - f. Accuver — XCAL
 - g. Infovista —
 - h. Approved equal.

D. Testing procedure:

1. Allow test equipment to stabilize in the test environment for a minimum of 30 minutes prior to testing. Temperature variations may invalidate calibration.
2. Verify that all remote units for the area under test are ON.
3. Record signal strengths of required frequency bands present at the donor antenna.
4. Each floor of the building shall be divided into a grid of equal test areas.
 - a. Floors with less than or equal to 128,000 sq-ft use a grid of 20 approximately equal test areas between 20 to 80 ft each.
 - b. Floors with greater than 128,000 sq-ft use equal grids that have a maximum of 80 ft. It is recommended that the floor be subdivided into sectors each having an area less than or equal to 128,000 sq-ft, and each sector be tested individually with 20 ft grid cells in each sector.
5. A test location approximately in the center of each test area shall be selected for the test. Once the location has been selected, the location shall represent the entire test area.
6. Downlink received signal level will be recorded in the coverage area using a continuous wave test signal. Measurements will be collected using a spectrum analyzer and a dipole antenna.
7. Signal strength and link spectrum: Must meet or exceed all critical areas and less than nine nonadjacent and/or six adjacent cell failures.
8. DAQ: Must meet or exceed all critical areas and not more than two non-adjacent grid cells failures. If two adjacent areas fail the DAQ test, then grid should be halved and retested with no more than eight nonadjacent and/or five adjacent cell failures.

E. Test reports:

1. Cable test results — includes every cable segment sweep.
2. Validation survey report Walk Testing-to include heat maps and or grid test results.
3. Test reports shall be provided in native electronic format and PDF.

3.8 TURNOVER AND TRAINING

A. Pre-emptive Maintenance Minimum Requirements: Perform the following just prior to closeout.

1. Clean filters, vents, and equipment components that may accumulate dust and dirt.
2. Organize and manage cables and cords that have been placed.
3. Update firmware with latest versions.
4. Document and photograph any conditions that may impact the ongoing functionality or long-term operation of the System and report all such conditions to the Owner.

- B. Present the completed system to the Owner, including functionality, features, ongoing maintenance, and warranty procedures. Demonstrate system operation, including signal strength at selected locations, to both the Owner and the Project Engineer.
- C. For this System, provide up to 8 hours of training for the Owner.

3.9 RECORDS

- A. The installation contractor shall maintain records of all installed DAS system including routing and labeling, for closeout as-built documentation in accordance with Section 27 05 00.
- B. The installation contractor shall provide As-Built Drawings, including:
 - 1. Cable routing, splitters, couplers, and coverage antenna locations
 - 2. Active component locations, layout, and configuration
 - 3. Test Reports
 - 4. Cable test results: include every cable segment.
- C. The installation contractor shall provide a completed Validation survey report to the owner.

3.10 ACCEPTANCE

- A. The installed system shall be fully tested, configured, and commissioned to verify performance across all designated areas. Final acceptance shall include complete documentation, including as-built drawings, labeling schedules, test results, and integration verification with carriers or AHJ representatives where applicable.
- B. The installation contractor shall participate in a punch walk with the engineer to demonstrate that the work complies with the requirements of this section.
- C. The installation contractor shall submit a Certificate of Compliance with manufacturers specifications to the project.
- D. The installation contractor shall submit final testing documentation to and obtain acceptance from the wireless carriers. Include these documents in the as-builts.

END OF SECTION

SECTION 28 10 00
ACCESS CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. The work covered under this Section consists of complete installation and integration to control the physical security and access to UC Davis UCDH buildings.
- B. The Owner is defined herein as "UCDH" which represents UCDH of California Davis UCDH and specifically includes IT Facilities, IT Facilities Infrastructure, IT Facilities Engineering, Network Operations, Auxiliary Services, and other relevant UCDH departments and representatives.
- C. All work in OSHPD-1 Hospital and associated facilities shall be executed in accordance with the requirements of UCDH Infection Control Risk Assessment (ICRA) and Pre-Construction Risk Assessment (PCRA) requirements, standards, forms, policies, and procedures.
- D. This Section requires the furnishing and installation of all items specified herein, indicated on the Drawings or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether specifically called for by item or not) reasonably necessary to facilitate each system's functionality as indicated by the design and the equipment specified.
- E. Elements of the work include, but are not limited to, materials, labor, supervision, supplies, equipment, transportation, storage, utilities, and all required licenses.
- F. Furnish and install all material, equipment, sensors, devices, relays, wiring and connectors, etc., to all building systems and equipment, as necessary for a complete and operational system as specified, drawn, and intended.
- G. Perform all work for this Project in accordance with the Drawings and Specifications and subject to the terms and conditions of the Contract. Install security wire and cable in a manner that is consistent with the provisions and intent of the Specifications, the Drawings, and the referenced Codes and Standards, and in accordance with equipment manufacturer's written Specifications and instructions.
- H. All installation workmanship must be, meet industry standards. This must include, but not be limited to, furnishing proper grounding of data lines and devices, providing neat wire and cable routing, identification of cables and/or conductors by asset tags, providing secure wire termination's, splices, ease of access for maintenance and testing, plumb and level installation of devices, etc.
- I. For purposes of these Specifications, "provide" and "furnish and install" shall be synonymous.
- J. Furnish and install security systems as shown on the Drawings and specified herein to provide a complete and operational system.

1.2 SYSTEM DESCRIPTION

- A. Access control is an integral part of the UCDH Campus Security program. This system shall provide security for staff and students to freely but securely enter buildings under a controlled access policy.

- B. UCDH has standardized on the Lenel OnGuard access control system platform. UCDH IT Facilities personnel shall provide access control system programming.
- C. Contractor shall provide and install access control hardware inclusive of Intelligent Controllers, Door Controllers, Input Boards, Output Boards, Card Readers, Door Position Switches, Request-to-Exit devices, Electronic Lock terminations, 12VDC and 24VDC power supplies and ancillary devices.
- D. Contractor shall be responsible for terminating electronic locking hardware, as provided per Division 08, including termination of request-to-exit devices when provided integral with the door hardware, at the frame side of the transfer hinge/wire transfer. The Division 08 Contractor shall be responsible for door hardware installation and wire terminations between the door hardware and the door side of the transfer hinge/wire transfer.
- E. Unless explicitly excluded, the access control system in each facility shall be interfaced to the building Intrusion Detection System via a wired output/input connection between access control system output board(s) and intrusion detection system devices. The interface shall generate an individual alarm signal at the intrusion detection system whenever a perimeter access control door, or specified interior doors, are forced, and a second if held open. Therefore, two output point must be provided for each perimeter and select interior doors.

1.3 RELATED SECTIONS

- A. Division 08 Door Hardware
- B. Division 26 Electrical
- C. Division 27 Communications
- D. 28 31 00 INTRUSION DETECTION

1.4 REFERENCES

- A. American National Standards Institute (ANSI)
- B. American Society for Testing and Materials (ASTM)
- C. Building Industry Consulting Services International (BICSI)
- D. Institute of Electrical and Electronic Engineers (IEEE)
- E. National Electrical Manufacturers Association (NEMA)
- F. National Fire Protection Association (NFPA)
- G. Telecommunications Industry Association (TIA)
- H. Underwriters Laboratories, Inc. (UL)
- I. California Building Standards Code (California Code Of Regulations, Title 24), 2019
- J. Public Safety (California Code of Regulations, Title 19), 2021
- K. Office of the California State Fire Marshal (CSFM) Building Materials Listing (BML) Program

- L. NFPA 70 National Electrical Code (NEC), 2020
- M. NFPA 70 National Electrical Code (NEC), Chapter 8 Communications Systems, Article 800 Communications Circuits, 2020
- N. NFPA 99 UCDH Care Facilities Code, 2021
- O. ANSI/TIA-568.0 Generic Telecommunications Cabling for Customer Premises, Rev. E, 2020
- P. ANSI/TIA-568.1 Commercial Building Telecommunications Infrastructure Standard, Rev. E, 2020
- Q. ANSI/TIA-568.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standard, Rev. D, 2018
- R. ANSI/TIA-568.3 Optical Fiber Cabling and Components Standard, Rev. D, 2016
- S. ANSI/TIA-568.4 Broadband Coaxial Cabling and Components Standard, Rev. D, 2017
- T. ANSI/TIA-569 Telecommunications Pathways and Spaces, Rev. E, 2019
- U. ANSI/UL 2900-1 Standard for Software Cybersecurity for Network-Connectable Products, General Requirements, 2020
- V. ANSI/UL 2900-2-1 Software Cybersecurity for Network-Connectable Products, Particular Requirements for Network Connectable Components of UCDHcare and Wellness Systems, 2020
- W. ANSI/UL 2900-2-3 Standard for Software Cybersecurity for Network-Connectable Products, Particular Requirements for Security and Life Safety Signaling Systems, 2020
- X. ANSI/UL 294 Standard for Access Control System Units, 2018

1.5 SUBMITTALS

- A. Submittals shall conform with Division 1 requirements Submittal Procedures.
- B. Submittals shall conform with Division-27 Section 27 05 00 Common Work Results for Communications.
- C. Procurement and installation shall be performed by a locally certified Lenel Value Added Reseller and shall not begin until certificates, product data, shop drawings, termination schedules, and voltage calculation submittals have been approved by UCDH.
- D. Submit copies of current Lenel Certified Professional (LCP) in Access certificates for applicable personnel, as detailed in article 1.6 of this section.
- E. Submit Access Control System product data submittals to UCDH for review and approval.
 - 1. Submit technical product data sheets for all devices, material and equipment specified in this Section.
 - 2. Manufacturer's published data sheets shall be marked with boxes, arrows, highlighting, lines, and notes as needed to clearly indicate the exact product make, model, and options to be provided
 - 3. Compile system, product, device, and equipment product data cutsheets, including templates, graphics, tables, diagrams, and installation instructions, in PDF format complete

with a Table of Contents linked to the bookmarks within the submittal and submit an electronic copy in .pdf format.

