



School District 4J
Eugene Public Schools
200 North Monroe Street
Eugene, OR 97402-4295

Date: 6/31/18
Project: VIDEO SURVEILLANCE SYSTEM RFP
Subject: ADDENDUM #3, CHANGES TO DOCUMENTS

FROM: 4J SCHOOL DISTRICT
715 W 4TH AVE
EUGENE, OR 97402

The following changes are additions/changes to the original RFP.

1. Due date for proposal is now June 19, 2018 at 2PM.
2. Replace Specifications Division 27 - Communications with the attached documents.

Division 27 – Communications

27 00 00 - Communications

27 05 00 - Common Work Results for Communications

27 05 13 - Communications Services

27 05 26 – Grounding and Bonding for Communications Systems

27 05 28 - Pathways for Communications Systems

27 05 28.29 - Hangers and Supports for Communications Systems

27 05 28.33 - Conduits and Backbones for Communications Systems

27 05 28.36 - Cable Trays for Communications Systems

27 05 28.39 - Surface Raceways for Communications Systems

27 05 53 - Identification for Communications Systems

27 08 00 - Commissioning of Communications

27 11 00 – Communications Equipment Room Fittings

27 11 16 – Communications Cabinets, Racks, Frames and Enclosures

27 11 19 - Communications Terminations Blocks and Patch Panels

27 11 23 - Communications Cable Management and Ladder Rack

27 15 13 - Communications Copper Horizontal Cabling

27 15 43 - Communications Faceplates and Connectors

27 16 19 – Patch Cords

SECTION 27 00 00 - COMMUNICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Division 27 – (Communications) governs the infrastructure for the Video Surveillance transport systems, including cabling and all necessary pathways.
- B. The Scope of Work covered by this document is to furnish all work related to a complete and functional structured cabling system.
- C. The components specified and shown on the Drawings is for complete, performance based, workable systems. Deviations from what is shown due to a particular manufacturer's requirements shall be made only with the written approval of the Owner, and at no additional cost to the Owner.

1.2 WORK COVERED BY THIS DIVISION (27):

- A. Structured Cabling System (SCS) including buildout of all infrastructure components necessary for telecommunications spaces:
 - 1. Category 6A horizontal cabling system.
 - 2. Pathways for Telecommunications Systems.
 - 3. Racks, ladder tray and seismic components as required
 - 4. Grounding and Bonding System (GBS) For Telecommunications Systems.
 - 5. Firestopping for Telecommunications Systems.
 - 6. Testing of all telecommunications cabling system.
 - 7. As-built documentation.

1.3 ENVIRONMENTAL CONSIDERATION

- A. Telecommunications infrastructure affects raw material consumption. The SCS design and installation methods influence product life and sustainability. These aspects of telecommunications infrastructure impact our environment. The telecommunications infrastructure design and installation process magnifies the need for sustainable infrastructures with respect to building life and considerations of effects on environmental waste. The structured cabling contractor is encouraged to research local building practices for a sustainable environment and conservation of fossil fuels as part of the construction process.
- B. When at all possible, equipment and materials are to be assembled at Distributors or Contractors location and delivered to construction site without packaging or shipping material.
- C. Except as noted for purposes of recycling, all construction related debris, packaging and waste materials will be removed from the job site each day and disposed of by the Contractor.

1.4 SITE SPECIFIC REQUIREMENTS

- A. This is a multi-site package. Contractor shall be prepared to coordinate scheduling and address any unique attributes with the Owner on a site-by-site basis.

1.5 SECTION INCLUDES

- A. Related Documents, Codes, and Sections
- B. Abbreviations, Acronyms and Definitions

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- C. Project Drawings
 - D. Quality Assurance
 - E. Submittal Requirements
 - F. Additional Requirements

1.6 RELATED DOCUMENTS AND CODES

- A. Comply with the referenced codes and standards and with the Contract Documents. Where conflicts occur, the more stringent shall apply.
- B. The latest versions, including addenda, as enforced by the local Authority Having Jurisdiction of the following codes, associations, acts and agencies:
 - 1. Federal Communications Commission (FCC).
 - 2. National Fire Protection Association (NFPA), specifically:
 - a. NFPA 70, National Electrical Code® (NEC®)
 - b. NFPA 76, Recommended Practice for the Fire Protection of Telecommunications Facilities
 - c. NFPA 101, Life Safety Code®
 - d. NFPA 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces
 - e. NFPA 780, Standard for the Installation of Lightning Protection Systems
 - f. NFPA 5000™, Building Construction and Safety Code
 - 3. National Electrical Safety Code (NESC)
 - 4. Occupational Safety and Health Administration (OSHA)
- C. The following standards bodies:
 - 1. American National Standards Institute (ANSI)
 - 2. National Electrical Manufacturers Association (NEMA)
 - 3. Telecommunications Industries Association (TIA), specifically:
 - a. ANSI/TIA-568.0-D, Generic Telecommunications Cabling for Customer Premises
 - b. ANSI/TIA-568.1-D, Commercial Building Telecommunications Infrastructure Standard
 - c. ANSI/TIA-568.3-D, Optical Fiber Cabling and Components Standard
 - d. ANSI/TIA-568-C.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standards
 - e. ANSI/TIA-569-D, Telecommunications Pathways and Spaces
 - f. ANSI/TIA-607-C, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
 - g. ANSI/TIA-862-B, Structured Cabling Infrastructure Standard for Intelligent Building Systems
 - h. ANSI/TIA-5017, Telecommunications Physical Network Security Standard
 - 4. Other Reference Materials
 - a. ANSI/NECA/GICSI-568-2006, Standard, Installing Commercial Building Telecommunications Cabling
 - b. ANSI/NECA/Bicsi® 568-2006, Standard for Installing Telecommunications Systems

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- c. Bicsi® Outside Plant Design Reference Manual (COOSP)
 - d. Bicsi® Electronic Safety and Security Reference Manual (ESSDRM)
 - e. Bicsi® Telecommunications Distribution Methods Manual (TDMM)
 - f. Bicsi® Wireless Design Reference Manual (WDRM)
 - g. Institute of Electrical and Electronic Engineers (IEEE)
 - h. National Electrical Manufacturers Association (NEMA)
 - i. Underwriters Laboratories (UL®) Cable Certification and Follow up Program

1.7 RELATED SECTIONS

- A. Section 27 05 00 – Common Work Results for Communications
- B. Section 27 05 13 – Communications Services
- C. Section 27 05 26 – Grounding and Bonding for Communications Systems
- D. Section 27 05 28 – Pathways for Communications Systems
- E. Section 27 05 28.33 - Conduits and Backboxes for Communications
- F. Section 27 05 28.36 – Cable Trays for Communications Systems
- G. Section 27 05 28.39 – Surface Mounted Raceway for Communications
- H. Section 27 05 53 – Identification for Communication Systems
- I. Section 27 08 00 – Commissioning of Communications
- J. Section 27 11 19 – Communications Terminations Blocks and Patch Panels
- K. Section 27 11 23 – Communications Cable Management and Ladder Rack
- L. Section 27 15 13 – Communications Copper Horizontal Cabling
- M. Section 27 15 43 – Communications Faceplates and Connectors

1.8 ABBREVIATIONS and ACRONYMS

- A. AFF: Above Finished Floor
- B. AHJ: Authority Having Jurisdiction
- C. AWG: American Wire Gauge
- D. Bicsi®: Formerly known as “Building Industry Consulting Services International”
- E. CAT6A: Category 6A Copper Cable
- F. CMP: Communications Multipurpose Plenum: cable rating
- G. CMR: Communications Multipurpose Riser: cable rating
- H. Gbps: Gigabits per second
- I. HVAC: Heating, Ventilation, and Air Conditioning
- J. Mbps: Megabits per second
- K. OSHA: Occupational Safety and Health Act
- L. PoE: Power over Ethernet
- M. SCS: Structured Cabling System
- N. TIA: Telecommunications Industry Association

O. TR: Telecommunications Room

P. UL®: Underwriters Laboratory

1.9 DEFINITIONS

A. Advanced System Warranty: An extended warranty held either by the connectivity or cabling manufacturer directly with the Owner for this project that guarantees product and performance of the entire cabling system for the warranty period.

B. AutoCAD®: A commercial computer-aided design and drafting software application. Developed, marketed, and a registered trademark, by Autodesk.

C. Building Information Modeling: A 3D model-based process used to plan, design, construct, and manage buildings and infrastructure.

D. Category 6A: A category of transmission performance that specifies electrical properties up to 500 MHz and capable of supporting data applications operating at 10Gbps. Refer to ANSI/TIA/568 family of standards for more information on Category 6.

E. Certification: The testing and documentation of the transmission performance of a permanent link or channel, based on sweep frequency testing of numerous parameters with results compared to a range of acceptable values. This project requires 100% certification of all permanent link cabling.

F. Conduit: A raceway of circular cross-section.

G. Contractor, Telecommunications: Entity responsible for all telecommunications work in the construction documents (Drawings and specifications in Section 27).

H. Conveniently Accessible: Being capable of being reached from floor or use of 8' step ladder without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping and duct work.

I. Equipment Room: An environmentally controlled centralized space for telecommunications equipment that usually houses a main or intermediate crossconnect, as well as video surveillance and security equipment.

J. Horizontal Cabling: Cabling used to connect individual work area outlets to local Floor Distributors (FD) or other collection points. Unlike backbone cabling, horizontal cabling does not typically carry aggregate traffic and, as such, impacts only single network devices or users. In buildings, horizontal cabling almost exclusively consists of copper cabling.

K. Listed Communications Cable: A cable listed by the Underwriters Laboratory (UL®) and accepted by the local AHJ as having met appropriate designated standards or has been tested and found suitable for installation in specific spaces. Refer to NEC® Article 800 for listing types and additional requirements.

L. MDF: Main Distribution Frame, also known as the Main Equipment Room.

M. Owner: Lane County School District 4J, Eugene Public Schools.

N. Permanent Link – A stationary cabling segment, consisting of the permanently installed cable and the permanently affixed jack at both ends (typically at the outlet faceplate and closet patch panel, or on a patch panel on both ends).

O. Plenum: A space within the building designed for the movement of environmental air; i.e., a space above a suspended ceiling or below an access floor.

P. Plenum-Rated: Listed by the Underwriters Laboratory as being suitable for installation into a plenum space. Communications cabling routed through plenum-rated space shall be plenum-rated and identified as Type CMP.

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- Q. Raceway: Any channel designed for holding wires or cables; i.e. conduit, electrical metal tubing, busways, wireways, ventilated flexible cableway.
 - R. Telecommunications: In general, telecommunications refers to infrastructure/equipment needed for the voice, data, and video communications and transport systems.
 - S. Telecommunications Room/Space: An environmentally enclosed architectural space designed to contain telecommunications equipment, cable terminations, or crossconnect cabling. The Main Equipment Room may also be known as the MDF, and may be co-located with the building's Entrance Room and Equipment Room. Telecommunications Rooms also house equipment for additional systems, such as security, cable television, and audio/video.

1.10 PROJECT DRAWINGS

- A. General Drawing Specifications: Detail and elevation Drawings shall be D size (24" x 36") with a minimum scale of 1/4" = 1'0" or larger. ER, TR and other enlarged detail floor plan Drawings shall be D size (24" x 36") with a minimum scale of 1/4" = 1'0" or larger. Building composite floor plan Drawings shall be D size (24" x 36") with a minimum scale of 1/8" = 1' 0".
- B. Building composite floor plans: Provide building floor plans video camera locations and run distance for cable, and cable routing/locations. Identify cameras that, according to location and available pathway systems, require cable length greater than allowed by standards. Recommend alternatives for Owners consideration.
- C. Telecommunications Drawings: a unique sub-set within the overall architectural drawing set that represents, in detail, telecommunications components and specific installation requirements. Referred to as "T" series in project manuals and specifications.
- D. Telecommunications space plans/elevations: Include enlarged floor plans of TRs indicating layout of equipment and devices, including receptacles and grounding provisions.

1.11 QUALITY ASSURANCE

- A. Telecommunications Contractor Qualifications
 - 1. Company Requirements
 - a. The Telecommunications Contractor shall have total responsibility for the coordination and installation of the work shown and described in the Drawings and Specifications.
 - b. Telecommunications Systems specified shall be assembled and installed under the direction of a qualified Contractor. Qualification requirements shall include submittal by the Telecommunications Contractor to the Architect of the following:
 - 1) List of previous projects of this scope and nature, including names and sizes of projects (to include square footage and construction cost – overall and that of the Telecommunications Contractor), description of work, times of completion, and names of contact persons for reference.
 - 2) Installers shall certify that they are manufacturer-authorized or trained for work to be performed.
 - 2. Lead Telecommunications Installer Requirements:
 - a. Lead Telecommunications Installer shall be a current member of Bicsi® in good standing and have completed (at a minimum) Bicsi® ITS Installer 2 Training (for both copper and fiber).
 - b. Submit certificate of ITS Installer 2 Training (or higher) with bid and preconstruction submittal package.

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- c. Advanced training from connectivity manufacturer may be submitted in lieu of Bicsi® ITS Installer 2 Training. Submit manufacturer training certificates for review by Owner as substitution request as part of Pre-Bid questions. This training must be by the same manufacturer that will hold the Advanced System Warranty.
 - 3. General Telecommunications Installer Requirements:
 - a. For all work associated with Specification Sections 27 all installers are to have a minimum of Bicsi® ITS Installer 1 Training or equivalent training from the connectivity manufacturer.
 - b. Submit a list with bid of names of all installers and appropriate copies of certificates verifying training with pre-construction submittal package.
 - B. When articles, materials, operations or methods related to execution of communications work are noted, specified, or described in the specifications or are indicated or reasonably implied on Drawings and schedules, execute work as required or appropriate to provide complete and proper function, operation and installation.
 - C. The Drawings utilize symbols and schematic diagrams to indicate items of work. These symbols and diagrams will not typically identify dimensions nor will they identify inclusion of specific accessories, appurtenances and related items necessary and appropriate for a complete and proper installation and operation. The Contractor shall install work complete and ready for the installation of telecommunications cabling, including related items not specifically identified, shown, indicated or specified. The work shall be installed, in accordance with the intent diagrammatically expressed on the Drawings, and in conformity with the dimensions indicated on architectural Drawings and on shop Drawings approved by the Owner.
 - D. The Drawings include details for various items, which are specific with regard to the dimensions and positioning of the work. These details are intended only for the purpose of establishing general feasibility; they do not obviate field coordination for the indicated work. Work shall not proceed until actual field conditions and requirements are verified by the Contractor.
 - E. The Drawings are diagrammatic and indicate the general arrangement of systems and equipment unless indicated otherwise by dimensions.
- 1.12 WARRANTY
- A. Warranty Requirements:
 - 1. Comply with additional requirements in contract general requirements and extended warranties required in other specification sections. Refer to all other Division 27 sections for specific additional warranty requirements that exceed or are in addition to those of this section.
 - B. Contractor Warranty:
 - 1. Provide all services, materials and equipment necessary for successful operation of entire SCS system for a period of one year after system acceptance. Scope of warranty includes all equipment, devices, wiring, accessories, software, hardware, installation, and configuration required to maintain a complete and operable system. This shall apply to all items except those specifically excluded, or items wherein a longer period of service and warranty is specified or indicated.
 - 2. All warranties shall be effective for one year, minimum, from date Certificate of Final Acceptance is issued. Use of systems provided under this section for temporary services and facilities shall not constitute final acceptance of work nor beneficial use by Owner and shall not institute warranty period.