- F. Submit shop drawings submittals to UCDH for review and approval.
 - 1. Submit shop drawings submittals including device and equipment locations.
 - 2. Prepare floor plans including room names, room numbers, and door numbers indicating all device locations labeled with unique device name and number.
 - 3. Include point-to-point drawings of systems, wiring diagrams of individual devices, equipment elevations, and installation details.
 - 4. Indicate wall space and rack space requirements.
 - 5. Indicate IP addresses, Ethernet switch ports, and fiber connectivity requirements.
 - 6. Indicate and label access controlled zones and electronic personal protection system secure zones, where applicable.
 - 7. Indicate which devices are to be controlled, and which areas and rooms are to be monitored, by a designated nursing station, reception station, or other location, where applicable.
 - 8. Compile shop drawings in AutoCAD and submit an electronic copy in .pdf format.
- G. Submit Access Control System Loading Schedule for coordination of programming, configuration, and addressing of the ACS with UCDH ITFT.
- H. Submit low voltage power calculations in conjunction with each ACS Termination Schedule. Each sheet shall show each device type connected to the 12VDC power supply(s) associated with the panel, each device type connected to the 24VDC power supply(s) associated with the panel, the quantity of each device, the maximum current draw of each device type, the calculated total maximum current draw for each device type, and the calculated total maximum current draw for the panel. This final calculation shall be used to size the 12VDC and 24VDC panel power supplies. Power supplies shall be sized at 80% or less of the maximum total available current draw.
- I. Submit Operation and Maintenance Manual (O&M) submittals to UCDH for review and approval.
 - 1. Provide a copy of the final approved acceptance testing reports and documentation.
 - 2. Reflect final UCDH occupancy room numbers in the O&M manuals, programming sheets, and system programming.
 - 3. Compile system, product, device, and equipment documentation (including graphics, tables, and diagrams) complete with a Table of Contents linked to the bookmarks within the manual and submit an electronic copy in Adobe Acrobat or Bluebeam Revu .pdf format.
- J. Submit as-built drawings submittals to UCDH for review and approval.
 - 1. As work progresses, maintain field redlines of actual installation conditions, including device, equipment, and cabling locations.
 - 2. At project close-out, transfer these redlines to as-built drawings in AutoCAD format.
 - 3. Reflect final UCDH occupancy room numbers on as-built drawings, programming sheets, and system programming.
 - 4. Include floor plans clearly indicating all device locations labeled with unique device name and number.
 - 5. Indicate and label access controlled zones and electronic personal protection system secure zones, where applicable.

6. Indicate which devices are to be controlled, and which areas and rooms are to be monitored, by a designated nursing station, where applicable.
7. Compile as-built drawings in AutoCAD and submit an electronic copy in AutoCAD .dwg and in Adobe Acrobat or Bluebeam Revu .pdf format.

1.6 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacturer.
- B. Contractor must be a Lenel Value Added Reseller (VAR) in good standing.
- C. Contractor shall have a Lenel Certified Professional (LCP) in Access,
- D. available to assist and supervise all system installation personnel.
- E. The Contractor shall also guarantee that a Project Manager and a Lenel Certified Professional (LCP) in Access shall be available, at the request of the University, at any time during installation, up to, and including, final acceptance testing.

1.7 WARRANTY

- A. Access control hardware products and components shall be covered by the manufacturer's warranty for a minimum of two years from date of UCDH acceptance of the project.
- B. Maintenance and repair service shall be available locally and within four hours of notification for emergency conditions.
- C. Contractor shall provide labor and hardware repairs and replacement for a period of one year following the acceptance of the installation.

PART 2 - PRODUCTS

2.1 ACCESS CONTROL PRODUCTS

- A. Intelligent Controller
 1. Intelligent system controllers serve as the primary communication devices between the access control system software and the individual door controllers and card readers. The Intelligent system controller provides decision-making, event reporting, and database storage for access control system field devices and card numbers.
 2. Performance Criteria: Intelligent system controllers must have and be configured to utilize the following capabilities:
 - a. Provide data encryption for all data stored at rest within the controller
 - b. Provide data encryption for all data when in transit to and from the UCDH networks
 - c. Provide data encryption for all data when in transit to and from associated door controllers and card readers
 - d. Communicate with the access control system server via on-board 10-BaseT/100Base-TX Ethernet port

- e. Provide secure encrypted communication to downstream door controllers and input/output boards via either of two SIO 2-wire RS-485 communication ports; card readers configured to utilize OSDP version 2 with Secure Channel
 - f. Include two digital inputs to monitor access control panel enclosure tamper switch and AC power fail monitoring
 - g. Power: 12-24VDC
 - h. Dimensions: 6"L by 5"W by 1"H
 - 3. Intelligent system controller:
 - a. LNL-X3300)
- B. Access Control Input Boards
 - 1. Provide input boards at intelligent system controller locations for alarm device and I/O interfaces.
 - 2. Input board:
 - a. LNL-1100-S3
- C. Access Control Output Boards
 - 1. Provide output boards at intelligent system controller locations for alarm device and I/O interfaces.
 - 2. Output board:
 - a. LNL-1200-S3
- D. Access Control Reader Interface Boards
 - 1. Reader interface boards serve as the primary communication devices between the intelligent system controller and the card reader.
 - 2. Performance Criteria: Reader interface boards must have and be configured to utilize the following capabilities:
 - a. Provide data encryption for all data stored at rest within the reader interface board
 - b. Provide data encryption for all data when in transit to and from associated intelligent system controller and card readers
 - c. Support OSDP Secure Channel technology for communication to card readers
 - d. Communicate to intelligent system controller via SIO 2-wire RS-485 communication
 - e. Power: 12-24VDC power
 - 3. Reader interface board:
 - a. LNL-1300-S3
 - b. LNL-1320-S3
- E. Access Control Card Readers
 - 1. Card readers serve as the primary communication devices between access control cards and the reader interface boards.
 - 2. Performance Criteria: Card readers must have and be configured to utilize the following capabilities:
 - a. Support the ability to read and process HID iCLASS SEOS credentials
 - b. Support the ability to read and process HID Mobile Identity credentials

- c. Support OSDP version 2 Secure Channel technology for communication to reader interface boards
 - d. Support Bluetooth/NFC communication technology for utilization with mobile credentials
 - e. Powered via reader interface boards
 - f. Including an autotuning feature to maximize and normalize signal strength
 - g. Utilize pig-tail wiring for connection to cabling
 - h. Provided with a standard mounting plate and black cover
 - i. Display no LED when the associated door is secure, and the card reader is ready to accept an access attempt
 - j. Provide an audible beep upon each card read
 - k. Display a solid green LED upon a valid card read that stays on for a fixed duration. (until the unlock time expires.)
 - l. Display a red LED upon invalid card read
 - m. Display a steady green LED when the door is unlocked via a time schedule
 - n. Provided in form factors that match existing reader mounting hardware and installation configurations
- 3. Card readers – mullion mount
 - a. HID Signo, model 20, part number 20NKS-02-00V3KM
 - b. 13.56 mHz Profile, OSDP, Pigtail, Mobile Ready
 - c. Dimensions - 1.77" x 4.78" x 0.77"
 - 4. Card readers – mullion mount with keypad
 - a. HID Signo, model 20K, part number 20KNKS-02-00V3KM
 - b. 13.56 mHz Profile, OSDP, Pigtail, Mobile Ready
 - c. 2x6 backlit keypad
 - d. Dimensions - 1.78" x 4.79" x 0.85"
 - 5. Card readers – wall mount
 - a. HID Signo, model 40, part number 40NKS-02-00V3KM
 - b. 13.56 mHz Profile, OSDP, Pigtail, Mobile Ready
 - c. Dimensions – 3.15" x 4.78" x 0.77"
 - 6. Card readers – wall mount with keypad
 - a. HID Signo, model 40K, part number 40KNKS-02-00V3KM
 - b. 13.56 mHz Profile, OSDP, Pigtail, Mobile Ready
 - c. 3x4 backlit keypad
 - d. Dimensions – 3.16" x 4.79" x 0.85"

F. Power Supplies:

- 1. Power supplies serve as the primary means of supplying low voltage power to intelligent controllers, door controllers, card readers, and field devices.
- 2. Performance Criteria: Power supplies must have and be configured to utilize the following capabilities:

- a. Delivers a 10 amp supply current.
 - b. Auto switch over to stand-by battery when AC fails w/ zero voltage drop.
 - c. Filtered and electronically regulated outputs.
 - d. Short circuit and thermal overload protection.
 - e. AC fail supervision (form "C" contacts).
 - f. Low battery supervision (form "C" contacts).
 - g. Battery presence supervision (form "C" contacts).
 - h. AC input and DC output LED indicators.
 - i. 115 VAC input.
 - j. 12 or 24 VDC output.
3. Products: Provide the power supplies (and associated distribution/relay boards) as identified on the Drawings, as specified below.
- a. Controller/Field device power supplies (12VDC) shall be:
 - 1) Altronix, Model AL600ULX
 - b. Lock power supplies (24VDC) shall be:
 - 1) Altronix, Model AL600ULX
 - c. Distribution board (12VDC) shall be:
 - 1) Altronix, Model PD8CB
 - d. Distribution board (24VDC) shall be:
 - 1) Altronix, Model ACM8CB
 - e. Batteries:
 - 1) Batteries are required in all security power supplies to provide a back-up power source in the event of 120VAC power disruption when not connected to a dedicated building UPS circuit.
 - 2) Provide one 12VDC/7Amphour battery for each 12VDC power supply.
 - 3) Provide two 12VDC/7Amphour batteries wired in series for each 24VDC power supply.
 - 4) Product:
 - 5) Yuasa NP7-12F, or equal.

G. Magnetic Door Contact

- 1. Flush concealed mounted in door frames and doors.
 - a. GE/Sentrol 1076C
 - b. Or approved equal
- 2. Surface mounted to door frames and doors.
 - a. GE/Sentrol 2505AD
 - b. Or approved equal

H. Request-To-Exit Motion Detector

- 1. Mounted above access controlled doors on egress side of door.
 - a. Detection Systems DS-150i

I. Door Alarm Sounder

- 1. Provide door alarm sounders where indicated on Drawings.

- a. System Sensor PA400W Mini-Alert Sounder
- b. System Sensor MHW Mini Horn
- c. Or approved equal

2.2 WIRE AND CABLE

- A. ACS cabling, wiring, and termination requirements shall meet or exceed device manufacturer's written specifications and installation instructions.
- B. Plenum rated cabling is specified. If conduit is provided from end point to security panel, PVC equivalent may be used.
- C. For cabling in underground conduit, use gel-filled indoor/outdoor equivalent.
- D. Single pair cabling is specified. Where devices and installation requirements permit multiple pair cabling, use the equivalent model including combinations of the cable pairs listed below.
- E. Products:
 - 1. Signal Cabling – Type A: West Penn Model 25290B, 22AWG, 1 pair, twisted, non-shielded, plenum rated, or equal.
 - 2. Low Voltage Power Cabling – Type B: West Penn Model 25224B, 18AWG, 1 pair, twisted, non-shielded, plenum rated, or equal.
 - 3. RS-485 Cabling – Type C: West Penn Model D252401, 24 AWG, 1 pair, individually shielded twisted pairs, plenum rated, or equal.
 - 4. Ethernet Cabling – Type E: Provided per applicable section in Division 27 specifications.
 - 5. Fiber Optic Cabling – Type F (#) (where # = number of strands): Provided per Division 27 specifications.
 - 6. Composite Card Reader Cabling – Type G: West Penn Model AC251822B3P, 22/6 twisted shielded, 22/2 twisted unshielded, 22/4 twisted unshielded, and 18/4 twisted unshielded.

2.3 DOOR HARDWARE PRODUCTS

- A. Electrified locking hardware installed on labeled fire door assemblies shall be installed without altering the rating of the fire door assembly. If a door is cored in the field for a door-mounted electrified door lock, the work shall be performed, and the fire door assembly shall have a new rating label applied, by a Nationally Recognized Testing Laboratory (NRTL) certified Contractor.
- B. Electric Strike
 - 1. Provide electric strike, non-handed, and constructed of stainless steel. The electric strike shall have the ability to accept locksets with $\frac{3}{4}$ " throw latch bolt. The solenoid shall be rated for continuous duty, 24VDC powered for silent operation. The unit shall meet all standards and shall be UL listed.
 - a. Von Duprin 6200 Series
 - b. Or approved equal
- C. Magnetic Lock
 - 1. Provide electromagnetic lock which meets ANSI/BHMA A156.23 for the minimum holding force of 1500 LBF.

- a. Locknetics MagForce+ Series
 - b. Or approved equal
- D. Electrified Exit Device
 - 1. Provide electrified exit device, shall be non-handed and constructed of stainless steel; it shall require no more than 15 pounds of force to operate. Additional functionality requirements
 - 2. Electrified exit devices shall internally provide request-to-exit function
 - 3. Fire alarm and auxiliary lock functionality
 - a. Von Duprin 99 series
- E. Delayed Egress Exit Device
 - 1. Provide code-compliant delayed egress where indicated on Drawings.
 - 2. Available on all 98/99 Series, XP98/99 Series, and 33A/35A Series electrified exit devices
 - a. Von Duprin CHEXIT Delayed Egress System
- F. Electric Power Transfer
 - 1. Electric power transfer provides a means of transferring electrical power from a door frame to the edge of a swinging door. The units are completely concealed when the door is in the closed position, and are ideally suited for installations involving abuse or heavy traffic.
 - 2. Ten 24-gauge conductors
 - 3. UL Listed for use on fire doors
 - 4. Coordinate door and frame preparation with Division 08 door hardware contractor.
 - a. Von Duprin EPT-10
- G. Electrified Lockset
 - 1. Provide electrified locksets with lever handles.
 - a. Schlage ND Series Grade 1 Cylindrical Lock

PART 3 - EXECUTION

3.1 GENERAL

- A. Coordinate with UCDH representatives the location, physical wall and rack space, power, and network connections required in designated Telecommunications Room (TR) for the installation of systems, products, devices, equipment, and enclosures in this Section.
- B. All materials and labor required to produce a completely operational and fully functional system shall be supplied by the Contractor. It will be the responsibility of the Contractor to conform to the requirements of this Section for system operation, final connection, testing, turnover, and warranty compliance.
- C. Card reader access controlled doors shall be "Fail Secure" unless required by code, authorities having jurisdiction, or as otherwise shown on Drawings to be "Fail Safe".

- D. Card reader access controlled doors are access controlled in the ingress direction. Card reader access controlled doors shall always allow free egress in the egress direction without special knowledge, effort, or the use of a key.
- E. Coordinate with elevator vendor for elevator to integrate into the card access system. Validate travelers are sufficient for the installation to support the card access reader installation within the cab.
- F. Coordinate with Division 08 door hardware contractor:
 - 1. Locking Door Hardware and Accessories
 - 2. Keying
 - 3. Electrified Exit Devices and Power Supplies
 - 4. Door Closers
- G. Coordinate the access control to intrusion detection interface with UCDH. Assign two independent output relay for each card reader door identified for intrusion detection monitoring. Associate the first input to annunciate door forced open and the second to annunciate door help open.
- H. Coordinate communications infrastructure with UCDH:
 - 1. Telecommunications Room (TR) Equipment
 - 2. Ethernet Connections
 - 3. IP Addresses
 - 4. Network Cabling
- I. Consideration for the following items shall be included in a typical installation:
 - 1. ADA Accessibility Requirements
 - 2. Elevator Interface / Cabling to Elevator Equipment Room
 - 3. Fire Relay Interface
 - 4. Overrides / Keypads
 - 5. Card Readers / Reader Stanchions
 - 6. Magnetic Lock Installation
 - 7. Lever Set / Door Coring
 - 8. Exit Device / Power Transfer / Remote Power Supply
 - 9. Independent Pharmacy Systems

3.2 PREPARATION

- A. Review approved Facility Access Control Plan, product data, and shop drawings submittals.
- B. Thoroughly examine installation conditions to verify conformance with manufacturer and technical specification tolerances.
- C. Complete design and verify equipment location placement.
- D. Validate quantity of reader modules, lock power supplies, and batteries to support readers prior to arrival on site.

3.3 GENERAL INSTALLATION

- A. Install the system in accordance with the requirements of this Section, the approved Facility Access Control Plan, product data, and shop drawings submittals.
- B. Install a fully functional and completely operational access control system as required and approved by UCDH for the project.
- C. Low-voltage power supplies for access control panels and electrified locking door hardware will be installed with a plug pigtail, and connected to a Power Distribution Unit (PDU).
 - 1. Ensure security low-voltage power supply is connected to a PDU receptacle (5-15) which is connected to a UPS.
 - 2. Low-voltage power supplies shall not be hardwired to 120VAC.
 - 3. Confirm with UCDH that a designated PDU is available for the access control panels, all expansions, and locking hardware power supplies.
 - 4. Provide AC power quick disconnect on all AC powered low-voltage power supplies.
- D. Connect automatic door operators at card reader access-controlled entrance doors.
- E. Confirm 120 VAC power for door hardware power supplies where required for electrified exit devices.
 - 1. Local power supply for door hardware shall be 120VAC, 60 Hz supplied from the emergency back-up source. Local power supply shall support battery backup.
 - 2. Local power supply not required for low-amperage electrified exit devices, such as Von Duprin Quiet Latch Retraction (QEL).
- F. Make provisions for field wiring to enter the access control panel enclosures and low-voltage power supply enclosures via standard knockouts at the top and sides. Provide sufficiently-sized conduits to allow for future expansion. Provide bushings on all conduit knock-outs and exposed conduit ends.
- G. All wire and cable shield drains shall be grounded at one point only. Cables that originate from equipment in electrical/telecommunication rooms and serve field devices shall be grounded to the signal ground terminal in the TR.

3.4 DEVICE INSTALLATION

- A. Install and terminate devices straight, level and plumb to walls, doors, finished ceiling and/or finished floors, as applicable.
- B. Cabling:
 - 1. Horizontal cabling may be "free run" in accessible plenum if supported by suitable hangers or trays as specified in Division 27. Free run cable shall be installed parallel or perpendicular to walls and column line, with 90 degree turns when necessary - diagonal runs across spaces are not permissible, unless alternative method is approved by UCDH prior to installation.
 - 2. Horizontal cabling shall be installed in EMT through non-accessible, hard-lid, and exposed ceilings.
 - 3. Exposed vertical cabling shall be installed in EMT or rigid conduit, as required by N.E.C. Vertical cabling in walls shall be EMT or flexible metal conduit.

4. All conduit, regardless of type or installation location shall be sized to accommodate no more than 40% fill, per N.E.C.
- C. Intelligent Controller Installation:
1. Intelligent Controller Addressing/DIP Switch/Jumper Settings:
 - a. Intelligent controller network IP address, subnet and gateway settings will be coordinated with the University and set by the Contractor during installation.
 - b. Set intelligent controller end-of-line termination jumpers as required for each RS-485 communication bus or port.
 - c. Set S1 Dip Switch to OFF, ON, OFF, OFF at power up and then toggle switch 1 to ON to temporarily enable default Username (admin) and Password (password).
 - d. Use Microsoft Edge and default IP address (192.168.0.251) to program IP information into the intelligent controller.
 - e. After IP address information has been loaded into the intelligent controller, toggle switch 1 back to OFF.
- D. Door Controller Installation:
1. Addressing/DIP Switch/Jumper Settings:
 - a. Individual door controller addresses shall be coordinated with the University and set by the Contractor during installation.
 - b. Set door controller end-of-line termination jumpers when the controller is the end of an RS-485 communication bus or port.
 - c. Set baud rate to 9,600.
 - d. Set downstream encryption to "on".
- E. Card Reader Installation:
1. Card readers shall be installed flush-mounted (unless otherwise noted), to new junction boxes. Contractor shall terminate all wiring and test card reader prior to installation.
 2. Run all wiring from each card reader door to its respective door controller, power supply or security equipment enclosure with no splices or termination points in between, as designated on the Drawings.
- F. Install new 1K/1K end of line resistors (EOL), at each applicable input device to provide 4-state supervision monitoring of all installed devices.
- G. Install, terminate, and test all devices and EOL resistors such that desired conditions occur upon activation, which are within the manufacturer's performance specifications.
- H. Individual tamper switches on power supply enclosure shall be wired in series and monitored as a single alarm point on the system.
- I. Adjust pattern and sensitivity of all devices to achieve desired coverage area, where applicable.
- J. All relays, whether specified herein or not, shall be provided by the Contractor as incidental to the project.
- K. No splices shall be made except as required to terminate field devices.

3.5 LABELING

- A. All system products, devices, equipment, power supplies, cabling, conduits, and cables shall be labeled with their unique device name and number in a manner approved by ITFT.
- B. Labeling shall match the text and nomenclature in the programming sheets, system programming, and on the as-built drawings.
- C. Labels shall be machine printed on adhesive labels. Handwritten labels are not acceptable.
- D. The font shall be at least 1/8 inch in height, block characters, and legible. The text shall be black characters on a white background.