3. The warranty shall cover repair or replacement of defective materials, equipment, workmanship, and installation that may be incurred during this period. Warranty work is to be done promptly and to Owner's satisfaction. In addition, warranty shall cover correction of damage caused in making necessary repairs and replacements under warranty.

C. Project Warranty

1. Equipment and materials required for installation under these specifications shall be the current model and new (less than one year from date of manufacture), unused and without blemish or defect, and are to be guaranteed to be free from defect.
2. When a defect or problem is observed within the first year after substantial completion, the Owner will notify the governing subcontractor through the proper channels. The appropriate Subcontractor then has 48 hours to fix the defect or furnish and install a replacement part/system, all at no cost to the project or Owner.

D. Advanced System Warranty for Telecommunications (Copper and Fiber Systems)

1. Beyond the initial one year project warranty, the Telecommunications Systems shall be warranted for a minimum of 20 years by a national and reputable connectivity or cabling manufacturer.
 - a. This warranty shall cover any material defect, as well as the performance of the cabling system. (Example: A Category 6A cabling system is to deliver 10,000BASE-T speed, or 10 "Gig" performance for the entire length of the warranty period.)
 - b. This warranty shall cover material and labor for the entire warranty period.
2. The Telecommunications Subcontract shall be certified by this manufacturer.
3. The following manufacturers are approved to provide the system warranties:
 - a. Copper Connectivity Manufacturers
 - 1) CommScope
 - 2) Panduit
 - b. Cabling Manufacturers
 - 1) CommScope
 - 2) General (for Panduit product Set)

- E. Owner's rights: This section shall not be interpreted to limit Owner's rights under applicable codes and under this Contract.

1.13 SUBSTITUTIONS

- A. Substitution requests: Substitution requests will be considered only if submitted to Owner not less than 7 working days prior to project bid date. Acceptance or rejection of proposed substitution is at Owner's sole discretion. No exceptions. Requests for substitutions shall be considered not approved unless approval is issued in writing by Owner.
- B. Rejection: For equipment, cabling, wiring, materials, and all other products indicated or specified as no substitutions or no alternates, Owner does not expect nor desire requests for substitutions and alternate products other than those specified. Owner reserves right to reject proposed substitution requests and submissions of alternates without review or justification.

1.14 "OR APPROVED EQUAL" CLAUSE

- A. In order to establish a basis of quality, certain processes, types of equipment, or kinds of materials may be specified, either by description of process or by designating a manufacturer by name and referring to his brand or product designation, or by specifying a kind of material. It is not the intent of these specifications to exclude other processes, equipment, or materials of equal value, utility or merit.
- B. Whenever a process is designated or a manufacturer's name, brand, or product is described, it shall be understood that the words, "or approved equal" follow such name, designation, or description, whether in fact they do so or not.
- C. If a Bidder proposes to furnish an item, process or material which it claims to be of equal utility to the one designated, then:
 - 1. Bidder shall deliver a substitution request to Owner at least seven (7) business days prior to the Bid due date and time, accompanied by a written statement describing it together with supporting data and details sufficient to permit Owner to evaluate the same.
 - 2. Owner may require demonstration, additional tests, and additional data, all to be supplied at the expense of the Bidder.
 - 3. Owner shall in its sole discretion determine if an item submitted as an alternate or approved equal is "equal" or "equivalent".
 - 4. Owner shall issue an addendum at least five (5) business days prior to the Bid due date and time for approved equal determinations.

1.15 SUBMITTALS

- A. General Requirements
 - 1. Owner is to review all submittals related to Division 27 work. This includes, but is not limited to, relevant:
 - a. Pre-bid questions.
 - b. Contractor and personnel qualifications with bid.
 - c. Voluntary alternates and unit pricings with bid.
 - d. Pre-construction product submittals and shop Drawings.
 - e. Change order requests, requests for information (RFIs), design change directives (DCDs), and any other changes as directed by the architect/engineer.
 - 2. Allow a minimum of one week (five working days) for the Owner to review.
- B. The following submittals are due at the Pre-Bid deadline for questions:
 - 1. Requests for product substitution shall be in accordance with this document.
 - 2. All products seeking approval either as "approved equivalent" or otherwise, shall be submitted as a product substitution request prior to bid. Failure to submit product substitution request in a timely manner (before pre-bid questions are due) may preclude product from being utilized on the project. Requests made with bid or post-bid will not be considered without a significant cost savings realized to the Owner.
 - a. The burden of proof is on the contractor to provide documentation that equivalent product meets the specifications and project requirements. Include in substitution request:
 - 1) Product being replaced.
 - 2) Reason for product substitution.

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- 3) Full manufacturer specification sheet clearly indicating that all requirements in project documents have been met.
 - b. Failure to meet these requirements will result in the product substitution request being returned without review.
 - c. All product substitution requests are to be reviewed and approved by the Owner. Not all requests will be approved, and all decisions are final, without recourse.
 - C. The following submittals are due with the Bid:
 1. Voluntary alternatives (that realize substantial cost savings).
 2. Unit pricing for the following items:
 - a. All unit pricing relating to Division 27 as identified in these documents and accompanying T series Drawings.
 - D. The following submittals are due at the Pre-Construction Phase (delivered to the Owner):
 1. General Requirements:
 - a. Follow submission guidelines as outlined in this section.
 - 1) Strictly electronic submission to Owner is acceptable.
 - b. Ensure a cover page with Project Title, Telecommunication Contractor Company, and point of contact is included for all physical submittals.
 2. Product Information, divided by Specification Section and in order as listed in specification. Identify the start of each specification section.
 - a. Provide manufacturer's product information cutsheet or specifications sheet with the specific product number identified or filled out.
 - 1) Submitted cutsheets without specific product identified will result in the whole submittal being returned without review.
 - 2) No product substitutions will be considered post bid without a significant cost savings to the project to be realized by the owner – a minimum of \$1000, either in material or labor savings. For any product substitution requests post-bid, Contractor shall submit an RFI through the proper channels with the requested documentation from the Pre-bid requirements above. Also, include realized cost savings. The project team may issue a change order (or its equivalent) for the product change at their discretion.
 - a) One exception to this is if the specified product goes out of production and is unavailable before submitted shop Drawings are approved. Contractor is to submit an RFI explaining the situation and recommending an equivalent product with the same features at no cost change to the project or Owner.
 - b) Other exceptions may be considered. Contractor is to submit an RFI explaining the situation.
 3. Shop Drawings
 - a. Projects will be based on AutoCAD® or Revit®. This contract will generate electronic shop Drawings in AutoCAD® and saved to USB flash drive with project name clearly indicated (or uploaded to project website). Shop Drawings shall include Telecommunications or Subcontractor title block and included readily printable Plot/Drawing tabs with mview-window at a scale to not be less than 1/8"=1'-0" unless otherwise noted. The scale shall also be indicated on the Drawings.

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- b. Acceptable electronic shop drawing sizes include:
 - 1) 8.5"x11"
 - 2) 11"x17"
 - 3) 22"x34" or
 - 4) 24"x36".
 - c. Refer to individual sections for additional requirements.
 - d. Communications pathways.
 - 1) Hangers and Supports – indicate proposed routing of all cabling supported by J-hooks.
 - 2) Firestopping – indicate manufacturer, product/assembly, and UL® system for all firestop penetrations required for communications cabling.
- E. The following submittals are due in accordance with the requirements of this Section 27 00 00 - Communications:
- 1. Record Drawings.
 - a. Modify reviewed and accepted shop Drawings to include revisions based upon completion of work.
 - b. Provide one printed set of record Drawings to scale (not less than 1/8" = 1'-0").
 - c. This set is to include system function diagrams and details not on original construction documents.
 - 2. With the exception of the (1) printed set of record Drawings, submit these files electronically on a USB flash drive, with project name and number clearly indicated.

1.16 ADDITIONAL REQUIREMENTS

- A. Integration: Responsibility for overall telecommunications system integration shall rest with Contractor named in this contract. All work related to telecommunications system and required for complete and operational systems as detailed in these specifications or the accompanying T series Drawings shall be performed under direct supervision of telecommunications installer in a manner approved by product manufacturer.
- B. Coordination of work: Contractor shall be responsible for coordination of work with Owner. This coordination of work includes following instructions provided throughout all Division 27 specifications and the accompanying Drawings as well as electrical work (Division 26) as called out in the RFP documents or so referenced in the accompanying Drawings.
- C. General compliance requirements: Provide a complete and operable system in compliance with project Drawings, specifications, referenced standards, applicable building codes, and requirements of the AHJ. Scope of this contract includes planning, design, materials, equipment, labor, configuration, programming, testing, startup and commissioning services, and documentation costs for complete and operable system that meets all requirements indicated on Drawings or contained in specifications. Comply with all contract documents, specifications, Drawings, manufacturer's instructions, and Owner and AHJ requirements. In case of conflict among applicable documents or standards, contractor shall notify owner's representative in writing of apparent conflict, and then comply with most stringent requirements unless otherwise directed in writing from owner's representative.

1.17 DELIVERY STORAGE AND HANDLING

- A. Owner will, at Contractor's request, provide appropriate space at each site for Contractor trailer or job box; however, Contractor shall be responsible for the deliveries, storing and handling of all materials that are part of the contract. Material shall be stored and protected according to manufacturer's instructions. Contractor shall be responsible for the security of all material during installation. For all material provided by contractor, or delivered to contractor on site, contractor assumes full responsibility and liability for any material shortages, damage or loss due to storage and handling methods.

1.18 PERMITS AND INSPECTIONS

- A. All telecommunications systems shall meet or exceed the latest requirements of all national, state, county, municipal, and other authorities exercising jurisdiction over the telecommunications systems and the Project.
- B. Contractor shall obtain and pay for all required licenses, permits, and inspection fees. Copies of all permits shall be delivered electronically to the Owner.
- C. Contractor agrees to furnish any additional labor or material required to comply with all local and other agencies having jurisdiction at no additional cost.
- D. Contractor shall obtain certificates of inspection and approval from all authorities having jurisdiction, and forward copies of same to Owner prior to request for Project acceptance inspections, final completion inspections, substantial completion inspections, and acceptance testing/demonstrations.
- E. All required permits and inspection certificates shall be made available at the completion of the telecommunications system installation and commissioning.
- F. Any portion of the telecommunications work which is not subject to the requirements of an electric code published by a specific AHJ shall be governed by the NEC[®] and other applicable sections of the National Fire Code, as published by the National Fire Protection Association (NFPA).
- G. Installation procedures, methods and conditions shall comply with the latest requirements of the Federal Occupational Safety and Health Administration (OSHA).
- H. All work shall satisfy seismic requirements, in terms of design and inspection, of the AHJ.
- I. All work shall comply with the TIA Standards listed in this document.

1.19 EXAMINATION

- A. Prior to submitting a proposal, Contractor shall, review Project Drawings and specifications, and determine exact extent of work required. Contractor shall include in their proposals all materials, labor, and equipment required to complete required work indicated. Work that is necessary to obtain complete and usable Project as specified herein shall be included in Contractor's proposal, even if not indicated or specified.
- B. Bidders' questions: Should bidders have questions as to intent of Drawings and specifications, quality of materials to be used, and work to be performed, questions shall be submitted in writing to the Owner in manner dictated by the Owner. All answers and clarifications to Drawings and specifications will be issued in writing.
- C. Extra payment will not be allowed for claims for due to unfamiliarity with work to be performed by other trades, existing conditions at job site, local or state laws and codes, and alterations due to field conditions.

1.20 ADDITIONAL COSTS

- A. General: Project acceptance inspections, final completion inspections, substantial completion inspections, and acceptance testing/demonstrations shall be conducted after verification of system operation and completeness by Contractor.
- B. Inspections and testing: For Project acceptance inspections, final completion inspections, substantial completion inspections, and/or testing/demonstrations that require more than one site visit by Owner to verify Project compliance for same material or equipment, Owner reserves right to obtain compensation from Contractor to defray cost of additional site visits that result from Project construction or testing deficiencies/incompleteness, incorrect information, or non-compliance with Project provisions. Owner will notify Contractor of hourly rates and travel expenses for additional site visits, and will issue an invoice to Contractor for additional site visits. Payment of additional site visit costs by Contractor is required within 30 days of invoicing. Owner reserves right to deduct additional costs defined herein that are indicated on past due invoices from Project amount due Contractor.
- C. Exclusions: Contractor shall not be eligible for extensions of Project schedule or additional charges resulting from additional site visits that result from Project construction or testing deficiencies/incompleteness, incorrect information, or non-compliance with Project provisions.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All products and materials shall be new and unused prior to their installation as part of this project. Refurbished items are not allowed.

2.2 REFERENCE BRANDS AND PART NUMBERS – BASIS OF DESIGN

- A. Reference brands and part numbers listed within Division 27 represent the Basis-of-Design and are as required by the Owner. Alternates may be proposed as per 1.13 - 1.14 above, but shall meet or exceed specifications for the items listed. Acceptance shall be at the Owner's sole discretion.
- B. Bidder shall confirm all reference part numbers, listed within Division 27, as current and suitable for the items described and specified and shall file a formal RFI for all perceived discrepancies prior to bidding.
- C. Prior to submitting bids, the Contractor shall call to the attention of the Owner any materials or apparatus that the bidder believes to be inadequate and to any necessary items of work omitted.
- D. All materials associated with reference parts shall be included so as to constitute a complete and functional system, whether or not specifically identified, itemized, and quantified.

PART 3 - EXECUTION

3.1 GENERAL

- A. Coordinate with all other trades prior to installation.
 - 1. Contractor shall meet with Owner prior to construction to identify pathway and infrastructure space requirements.
 - a. At a minimum, the following items shall be discussed:
 - 1) Cable routing and where required, cable tray locations and clearance space above (12" if possible).
 - 2) Placement for sleeving and wall penetrations.