3.6 EXAMINATION / ACCEPTANCE

- A. Contractor shall conduct and document System Functional Testing and Onsite Acceptance Testing. System Functional Testing shall be performed by Contractor to ensure that the system is fully functional and completely operational in accordance with the requirements of this Section. Onsite Acceptance Testing shall be performed with UCDH representatives to demonstrate the operation of the completed system.
 - 1. Onsite Acceptance Testing shall only be performed after the System Functional Testing is approved and accepted.
 - 2. Contractor shall provide all personnel and equipment necessary to perform the System Functional Testing and the Onsite Acceptance Testing.
 - 3. Punch list items from the System Functional Testing and Onsite Acceptance Testing shall be satisfactorily resolved by the Contractor prior to UCDH issuing a written notice of acceptance.
- B. System Functional Testing:
 - 1. At least ten working days (two weeks) prior to the scheduled Onsite Acceptance Testing date, Contractor shall provide printed System Functional Testing documentation indicating each device has been successfully tested and is in conformance with the operational intent outlined in the Contract Documents.
 - 2. Printed System Functional Testing documentation should clearly indicate any remaining outstanding items, issues, and punch list items.
 - 3. Failure to provide printed System Functional Testing documentation will prevent Onsite Acceptance Testing from being conducted.
- C. Onsite Acceptance Testing:
 - 1. After approval and acceptance of the printed System Functional Testing documentation, Contractor shall perform Onsite Acceptance Testing in collaboration with the UCDH representative.
 - 2. Upon completion and resolution of all remaining outstanding punch list items, Contractor shall perform follow-up Onsite Acceptance Testing in collaboration with the UCDH representative.
 - 3. Upon successful completion of the follow-up Onsite Acceptance Testing, resolution of all punch list items, delivery and acceptance of the final printed System Functional Testing documentation, and delivery and acceptance of the O&M manuals and as-built drawings, UCDH shall issue a written notice of acceptance, the project shall be considered substantially complete, and the warranty period shall begin.

END OF SECTION

SECTION 28 20 00
VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 SUMMARY

- A. Create an IP-based, video security surveillance system, providing proper visual coverage and recording as defined by the customer.
- B. The Owner is defined herein as "UCDH" which represents University of California Davis Health and specifically includes IT Facilities, IT Facilities Infrastructure, IT Facilities Engineering, Network Operations, Auxiliary Services, and other relevant UCDH departments and representatives.
- C. All work in OSHPD-1 Hospital and associated facilities shall be executed in accordance with the requirements of UCDH Infection Control Risk Assessment (ICRA) and Pre-Construction Risk Assessment (PCRA) requirements, standards, forms, policies, and procedures.
- D. This Section requires the furnishing and installation of all items specified herein, indicated on the Drawings or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether specifically called for by item or not) reasonably necessary to facilitate each system's functionality as indicated by the design and the equipment specified.
- E. Elements of the work include, but are not limited to, materials, labor, supervision, supplies, equipment, transportation, storage, utilities, and all required licenses.
- F. Furnish and install all material, equipment, sensors, devices, relays, wiring and connectors, etc., to all building systems and equipment, as necessary for a complete and operational system as specified, drawn, and intended.
- G. Perform all work for this Project in accordance with the Drawings and Specifications and subject to the terms and conditions of the Contract. Install security wire and cable in a manner that is consistent with the provisions and intent of the Specifications, the Drawings, and the referenced Codes and Standards, and in accordance with equipment manufacturer's written Specifications and instructions.
- H. All installation workmanship must be, meet industry standards. This must include, but not be limited to, furnishing proper grounding of data lines and devices, providing neat wire and cable routing, identification of cables and/or conductors by asset tags, providing secure wire termination's, splices, ease of access for maintenance and testing, plumb and level installation of devices, etc.
- I. For purposes of these Specifications, "provide" and "furnish and install" shall be synonymous.
- J. Furnish and install security systems as shown on the Drawings and specified herein to provide a complete and operational system.

1.2 SYSTEM DESCRIPTION

- A. The Video Surveillance System (VSS) utilized by the University is OnSSI Ocularis.

- B. VSS design is based on a distributed network model where all cameras terminate to the nearest PoE+ network switch in the TR room on the same floor as the device, unless specifically approved by ITFT.
- C. The NVR shall be connected to the network switch via an intermediate ethernet patch panel. specification. Cameras shall connect to the network switch via an intermediate patch panel at the switch and via an ethernet jack installed at the camera. CAT6A ethernet cabling, patch panels, network jacks, and patch cords shall be provided per Data Center Services specifications included in Division 27.
- D. All VSS equipment terminating in a TR shall be on UPS power.
- E. The VSS shall include installation of some or all the following equipment:
 - 1. Network Video Recorders
 - 2. Fixed IP indoor and outdoor cameras
 - 3. 180 to 360-degree fixed IP indoor and outdoor cameras
 - 4. Pan-tilt-zoom indoor and outdoor camera
 - 5. Video camera accessories and mounts
- F. Complete a VSS Loading Schedule for each NVR included in the project. This loading schedule shall include NVR configuration data, including the IP information provided by ITFT, as well as specific MAC address, username and password. The loading schedule shall also include specific IP addressing and point-to-point termination information for all cameras connected to the associated NVR, as keyed to the project drawings. The termination schedules shall also include areas to document testing and commissioning of the NVR and associated camera
- G. Programming, addressing and adjusting of cameras shall be performed by the Contractor and shall include the following:
 - 1. Updating cameras to the current firmware version published by the manufacturer.
 - 2. IP address, subnet mask and gateway as coordinated with UCDH.
 - 3. Camera login and password as coordinated with UCDH.
 - 4. Field of view and focus adjustments as coordinated with UCDH.

1.3 RELATED SECTIONS

- A. Division 27 Communications Sections
- B. 27 05 41 FIRE-STOPPING SYSTEMS
- C. 27 52 23 NURSE CALL CODE BLUE SYSTEMS
- D. 28 10 00 ACCESS CONTROL
- E. 28 31 00 INTRUSION DETECTION
- F. 28 49 00 ELECTRONIC PERSONAL PROTECTION SYSTEMS

1.4 REFERENCES

- A. American National Standards Institute (ANSI)

- B. American Society for Testing and Materials (ASTM)
- C. Building Industry Consulting Services International (BICSI)
- D. Institute of Electrical and Electronic Engineers (IEEE)
- E. National Electrical Manufacturers Association (NEMA)
- F. National Fire Protection Association (NFPA)
- G. Telecommunications Industry Association (TIA)
- H. Underwriters Laboratories, Inc. (UL)
- I. California Building Standards Code (California Code Of Regulations, Title 24), 2019
- J. Public Safety (California Code of Regulations, Title 19), 2021
- K. Office of the California State Fire Marshal (CSFM) Building Materials Listing (BML) Program
- L. NFPA 70 National Electrical Code (NEC), 2020
- M. NFPA 70 National Electrical Code (NEC), Chapter 8 Communications Systems, Article 800 Communications Circuits, 2020
- N. NFPA 99 Health Care Facilities Code, 2021
- O. ANSI/TIA-568.0 Generic Telecommunications Cabling for Customer Premises, Rev. E, 2020
- P. ANSI/TIA-568.1 Commercial Building Telecommunications Infrastructure Standard, Rev. E, 2020
- Q. ANSI/TIA-568.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standard, Rev. D, 2018
- R. ANSI/TIA-568.3 Optical Fiber Cabling and Components Standard, Rev. D, 2016
- S. ANSI/TIA-568.4 Broadband Coaxial Cabling and Components Standard, Rev. D, 2017
- T. ANSI/TIA-569 Telecommunications Pathways and Spaces, Rev. E, 2019
- U. ANSI/UL 2900-1 Standard for Software Cybersecurity for Network-Connectable Products, General Requirements, 2020
- V. ANSI/UL 2900-2-1 Software Cybersecurity for Network-Connectable Products, Particular Requirements for Network Connectable Components of Healthcare and Wellness Systems, 2020
- W. ANSI/UL 2900-2-3 Standard for Software Cybersecurity for Network-Connectable Products, Particular Requirements for Security and Life Safety Signaling Systems, 2020
- X. ANSI/NECA 303-2019 Standard for Installing and Maintaining Closed-Circuit Television Systems

1.5 SUBMITTALS

- A. Submittals shall conform with Division 1 requirements Submittal Procedures.

- B. Submittals shall conform with Division-27 Section 27 05 00 Common Work Results for Communications.
- C. Procurement and installation shall not begin until product data and shop drawings submittals have been approved by UCDH.
- D. Submit shop drawings submittals to UCDH for review and approval.
 - 1. Submit shop drawings submittals including device and equipment locations.
 - 2. Prepare floor plans including room names, room numbers, and door numbers indicating all device locations labeled with unique device name and number.
 - 3. Include point-to-point drawings of systems, wiring diagrams of individual devices, equipment elevations, and installation details.
 - 4. Indicate wall space and rack space requirements.
 - 5. Indicate IP addresses, Ethernet switch ports, and fiber connectivity requirements.
 - 6. Provide video surveillance camera schedule including camera unique device name and number, type of camera, lens, location, room number, cable, TR, cabling distances, mounting, and all accessories. Indicate intended video surveillance camera field of view. Indicate dedicated camera power supplies, where provided.
 - 7. Indicate and label access controlled zones and electronic personal protection system secure zones, where applicable.
 - 8. Indicate which devices are to be controlled, and which areas and rooms are to be monitored, by a designated nursing station, where applicable.
 - 9. Compile shop drawings in AutoCAD and submit an electronic copy in .pdf format.
- E. Submit Video Surveillance System Loading Schedule for coordination of programming, configuration, and addressing of the ACS with UCDH ITFT
- F. Submit Operation and Maintenance Manual (O&M) submittals to UCDH for review and approval.
 - 1. Provide a copy of the final approved acceptance testing reports and documentation.
 - 2. Reflect final UCDH occupancy room numbers in the O&M manuals, programming sheets, and system programming.
 - 3. Compile system, product, device, and equipment documentation (including graphics, tables, and diagrams) complete with a Table of Contents linked to the bookmarks within the manual and submit an electronic copy in Adobe Acrobat or Bluebeam Revu .pdf format.
- G. Submit as-built drawings submittals to UCDH for review and approval.
 - 1. As work progresses, maintain field redlines of actual installation conditions, including device, equipment, and cabling locations.
 - 2. At project close-out, transfer these redlines to as-built drawings in AutoCAD format.
 - 3. Reflect final UCDH occupancy room numbers on as-built drawings, programming sheets, and system programming.
 - 4. Include floor plans clearly indicating all device locations labeled with unique device name and number.
 - 5. Include final updated video surveillance camera schedule including camera unique device name and number, type of camera, lens, location, room number, cable, TR, cabling distances, mounting, and all accessories. Include video surveillance camera field of view. Indicate dedicated camera power supplies, where provided.

6. Indicate and label access controlled zones and electronic personal protection system secure zones, where applicable.
7. Indicate which devices are to be controlled, and which areas and rooms are to be monitored, by a designated nursing station, where applicable.
8. Compile as-built drawings in AutoCAD and submit an electronic copy in AutoCAD .dwg and in Adobe Acrobat or Bluebeam Revu .pdf format.