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- 3) Failure to coordinate sufficient space for telecommunications infrastructure may result in relocation of various systems by the Contractor at no additional cost to owner.
2. Prior to the start of work, the Telecommunications Contractor shall carefully inspect each site and accept existing conditions. Start of work indicates acceptance of conditions.
 3. Coordinate location of equipment and conduit with Owner to minimize interference and disruption of in-place operational systems.
 - a. Holes through structural concrete and masonry components shall be cut with a diamond core drill or concrete saw only upon approval of :
 - 1) The structural engineer of record for the base building, or
 - 2) A licensed structural engineer who shall provide a statement of compliance attesting to building integrity, post drill.
 - b. Pneumatic hammer, impact electric, hand or manual hammer type drills shall not be allowed.
 - c. Holes shall be located so as not to affect structural sections such as ribs or beams.
 - d. Holes shall be laid out in advance. The Owner shall be advised prior to drilling through structural sections, for determination of proper layout.
 - e. Structural Penetrations: Where conduits, wireways and other raceways pass through fire partitions, fire walls or walls and floors, provide an effective barrier against the spread of fire, smoke and gases.
- B. Follow all manufacturers' instructions and install equipment in accordance with applicable codes and regulations, the original design and the referenced standards.
1. In the event of discrepancy, immediately notify the Owner. Do not proceed with installation until unsatisfactory conditions and discrepancies have been fully resolved.
- C. Protection of Systems and Equipment
1. Protect materials and equipment from damage during storage at the site and throughout the construction period. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, theft, moisture, extreme temperature and rain.
 2. Damage from rain, dirt, sun and ground water shall be prevented by storing the equipment on elevated supports and covering them on sides with securely fastened protective rigid or flexible waterproof coverings.
 3. During installation, equipment shall be protected against entry of foreign matter on the inside and be vacuum-cleaned both inside (as appropriate) and outside before testing, operating or painting.
- D. As determined by the Owner, damaged equipment shall be fully repaired or shall be removed and replaced with new equipment to fully comply with requirements of the Contract Documents. Decision of the Owner shall be final.
- E. Painted surfaces shall be protected with removable heavy kraft paper, sheet vinyl or equal, installed at the factory and removed prior to final inspection.
- F. Damaged paint on equipment and materials shall be repainted with painting equipment and finished with same quality of paint and workmanship as used by manufacturer.

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- G. Access to Equipment
1. Equipment shall be installed as per the scaled detail on the Drawings.
 2. Working spaces shall be not less than specified in the *NEC*[®] for voltages specified.
 3. Where the Owner determines that the Contractor has installed equipment not “conveniently accessible” for operation and maintenance, equipment shall be removed and reinstalled, one time only, as directed by the Owner, at no additional cost to the Owner.
- H. Cleaning
1. During construction, and prior to Owner acceptance of the building, remove from the premises and dispose of packing material and debris caused by telecommunications work.
 2. Remove dust and debris from interiors and exteriors of telecommunications equipment (including electrical rough-in). Clean accessible current carrying elements prior to being energized.
- I. Completion
1. General:
 - a. Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and similar items. Leave the premises clean, neat and orderly.
 2. Results Expected:
 - a. Systems shall be complete and operational.
 - b. Cleaning work shall be complete.
 3. Testing and Verification – General Requirements.
 - a. Refer to individual sections for additional testing and verification requirements.
 - b. The Telecommunications Contractor shall verify that requirements of this specification are met. Verification shall be through a combination of analyses, inspections, demonstrations and tests, as described below.
 - c. Verification by Inspection: Verification by inspection includes examination of items and comparison of pertinent characteristics against the qualitative or quantitative standard set forth in the specifications.
 - d. Verification by Test and Demonstration: The Telecommunications Contractor shall verify by formal demonstrations or tests that the requirements of this Specification have been met. The Communications Subcontractor shall demonstrate that the communications systems components and subsystems meet specification requirements in the "as-installed" operating environment during the "System Operation Test".
 - e. Perform system operation tests after full enclosure of walls.
 - f. System Operation Tests Conducted Upon Completion of Work: Upon completion of the Telecommunications Contractor's Work, subject the system to functional and operational tests. When required corrections determined by initial test results have been completed, fully retest the system. The Owner shall be notified in writing not less than seven days in advance of date of proposed final testing and inspection. The advance notice shall include certification that the installation is complete and operable and that the Telecommunications Contractor has satisfactorily performed the final tests specified herein.

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- g. The acceptance testing and final inspection shall be accomplished in the presence of the Owner. At least 10 days prior to scheduled system completion, the Telecommunications Contractor shall submit, for approval by Owner, a test plan to completely test the telecommunications system. The Telecommunications Contractor shall include in test plan, for acceptance by the Owner, a complete and detailed final acceptance test check-off list ("punch list"). The list shall be a complete representation of specified functions and conditions.
4. Commissioning
- a. There shall be three phases of commissioning:
- 1) Rough-in inspection.
 - 2) Above-ceiling inspection (after cables are placed).
 - 3) Final inspection.
- b. At a minimum, the Owner shall check the following items:
- 1) Accurate location for camera placement.
 - 2) Location and size of communications conduits or pathways.
 - 3) The Owner is then to issue a written report to the Contractor identifying all items which currently do not meet the construction document requirements. This report is to be forwarded to the appropriate subcontractor(s) and all items are to be addressed.
 - 4) This report is not necessarily all inclusive; should issues be discovered later in the project, the appropriate communications subcontractor is still responsible for corrections/repairs.
- c. Once all communication cabling has been installed and properly supported and walls have been painted, but prior to the installation of ceiling tiles/material, the Owner shall schedule a time to be on-site to conduct above-ceiling inspection. At a minimum, the Owner shall check the following items:
- 1) That all items from the previous inspection have been corrected.
 - 2) That communications cabling is routed correctly and adequately supported.
 - 3) That the installed communications cabling matches what was specified / submitted.
 - 4) That there are no kinks, splices, or other damage to the installed communications cabling.
- d. The Owner is then to issue a written report to the Telecommunications Contractor identifying all items which currently do not meet the construction document requirements. This report is to be forwarded to the appropriate subcontractor(s) and all items are to be addressed. This report is not necessarily all inclusive; should issues be discovered later in the project, the appropriate communications subcontractor is still responsible for corrections/repairs.
- e. Once all communications work has been completed, contractor shall request final inspection. This request shall be made 3 weeks before substantial completion. The Owner shall then schedule a time to be on-site to conduct this inspection. At a minimum, the Owner shall check the following items:
- 1) That all items from the previous inspections have been corrected.
 - 2) That all faceplates are installed, with the correct modules, quantity of modules, and approved labeling scheme.

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- 3) That all equipment and cabling within communications rooms is installed per the contract documents, including all patch panels and wall blocks (with specified spare capacity), horizontal and backbone cabling labeling, and telecommunications grounding.
 - 4) And all other items necessary to guarantee contract documents are met and complete and functioning communications systems are installed.
- f. The Owner is then to issue a written report to the Telecommunications Contractor identifying all items which currently do not meet the construction document requirements. This report is to be forwarded to the appropriate subcontractor(s) and all items are to be addressed prior to substantial completion. This report is not necessarily all-inclusive; should issues be discovered within one year after substantial completion, the appropriate communications subcontractor is still responsible for corrections/repairs. 27 00 00

END OF SECTION 27 00 00

SECTION 27 05 00 - COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. General Requirements
- B. Summary
- C. Environmental Considerations

1.2 RELATED SECTIONS

- A. Section 27 00 00 - Communications
- B. Section 27 05 13 – Communications Services
- C. Section 27 05 26 – Grounding and Bonding for Communications Systems
- D. Section 27 05 28 – Pathways for Communications Systems
- E. Section 27 05 28.33 - Conduits and Backboxes for Communications
- F. Section 27 05 28.36 – Cable Trays for Communications Systems
- G. Section 27 05 28.39 – Surface Mounted Raceway for Communications
- H. Section 27 05 53 – Identification for Communication Systems
- I. Section 27 08 00 – Commissioning of Communications
- J. Section 27 11 00 – Communications Equipment Room Fittings
- K. Section 27 11 16 – Communications Cabinets, Racks, Frames and Enclosures
- L. Section 27 11 19 – Communications Terminations Blocks and Patch Panels
- M. Section 27 11 23 – Communications Cable Management and Ladder Racks
- N. Section 27 15 13 – Communications Copper Horizontal Cabling
- O. Section 27 15 43 – Communications Faceplates and Connectors

1.3 SPECIFIC REQUIREMENTS

- A. Eugene Public Schools are tobacco free environments. Tobacco in any form whatsoever is not permitted in any school or on the property owned by the District.
- B. Eugene Public Schools is performing work as per the accompanying drawings. This contract will be responsible for all aspects of telecommunications cabling and supporting infrastructure required for functional systems, specifically:
 - 1. Pathways as per Section 27 05 28 and as called out on drawings.
 - 2. Installation of horizontal cabling system and related components as per Sections 27 15 13 and 27 15 43.
 - 3. Testing of telecommunications cabling systems in accordance with ANSI/TIA-568 and as per Section 27 08 00.
 - 4. Creation of as-built documentation, both electronically and printed, in AutoCAD® format. Drawing base(s) will be provided electronically in dwg format.

1.4 SUMMARY

- A. The intent of the Division 27 Specifications and the accompanying Drawings is to provide complete telecommunications pathways and a bonding and grounding system as specified and required by applicable codes and the AHJ. Include all work as specified in Division 27 and shown on the accompanying Drawings, including appurtenances, to provide complete and functional systems
- B. The Division 27 Specifications and accompanying Drawings are complementary and what is called for in one shall be as binding as if called for in both. Items shown on the Drawings are not necessarily included in or called out in the Specifications and vice versa. Specifications shall supersede Drawings in the case of a conflict.
- C. Imperative language is frequently used in the Division 27 Specifications. Except as otherwise noted, such requirements are to be performed by the Contractor or a Sub-contractor directly responsible to the Prime Contractor performing the Division 27 work.
- D. The Drawings accompanying Division 27 are diagrammatic. They do not show every component of a complete premises distribution system which may be required to accommodate unique building construction features or materials installed by other trades. The Drawings are to be followed as closely as practical while making necessary adjustments in the placement of cable to facilitate the overall construction of the building without additional cost to the Owner. The right is reserved to make any reasonable changes in locations.

1.5 ENVIRONMENTAL CONSIDERATION

- A. When at all possible, equipment and materials are to be assembled at Distributors or Contractors location and delivered to construction site without packaging or shipping material.
- B. Except as noted for purposes of recycling, all construction related debris; packaging and waste materials will be removed from the job site each day and disposed of by the Contractor.

1.6 SITE SPECIFIC REQUIREMENTS

- A. Contractor must conform to schedule prescribed by Owner.
- B. Site details are shown on the Drawings to be provided by the Owner.

1.7 DEVICE LOCATIONS

- A. Cabling, pathway, fire stopping, and support structures as per the Drawings and specifications.
- B. Video camera placement will be as per the Drawings.

PART 2 - PART 2 - (NOT USED)

PART 3 - (NOT USED)

END OF SECTION 27 05 00

SECTION 27 05 13 COMMUNICATIONS SERVICES

PART 1 - GENERAL REQUIREMENT

1.1 SECTION INCLUDES

- A. Basic Communication Requirements
- B. Administrative Requirements
 - 1. Contract Documents, Quality Assurance, and Manufacturer's Warranty
 - 2. Technical Qualifications
 - 3. Certificates and Reference Standards
 - 4. Laws and Regulations, Permits
 - 5. Submittal and Substitution Information
 - 6. Environmental Requirements
 - 7. Progress Drawings and Schedules

1.2 PROJECT SUBMITTAL COMPLIANCE

- A. Owner shall be responsible for receiving and compiling all submittal information. As such, all such data pertaining to Section 27 shall conform to the following Division 1 Sections:
 - 1. Section 01 78 00 – Closeout Submittals

1.3 RELATED SECTIONS

- A. Section 27 00 00 – Communications
- B. Section 27 05 00 – Common Work Results for Communications
- C. Section 27 05 26 – Grounding and Bonding for Communications Systems
- D. Section 27 05 28 – Pathways for Communications Systems
- E. Section 27 05 28.29 - Hangers and Supports for Communications Systems
- F. Section 27 05 28.33 - Conduits and Backboxes for Communications Systems
- G. Section 27 05 28.36 - Cable Trays for Communications Systems
- H. Section 27 05 28.39 - Surface Raceways for Communications Systems
- I. Section 27 05 53 – Identification for Communication Systems
- J. Section 27 08 00 – Commissioning of Communications
- K. Section 27 11 00 – Communications Equipment Room Fittings
- L. Section 27 11 16 – Communications Cabinets, Racks, Frames and Enclosures
- M. Section 27 11 19 – Communications Terminations Blocks and Patch Panels
- N. Section 27 11 23 – Communications Cable Management and Ladder Racks
- O. Section 27 15 13 – Communications Copper Horizontal Cabling
- P. Section 27 15 43 – Communications Faceplates and Connectors

1.4 BASIC COMMUNICATION REQUIREMENTS

- A. All materials and equipment installed under this contract shall be new, unused, free of defects, and of current manufacture.
- B. The Contractor shall be required to field-investigate each facility to ascertain the exact physical conditions in the Telecommunications Rooms and to become familiar with the physical environment of the building.
- C. The Contractor shall provide, install, and test the entire cable infrastructure as described under this contract.
- D. The Contractor shall call attention to the Owner any error, conflict, or discrepancy in Plans and/or Specifications. Do not proceed with any questionable items of work until a resolution or clarification has been made. Supplemental Plans and Specifications may be supplied as required and shall become part of the Contract Documents.

1.5 CONTRACT DOCUMENTS

- A. The contract documents, such as drawings, schedules and specifications are used to describe the required work.
- B. The work to be performed under the contract documents includes furnishing all labor, materials, equipment and services necessary, whether listed in the specifications or not, to construct and install the complete communications infrastructure as shown on contract drawings and specifications.
- C. The drawings and schedules depict, in general, application-dependent data while the narrative/specifications, in general, define broader requirements, such as overall quality.
- D. The Contractor shall follow all specifications herein. In case of conflict between drawings and specifications, the latter shall prevail unless authorized in writing by the Owner.
- E. Supplementary Details and Plans may be supplied as required. They shall be issued as addendum and shall become a part of the Contract Documents.

1.6 QUALITY ASSURANCE

- A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner.
- B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the owner or the owner representative.
- C. Strictly adhere to all Telecommunications Industry Association (TIA) and BICSI recommended installation practices and manufacturer's guidelines when installing communications components.

1.7 MANUFACTURER'S WARRANTY CERTIFICATION

- A. The manufacturer's certification must be supported by Contractor's successful completion of an installation class recognized by an independent organization (such as BICSI or an accredited school). A written test is strongly preferred.

1.8 TECHNICAL QUALIFICATIONS

- A. Contractor must be certified by manufacturer as able to provide a 20 year (minimum) manufacturer's warranty certificate.

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- B. A minimum of three references demonstrating Contractor's past installation experience in Certified Category 6A systems in similar facilities with a minimum of 500 nodes shall be submitted. The Contractor must supply a one year warranty upon completion of the job.
 - C. At least 50% of the technicians, to include all on-site Journeymen Electricians, must have successfully completed the manufacturer's warranty certification class.
 - D. All Journeymen are to possess a current Oregon License.
 - E. All Apprentices are to be actively enrolled in an Oregon State approved electrical apprenticeship program.
 - F. All equipment and telecommunications cabling equipment shall be installed and tested on-site by a technician(s) who, by virtue of an acceptable training course or documented experience, is qualified to perform these procedures. Acceptable training may include successful completion of the manufacturer's training course, documented on-the-job experience or successful completion of applicable technical courses in a recognized trade school.
 - G. Verification of the above requirements must be submitted in writing with bid.

1.9 CERTIFICATES

- A. Contractor must provide evidence of ability to provide a Manufacturer's Certificate of Warranty for the system bid.
- B. Contractor must provide Technician Certificate(s) for the 50% mentioned above.