1.6 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacturer.
- B. Equipment and accessories furnished under this Section shall be the standard products of manufacturers regularly engaging in the manufacture of this type of product for a period of at least three years.
- C. The manufacturer shall guarantee the availability of parts for a minimum of three years from date of shipment.
- D. The system shall be installed by a factory-trained and certified Ocularis-QOGNIFY technician.

1.7 WARRANTY

- A. Warranty workmanship and all material for a period of one year from the date of the installation and acceptance by UCDH.

PART 2 - PRODUCTS

2.1 NETWORK VIDEO RECORDERS

- A. VSS NVR shall be by Razberri – project specific part number will be provided by ITFT to meet policy requirements for field of view, focus, pixels-on-target, and video retention. All cameras shall be configured for 24/7 recording at frame and bit rates defined in policy.
 1. Install NVR in TR equipment rack per Division 27 requirements.
 2. Program NVR to meet project specific requirements as provided and coordinated with ITFT.

2.2 VSS CABLING

- A. VSS cabling shall be provided and installed per Division 27 specifications.

2.3 FIXED CAMERAS

- A. Fixed cameras shall be powered to Type 3 PoE.
- B. Fixed cameras shall be connected to PoE network switch or PoE injectors/midspans as coordinated with the University representative.

- C. Fixed cameras provided for this project shall provide 75-80 pixels per foot, horizontal resolution, on target from the installed camera location.
- D. Fixed cameras shall be configured to stream H. 264 compression.
- E. All fixed cameras shall be programmed to record at the highest available resolution and 10 images per second without reducing recording duration below 30 days across all cameras configured on a particular VSS Server.
- F. Fixed IP cameras shall be from Axis M and/or P32 series, including all necessary accessories and mounts, as detailed on the Drawings.

2.4 180 AND 360-DEGREE PANORAMIC FIXED CAMERAS

- A. Panoramic cameras shall be powered over via Class 3 PoE.
- B. Panoramic cameras shall be connected to PoE network switch as coordinated with the University representative.
- C. Panoramic cameras provided for this project shall provide 180 to 360-degree field of view by positioning of the individual imagers in each camera with a minimum resolution of 1080HD per imager.
- D. Panoramic cameras shall be configured to stream H.264.
- E. All panoramic cameras shall be programmed to record at the highest available resolution and 10 images per second without reducing recording duration below 30 days across all cameras configured on a particular VSS Server.
- F. Panoramic IP cameras shall be from Axis P37, P47, or Q60 series, including all necessary accessories and mounts, as detailed on the Drawings.

2.5 PAN-TIL-ZOOM (PTZ) CAMERAS

- A. PTZ cameras shall be powered over via an included 120VAC to PoE midspan.
- B. PTZ cameras shall be connected to PoE network switch as coordinated with the UCDH representative.
- C. PTZ cameras provided for this project shall provide a minimum resolution of 1080HD.
- D. PTZ cameras shall be configured to stream H. 264 compression.
- E. All PTZ cameras shall be programmed to record at the highest available resolution and 10 images per second without reducing recording duration below 30 days across all cameras configured on a particular VSS Server.
- F. PTZ IP cameras shall be from Axis Q60 series, including all necessary accessories and mounts, as detailed on the Drawings.

PART 3 - EXECUTION

3.1 GENERAL

- A. Coordinate with UCDH representatives the location, physical wall and rack space, power, and network connections required in designated Telecommunications Room (TR) for the installation of systems, products, devices, equipment, and enclosures in this Section.
- B. All materials and labor required to produce a completely operational and fully functional system shall be supplied by the Contractor. It will be the responsibility of the Contractor to conform to the requirements of this Section for system operation, final connection, testing, turnover, and warranty compliance.
- C. Network cable and patch cables for cameras shall be provided in accordance with the requirements of Division 27 Communications Sections.
- D. Exterior cameras shall be IP66 rated for outdoor installation.

3.2 PREPARATION

- A. Contractor shall proactively initiate the planning, communication, and preparation for site visits and installation, including distribution of, and schedule for installation work, with project and UCDH representatives.
- B. Contractor shall request IP addresses in advance of the need.
- C. Thoroughly examine installation conditions to verify conformance with manufacturer and technical specification tolerances.
- D. Validate intended site views prior to camera installation. Contractor and UCDH representative to walk jobsite and view every camera location.
- E. Validate cable parameters and operational status to server(s).
- F. Validate network equipment and capacity, licensing, and firmware with UCDH.
- G. Coordinate Power over Ethernet (PoE) network switch requirements with UCDH.

3.3 INSTALLATION

- A. Contractor to test network cable before installing camera.
- B. Contractor shall install and configure initial camera field of view and focus for confirmation by UCDH representative. Refocus and fine tune camera field of view and focus with UCDH representative present for approval.
- C. Contractor shall program initial camera settings such as resolution and frame rate for live and recorded video for confirmation by UCDH representative. Configure video data storage per UCDH requirements (Camera, Server, Enterprise).
- D. Configure camera bandwidth utilization and codec compression as required by UCDH standards.
- E. Program camera with IP address provided by UCDH.

- F. Label MAC address on camera base during installation.

3.4 LABELING

- A. All system products, devices, equipment, power supplies, cabling, conduits, patch panels, and patch cables shall be labeled with their unique device name and number.
- B. Camera labels shall be installed on the outer side of the camera trim ring or housing so that it can be seen and read from the ground. The label shall use the ITFT device identification schema.
- C. Labeling shall match the text and nomenclature in the programming sheets, system programming, and on the as-built drawings.
- D. Labels shall be machine printed on adhesive labels. Handwritten labels are not acceptable.
- E. The font shall be at least 1/8 inch in height, block characters, and legible. The text shall be black characters on a white background.

3.5 EXAMINATION / ACCEPTANCE

- A. Contractor shall conduct and document System Functional Testing and Onsite Acceptance Testing. System Functional Testing shall be performed by Contractor to ensure that the system is fully functional and completely operational in accordance with the requirements of this Section. Onsite Acceptance Testing shall be performed with UCDH representatives to demonstrate the operation of the completed system.
 - 1. Onsite Acceptance Testing shall only be performed after the System Functional Testing is approved and accepted.
 - 2. Contractor shall provide all personnel and equipment necessary to perform the System Functional Testing and the Onsite Acceptance Testing.
 - 3. Punch list items from the System Functional Testing and Onsite Acceptance Testing shall be satisfactorily resolved by the Contractor prior to UCDH issuing a written notice of acceptance.
- B. System Functional Testing:
 - 1. At least ten working days (two weeks) prior to the scheduled Onsite Acceptance Testing date, Contractor shall provide printed System Functional Testing documentation indicating each device has been successfully tested and is in conformance with the operational intent outlined in the Contract Documents.
 - 2. Printed System Functional Testing documentation should clearly indicate any remaining outstanding items, issues, and punch list items.
 - 3. Failure to provide printed System Functional Testing documentation will prevent Onsite Acceptance Testing from being conducted.
- C. Onsite Acceptance Testing:
 - 1. After approval and acceptance of the printed System Functional Testing documentation, Contractor shall perform Onsite Acceptance Testing in collaboration with the UCDH representative.
 - 2. Upon completion and resolution of all remaining outstanding punch list items, Contractor shall perform follow-up Onsite Acceptance Testing in collaboration with the UCDH representative.

3. Upon successful completion of the follow-up Onsite Acceptance Testing, resolution of all punch list items, delivery and acceptance of the final printed System Functional Testing documentation, and delivery and acceptance of the O&M manuals and as-built drawings, UCDH shall issue a written notice of acceptance, the project shall be considered substantially complete, and the warranty period shall begin.

END OF SECTION

SECTION 28 31 00
INTRUSION DETECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. The work covered under this Section consists of the complete installation and integration of a building Intrusion Detection System.
- B. The Owner is defined herein as "UCDH" which represents University of California Davis Health and specifically includes IT Facilities, IT Facilities Infrastructure, IT Facilities Engineering, Network Operations, Auxiliary Services, and other relevant UCDH departments and representatives.
- C. All work in OSHPD-1 Hospital and associated facilities shall be executed in accordance with the requirements of UCDH Infection Control Risk Assessment (ICRA) and Pre-Construction Risk Assessment (PCRA) requirements, standards, forms, policies, and procedures.

1.2 SYSTEM DESCRIPTION

- A. The Integrated Digital Alarm Communicator System (DACS) includes but is not limited to:
 - 1. Alarm Control Panels
 - 2. Alarm Keypads
 - 3. Panic and holdup sensors
 - 4. Motion and Glass break Detection
 - 5. Door sensors
 - 6. Remote annunciators and bells
 - 7. Other devices required for integration with Access Control System, including door forced and door held outputs from card reader doors identified for intrusion detection monitoring.
 - 8. Engineering, provision, coordination, installation, termination, testing and documentation of alarm panel and functions, as required.
- B. The system shall support the integration of the building access system and reporting of intrusion/access monitoring devices to a remote Digital Alarm Communicator Receiver (DACR).
- C. The system shall be modular in nature and will permit expansion in both capacity and functionality through the addition of controllers or sensors.

1.3 RELATED SECTIONS

- A. Division 27 Communications Sections
- B. 27 05 41 FIRE-STOPPING SYSTEMS
- C. 27 52 23 NURSE CALL CODE BLUE SYSTEMS
- D. 28 10 00 ACCESS CONTROL

- E. 28 20 00 VIDEO SURVEILLANCE
- F. 28 49 00 ELECTRONIC PERSONAL PROTECTION SYSTEMS

1.4 REFERENCES

- A. American National Standards Institute (ANSI)
- B. American Society for Testing and Materials (ASTM)
- C. Building Industry Consulting Services International (BICSI)
- D. Institute of Electrical and Electronic Engineers (IEEE)
- E. National Electrical Manufacturers Association (NEMA)
- F. National Fire Protection Association (NFPA)
- G. Telecommunications Industry Association (TIA)
- H. Underwriters Laboratories, Inc. (UL)
- I. California Building Standards Code (California Code Of Regulations, Title 24), 2019
- J. Public Safety (California Code of Regulations, Title 19), 2021
- K. Office of the California State Fire Marshal (CSFM) Building Materials Listing (BML) Program
- L. NFPA 70 National Electrical Code (NEC), 2020
- M. NFPA 70 National Electrical Code (NEC), Chapter 8 Communications Systems, Article 800 Communications Circuits, 2020
- N. NFPA 99 Health Care Facilities Code, 2021
- O. ANSI/TIA-568.0 Generic Telecommunications Cabling for Customer Premises, Rev. E, 2020
- P. ANSI/TIA-568.1 Commercial Building Telecommunications Infrastructure Standard, Rev. E, 2020
- Q. ANSI/TIA-568.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standard, Rev. D, 2018
- R. ANSI/TIA-568.3 Optical Fiber Cabling and Components Standard, Rev. D, 2016
- S. ANSI/TIA-568.4 Broadband Coaxial Cabling and Components Standard, Rev. D, 2017
- T. ANSI/TIA-569 Telecommunications Pathways and Spaces, Rev. E, 2019
- U. ANSI/UL 2900-1 Standard for Software Cybersecurity for Network-Connectable Products, General Requirements, 2020
- V. ANSI/UL 2900-2-1 Software Cybersecurity for Network-Connectable Products, Particular Requirements for Network Connectable Components of Healthcare and Wellness Systems, 2020

- W. ANSI/UL 2900-2-3 Standard for Software Cybersecurity for Network-Connectable Products, Particular Requirements for Security and Life Safety Signaling Systems, 2020
- X. ANSI/TIA-968 Telecommunications Telephone Terminal Equipment Technical Requirements for Connection of Terminal Equipment to the Telephone Network, 2016

1.5 SUBMITTALS

- A. Submittals shall conform with Division 1 requirements Submittal Procedures.
- B. Submittals shall conform with Division-27 Section 27 05 00 Common Work Results for Communications.
- C. Submit shop drawings submittals to UCDH for review and approval.
 - 1. Submit shop drawings submittals including device and equipment locations.
 - 2. Prepare floor plans including room names, room numbers, and door numbers indicating all device locations labeled with unique device name and number.
 - 3. Include point-to-point drawings of systems, wiring diagrams of individual devices, equipment elevations, and installation details.
 - 4. Indicate wall space and rack space requirements.
 - 5. Indicate IP addresses, Ethernet switch ports, and fiber connectivity requirements.
 - 6. Indicate and label access controlled zones and electronic personal protection system secure zones, where applicable.
 - 7. Indicate which devices are to be controlled, and which areas and rooms are to be monitored, by a designated nursing station, where applicable.
 - 8. Compile shop drawings in AutoCAD and submit an electronic copy in .pdf format.
- D. Submit Intrusion Detection System Termination Schedule for coordination of programming, configuration, and addressing of the ICS with UCDH ITFT.
- E. Submit Operation and Maintenance Manual (O&M) submittals to UCDH for review and approval.
 - 1. Provide a copy of the final approved acceptance testing reports and documentation.
 - 2. Reflect final UCDH occupancy room numbers in the O&M manuals, programming sheets, and system programming.
 - 3. Compile system, product, device, and equipment documentation (including graphics, tables, and diagrams) complete with a Table of Contents linked to the bookmarks within the manual and submit an electronic copy in Adobe Acrobat or Bluebeam Revu .pdf format.
- F. Submit as-built drawings submittals to UCDH for review and approval.
 - 1. As work progresses, maintain field redlines of actual installation conditions, including device, equipment, and cabling locations.
 - 2. At project close-out, transfer these redlines to as-built drawings in AutoCAD format.
 - 3. Reflect final UCDH occupancy room numbers on as-built drawings, programming sheets, and system programming.
 - 4. Include floor plans clearly indicating all device locations labeled with unique device name and number.
 - 5. Indicate and label access controlled zones and electronic personal protection system secure zones, where applicable.

6. Indicate which devices are to be controlled, and which areas and rooms are to be monitored, by a designated nursing station, where applicable.
7. Compile as-built drawings in AutoCAD and submit an electronic copy in AutoCAD .dwg and in Adobe Acrobat or Bluebeam Revu .pdf format.

1.6 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new and unused, and of current manufacturer.
- B. Installation shall be accomplished in a professional manner by qualified personnel.
- C. The manufacturer shall be able to demonstrate the features, functions, and operating characteristics to UCDH.

1.7 WARRANTY

- A. Contractor shall provide labor and hardware repairs and replacement for a period of one year following the acceptance of the installation.

PART 2 - PRODUCTS

2.1 INTRUSION DETECTION PRODUCTS

- A. Control Panel
 1. Alarm Panel: Bosch model B9512G in enclosure with door tamper switch
 2. Power Supply: Bosch model D1640
 3. Eight Zone Input Expansion Module: Bosch B208
- B. Keypad / Annunciator
 1. Bosch model B930
- C. Glass Break detectors
 1. Honeywell FG-730 with sensitivity adjustment
- D. Motion Detectors
 1. Bosch motion detector ISC-BPQ2-W12
- E. Panic/Robbery Switch
 1. Potter HUB- M Single Button Hold up switch.
- F. Door Contacts
 1. Magnetic door contact, flush – 1078 C-N 3/4" White, Preferred
 2. Magnetic door contact, flush – 1078 C-N 1"

2.2 WIRE AND CABLE

- A. ICS cabling, wiring, and termination requirements shall meet or exceed device manufacturer's written specifications and installation instructions.
- B. Plenum rated cabling is specified. If conduit is provided from end point to alarm panel, PVC equivalent may be used.
- C. For cabling in underground conduit, use gel-filled indoor/outdoor equivalent.
- D. Single pair cabling is specified. Where devices and installation requirements permit multiple pair cabling, use the equivalent model including combinations of the cable pairs listed below.
- E. Products:
 - 1. Signal Cabling – Type A: West Penn Model 25290B, 22AWG, 1 pair, twisted, non-shielded, plenum rated, or equal.
 - 2. Low Voltage Power Cabling – Type B: West Penn Model 25224B, 18AWG, 1 pair, twisted, non-shielded, plenum rated, or equal.
 - 3. RS-485 Cabling – Type C: West Penn Model D252401, 24 AWG, 1 pair, individually shielded twisted pairs, plenum rated, or equal.
 - 4. Ethernet Cabling – Type E: Provided per applicable section in Division 27 specifications.

PART 3 - EXECUTION

3.1 GENERAL

- A. Coordinate with UCDH representatives the location, physical wall and rack space, power, and network connections required in designated Telecommunications Room (TR) for the installation of systems, products, devices, equipment, and enclosures in this Section.
- B. All materials and labor required to produce a completely operational and fully functional system shall be supplied by the Contractor. It will be the responsibility of the Contractor to conform to the requirements of this Section for system operation, final connection, testing, turnover, and warranty compliance.
- C. Intrusion detection system enclosure doors must have a minimum of 180-degree swing and maintain clearances to avoid blocking personnel movement within the room.

3.2 PREPARATION

- A. Develop security system plan and complete approval process with UCDH. Include provisioning the input/output interface between the Access Control System relay output module and associated input on the alarm panel. Create the hardwired interface to independently monitor door held and door forced alarms generated in the Access Control System on card reader doors identified for intrusion detection monitoring.
- B. IDS configuration shall be based on an account area model where all field devices covering areas in a specific departmental or administrative area terminate to a panel in the area.
- C. IDS panel design shall include a panel enclosure with the required 12VDC power supplies, power distribution modules, expansion modules, and an alarm keypad for programming and control. The

alarm panel and expansion modules, keypads, and field devices that require power shall be powered via 12VDC service from the IDS panel 12VDC power supply.

- D. One independent 120V 20Amp UPS circuit shall be provided, per Division 26, to service each IDS panel. IDS power supplies shall be hard wired to this circuit.
- E. Complete an IDS Loading Schedule for each alarm panel included in the project. This loading schedule shall include alarm panel configuration data, including the analog (POTS) phone line and IP information provided by ITFT, as well as panel specific MAC address, username and password. The loading schedule shall also include specific addressing and point-to-point termination and designation information for all expansion modules, keypads, and field devices, as keyed to the project drawings. The termination schedules shall also include areas to document testing and commissioning of the alarm panel and associated devices.

3.3 INSTALLATION

- A. Low-voltage power supplies for intrusion detection system equipment will be installed with a plug and connected to a Power Distribution Unit (PDU).
 - 1. Ensure security low-voltage power supply is connected to a PDU receptacle (5-15) which is connected to a UPS.
 - 2. Low-voltage power supplies shall not be hardwired to 120VAC.
 - 3. Confirm with UCDH that a designated PDU is available for the intrusion detection system panels and all expansions.
 - 4. Provide AC power quick disconnect on all AC powered low-voltage power supplies.
- B. Installation shall be accomplished in a professional manner by qualified personnel.
- C. Install a fully functional access control system as required and approved by UCDH for the project.

3.4 LABELING

- A. All system products, devices, equipment, power supplies, cabling, conduits, patch panels, and patch cables shall be labeled with their unique device name and number in a manner approved by ITFT.
- B. Labeling shall match the text and nomenclature in the programming sheets, system programming, and on the as-built drawings.
- C. Labels shall be machine printed on adhesive labels, minimum 1"x1.5" with minimum 12pt. font. Handwritten labels are not acceptable.
- D. The font shall be at least 1/8 inch in height, block characters, and legible. The text shall be black characters on a white background.

3.5 EXAMINATION / ACCEPTANCE

- A. Contractor shall conduct and document System Functional Testing and Onsite Acceptance Testing. System Functional Testing shall be performed by Contractor to ensure that the system is fully functional and completely operational in accordance with the requirements of this Section. Onsite Acceptance Testing shall be performed with UCDH representatives to demonstrate the operation of the completed system.

1. Onsite Acceptance Testing shall only be performed after the System Functional Testing is approved and accepted.
2. Contractor shall provide all personnel and equipment necessary to perform the System Functional Testing and the Onsite Acceptance Testing.
3. Punch list items from the System Functional Testing and Onsite Acceptance Testing shall be satisfactorily resolved by the Contractor prior to UCDH issuing a written notice of acceptance.

B. System Functional Testing:

1. At least ten working days (two weeks) prior to the scheduled Onsite Acceptance Testing date, Contractor shall provide printed System Functional Testing documentation indicating each device has been successfully tested and is in conformance with the operational intent outlined in the Contract Documents.
2. Printed System Functional Testing documentation should clearly indicate any remaining outstanding items, issues, and punch list items.
3. Failure to provide printed System Functional Testing documentation will prevent Onsite Acceptance Testing from being conducted.

C. Onsite Acceptance Testing:

1. After approval and acceptance of the printed System Functional Testing documentation, Contractor shall perform Onsite Acceptance Testing in collaboration with the UCDH representative.
2. Upon completion and resolution of all remaining outstanding punch list items, Contractor shall perform follow-up Onsite Acceptance Testing in collaboration with the UCDH representative.
3. Upon successful completion of the follow-up Onsite Acceptance Testing, resolution of all punch list items, delivery and acceptance of the final printed System Functional Testing documentation, and delivery and acceptance of the O&M manuals and as-built drawings, UCDH shall issue a written notice of acceptance, the project shall be considered substantially complete, and the warranty period shall begin.