1.10 REFERENCE STANDARDS

- A. The following standards:
 - 1. American National Standards Institute (ANSI)
 - 2. National Electrical Manufacturers Association (NEMA)
 - 3. Telecommunications Industries Association (TIA), specifically:
 - a. ANSI/TIA-568.0-D, Generic Telecommunications Cabling for Customer Premises
 - b. ANSI/TIA-568.1-D, Commercial Building Telecommunications Infrastructure Standard
 - c. ANSI/TIA-568-C.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standards
 - d. ANSI/TIA-569-D, Telecommunications Pathways and Spaces
 - e. ANSI/TIA-607-C, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
 - f. ANSI/TIA-862-B, Structured Cabling Infrastructure Standard for Intelligent Building Systems
 - g. ANSI/TIA-5017, Telecommunications Physical Network Security Standard
 - h. ANSI/NECA/BICSI 568-2006, Standard for Installing Telecommunications Systems

1.11 LAWS AND REGULATIONS

- A. The latest versions, including addenda, as enforced by the local authority having jurisdiction of the following codes, associations, acts and agencies:
 - 1. Federal Communications Commission (FCC)
 - 2. National Fire Protection Association (NFPA), specifically:

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- a. NFPA 70, National Electrical Code® (NEC®) plus all Oregon State Electrical Code plus local County and City Amendments
 - b. NFPA 76, Recommended Practice for the Fire Protection of Telecommunications Facilities
 - c. NFPA 101, Life Safety Code®
 - d. NFPA 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces
 - e. NFPA 780, Standard for the Installation of Lightning Protection Systems,
 - f. NFPA 5000™, Building Construction and Safety Code
3. National Electrical Safety Code (NESC)
 4. Occupational Safety and Health Administration (OSHA)
 5. 2017 Oregon Fire Code (OFC)

1.12 UNDERWRITERS LABORATORIES LISTING

- A. Unless otherwise specified, electrical equipment and material shall be listed and labeled by Underwriters Laboratories (UL®) for the purpose for which it is used. This requirement may be waived only if a UL® listing is not available for this type of product. Telecommunications cables are acceptable if UL® recognized.

1.13 ADDITIONAL REFERENCE MATERIALS

- A. ANSI/NECA/GICSI-568-2006, Standard, Installing Commercial Building Telecommunications Cabling
- B. ANSI/NECA/Bicsi® 568-2006, Standard for Installing Telecommunications Systems
- C. Bicsi® Outside Plant Design Reference Manual (COOSP)
- D. Bicsi® Electronic Safety and Security Reference Manual (ESSDRM)
- E. Bicsi® Telecommunications Distribution Methods Manual (TDMM)
- F. Bicsi® Wireless Design Reference Manual (WDRM)
- G. Institute of Electrical and Electronic Engineers (IEEE)
- H. National Electrical Manufacturers Association (NEMA)
- I. Underwriters Laboratories (UL®) Cable Certification and Follow up Program

1.14 SUBMITTALS

A. GENERAL

1. Owner must approve all submittals before the start of fabrication (or shipment, for stock items) of any equipment requiring submittals.

B. DRAWINGS

1. The Contractor shall submit shop drawings for any modification or new product installation not previously identified in bid documents.
2. The drawing must be submitted not less than five (5) days (weekends and national holidays excluded) before the scheduled work begins.
3. The Contractor shall proceed with the installation only after approval from the Owner.

C. MATERIALS LIST

1. The Contractor shall submit a list of all materials for the proposed work.

D. FIRESTOPPING

1. The Contractor shall comply with all requirements of the AHJ.

E. MATERIAL SAFETY DATA SHEETS

1. Supply Material Safety Data Sheets (MSDS) to Owner for all material accompanied by such.

F. TEST PLANS

1. The Contractor shall submit a plan for the testing the installed network.
2. The test plan shall include test equipment to be used, procedure and report structure.

G. CERTIFICATES

1. Low Voltage Electrical Permit
2. The Contractor shall post a copy of the permit and email a copy to the Owner.
3. The Contractor shall provide copy of approved permit to the Owner certifying that the work has been inspected and that the work conforms to the requirements of the AHJ.

H. PRODUCT WARRANTY

1. A manufacturer's warranty is required for this work in addition; Contractor shall provide no-cost warranty on the installed work for a period of one year.

1.15 REQUESTS FOR SUBSTITUTION

- A. Substitution of items shown in the contract documents must be requested in writing.
- B. Approval shall be by written addendum or change order. Substitutions made without prior written approval will be reversed and all costs related to reversal will be the responsibility of the Contractor.
- C. Contractor shall be responsible for any design changes and costs related to substitution approval.
- D. The functions and features specified are vital to the operation of these facilities; therefore the acceptance of alternate manufacturers does not release Contractor from strict compliance with the requirements of the specification.

1.16 ENVIRONMENTAL REQUIREMENTS

- A. Power and lighting, and parking spaces for standard installer's trucks shall be provided by the Owner.
- B. Job site trailer, if required, shall be coordinated with the Owner prior to placement. Secured storage is the responsibility of the Contractor.

1.17 PROGRESS DRAWINGS AND SCHEDULES

- A. All drawings shall be revised as necessary during the course of the work.
- B. The Contractor shall maintain on-site, one neatly and legibly marked (redlined) set of full-size Drawings accurately depicting as-built locations, changes, and repairs made during the work.
 1. Marking of the Drawings shall be kept current.
 2. Drawings shall be delivered to the Owner.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The use of a manufacturer's name and model or catalog number herein is for the purpose of establishing the product set, which the Contractor is to supply and install.
- B. Quantities are to be determined by Contractor unless specified.
- C. Products shall be UL® listed for the purpose they are to be used.

2.2 PRE-APPROVED PRODUCT SETS

- A. The following product sets are pre-approved for this project. Except as noted, all others will require a substitution request to be completed and approved as per these documents. The District will not consider product sets that have not been pre-approved or accepted as per the substitution request process.
 - 1. Structured Cable Systems:
 - a. CommScope - all category 6A components, i.e., cable, jacks, plugs, and patch panels.
 - b. Panduit - all category 6A components, i.e., jacks, plugs, and patch panels. Partner cable, i.e., General is acceptable for the Panduit solution.

2.3 FIRESTOPPING

- A. Products may be in the form of caulk, putty, strip, sheet, or devices that shall be specifically designed to fill holes, spaces, and voids at communications penetrations.
- B. Firestopping materials shall also provide adhesion to substrates and maintain fire and smoke seal under normal expected movements of substrates, conduits and cables.

2.4 ACOUSTIC SEPARATION

- A. Acceptable products for 2" through 4" penetrations are as follows
 - 1. STI EasyPath™
 - 2. Resilient latex caulk and re-enterable putty manufactured by 3M™, Specified Technologies or Hilti.
 - 3. Or approved substitution
- B. Acceptable products for less than 2" penetrations are as follows
 - 1. Resilient latex caulk and re-enterable putty manufactured by 3M™, Specified Technologies or Hilti.
 - 2. Or approved substitution

PART 3 - EXECUTION

3.1 GENERAL

- A. Manufacturer's installation instructions and requirements shall be strictly adhered to in the telecommunications equipment installation, fabrication and testing process.
- B. Where conflicts arise between the requirements of this Specification and the manufacturer's installation instructions, the Owner shall be consulted for resolution.
- C. All twisted pair wiring systems shall be installed according to manufacturers' installation guidelines, and according to related ANSI/TIA-568 standards.

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- D. All installed cables shall be kept free from nicking, abrading, or cutting during storage and during the installation process.
 - E. Cable shall be installed into conduits after conduit installation is complete and appropriate bushings or couplers have been installed. Manufacturers' recommendations for maximum pulling tensions and minimum bend radii for all cables must not be exceeded.
 - F. Care shall be exercised in wiring to avoid damage to wiring and equipment.
 - G. Connections shall be made with approved mechanical connectors.
 - H. All wiring and connectors shall be installed in strict adherence to standard communications installation practices and to federal, state or local applicable codes.
 - I. Equipment shall be firmly held in place. Fastenings, supports, and hangers shall be adequate to support their loads.
 - J. Open areas requiring suspension for cables will employ properly rated support mechanisms and devices to accommodate future addition of cable.
 - K. Cable ties will be used in concealed areas only as mandated by code or ANSI/TIA-568. Cable ties shall bear the same rating as the cable when installed in plenum areas.
 - L. Cable running in exposed areas will be bundled using Velcro® or similar hook and loop material. Such material will be used exclusively in the ER and TRs. Cable ties are permitted for temporary cable dressing only and shall be removed prior to substantial completion.
 - M. The installation must conform to OSHA standards and comply with state and local safety codes.
 - N. Applicable fire codes will be strictly adhered to in regards to plenum ratings for cable and associated cable ties. Fire stopping will be the responsibility of this contract in areas penetrated as a part of this project.
 - O. Installation shall be neat, well organized, and professional.
 - P. Installation shall be conducted as to maintain consistency between color-coding, labeling and documentation.
 - Q. Splicing of any unshielded twisted pair or fiber optic is not acceptable, unless directed to by specifications, addendum, drawings or other written communication with owner or authorized representative.
 - R. Any discrepancies, conflicts or issues must be brought to the attention of the Owner before installation or as soon as possible thereafter.
 - S. The Contractor shall clean up the work area at the end of each day. At the end of the project all material removed or left over, and/or not being used shall be removed from the project site unless other arrangements have been made. A final clean up shall be made before final payment is made.
 - T. The Contractor shall coordinate with the Owner for final cleaning. Final cleaning shall include necessary steps to remove all debris and provide completely dust-free surfaces on all installed components.
 - U. All wall and floor penetrations shall be fire stopped.

3.2 PREPARATION

- A. Before installation of cabling and/or equipment in telecommunications spaces, the Contractor shall field-investigate each facility and ascertain if the physical and electrical conditions within the facility shall permit commencement of the Contractor's work.
- B. Any discrepancies, questions, or concerns noted at that time should be brought to the immediate attention of the Owner.

3.3 DOCUMENTATION

A. TEST REPORTS

1. The Contractor shall compile test results into the forms that contain all applicable test data. Hard copy output indicating successful testing of every location is not required.
2. A solid state USB memory device containing all test data and the appropriate application to display such in a Windows-based environment shall be provided.

3.4 AS BUILTS

- A. Contractor will be provided the T series AutoCAD® drawings electronically. These drawings shall be the base drawings for the as built documentation with the following being provided by the Contractor as a separate AutoCAD® layer:

1. Camera location
2. Cable ID

3.5 CAMERA LOCATIONS

- A. All camera locations shall be annotated with information that duplicates the labeling on the jack or plug.

END OF SECTION 27 05 13

SECTION 27 05 26 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Note: Existing telecommunications grounding and bonding may be used if such completely complies with the requirements of ANSI/TIA-607.C and Articles 250 and 800 of the 2017 version of the *NEC*[®].
- B. In the event the installed grounding and bonding system(s) need to be supplemented or replaced, this section includes the requirements for establishing a telecommunications grounding and bonding system.

1.2 SCOPE

- A. Provide all labor, materials, tools, and equipment required for the complete installation of a telecommunications grounding system.
- B. Included in this section are the minimum composition requirements and installation methods for the following:
 - 1. Telecommunications grounding system
 - 2. Busbars
 - 3. Bonding accessories

1.3 REFERENCES

- A. References, Codes and Standards as required by Section 27 00 00, Communications.
- B. ANSI/TIA-607-C, Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
- C. UL 467 Standard for Grounding and Bonding Equipment.

1.4 QUALITY ASSURANCE

- A. See Section 27 05 13
- B. All grounding and bonding cables shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.
- C. Grounding and bonding shall meet applicable ANSI/TIA-607-C, *NEC*[®] Articles 250 and 800 requirements and practices except where other authorities or codes may impose a more stringent requirement or practice.

1.5 TERMS AND DEFINITIONS

- A. Bonding: The joining of metallic parts to form an electrically conductive path.
- B. Common Bonding Network (CBN): The set of metallic components that are interconnected to form the principle means for effectively bonding equipment inside a building to the grounding electrode system
- C. Telecommunications Equipment Room (ER or MDF): A centralized space for telecommunications equipment that serves the occupants of the building.
- D. Exothermic Weld: A method of permanently bonding two metals together by a controlled heat reaction resulting in a molecular bond.
- E. Ground: A conducting connection, whether intentional or incidental, between an electrical circuit or equipment and the earth or to some conducting body that serves in place of the earth.
- F. Telecommunications Bonding Conductor (TBC): The conductor used to connect the grounding electrode to the equipment grounding conductor, to the grounded conductor, or both of the circuits at the service equipment, or at the source of a separately derived system.
- G. Primary Bonding Busbar (PBB): A busbar placed in a convenient and accessible location and bonded, by means of the telecommunications bonding conductor (TBC), to the building service equipment (power) ground.
- H. Secondary Bonding Busbar (SBB): A common point of connection for telecommunications system and equipment bonding to ground.
- I. Telecommunications Bonding Backbone (TBB): A conductor that interconnects the primary bonding busbar (PBB) to the secondary bonding busbar (SBB).
- J. Telecommunications Equipment Bonding Conductor (TEBC): A conductor that connects the primary bonding busbar (PBB) or secondary bonding busbar (SBB) to equipment racks or cabinets.

PART 2 - PRODUCTS

2.1 PRIMARY BONDING BUSBAR

- A. NOTE: Existing product may be used if it meets or exceeds the requirements so detailed in this Section.
- B. PBB shall be constructed of .25" thick solid copper bar.
- C. The busbar shall be 4" high and 20" long and shall have 30 attachment points (two rows of 15 each) for two-hole grounding lugs.
- D. The hole spacing pattern for attaching grounding lugs shall meet the requirements of ANSI/TIA/607-C and shall accept lugs with 5/8" with 1" centers.
- E. The busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating a 4" (100 mm) standoff from the wall.
- F. The busbar shall be UL® Listed as grounding and bonding equipment.

G. Manufacturer shall be:

1. Harger
2. Chatsworth (CPI)
3. Or approved alternate

2.2 SECONDARY BONDING BUSBAR

A. NOTE: Existing product may be used if it meets or exceeds the requirements so detailed in this Section.

B. SBB shall be constructed of .25" thick solid copper bar.

C. The busbar shall be 2" high and 12" long and shall have 9 attachment points (one row) for two-hole grounding lugs.

D. The hole spacing pattern for attaching grounding lugs shall meet the requirements of ANSI/TIA/607-C and shall accept lugs with 5/8" and 1" centers.

E. The busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating a 4" standoff from the wall.

F. The busbar shall be UL[®] Listed as grounding and bonding equipment.

G. Manufacturer shall be:

1. Harger
2. Chatsworth (CPI)
3. Or approved alternate

2.3 BONDING ACCESSORIES

A. Two Mounting Hole Ground Terminal Block

1. Ground terminal block shall be made of electroplated tin aluminum extrusion.
2. Ground terminal block shall accept conductors ranging from #14 AWG through 2/0.
3. The conductors shall be held in place by two stainless steel set screws.
4. Ground terminal block shall have two .25" holes spaced on 5/8" centers to allow secure two-bolt attachment to the rack or cabinet.
5. Ground terminal block shall be UL[®] Listed as a wire connector.

B. Compression Lugs

1. Compression lugs shall be manufactured from electroplated tinned copper.
2. Compression lugs shall have two holes spaced on 5/8" or 1" centers, as stated below, to allow secure two bolt connections to busbars.
3. Compression lugs shall be sized to fit a specific size conductor, sizes #6 to 4/0, as stated below.
4. Compression lugs shall be UL[®] Listed as wire connectors.

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- C. Antioxidant Joint Compound: Oxide inhibiting joint compound for copper-to-copper, aluminum-to-aluminum or aluminum-to-copper connections.
 - D. C-Type, Compression Taps
 - 1. Compression taps shall be manufactured from copper alloy.
 - 2. Compression taps shall be C-shaped connectors that wrap around two conductors forming an irreversible splice around the conductors; installation requires a hydraulic crimping tool
 - 3. Compression taps shall be sized to fit specific size conductors, sizes #6 AWG to 4/0.
 - 4. Compression taps shall be UL® Listed.

PART 3 - EXECUTION

3.1 GENERAL

- A. A copper bonding and grounding system shall be installed which places a properly sized (as per Table 250-122 of the *NEC*®) copper cable in the immediate vicinity of the telecommunications backboard. Contractor shall be responsible for placement of the above referenced ground busbars and terminal(s) as well as their connection to the building system grounding cable using an exothermic-welded type connector or appropriate compression applied connector to satisfy the Authority Having Jurisdiction.
- B. Bonding and grounding shall meet applicable ANSI/TIA-607-C, *NEC*® Articles 250 and 800 requirements and practices except where other authorities or codes may impose a more stringent requirement or practice. All racks and cable trays shall be bonded to a ground busbar with #6 AWG cable. All termination equipment shall be bonded to a known source of building system ground according to the specifications of the manufacturer.
- C. Hard bends shall not be used on the bonding jumpers or wire, rather gradual bends with smooth radius.

3.2 BONDING AND GROUNDING SYSTEM USING STRUCTURAL METAL

- A. When structural metal is bonded to the building's grounding electrode system it may be used in place of a TBB, a BBC or both. Before utilizing structural metal in place of a TBB or a BBC, building plans (including as-builts as applicable) and specifications shall be reviewed to ensure the structural metal is electrically continuous or can be made so. Additionally, the two point continuity test as described in ANSI/TIA-607-C paragraph 9.1, or equivalent, should be performed on the structural metal to verify electrical continuity and acceptable resistance along the paths used as bonding conductors. Concrete reinforcing steel shall not be used as a TBB or a BBC.
- B. Connections to the PBB/SBB: The bonding conductor from the structural metal to the PBB or SBB shall be sized according to ANSI/TIA-607-C, Table 1. Additionally, this conductor should be no smaller than any conductor that comprises the telecommunications bonding backbone system. Bonds to structural metal shall be made using listed exothermic welding, listed compression, or listed mechanical connectors and shall be accessible. Bonds to the PBB or SBB shall be made as specified in ANSI/TIA-607-C, paragraphs 7.2.2 and 7.3.2, respectively.

3.3 PREPARATION

- A. Preparation of surfaces: Clean contacting surfaces of ground connections to bright metal before connecting
- B. When making connection between dissimilar metals, i.e., copper to aluminum or galvanized structures, apply a corrosion-inhibitor such as Penetrox A to contact surfaces between connector, and surface of structure.

3.4 INSTALLATION

- A. All metallic components that make up the equipment racks and ladder rack shall be bonded together in a manner that provides continuous electrical continuity between the components. Attention must be given to the removal of paint or powder coating to present bare metal where bonding straps are fastened to the metallic component.
- B. Outdoor Grounding and Bonding Connections: All outdoor grounding and bonding (earthing) connections shall be accomplished using exothermic welding.
- C. Wall-Mount Busbars
 - 1. Attach busbars to the wall with appropriate hardware according to the manufacturer's installation instructions.
 - 2. Conductor connections to the PBB or SBB shall be made with two-hole bolt-on compression lugs sized to fit the busbar and the conductors.
 - 3. Each lug shall be attached with stainless steel hardware after preparing the bond according to manufacturer recommendations and treating the bonding surface on the busbar with antioxidant to help prevent corrosion at the bond.
 - 4. The wall-mount busbar shall be bonded to ground as part of the overall telecommunications bonding and grounding system.
- D. Ground Terminal Block
 - 1. Every rack and cabinet shall be bonded to the PBB or SBB.
 - 2. Minimum bonding connection to racks and cabinets shall be made with a rack-mount two-hole ground terminal block sized to fit the conductor and rack and installed according to manufacturer recommendations.
 - 3. Remove paint between rack/cabinet and terminal block, clean surface and use antioxidant between the rack and the terminal block to help prevent corrosion at the bond.

END OF SECTION 27 05 26

SECTION 27 05 28 – PATHWAYS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Drawings and general provision of the Contract, including General and other Conditions and other General Requirements sections, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

- A. This contract shall be responsible for all pathways, cable trays, sleeves, hangers, and support mechanisms required to support all telecommunications cables and to satisfy the local AHJ.
- B. This contract shall be responsible for all pathways as called out on Drawings, specifically:
 - 1. Conduits and “J-Boxes” as detailed on Drawings to accommodate camera locations. Any necessary penetrations shall accommodate a minimum of a Trade Size 1 EMT conduit.
 - 2. Any in-slab or under-slab conduits shall be a minimum of Trade size 1 ¼ schedule 40 PVC.
- C. The Contractor shall coordinate with all other trades (if applicable) prior to final placement of telecommunications pathways. Placement shall be such that pathway will be accessible for future additions requiring placement of telecommunications cable.
- D. The Contractor shall provide all labor, equipment and supplies to furnish and install the communications pathway, hangers and supports.
- E. Installation shall include the actual physical installation of the hardware and/or support structure, firestopping and documentation.

1.3 RELATED SECTIONS

- A. Section 26 05 29 – Hangers and Supports for Electrical Systems
- B. Section 26 05 33 - Raceways and Boxes for Electrical Systems
- C. Section 27 05 28.33 - Conduits and Backboxes for Communications
- D. Section 27 05 28.36 – Cable Trays for Communication Systems
- E. Section 27 05 28.39 – Surface Mounted Raceway for Communications

1.4 REFERENCES

- A. ANSI/NFPA 70, Article 250 - Grounding and Bonding
- B. ANSI/NFPA 70, Article 318 – Cable Trays
- C. ASTM A 510 - Specifications for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
- D. ASTM B 633 - Specifications for Electrodepositing Coatings of Zinc on Iron and Steel, Sections SC2 and SC3

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- E. ASTM A653 - Specifications for Steel Sheet, Zinc-Coated (Galvanized) by Hot Dip Process
 - F. ASTM A123 - Specifications for Zinc (Hot Galvanized) Coatings on Iron and Steel
 - G. ANSI/TIA/569 - Commercial Building Standard for Telecommunications Pathways and Spaces
 - H. NEMA VE 2-2006 Cable Tray Installation Guidelines
 - I. NEMA VE-1/CSA C22.2 No 126 1-02 Metal Cable Tray Systems
 - J. UL[®] E209183
 - K. ANSI C80.1 Rigid Steel Conduit - Zinc Coated
 - L. ANSI C80.4 Fittings for Rigid Metal Conduit
 - M. *Bicsi*[®] Electronic Safety and Security Reference Manual (ESSDRM)
 - N. *Bicsi*[®] Information Transport Systems Installation Methods Manual (ITSIM)
 - O. *Bicsi*[®] Network Design Reference Manual (NDRM)
 - P. *Bicsi*[®] Telecommunications Distribution Methods Manual (TDMM)

1.5 QUALITY ASSURANCE

- A. All components and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the manufacturers listed.
- B. Assure that the "as installed" system is correctly and completely documented including engineering drawings, manuals, and operational procedures in such a manner as to support maintenance and future expansion of the system.

1.6 SUBMITTALS

- A. The following information shall be provided:
 - 1. Manufacturer's literature and catalog cuts indicating:
 - a. Physical dimensions
 - b. Materials of construction

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials and equipment installed under this contract shall be new, unused, free of defects, and of current manufacture. Equipment and material shall carry Underwriters Laboratory certification if required by local, state or national codes. Products are to be from the acceptable manufacturer listed below or an approved alternate. In no case will field fabrication or "shop built" cable support products be acceptable.

2.2 ADJUSTABLE CABLE SUPPORT SYSTEM

- A. Cable support system shall be a factory produced assembly and sized to accommodate 100 percent expansion, i.e., rated to hold double the number of initially installed cables.
- B. Acceptable product is: CADDY® CABLECAT Adjustable Cable Support

2.3 ROD MOUNTED CABLE SUPPORT SYSTEMS

- A. Acceptable product is: CADDY® CAT-CM Cable Support System

2.4 FIRE STOPPING SYSTEMS FOR TELECOM RACEWAYS

- A. Acceptable products for 2" through 4" penetrations are as follows
 - 1. STI EasyPath™
 - 2. Resilient elastomeric caulk and re-enterable putty manufactured by 3M™, Specified Technologies or Hilti.
- B. Acceptable products for less than 2" penetrations are as follows
 - 1. Resilient elastomeric caulk and re-enterable putty manufactured by 3M™, Specified Technologies or Hilti.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install per manufacturer's instruction per weight loading.
- B. All conduits shall be attached to walls unless conditions exist which prohibit this type of installation. When this condition exists, mount conduits with 3/8" rod attached to building structure utilizing UniStrut® channel.
- C. Installation and configuration shall conform to the requirements of the current revision levels of ANSI/TIA-569, NEC®, applicable local codes, and to the manufacturer's installation instructions.
- D. Do not exceed load ratings specified by manufacturer.
- E. Metal components shall be bonded and grounded in accordance with ANSI/TIA-607-C.
- F. Adjustable cable support systems are to be securely attached to building structure and loaded as per manufacturer's instruction.
- G. Fire Rated wall and floor penetrations shall be fire-stopped in accordance with the manufacturer's instructions using the product set referenced in 2.4 above.

END OF SECTION 27 05 28

SECTION 27 05 28.29 - HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes discrete J-Hooks, slings and related accessories for supporting low voltage cable bundles above accessible ceilings.

1.2 REFERENCES

- A. American National Standards Institute (ANSI)/Telecommunications Industry Association (TIA)
 - 1. ANSI/TIA-569-D Standard for Telecommunications Pathways and Spaces for Commercial Building
 - 2. ANSI/NFPA 70 National Electrical Code (NEC®)
- B. Underwriters Laboratories, Inc. (UL®)
 - 1. UL® 2043 Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
 - 2. UL® 2239 Conduit, Tubing and Cable Support Hardware

1.3 DEFINITIONS

- A. Pathway - A series of supports and accessories for placement of low voltage systems cables
- B. Main Pathway - A low voltage systems pathway where the cable count exceeds 30 cables

1.4 SUBMITTALS

- A. Product Data: Submit product data on all cable support devices and accessories. Indicate materials, finishes, load ratings, dimensions, listings, approvals and attachment methods.
- B. Closeout Submittals
 - 1. As-built Drawings: Provide marked up as-built drawings of main pathways

1.5 QUALITY ASSURANCE

- A. Low voltage system cable supports and accessories shall be listed to Underwriters Laboratories, Inc. Standard 2239.
- B. Low voltage system cable supports and accessories shall have the manufacturers name and part number stamped on the part for identification.
- C. Pre-Installation Meetings: Contractor shall set up a pre-installation meeting with the Owner to discuss low voltage cable support layout work and installation guidelines. Purpose of meeting shall be to coordinate work between the parties to have, wherein at all possible, a consistent layout for camera system cables, minimize interferences, and to make cable system accessibility for future Owner modifications and maintenance.

1.6 COORDINATION

- A. Revise locations and elevations as required to suit field conditions and as approved by Owner.

PART 2 - PRODUCTS

2.1 NON-CONTINUOUS CABLE SUPPORT SYSTEMS (J-HOOKS)

- A. Shall be constructed of galvanized steel, stainless steel, or hot dipped zinc
- B. Fastener is to be installed using dedicated wire/rod with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments. Product is to be UL® Listed for the application.

1. Non-Continuous Cable Supports

- a. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables; UL® Listed.
- b. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.
- c. Non-continuous cable supports sized 1 - 5/16" and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.
- d. Non-continuous cable supports shall have an electro-galvanized or G60 finish and shall be rated for indoor use in non-corrosive environments.
- e. Stainless Steel non-continuous cable supports are intended for indoor and outdoor use in non-corrosive environments or where only mildly corrosive conditions apply.
- f. Non-continuous cable supports shall be ERICO CableCat™ J-hook series CAT12, CAT21, CAT32, CAT64, CAT21SS, CAT32SS, CAT64SS; CAT-CM™ Double J-Hook CAT100CM; CAT-CM™ U-hook series CAT200CMLN, CAT300CMLN; and CAT-CM™ retainer CATRT200CM, CATRT300CM or approved equal
- g. Non-continuous cable supports shall be ERICO CableCat™ J-hook series CAT12, CAT21, CAT32, CAT64, CAT21SS, CAT32SS, CAT64SS; CAT-CM™ Double J-Hook CAT100CM; CAT-CM™ U-hook series CAT200CMLN, CAT300CMLN; and CAT-CM™ retainer CATRT200CM, CATRT300CM or approved equal.

2. Adjustable non-continuous cable support sling

- a. Constructed from steel and woven laminate; sling length can be adjusted to hold up to 425, 4-pair UTP; rated for indoor use in non-corrosive environments. Rated to support Category 6 and higher cable, or optical fiber cable; UL® Listed.
- b. Adjustable non-continuous cable support sling shall have a static load limit of not less than 100 lbs.
- c. Adjustable non-continuous cable support sling shall be suitable for use in air handling spaces.
- d. If required, assemble to manufacturer recommended specialty fasteners including beam clips, flange clips, C and Z purlin clips.
- e. Acceptable products: ERICO CADDY® CableCat™ CAT425; or approved equal.

3. Multi-tiered non-continuous cable support assemblies

- a. Multi-tiered non-continuous cable support assemblies shall be used where separate cabling compartments are required. Assemblies may be factory assembled or assembled from pre-packaged kits. Assemblies shall consist of a steel angled hanger bracket holding up to six non-continuous cable supports, rated for indoor use in non-corrosive environments; UL® Listed.
- b. If required, the multi-tier support bracket may be assembled to manufacturer recommended specialty fasteners including beam clamps, flange clips, C and Z purlin clips.
- c. The multi-tiered support bracket shall consist of ERICO CADDY® CATHBA and CableCat™ J-Hooks with screws; or approved equal.