END OF SECTION

SECTION 28 49 00
ELECTRONIC PERSONAL PROTECTION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- 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 a Electronic Personal Protection Systems, defined herein as "HUGS" and "PES" (Patient Elopement System).
- B. The Owner is defined herein as "UCDH" which represents University of California Davis Health and specifically includes IT Facilities, IT Facilities Infrastructure, IT Facilities Engineering, Network Operations, Auxiliary Services, and other relevant UCDH departments and representatives.
- C. All work in OSHPD-1 Hospital and associated facilities shall be executed in accordance with the requirements of UCDH Infection Control Risk Assessment (ICRA) and Pre-Construction Risk Assessment (PCRA) requirements, standards, forms, policies, and procedures.
- D. ITFT, in coordination with Securitas Healthcare and the Department of Health Care Access and Information (HCAI), has jurisdiction over the HUGS-PES design, installation, testing, and commissioning requirements on all projects and at all buildings owned or leased by UC Davis Health.
- E. Tag alarm management shall be the responsibility of Nursing Staff, within each monitored Nursing Suite.

1.2 SYSTEM DESCRIPTION

- A. System Platform:
 - 1. Securitas HUGS and Patient
- B. System Devices:
 - 1. Indoor Exciter: EX-3220
 - 2. Long Range Exciter: EX5200
 - 3. Controller: EX5500
 - 4. External LF Antenna: ANT4210
 - 5. Hugs Wi-Fi Tag: TAG-HGS-1000-C
 - 6. Hugs Wi-Fi Tag Charger: CGS-HGS-1000-U
 - 7. Standard Exciter Mounting Kit: EXAC-STD-1000
 - 8. Heavy Duty, Off-Grid, Exciter Mounting Kit: EXAC-HDUTY-1000
 - 9. Wall Mount Bracket for EX5500 and EX5200 Exciters: EXAC-143
 - 10. Low Voltage Power Supplies: per project requirements
 - 11. Hugs - Patient Protection Band, 100 Pack: per project requirements
 - 12. Project Based Professional Services: as required and detailed by vendor

C. System Operation:

1. The HUGS-PES shall be designed to monitor tagged patients and alarm on unauthorized movement of infants, pediatric, or adult patients from protected areas. The system shall report violations of restricted passage to and from areas being monitored to generate an appropriate staff response.
2. When patients are admitted to a protected area, a monitoring tag shall be physically attached to the patient. Then, the monitoring tag shall be configured in software, with parameters specific to that patient and area. The monitoring tag shall be continuously monitored by the system software, to validate the appropriate location of the patient. When a tag is attached to a patient and admitted, an auto-admit signal shall be sent to the Server through a system Receiver. A tag description shall be entered at any dedicated workstation to identify the patient, along with the pre-determined zone ID, representing the physical area where the patient is to be monitored. While active, the tag shall transmit a "heartbeat" every 10 seconds, monitored by the Controller system software. If the heartbeat is not detected within a specified amount of time the system shall alarm. If the tag or band is tampered with, the tag shall alarm.
3. Perimeter areas shall be established that monitor patient traffic and differentiate monitored patients versus allowed foot traffic. UCDH representatives shall determine how the system reacts and alarms to unauthorized patient travel
4. The HUGS-PES system shall establish a "Safe Zone" within each protected Nursing Suite, within a particular building. A "Safe Zone" establishes a perimeter, through which a monitored patient is not allowed, without proper authorized Staff escort. Refer to the Drawings and Bid Instructions to determine the scope limitations for this work.
5. Patient Tag Registration: Patient tag registration shall occur at the Reception desk and all Nursing Stations, within the "Safe Zone" within each protected Nursing Suite. Login/Password authentication is required prior to tag configuration.

D. System Design:

1. The project HUGS-PES design shall include project specific software, field hardware, infant/patient tags and professional and construction services provided on a per project basis through Securitas Healthcare.
2. In general, HUGS-PES devices will be installed to secure the perimeter area where risk of infant abduction or patient elopement are present. Excited and antennae will be installed at portals on the perimeter of the space. These devices activate infant/patient tags when an individual with one of these tags approaches or passes through the portal. Interface with the access control system (ACS) door position switches may be required as well. At these locations, the ACS will utilize double-pole, double-throw door contacts with one pole connected to the ACS and the other connected to HUGS-PES.
3. All HUGS-PES cabling, wiring, and termination requirements shall meet or exceed device manufacturer's written specifications and installation instructions.

1.3 RELATED SECTIONS

- A. Division 27 Communications Sections
- B. 27 05 41 FIRE-STOPPING SYSTEMS
- C. 27 52 23 NURSE CALL CODE BLUE SYSTEMS
- D. 28 10 00 ACCESS CONTROL

- E. 28 20 00 VIDEO SURVEILLANCE
- F. 28 31 00 INTRUSION DETECTION

1.4 REFERENCES

- A. American National Standards Institute (ANSI)
- B. American Society for Testing and Materials (ASTM)
- C. Building Industry Consulting Services International (BICSI)
- D. Institute of Electrical and Electronic Engineers (IEEE)
- E. National Electrical Manufacturers Association (NEMA)
- F. National Fire Protection Association (NFPA)
- G. Telecommunications Industry Association (TIA)
- H. Underwriters Laboratories, Inc. (UL)
- I. California Building Standards Code (California Code Of Regulations, Title 24), 2019
- J. Public Safety (California Code of Regulations, Title 19), 2021
- K. Office of the California State Fire Marshal (CSFM) Building Materials Listing (BML) Program
- L. NFPA 70 National Electrical Code (NEC), 2020
- M. NFPA 70 National Electrical Code (NEC), Chapter 8 Communications Systems, Article 800 Communications Circuits, 2020
- N. NFPA 99 Health Care Facilities Code, 2021
- O. ANSI/TIA-568.0 Generic Telecommunications Cabling for Customer Premises, Rev. E, 2020
- P. ANSI/TIA-568.1 Commercial Building Telecommunications Infrastructure Standard, Rev. E, 2020
- Q. ANSI/TIA-568.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standard, Rev. D, 2018
- R. ANSI/TIA-568.3 Optical Fiber Cabling and Components Standard, Rev. D, 2016
- S. ANSI/TIA-568.4 Broadband Coaxial Cabling and Components Standard, Rev. D, 2017
- T. ANSI/TIA-569 Telecommunications Pathways and Spaces, Rev. E, 2019
- U. ANSI/UL 2900-1 Standard for Software Cybersecurity for Network-Connectable Products, General Requirements, 2020
- V. ANSI/UL 2900-2-1 Software Cybersecurity for Network-Connectable Products, Particular Requirements for Network Connectable Components of Healthcare and Wellness Systems, 2020

- W. ANSI/UL 2900-2-3 Standard for Software Cybersecurity for Network-Connectable Products, Particular Requirements for Security and Life Safety Signaling Systems, 2020

1.5 SUBMITTALS

- A. Submittals shall conform with Division 1 requirements Submittal Procedures.
- B. Submittals shall conform with Division-27 Section 27 05 00 Common Work Results for Communications.
- C. Procurement and installation shall not begin until product data and shop drawings submittals have been approved by UCDH.
- D. Submit shop drawings submittals to UCDH for review and approval.
1. Submit shop drawings submittals including device and equipment locations.
 2. Prepare floor plans including room names, room numbers, and door numbers indicating all device locations labeled with unique device name and number.
 3. Include point-to-point drawings of systems, wiring diagrams of individual devices, equipment elevations, and installation details.
 4. Indicate wall space and rack space requirements.
 5. Indicate IP addresses, Ethernet switch ports, and fiber connectivity requirements.
 6. Indicate and label access-controlled zones and electronic personal protection system secure zones.
 7. Indicate which devices are to be controlled, and which areas and rooms are to be monitored, by a designated nursing station.
 8. Include user defined information per floor and per system component.
 9. Local Area Receivers (LAR) and Portal Exciters shall be accurately located on the shop drawings graphically indicating the diameter of the Local Area Receivers (LAR) coverage areas and the Portal Exciter coverage areas at the associated door.
 10. Compile shop drawings in AutoCAD and submit an electronic copy in .pdf format.
- E. Submit Operation and Maintenance Manual (O&M) submittals to UCDH for review and approval.
1. Provide a copy of the final approved acceptance testing reports and documentation.
 2. Reflect final UCDH occupancy room numbers in the O&M manuals, programming sheets, and system programming.
 3. Compile system, product, device, and equipment documentation (including graphics, tables, and diagrams) complete with a Table of Contents linked to the bookmarks within the manual and submit an electronic copy in Adobe Acrobat or Bluebeam Revu .pdf format.
- F. Submit as-built drawings submittals to UCDH for review and approval.
1. As work progresses, maintain field redlines of actual installation conditions, including device, equipment, and cabling locations.
 2. At project close-out, transfer these redlines to as-built drawings in AutoCAD format.
 3. Reflect final UCDH occupancy room numbers on as-built drawings, programming sheets, and system programming.
 4. Include floor plans clearly indicating all device locations labeled with unique device name and number.

5. Indicate and label access-controlled zones and electronic personal protection system secure zones.
6. Indicate which devices are to be controlled, and which areas and rooms are to be monitored, by a designated nursing station.
7. Local Area Receivers (LAR) and Portal Exciters shall be accurately located on the as-built drawings graphically indicating the diameter of the Local Area Receivers (LAR) coverage areas and the Portal Exciter coverage areas at the associated door.
8. Compile as-built drawings in AutoCAD and submit an electronic copy in AutoCAD .dwg and in Adobe Acrobat or Bluebeam Revu .pdf format.