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4. Non-continuous cable support assemblies from tee bar
 - a. Tee bar support bracket with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; UL® Listed.
 - b. Acceptable products: ERICO CADDY® CAT12TS, CAT21528, CAT32528; or approved equal.
 5. Non-continuous cable support assemblies from drop wire/ceiling
 - a. Fastener to wire/rod with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; UL® Listed.
 - b. Acceptable products: ERICO CADDY® CAT124Z34, CAT126Z34, CAT214Z34, CAT216Z34, CAT324Z34 or CAT326Z34; or approved equal.
 6. Non-continuous cable support assemblies from beam, flange
 - a. Fastener to beam or flange with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; UL® Listed.
 - b. Acceptable products: ERICO CableCat™ J-hook series CAT12, CAT21, CAT32, CAT64 with CADDY® beam clamps and CADDY® flange clips; or approved equal.
 7. Non-continuous cable support assemblies from C & Z Purlin
 - a. Fastener to C or Z purlin with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments, UL® Listed.
 - b. Acceptable products: ERICO CableCat™ J-hook series CAT12, CAT21, CAT32, CAT64 with CADDY® Purlin hangers; or approved equal.
 8. Non-continuous cable support assemblies from wall, concrete, or joist
 - a. Fastener to wall, concrete, or joist with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments, UL® Listed.
 - b. Acceptable products: ERICO CableCat™ J-hook series CAT12, CAT21, CAT32, CAT64, with CADDY® angle bracket; or approved equal.
 9. Non-continuous cable support assemblies from threaded rod
 - a. Fastener to threaded rod with one non-continuous cable support, factory or jobsite assembled, rated for indoor use in non-corrosive environments, UL® Listed.
 - b. The multi-tiered support bracket shall have a static load limit of 300 lbs.
 - c. U-hooks and Double J-hook shall attach directly to threaded rod using standard nuts.
 - d. Acceptable products: ERICO CableCat™ J-hook, CAT12, CAT21, CAT32, CAT64 with CADDY® CATHBA series; CAT-CM™ Double J-hook CAT100CM, CAT-CM™ Direct mount U-hook CAT200CMLN, CAT300CMLN; or AFAB series; or approved equal.
 10. Cantilever-Mounted cable supports
 - a. U-hook shall be able to be assembled to a wide variety of wall mount brackets.
 - b. Spacing of individual U-hooks as needed, max of 4' to 5' apart.
 - c. U-hooks may have the optional attachment of a cable roller for ease in pulling cables.
 - d. Acceptable products: ERICO CAT-CM™ U-hooks CAT200CMLN, CAT300CMLN: CAT-CM roller assemblies CATRL200CM, CATRL300CM; CATWMCM bracket; or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Cable installation and supports shall comply with applicable provisions of ANSI/TIA-569-D and ANSI/NFPA 70
- B. All low voltage systems cables shall be supported. Provide supports along entire pathway.
- C. Space supports a maximum of 60 inches apart and at each change of direction of the cables. In areas covered by dropped ceiling, tiles shall be left open to allow inspection by Owner.
- D. Hang cable supports from 3/8" all thread rods, dedicated #8 galvanized ceiling drop wire or wall brackets connected directly to structure. Do not support from the ceiling grid or ceiling wire system.
- E. Where main pathways are indicated on the Drawings, contractor shall follow the indicated pathways as closely as possible according to field conditions. Pathways for smaller cable counts shall be designed and documented on the as-built drawings by the contractor.
- F. Install support wires, brackets or rods to route cables parallel and perpendicular to building lines.
- G. Provide multiple hooks or slings at each hanger location as required by cable count and cable segregation requirements.
- H. Fill supports with cabling to 50% or less of the manufacturer's recommended fill. Provide multiple supports where required cable count exceeds 50% fill.
- I. Install low voltage cable support system above accessible ceilings only.
- J. Elevation of Cable Supports: Contractor shall coordinate the allocation of ceiling space and the mounting elevations to allow maintenance and accessibility for future modifications. Telecommunications cable supports shall be as close to the ceiling as possible while allowing ceiling tiles to be removed. Supports shall be located to avoid interference with maintenance access to other equipment.

END OF SECTION 27 05 28.29

SECTION 27 05 28.33 – CONDUITS AND BACKBOXES FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Related Sections

1. Section 27 00 00 – Communications
2. Section 27 05 26 – Grounding and Bonding for Communications Systems
3. Section 27 05 28 – Pathways for Communications Systems
4. Section 27 05 28.36 – Cable Trays for Communications Systems

B. Other References

1. ANSI/TIA-569-D - Commercial Building Standard for Telecommunications Pathways and Spaces

1.2 DESCRIPTION

- A. Provide raceway systems for the installation of the telecommunications cables. Installation shall include raceways, outlet boxes; plaster rings and, outlet box cover plates.

1.3 REFERENCES

- A. Comply with the References requirements of Section 27 0000.

- B. In addition, comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. ANSI C80.1, American National Standard for Electrical Rigid Steel Conduit (ERSC)
2. ANSI C80.3-2015, Electrical Metallic Tubing - Steel (EMT-S)
3. ANSI/NEMA FB-1-2012, Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable
4. ANSI/NEMA OS 1, Sheet Steel Outlet Boxes, Device Boxes, Covers and Box Supports
5. NEMA 250-2014, Enclosures for Electrical Equipment

1.4 DEFINITIONS

- A. EMT - electrical metallic tubing.

- B. RMC - rigid metal conduit

- C. Raceway - any enclosed channel for routing wire or cable

- D. Pull box - a NEMA listed box with a removable cover, used to facilitate pulling cable through conduit runs longer than 100' or in which there are more than 180 degrees of bends.

- E. Junction box – a NEMA listed box wherein a conduit run transitions from a feeder conduit to multiple distribution conduits.

1.5 SUBMITTALS

- A. General: Conform to Submittal requirements as described in Section 27 0000.
- B. Submittal Requirements at Start of Construction:
 - 1. Product Data Submittal
- C. Submittal Requirements at Close Out:
 - 1. Record Drawings Submittal
- D. Substitutions:
 - 1. As per requirements in Section 27 00 00.

1.6 QUALITY ASSURANCE

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

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Comply with Delivery, Storage and Handling requirements of Section 27 00 00.

1.8 WARRANTY

- A. Comply with Warranty requirements of Section 27 00 00.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Conduit: Minimum conduit size shall be 1 inch. Provide EMT conduit except as noted below:
 - 1. Under slab, and in floor: Provide RMC with external PVC coating. Protect male threads of conduit with PVC coating using an application of an electrically conductive two-part urethane coating.
- B. Device boxes: Provide device boxes as follows:
 - 1. For flush outlets locations:
 - a. Device boxes shall be 4 11/16" square (2 1/8" depth) with single gang extension rings (i.e. device covers, mud rings).
 - 2. For surface mounted outlets:
 - a. Device boxes shall be minimum 4" square (2 1/8" depth) unless otherwise noted on the Drawings.
 - 3. Sleeves: Provide sleeves where required for wall and floor penetrations. Provide core drilling where required for sleeve installation. Sleeves shall be STI EZ® Path. Sizing shall be as noted on the Drawings.
 - 4. Firestopping: Provide firestopping material to maintain the fire rating of all penetrated walls, floors, and ceiling structures. Material shall be acceptable to the local fire and building authorities as well as applicable codes and shall be re enterable. STI EZ® Path sleeves satisfy this requirement

2.2 RIGID METAL CONDUIT (RMC) FITTINGS

- A. RMC fittings shall be hot dipped galvanized or with a sheradised finish. Couplings shall be un-split, NPT threaded steel cylinders with galvanizing equal to the conduit. Nipples shall be factory made through eight inches in length. Running threads will not be allowed.

2.3 ELECTRICAL METALLIC TUBING (EMT) FITTINGS

- A. Couplings and connectors shall be compression type employing a split, corrugated ring and tightening nut. They shall be steel. Cast metal or malleable iron will not be acceptable. Connectors shall be complete with integral insulated throat bushings, thread bushings and locknuts. Indent or set screw couplings and connectors are not acceptable.

2.4 CONDUIT SUPPORTS

- A. Conduit Clamps, Straps, and Supports: Steel.
- B. Support Channels
1. Acceptable Manufacturers:
 - a. B-line
 - b. Kindorf
 - c. Unistrut®
 - d. Or approved equal
 2. 12 gauge galvanized or painted steel, "U" section, 1-½" square nominal in section.
 3. Hardware: Manufacturer's standard as required to support equipment. Supports and anchors shall be galvanized steel in dry areas; stainless steel in wet areas.
 4. Threaded Rod: Zinc plated steel, 3/8" diameter minimum, sized to support load

2.5 SEALANT

- A. Conduit sealant shall be clear or colorless RTV silicone or equal.

2.6 PROTECTIVE COATINGS

- A. Corrosion Resistant Coatings: Asphaltic base liquid; Koppers Bitumastic 50.

2.7 OUTLET, PULL AND JUNCTION BOXES

- A. Junction and device boxes for dry locations shall be stamped steel, deep drawn one piece (without welds or tab connections), galvanized with knockouts for conduit or connector entrance.
- B. Junction and device boxes and fittings which are outdoors, below grade, or in wet or damp locations shall be galvanized cast iron or cast aluminum with threaded holes or hubs.
- C. Covers for junction boxes and fittings (and those device boxes which do not have device covers) shall be the same material and finish as the boxes to which they are attached. Neoprene gaskets shall be provided.

2.8 JUNCTION BOXES FOR UNDERGROUND CIRCUITS

- A. Approved hand holes and vaults are those manufactured by Utility Vault or approved equivalent. See drawings for type and installation details.

2.9 OUTLETS

- A. Outlets in all but dropped ceiling locations shall be 4-11/16" square, 2-3/4" deep (minimum) with a 5/8" deep single gang device (mud) ring.

2.10 DROPPED CEILING OUTLETS

- A. Provide brackets, such as Erico 512HD, Heavy Duty T-Grid Box Hanger, to facilitate the flush mounting cameras in dropped ceilings.

2.11 PULL STRING

- A. Provide plastic or nylon pull string for all conduits. Pull string shall have not less than 200-pound tensile strength.

PART 3 - EXECUTION

3.1 GENERAL

- A. Where at all possible, pathway shall be installed at a minimum of 96" above finished floor.
- B. Install pathway in a manner that discourages tampering.
- C. Conduits are to be mounted directly to hard surfaces with "U" shaped clamps and anchored with tamper resistance fasteners.

3.2 CONDUIT SIZING TABLE

- A. Provide conduits for camera locations as per drawings. Where not specified, minimum size shall be Trade Size 1.

3.3 RACEWAYS

- A. No length of run shall exceed 100 feet and shall not contain more than two 90-degree bends or the equivalent without a code size pull box. Provide pull boxes where necessary to comply with these requirements. Locate pull boxes in straight runs only, not as a replacement for an elbow.
- B. Conduits with an internal diameter of two inches or less shall have a bend radius at least 6 times the internal conduit diameter. Conduits greater than two inches shall have a bend radius at least 10 times the internal conduit diameter.
- C. Provide an insulated bushing on all conduits terminated in a cabinet and/ or pull boxes.
- D. Terminate conduits stubbed out above accessible ceiling space so that the conduit is parallel with the ceiling and provide an insulating bushing.

3.4 PULL BOXES

- A. Pull boxes, as required, shall be sized per the following table:

Metric designator (trade size)	Width mm (in)	Length mm (in)	Depth mm (in)	Width increase for additional conduit mm (in)
27 (1)	102 (4)	406 (16)	76 (3)	51 (2)
35 (1-¼)	152 (6)	508 (20)	76 (3)	76 (3)
41 (1-½)	203 (8)	686 (27)	102 (4)	102 (4)
53 (2)	203 (8)	914 (36)	120 (4)	127 (5)
63 (2-½)	254 (10)	1067 (42)	127 (5)	152 (6)
78 (3)	305 (12)	1219 (48)	127 (5)	152 (6)
91 (3-½)	305 (12)	1372 (54)	152 (6)	152 (6)
103 (4)	381 (15)	1524 (60)	203 (8)	203 (8)

3.5 JUNCTION BOXES

- A. Provide junction boxes as shown on the Drawings. 90 degree condulets (LB's) are not acceptable. Pull boxes shall be sized as follows:

Metric designator (trade size)	Width mm (in)	Length mm (in)	Depth mm (in)	Width increase for additional conduit mm (in)
27 (1)	102 (4)	305 (12)	102 (4)	51 (2)
35 (1-¼)	102 (4)	305 (12)	120 (4)	51 (2)
41 (1-½)	102 (4)	305 (12)	102 (4)	102 (4)
53 (2)	102 (4)	610 (24)	120 (4)	102 (4)
63 (2-½)	152 (6)	610 (24)	152 (6)	102 (4)
78 (3)	152 (6)	915 (36)	152 (6)	152 (6)
91 (3-½)	152 (6)	1220 (48)	152 (6)	152 (6)
103 (4)	152 (6)	1525 (60)	152 (6)	152 (6)

3.6 PULL STRINGS

- A. Nylon type pull strings shall be included in all raceways over 10 feet long. Leave not less than 12 inches of slack at each end of the pull wire.

3.7 HARD CEILING BOXES

- A. Hard ceiling boxes shall be secured in a manner that renders the faceplate flush and tight to the ceiling. Faceplate shall completely cover the opening cut into the ceiling tile.

3.8 RACEWAY RISER SLEEVES

- A. Where it is necessary to place riser raceways to be between floors, install such with tops six inches above each floor to give continuous cable riser capability. Stuff sleeves with an approved non-combustible material such as rock wool to maintain floor fire separation.

END OF SECTION 27 05 28.33

SECTION 27 05 28.36 - CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, tests and services to completely execute a complete wire basket cable tray system as described in this specification and as shown on the Drawings.
- B. Wire basket cable tray systems are defined to include, but are not limited to straight sections of continuous wire mesh, field formed horizontal and vertical bends, tees, drop outs, supports and accessories.
- C. Material listed in this section is for use in non-telecom spaces.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM) International:
 - 1. ASTM A1011 / A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
 - 2. ASTM A123 / A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 3. ASTM A510 - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
 - 4. ASTM A513 - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
 - 5. ASTM A580 – Standard Specification for Stainless Steel Wire
 - 6. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
 - 7. ASTM A641 / A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
 - 8. ASTM A653 / A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 9. ASTM D769 - Standard Specification for Black Synthetic Iron Oxide
- B. National Electrical Manufacturers Association:
 - 1. NEMA FG 1 - Fiberglass Cable Tray Systems.
 - 2. NEMA VE 1 - Metal Cable Tray Systems.
 - 3. NEMA VE 2 - Cable Tray Installation Guidelines.
- C. NFPA 70: National Electrical Code (*NEC*[®])
- D. ANSI/TIA-569-D – Commercial Building Standard for Telecommunications Pathways and Spaces

1.3 DRAWINGS

- A. Specifications and Drawings are for assistance and guidance, but exact routing, locations, distances and levels will be governed by actual field conditions. Contractor is directed to make field surveys a part of his work prior to submitting system layout drawings.

1.4 QUALITY ASSURANCE

- A. All components and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner.
- B. Supply all equipment and accessories new and free from defects.
- C. Supply all equipment and accessories in compliance with the most current version of applicable standards listed in Part 1.2 of this section and with all applicable national, state and local codes.
- D. All items of a given type shall be the products of the same manufacturer.
- E. Zinc plated wire basket cable tray shall be classified by Underwriters Laboratories (UL®).
- F. Wire basket cable tray shall be of uniform quality and appearance.
- G. Comply with the *NEC*®, as applicable, relating to construction and installation of cable tray and cable channel systems (Article 392, *NEC*®).
- H. Comply with NFPA 70B, "Recommended Practice for Electrical Equipment Maintenance" pertaining to installation of cable tray systems.

1.5 SUBMITTALS

- A. Submittal Drawings: Submit drawings of wire basket cable tray and accessories including connector assemblies, clamp assemblies, brackets, splice plates, splice bars, grounding clamps and hold-down plates showing accurately scaled components. Indicate wire basket cable tray dimensions, support points, and finishes.
- B. Product Data: Submit manufacturer's data on wire basket cable tray system including, but not limited to, types, materials, finishes and inside depths.
- C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under references. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual routing of cable tray and locations of supports.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Ship and store wire basket cable tray system equipment in its original packages and in a clean, dry space to prevent damaging from weather, construction traffic or foreign matter. All handling performed in accordance with manufacturer's recommendations. Provide protective coverings during construction.

- B. Deliver wire basket cable tray systems and components carefully to avoid breakage, bending and scoring finishes. Do not install damaged equipment.
- C. Replace at no expense to Owner, equipment or material damaged during storage or installation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with these specifications, wire basket cable tray systems to be installed shall be as manufactured by the following:
 - 1. Chatsworth Products Incorporated
 - 2. Cooper B-Line
 - 3. Approved equivalent

2.2 WIRE BASKET CABLE TRAY SECTIONS AND COMPONENTS

- A. Provide wire basket cable tray of types and sizes indicated with connector assemblies, clamp assemblies, connector plates, splice plates and splice bars. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the additional construction highlighted in Section 2.2
- B. All straight section longitudinal wires shall be constructed with a continuous top wire safety edge. Safety edge must be kinked and T-welded on all tray sizes.
- C. Wire basket cable tray shall be made of high strength steel wires and formed into a standard 2" by 4" wire mesh pattern with intersecting wires welded together. All mesh sections must have at least one bottom longitudinal wire along entire length of straight section.
- D. Wire basket cable tray sizes shall conform to the following nominal criteria:
 - 1. Straight sections shall be furnished in standard 118" - 120" lengths.
 - 2. Wire basket cable tray shall have a 4 inch usable loading depth by 12" or 18" wide as called out on Drawings.
- E. In order for a system to be approved as an equipment ground conductor (EGC), all splicing assemblies shall be UL® Classified or CSA approved as an EGC. When using powder coated wire mesh cable tray as an EGC, the paint must be completely removed at all contact points of splice/ground bolt attachments.
- F. All fittings shall be field formed from straight sections in accordance with manufacturer's instructions.
- G. Wire basket cable tray supports shall be center support hangers, trapeze hangers or wall brackets.
- H. Special accessories shall be furnished as required to protect, support and install a wire basket cable tray system.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wire basket cable tray in accordance with NEMA VE 2 to ensure that the cable tray equipment complies with the requirements of the *NEC*[®], applicable portions of NFPA 70B, and the National Electrical Contractors Association's (NECA) 'Guide to Quality Electrical Installations' pertaining to general electrical installations practices.
- B. All trays should be supported using a minimum of 3/8" All Threaded Rod (ATR).
- C. Special accessories shall be furnished as required to protect, support and install a wire basket cable tray system.
- D. Coordinate wire basket cable tray with other electrical work as necessary to properly interface installation of wire basket cable tray with other work.
- E. Support trays and fasten to structure. Install supports at each connection point, at end of each run, and at other points to maintain spacing between supports of **5 feet** maximum.
- F. Install firestopping in accordance with local and NFPA regulations to sustain ratings when passing wire basket cable tray through fire-rated elements.
- G. Ground and bond metal cable tray in accordance with ANSI/TIA-607-C and NFPA 70, National Electrical Code Article 392: Cable Trays.
 - 1. Provide continuity between wire basket cable tray components. Powder coating must be thoroughly removed at grounding device connection point.
 - 2. Make connections to tray using mechanical, compression or exothermic connectors.
 - 3. If required, ground cable trays by mounting up to two #6 AWG bare copper wires to each wire basket cable tray section, bonded with a grounding clamp.
- H. Provide sufficient space encompassing wire basket cable tray to permit access for installing and maintaining cables.

3.2 TESTING

- A. Test wire basket cable tray support systems to ensure electrical continuity of bonding and grounding connections, and to demonstrate compliance with specified maximum grounding resistance. See NFPA 70B, Chapter 18, for testing and test methods.

END OF SECTION 27 05 28.36

SECTION 27 0528.39 - SURFACE RACEWAYS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Surface mounted raceway (SMR).

1.2 RELATED SECTIONS

- A. Section 27 05 28 – Pathways for Communications Systems
- B. Section 27 05 28.33 - Conduits and Backboxes for Communications Systems
- C. Section 27 05 28.36 - Cable Trays for Communications Systems

1.3 SUBMITTALS

- A. Submit under provisions of Section 27 05 13
- B. Samples: If other than specified product is bid, Contractor must submit a 24-inch length of proposed product. Show finished detail with boxes, faceplate, connectors, angles and transitions.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firms regularly engaged in manufacturer of raceway systems, boxes and fittings of the types and sizes required, whose products have been in satisfactory use in similar service for not less than 10 years. Provide fittings and boxes produced by a manufacturer listed in this section.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver raceways and distribution systems in factory labeled packages.
- B. Store and handle in strict compliance with manufacturer's written instructions and recommendations.
- C. Protect from damage due to weather, excessive temperature, and construction operations.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

- A. Provide surface mount raceway distribution components as manufactured by Panduit (TG70 Series), or approved alternate.
- B. SMR shall be manufactured by Panduit (TG70 or equal). All fittings and transitions pieces are to be of the same manufacturer; however, low voltage receptacles may be from a different manufacturer so long as the product is designed to be an integral part of the completed system

2.2 SURFACE MOUNTED RACEWAYS AND FITTINGS

A. General:

1. System: Surface raceway systems shall consist of bases, covers, appropriate fittings, mounting brackets, workstation boxes / enclosures and device mounting brackets and fasteners necessary for a complete installation.
2. Surface mounted raceways shall be a rectangular design with removable covers or solid construction, constructed of shatter-proof thermoplastic (or similar) raceway, utilizing elbows, couplings, and connectors of the same material.
3. Mounting Brackets: Surface mounted raceway shall be secured to wall using properly rated anchors or mounting brackets. Brackets shall provide un-obscured inspection of fastening bolts at point of wall penetration. In no case whatsoever will surface mounted raceways be attached with drywall screws.
4. Fittings: Fittings shall include flat, internal and external elbows, tees, couplings for joining raceway sections, wire clips, blank end fittings, and device mounting brackets and plates as applicable. Provide full capacity corner elbows and fittings to maintain a controlled 2-inch cable bend radius, meeting the specification for balanced twisted pair cabling and exceeding the ANSI/TIA-569-D requirements for communications pathways.

- B. Termination Boxes: Boxes should be at least 4-inch high by 2-inch wide by 3 -inch deep, constructed from same material as the SMR and pre-punched holes or knockouts. Boxes shall be surface mounted on the wall approximately 18 to 48 inches above final floor line depending on room furniture type and layout. Boxes shall have a minimum of two separate wall-fastening points and fastened to the wall using screws or bolts

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions under which raceways, boxes, distribution systems, accessories, and fittings are to be installed and substrate that will support raceways. Notify the Owner's Representative in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Strictly comply with manufacturer's installation instructions and recommendations and approved installation practices. Care should be taken to prevent "over tightening" of fastening devices.
- B. The SMR shall be surface mounted on the wall using properly rated anchors or brackets. The top edge of the SMR shall be horizontally level below the suspended ceiling line or the true ceiling line, whichever is lower, shall be installed to permit visually inspection to verify the physical integrity of the raceway for its entire run, shall not block doorways or access to emergency exits, shall not inhibit the operation of windows, and shall not run across windows.
1. Support: SMR shall be supported by properly rated anchors or mounting brackets at intervals not to exceed 5 feet or in accordance with manufacturer's installation sheets.
 2. Accessories: Provide accessories as required for a complete installation.

3.3 FINAL FINISH

- A. All surfaces are to be left completely smooth and finished. No cut edges are to be exposed. In the event a metallic product is used, all rough edges are to be dressed and covered with appropriate fittings that prevent any access whatsoever with sharp edges.
- B. The Contractor shall coordinate with Owner to schedule paint of metallic product to match wall. Non-metallic product shall not be painted.

3.4 CLEANING AND PROTECTION

- A. Clean exposed surfaces using non-abrasive materials and methods recommended by manufacturer.
- B. Protect raceways and boxes until acceptance.

END OF SECTION 27 05 28.39

SECTION 27 05 53 IDENTIFICATIONS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide all labor, materials, tools, and equipment required for the complete labeling of the telecommunications infrastructure.

1.2 SCOPE

- A. This section includes all telecommunications cables and the associated infrastructure.

1.3 QUALITY ASSURANCE

- A. All cable identification tags and labels shall be installed in a neat and workmanlike manner.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The labels shall be machine generated.
- B. The label background shall be white with either black or blue ink.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General

- 1. All horizontal (station) cables shall be identified by the Contractor at both ends.
- 2. Eugene 4J has a unique labeling scheme and this project will be required to coordinate with the Owner for the exact criteria prior to placement of cable.

B. Cables

- 1. Cables will be labeled no more than 4 inches from the both ends. The tag shall be secured to the sheath. The cables will be labeled with specific information that indicates:
 - a. Room number where camera is located
 - b. Relative position within the room
 - c. Patch panel port numbers shall be included (pre-printed on patch panel, i.e., 1-48)

C. Camera locations

- 1. Camera location shall be labeled with the exact criteria selected by the Owner.

D. Patch Panels

- 1. Patch panels shall be labeled identical to the cables and camera locations.

END OF SECTION 27 05 53

SECTION 27 08 00 - COMMISSIONING OF COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide all labor, materials, tools, and equipment required for complete end-to-end testing of all cabling installed by this contract.

1.2 TESTING, IDENTIFICATION AND ADMINISTRATION

- A. All cables and termination points will be tested and labeled per specifications.
- B. Testing is required for all cables.
- C. All test results shall be forwarded to the Owner for certification. Results observed to be outside stated performance parameters shall be used by the Contractor for immediate correction.

1.3 POST INSTALLATION SERVICES

- A. The Contractor shall provide on-site service as part of the warranty in the event of the failure of any installed components.
- B. The contractor will provide support and warranty for installed cabling.
 - 1. The Contractor will be the first contact point and will interface between manufacture and Owner for warranty issues.
 - 2. The Contractor will provide the Owner with contact information of the manufacture for warranty coverage prior to cable acceptance.

1.4 QUALITY ASSURANCE

- A. See Section 27 05 13

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. The Contractor shall provide all tools and instruments used to test the installed telecommunications signal cabling.
- B. Test instruments used by the Contractor shall be suitable for the purpose at hand, and shall be of industry-recognized manufacture. Note that copper testing parameters are written for Fluke DTX-1800 or newer tester.
- C. Tools leased by the Contractor are acceptable, provided the operator of the test instrument(s) has a sufficient degree of operational awareness to use the rented instrument(s) correctly and obtain test data that is both, accurate and relevant.

2.2 WARRANTY

- A. All telecommunications cable installed as part of a manufacturer's certified system shall carry the manufacturer's warranty for a minimum of 20 years.
- B. The manufacturer shall provide certification attesting to on-site service as part of the warranty in the event of the failure of any installed balanced twisted pair cables, fiber-optic cables, telecommunications room terminations, telecommunications outlet terminations, or cross-connect cables.
- C. Such service shall be free of charge to the Owner and shall commence from the date of project acceptance and terminate not earlier than the twenty year anniversary of that date.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. The basic link shall be tested.
- B. All test results observed shall be used by the Contractor to determine any polarity and noise anomalies for immediate correction.
- C. Test results shall be used jointly by the Contractor and the Owner to determine the viability of each cable for transmission in accordance with the specifications of the cable manufacturer, and the requirements imposed by the transmission system. This shall form part of the acceptance procedure for the cable plant.
- D. All results obtained by use of pair-scanner testing shall be collated by camera location (ID to be provided by Owner) and presented to the Owner at the conclusion of the testing. Test compilation shall be certified by the Contractor's technician performing the test.
- E. Hard copy of the test results will not be accepted, rather solid-state media containing test data and the appropriate application to display such in a Windows base environment is required.

3.2 GENERAL TESTING PARAMETERS - COPPER

- A. Copper cabling shall be tested and certified after installation as follows and as required for cable manufacturer's warranty. Twisted-pair copper cable channels shall be tested for continuity as specified below, presence of ac/dc voltage, and performance. All cabling shall be tested for conformance to horizontal cable specifications as outlined herein, and shall be tested according to test set manufacturer's instructions utilizing latest firmware and software. Testing shall include all of electrical parameters as specified in Paragraph D below.
- B. All cables and termination hardware shall be 100 percent tested under installed conditions. All conductors of each installed cable shall be verified useable by Contractor prior to system acceptance. All cables shall be tested according to contract documents, manufacturer's warranty provisions, and best industry practices. If any of these are in conflict, Contractor shall comply with most stringent requirements. All defects in cabling system installation shall be repaired or replaced in order to ensure 100 percent useable conductors in all cables installed, at no additional cost to Owner.
- C. Balanced twisted pair testing shall provide certification and summary for all locations.

D. All cable paths shall be tested at each jack for the following parameters and meet category 6A requirements imposed by the ANSI/TIA-568-C.2 and the manufacture's written specification. Testing will include the following parameters:

1. Wire Map
2. Cable Length
3. Pair-to-pair NEXT
4. Power Sum NEXT
5. Attenuation
6. Pair-to-Pair ELFEXT
7. Power Sum ELFEXT
8. Return Loss
9. Propagation Delay
10. Delay Skew

END OF SECTION 27 08 00

SECTION 27 11 00 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Note: Existing communications infrastructure may be used if sufficient rack space is available. In the event such is not the case, this Section, along with Sections 27 11 16 and 27 11 23, details the requirements for expansion.
- B. Drawings and general provision of the Contract, including General and other Conditions and other General Requirements sections, apply to the work specified in this section.

1.2 SECTION INCLUDES

- A. Construction Requirements
- B. Environmental Considerations
- C. Site Specific Requirements
- D. Permits and Inspections

1.3 RELATED SECTIONS

- A. Section 27 05 13 – Communications Services
- B. Section 27 05 26 – Grounding and Bonding for Communications Systems
- C. Section 27 05 28 – Pathways for Communications Systems
- D. Section 27 05 28.33 - Conduits and Backboxes for Communications
- E. Section 27 05 28.26 – Cable Trays for Communications Systems

1.4 CONSTRUCTION REQUIREMENTS

- A. This contract shall only be responsible for the plywood backboard material in the telecommunications spaces if shown on the Drawings or required due to addition of racks.
- B. This contract will be responsible for procurement and installation of specified components from the drywall out, i.e., all plywood backboards, telecommunications grounding busbars and bonding to such busbars as shown on the Drawings or deemed necessary for a complete system.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The use of a manufacturer's name and model or catalog number herein is for the purpose of establishing the product set, which the Contractor is to supply and install.
- B. Quantities are to be determined by Contractor unless specified.

2.2 PRE-APPROVED PRODUCT SETS

- A. Fittings and all required ancillary components – bench stock parts that are equal or greater than required to satisfy local AHJ.
- B. Telecommunications grounding busbars as per Section 27 05 26.