1.6 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and of current manufacture.
 1. Tags shall be provided with long-life batteries. Batteries shall be guaranteed to have a minimum one (1) year active life (tag performance shall show no signs of significant performance degradation for 1 year from the date of first-time enrollment). Tag battery expiration date shall be clearly and indelibly printed on the tag, where it may be readily viewed, without disturbing the patient or tag placement.
 2. All PCs, Server (if provided), and other, system-related durable electronic appliances shall be warranted by the Contractor for a period of at least one year from date of acceptance.
 3. All system-related, durable electronic equipment shall be warranted by the Contractor, for a period of at least one year from date of final acceptance. In the event of equipment failure, the Contractor shall provide replacement equipment, including parts, any required mounting hardware, and installation labor, for the period of one (1) year from the date of final acceptance. Further, Contractor shall either 1. Provide spare equipment to UCDH, for replacement use, or 2. Keep sufficient spare equipment on-hand, in new condition and specifically designate said equipment for use on UCDH site, in case of equipment failure. Spare parts and equipment costs may be included in Contractor's original bid package. Bid package must include type and quantity of each spare part and/or piece of equipment and be specified on individual line items.
 4. The Contractor shall guarantee all wiring, terminations and connections, free from inherent mechanical and electrical defects for a period of one (1) year from the date of Final Acceptance by authorized UCDH personnel. Warranty service shall be provided within four hours' notice. If the problem cannot be corrected at that time a written plan of correction with a projected time schedule for completion shall be submitted to authorize UCDH personnel at that time.
 5. Upon completion of system verification, Contractor shall submit a point-by-point checklist, indicating the date and time of each item inspected. Contractor shall furnish authorized UCDH personnel a System Certification of Inspection and Function, signifying that the system adheres to all contractually agreed requirements.
 6. Prior to submitting a request for payment, based upon substantial completion, Contractor shall provide a written test report from an authorized representative of the equipment manufacturer, certifying that the system has been 100% tested and approved.
 7. A UCDH representative shall be present during final testing of all system components and shall certify that the system meets or exceeds system technical specifications and the requirements of this Section. Any and all failures shall be corrected and retested at Contractor's expense, in the presence of UCDH personnel, to verify corrections.

8. Where needed, Contractor shall provide eight hours of use and operational training for the number of personnel specified by Auxiliary Services. Training can be spread over multiple days, if so agreed-upon in writing.
 9. Provide 24 hour/7days per week of technical support from an employee of the HUGS-PES system manufacturer, or their designee, for initial programming and startup, and for a period of not less than 90 days after final system acceptance.
- B. Installation shall be accomplished in a professional manner by qualified personnel regularly engaging in and experienced in this type of work for a period of at least 5 years.

1.7 WARRANTY

- A. Contractor shall provide labor and hardware repairs and replacement for a period of one year following the acceptance of the installation.

PART 2 - PRODUCTS

2.1 SYSTEM SERVER AND WORKSTATIONS

- A. Server:
1. Server shall be in the designated Data Center, per the Drawings and Bid Instructions. System management e.g. User definition, patient identification, workstation configuration, and system configuration, device installation and alarm monitoring history shall be stored in the system database at this location. The Server interfaces with system hardware on each monitored Nursing suite, via network interfaces, installed at each suite.
- B. Workstations:
1. Patient Security Monitoring Locations (Workstations): Additional patient security monitoring workstations are provided for monitoring tags and system alarms in real time. Workstations shall be installed at Nurse Stations and other specified locations. (See Drawings and Bid Instructions.)

2.2 SYSTEM SOFTWARE

- A. AeroScout Location Engine for Cisco Environment (ENG-8500)
- B. MobileView Hugs Enterprise Infant Protection Software License (MVINFS-1000-L300)
- C. License for MobileView High Availability (MVHA-2200)

2.3 SYSTEM DEVICES

- A. Indoor Exciter: EX-3220
- B. Long Range Exciter: EX5200
- C. Controller: EX5500
- D. External LF Antenna: ANT4210

- E. Hugs Wi-Fi Tag: TAG-HGS-1000-C
- F. Hugs Wi-Fi Tag Charger: CGS-HGS-1000-U
- G. Standard Exciter Mounting Kit: EXAC-STD-1000
- H. Heavy Duty, Off-Grid, Exciter Mounting Kit: EXAC-HDUTY-1000
- I. Wall Mount Bracket for EX5500 and EX5200 Exciters: EXAC-143
- J. Low Voltage Power Supplies: per project requirements
- K. Hugs - Patient Protection Band, 100 Pack: per project requirements
- L. Project Based Professional Services: as required and detailed by vendor
- M. Miscellaneous parts
 - 1. Provide a sample of each product used in the installation of system as a spare parts crash kit.
 - 2. Provide a full product list of items that are available for installation with the system at the time of system acceptance.

PART 3 - EXECUTION

3.1 GENERAL

- A. Coordinate with UCDH representatives the location, physical wall and rack space, power, and network connections required in designated Telecommunications Room (TR) for the installation of systems, products, devices, equipment, and enclosures in this Section.
- B. All materials and labor required to produce a completely operational and fully functional system shall be supplied by the Contractor. It will be the responsibility of the Contractor to conform to the requirements of this Section for system operation, final connection, testing, turnover, and warranty compliance.
- C. The use of wire nuts and crimp type connectors shall not be permitted. Where shielded wire is used it shall be connected to an earth ground at the power supply panel. All data signal wiring shall meet Echelon LonWorks network technical specifications.
- D. No power supply enclosure shall be mounted where it is not readily accessible, the highest connection point shall not be above 8', nor shall the bottom of the panel be below 30".

3.2 PREPARATION

- A. Connect equipment to 20 ampere 120 VAC circuit(s) from the UPS power system.
- B. All equipment shall be listed by Underwriter's Laboratories.
- C. Minimum conduit size for multiple conductor runs shall be ¾". In each control panel 2 empty ¾" conduits shall be installed for future use. These conduits shall be routed to an accessible area above the ceiling or to a location approved by UCDH. Run circuits for AC separate from circuits using DC.

- D. Thoroughly examine site conditions for acceptance of supporting device installation to verify conformance with manufacturer and technical specification tolerances. Do not commence with installation until all conditions are made satisfactory.
- E. All equipment and material shall be new and not used even for demonstration purposes.
- F. The Infant Security system shall co-exist with the access control system.
- G. Review floor plan for access
 - 1. Review for camera views
 - 2. Isolate an area where foot traffic can be controlled
 - 3. Determine square footage
 - 4. Locate Patient Security Receivers (PSRs) and Portal Exciters

3.3 INSTALLATION

- A. Equipment shall be installed in accordance with manufacturer's recommendations.
- B. Installation shall be accomplished in a professional manner by qualified personnel regularly engaging in and experienced in this type of work for a period of at least 5 years and specifically trained to install Stanley Healthcare HUGS systems.
- C. Bundle system conductors with nylon cable straps. General: All Cables installed in ceiling spaces shall be rated for plenum use.
- D. Conduct ongoing local and remote diagnostic tests and validations as work progresses.
- E. Controller Cable: Belden 9940, or equivalent, or as recommended by the manufacturer to ensure performance.
 - 1. 2-wire alarm cable: Belden 8761, or equivalent as recommended by the manufacturer to ensure performance.
 - 2. 4-wire alarm cable: Belden 9302, or equivalent as recommended by the manufacturer to ensure performance.
 - 3. Electric Lock cable: Belden 8461, or equivalent as recommended by the manufacturer to ensure performance.
 - 4. All wiring shall run continuous from device to device. No splices shall be permitted. The use of wire nuts and crimp type connectors shall not be permitted. Where shielded wire is used it shall be connected to an earth ground at the power supply panel. All data signal wiring shall meet Echelon LonWorks network technical specifications.
 - 5. Installation shall be accomplished in a professional manner by qualified personnel regularly engaging in and experienced in this type of work for a period of at least 5 years.

3.4 LABELING

- A. All system products, devices, equipment, power supplies, cabling, conduits, patch panels, and patch cables shall be labeled with their unique device name and number.
- B. Labeling shall match the text and nomenclature in the programming sheets, system programming, and on the as-built drawings.

- C. Labels shall be machine printed on adhesive labels, minimum 1"x1.5" with minimum 12pt. font. Handwritten labels are not acceptable.
- D. The font shall be at least 1/8 inch in height, block characters, and legible. The text shall be black characters on a white background.

3.5 EXAMINATION/ACCEPTANCE

- A. Contractor shall conduct and document System Functional Testing and Onsite Acceptance Testing. System Functional Testing shall be performed by Contractor to ensure that the system is fully functional and completely operational in accordance with the requirements of this Section. Onsite Acceptance Testing shall be performed with UCDH representatives to demonstrate the operation of the completed system.
 - 1. Onsite Acceptance Testing shall only be performed after the System Functional Testing is approved and accepted.
 - 2. Contractor shall provide all personnel and equipment necessary to perform the System Functional Testing and the Onsite Acceptance Testing.
 - 3. Punch list items from the System Functional Testing and Onsite Acceptance Testing shall be satisfactorily resolved by the Contractor prior to UCDH issuing a written notice of acceptance.
- B. System Functional Testing:
 - 1. At least ten working days (two weeks) prior to the scheduled Onsite Acceptance Testing date, Contractor shall provide printed System Functional Testing documentation indicating each device has been successfully tested and is in conformance with the operational intent outlined in the Contract Documents.
 - 2. Printed System Functional Testing documentation should clearly indicate any remaining outstanding items, issues, and punch list items.
 - 3. Failure to provide printed System Functional Testing documentation will prevent Onsite Acceptance Testing from being conducted.
- C. Onsite Acceptance Testing:
 - 1. After approval and acceptance of the printed System Functional Testing documentation, Contractor shall perform Onsite Acceptance Testing in collaboration with the UCDH representative.
 - 2. Upon completion and resolution of all remaining outstanding punch list items, Contractor shall perform follow-up Onsite Acceptance Testing in collaboration with the UCDH representative.
 - 3. Upon successful completion of the follow-up Onsite Acceptance Testing, resolution of all punch list items, delivery and acceptance of the final printed System Functional Testing documentation, and delivery and acceptance of the O&M manuals and as-built drawings, UCDH shall issue a written notice of acceptance, the project shall be considered substantially complete, and the warranty period shall begin.

3.6 DEMONSTRATION AND TRAINING

- A. Provide the services of a factory-authorized service representative to demonstrate and train UCDH maintenance personnel as described below.

- B. Train UCDH personnel in the procedures and schedules involved in operating, troubleshooting servicing, and preventive maintenance of the systems. Provide a minimum of 16-hours training. Training shall be scheduled in more than one session, as agreed-upon by Contractor and UCDH.
- C. Train UCDH personnel in proper use of the system. Periods of training shall be coordinated with the UCDH representative to assure all nursing shifts receive the required training. Each session shall include instructions utilizing hands-on operation of the HUGS equipment in a typical system as selected by the staff. Provide handout material describing system features and functions to all who attend. Schedule all training through the UCDH representative a minimum of 14 days in advance.
- D. Provide on-site assistance in adjusting sound levels and adjusting controls to suit actual occupied conditions on an as-requested basis for the first year of operation.
- E. A failure of any test or any component during a test will require a complete retest program at no additional cost to UCDH.

END OF SECTION