2.3 PLYWOOD BACKBOARD

- A. Note: Only if shown on Drawings or required due to additional racks.
- B. Do not use fire rated plywood.
- C. Backboard shall be 4' x 8' x 3/4" standard lumber yard stock with a minimum grade of "AC".
- D. Finish – plywood shall be painted on all exposed surfaces with two coats of white paint prior to installation of any equipment. Approved product is Benjamin-Moore Super Spec Hp 220 Latex Flat Fire Retardant P59 or equivalent.

PART 3 - EXECUTION

3.1 GENERAL

- A. The installation must conform to TIA standards and comply with state and local codes.
- B. Installation shall be neat, well organized, and professional.
- C. The Contractor shall clean up the work area at the end of each day. Except as noted elsewhere in these specifications, all material removed or left over, and/or not being used shall be removed from the project
- D. All wall and floor penetrations shall be fire stopped before substantial completion.

3.2 PLYWOOD BACKBOARD

- A. Placement - The backboard shall be 4' x 8' sheets, mounted vertically with the bottom of the plywood mounted 6" AFF with the best side toward the room.
- B. Finish - Plywood shall be painted prior to installation of any equipment. All exposed edges are to be finished with two coats of paint. Attach a complete copy of the MSDS to the finished backboard in each telecommunications space.
- C. Attachment - Plywood shall be fastened to the wall by means of wall anchors utilizing galvanized, zinc plated, or stainless steel hardware with a flat head. Finished installation shall have flush appearance with countersunk screw heads to prevent splitting of the plywood.

3.3 EQUIPMENT INSTALLATION

- A. Equipment shall be firmly held in place. Fastenings, supports, and hangers shall be adequate to support their loads.
- B. Installation shall satisfy the local AHJ in terms of seismic bracing.
- C. Where brackets or attachment points touch the walls, plywood backboard shall be in place between attachment point and wall. In no case shall any attachment be directly to drywall.

3.4 PREPARATION

- A. Before commencing work, the Contractor shall field-investigate the facility and ascertain if the physical and electrical conditions within the facility shall permit commencement of the Contractor's work.
- B. Telecommunications spaces must be cleaned and free of construction activities prior to installation of equipment.
- C. Any discrepancies, questions, or concerns noted at that time should be brought to the immediate attention of the Owner.

END OF SECTION 27 11 00

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

PART 1 - GENERAL

1.1 SUMMARY

- A. Note: This Section only applies if additional rack(s) are shown on site Drawings or if such is required to house additional patch panels.
- B. Provide all labor, materials, and equipment for the complete installation of work called for in the Contract Documents.
- C. This section includes the minimum requirements for installation of equipment racks in Telecommunications Rooms.

1.2 RELATED SECTIONS

- A. Section 27 05 26 – Grounding and Bonding for Communications Systems
- B. Section 27 05 28.36 – Cable Trays for Communications Systems
- C. Section 27 11 00 – Communications Equipment Room Fittings
- D. Section 27 11 19 – Communications Terminations Blocks and Patch Panels
- E. Section 27 11 23 – Communications Cable Management and Ladder Rack

1.3 QUALITY ASSURANCE

- A. All equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner. Equipment and materials shall be of the quality and manufacture indicated.
- B. Strictly adhere to all TIA and Bicsi® recommended installation practices when installing communications/data cabling.
- C. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:
 - 1. ANSI/TIA/568-D Series Commercial Building Telecommunications Cabling Standard
 - 2. ANSI/TIA/569-D Commercial Building Standard for Telecommunications Pathways and Spaces
 - 3. ANSI/TIA/607-C Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
 - 4. NFPA 70 – National Electric Code (*NEC*®)
 - 5. Bicsi® – Telecommunications Distribution Methods Manual

1.4 SEISMIC CONSIDERATIONS

- A. All equipment must meet or exceed the requirements of Seismic Zone 3 and satisfy the AHJ for suitable components.
- B. All design or engineering requirements imposed by the AHJ in relation to the mounting of telecommunications racks, ladder tray, bracing or associated components are the responsibility of this contract. This includes any requirements for stamped drawings of approved configuration.

SECTION 27 11 19 - COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. General Conditions and other Division 27 00 00 – Communications requirements and sections, apply to the work specified in this section.
- B. Provide all labor, materials, tools, and equipment, including all support structure whether called out for or not, required for the complete installation of work called for in these documents.
- C. Install modular, rack mounted patch panels, and all support structure in the Telecommunication Rooms as required or as outlined on drawings and specifications.

1.2 SECTION INCLUDES

- A. Balanced twisted pair cables placed between the camera locations and Telecommunications Rooms.

1.3 QUALITY ASSURANCE

- A. All equipment shall be installed in a neat and workmanlike manner.
- B. All materials shall be installed per manufacturer's specifications.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All products must be new and UL® Listed for their use.

2.2 PATCH PANELS

- A. Category 6A, 48 port 8-pin modular rack mounted. Approved are:
 - 1. CommScope
 - 2. Panduit

PART 3 - EXECUTION

3.1 GENERAL

- A. Patch panels shall be installed in upper most position of existing (or new) equipment racks.
- B. All balanced twisted pair cable shall be terminated sequentially on patch panels.

END OF SECTION 27 11 19

SECTION 27 11 23 - COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Note: This Section only applies to sites where new equipment racks will be required or are called out in Drawings as necessary as a part of this project.
- B. Provide all labor, materials, tools, and equipment required for the complete installation of work called for in the Contract Documents.
- C. Install ladder racks, cable trays, and all support structure in the Telecommunication Rooms as outlined on drawings and specifications.
- D. Equipment installed shall include:
 - 1. Ladder trays
 - 2. Vertical cable management
 - 3. Brackets and support pieces
 - 4. All related materials required to provide cable management and transition pathways within the Equipment and Telecommunications Rooms of this project.
- E. Material listed in this section is for use within the telecommunications rooms. See section 27 05 28.36 for cable tray in non-telecommunications room spaces.

1.2 RELATED SECTIONS

- A. Section 27 11 00 – Communications Equipment Room Fittings
- B. Section 27 11 16 – Communications Cabinets, Racks, Frames and Enclosures

1.3 QUALITY ASSURANCE

- A. All equipment shall be installed in a neat and workmanlike manner.
- B. All materials shall be installed per standard installation practices and manufacturer's specifications.

1.4 SEISMIC CONSIDERATIONS

- A. All equipment must meet or exceed the requirements of Seismic Zone 3 and satisfy the AHJ for suitable components.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Chatsworth Products Incorporated (CPI) is the approved for the products listed in this Section.
- B. Attachment hardware not supplied in kits from manufacturer shall be Grade 5 or greater.

2.2 CHANNEL RACK-TO-RUNWAY

- A. Use a Channel Rack-to-Runway Mounting Plate Kit to securely attach 12" wide cable tray to equipment rack. A kit from Chatsworth includes all necessary bolts, washers, and nuts to make the attachments. CPI Part 12730-712

2.3 HORIZONTAL WIRE MANAGEMENT

- A. Horizontal cabling managers shall be used to organize and contain patch cord runs from patch port to vertical cable wire management. Manufacturer to be same as structured cabling system.
- B. Double (3.5') RMU units only are acceptable and are to be supplied at the rate of 1 RMU per each 24 ports of patch panel.

2.4 VERTICAL CABLE MANAGEMENT

- A. Vertical cable managers shall be installed as per Drawings.
- B. The cable manager shall be sized to match cabling requirements. The initial quantity of cables within the cable manager shall not exceed a whole number value equal to 40% of the interior area of the cable manager.
- C. Epoxy-polyester hybrid powder coat finish, black in color.
- D. Vertical cable management panels shall have front and rear channels, with covers.
- E. Provide horizontal crossover cable manager at the top of each rack, with a minimum height of two rack units each.
- F. Double-sided 3.65-inch wide by 84-inches tall. Chatsworth Products Inc., 12096-703.
- G. Double-sided 6-inch wide by 84-inches tall. Chatsworth Products Inc., 11729-703.

2.5 LADDER RACK, SUPPORTS, AND ACCESSORIES

- A. The ladder rack shall be 12" wide universal cable runway as shown on the drawings. CPI 10250-712 (Universal Cable Runway).
 - 1. Ladder rack shall be manufactured from 3/8" wide by 1-1/2" high tubular steel with .065" wall thickness.
 - 2. Ladder rack (side stringers) will be 9' - 11½" long. Cross members will be welded in between stringers on 12-inches intervals/centers beginning 5-3/4" from one end so that there are 10 cross members per ladder rack. There will be 10-1/2" of open space in between each cross member.
 - 3. Ladder rack will be UL® Classified for suitability as an equipment grounding conductor only (the installer must remove paint or use ground straps at splices and intersections)
 - 4. Finish shall be epoxy-polyester hybrid powder coat (paint) in the color(s) specified below.
- B. Ladder Rack Splices
 - 1. Splice kits will provide a method of mechanically connecting ladder rack sections and turns together end-to-end or side-to-end to form a continuous pathway for cables.

-
2. Grounding kits will provide a method of bonding ladder rack sections together that is independent of the pathway splices. The grounding kit should be constructed of UL[®] Listed components.
 3. Splices (splice plates) will be manufactured from steel.
 4. Finish (of splice plates and hardware) shall be zinc plate in the color(s) specified below. Colors are applied as a chemical film over the zinc plate.
 5. Manufacturer: Chatsworth Products, Inc. (CPI), Cable Runway Splices:
 - a. Part Number 11301-701, Butt-Splice Kit, Black. Compression splice for end-to-end connections.
 - b. Part Number 11302-701, Junction-Splice Kit, Black. Compression splice for T- or L-connections.

C. Ladder Rack Supports

1. Supports will be sized to match the width of the ladder rack that is supported.
2. Manufacturer: Chatsworth Products, Inc. (CPI), Cable Runway Supports:
 - a. Part Number 11421-712, Wall Angle Support Kit, for 12-inches Wide Cable Runway (Ladder Rack), Steel, Black.
 - b. Part Number 10595-712, Rack-To-Runway Mounting Plate, for 9-inches to 12-inches Wide Cable Runway (Ladder Rack), for Standard and Universal Racks with 3-inches Deep Equipment Mounting Channels, Steel, Black.

D. Ladder Rack Accessories

1. Cable straps used for attaching cable bundles to the ladder rack cross members must be reusable with a hook and loop-style closure, at least 3/4" wide, and sized for cable bundles that are 2-inches, 3-inches or 4-inches in diameter.
2. End caps used to cover the ends of ladder. Part Number 10642-001.
3. End closing kits used to cover the end of ladder rack will be manufactured from 3/8" wide by 1-1/2" high tubular steel with .065" wall thickness. Kits will consist of a bar cut to match the width of the ladder rack and the hardware required to attach the bar to the end of a length of ladder rack.
4. Movable cross members used to support cross member radius drops in between welded cross members on ladder rack will be manufactured from 3/8" by 1-1/2" aluminum bar. Movable cross members will attach to ladder rack at the side stringers with included hardware so that the location of the movable cross member can be adjusted. Moveable cross member will support a cross member radius drop.

- E. Grounding straps shall be CPI 40164-001 (available in lots of 25 each as CPI 40164-025)

2.6 CHANNEL RACK-TO-RUNWAY

- A. Use a Channel Rack-to-Runway Mounting Plate Kit to securely attach 12" wide cable tray to equipment rack. A kit from Chatsworth includes all necessary bolts, washers, and nuts to make the attachments. CPI Part 12730-712
- B. Grounding straps shall be CPI 40164-001 (available in lots of 25 each as CPI 40164-025)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment Racks

1. Equipment racks shall be equipped with a mounting plate suitable for securing a 12" width cable tray from the rack to the backboard.
2. A two RMU horizontal wire management panel shall be installed at the top of the rack. Additional horizontal wire management shall be installed as described above.
3. Bolts used to attach the rack to the floor shall be stainless steel or zinc coated steel. Fasteners shall be Grade 5 or higher

B. Cable Tray

1. The cable tray shall be installed as per Drawings to support cable runs from equipment rack to wall connections.
2. Appropriate vertical wall brackets, support brackets, and splice kits are to be used when securing the runway.

C. All racks and associated components shall be grounded in accordance with ANSI/TIA-607-C, NEC®, and the local AHJ.

3.2 SEISMIC COMPLIANCE

- A. This contract is responsible for satisfying all requirements pertaining to seismic compliance. All inspections or engineering associated with seismic compliance shall be included in this contract at no additional cost to the Owner.

END OF SECTION 27 11 23

SECTION 27 15 13 - COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL REQUIREMENT

1.1 GENERAL

- A. Drawings and general provision of the Contract, including General and other Conditions and other General Requirements sections, apply to the work specified in this section.

1.2 WORK INCLUDED

- A. Provide all labor, materials, tools, and equipment required for the complete installation of work called for in the specifications and depicted on the drawings.
- B. Intent is to have category 6A balanced twisted pair cable in the locations and quantities as called out and detailed on the drawings.
- C. Install cable as outlined on drawings and specifications. Includes sleeves for any ceiling or wall penetrations and fire stopping as directed by the AHJ. All support structure needed to install the above components.
- D. Verify actual counts on prints and drop detail.

1.3 SCOPE OF WORK

- A. It is the intent of this section for the Contractor to provide a complete workable cabling system ready for the Owner's use in accordance with the latest current version of ANSI/TIA-568 standards to support PoE powered IP based video cameras.

1.4 QUALITY ASSURANCE

- A. All cable shall be installed in a neat and workmanlike manner.
- B. Strictly adhere to all category 6A installation practices when installing horizontal cabling. Testing and certification for both systems shall be as detailed in Section 27 08 00.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Refer to Section 27 05 13 for General Requirements.
- B. The horizontal balanced twisted pair cabling system shall be a category 6A warranted link systems, including the patch cords, patch panels, cables, and telecommunications outlets.
- C. All four-pair balanced twisted pair cable installed above slab shall be rated CMP.
- D. All four-pair balanced twisted pair cable installed in conduits running at or below slab shall be rated for outside plant applications.

2.2 APPROVED COPPER CABLE

- A. The horizontal copper cable shall be; 4-Pair balanced twisted pair rated for category 6A. Color to be Green. Product set as per Section 27 05 13.

PART 3 - EXECUTION

3.1 GENERAL

- A. Cable ties must be finger tight. The cable tie must not distort the outer jacket.
- B. The bend radius shall be no less than 4 times the outside cable jacket diameter for the cable.
- C. Only Velcro® type cable wraps shall be used to bundle cables on the back of the equipment racks and in the cable trays located in the telecommunication rooms.

3.2 PREPARATION

- A. Conduits
 - 1. All conduits and sleeves shall be inspected for bushings prior to cable installation.
 - 2. Missing bushings shall be brought to the attention of the owner or authorized representative.

3.3 INSTALLATION

- A. Installation shall be in a manner to meet the specifications as outlined by the cable manufacturer for the product set being installed.
- B. Copper horizontal cables shall be pulled from the Telecommunications Room to the camera location.
- C. Service loops of:
 - 1. 10' minimum shall be left coiled as high as possible in the Telecommunications Rooms.
 - 2. Placement of service loops subject to verification by Owner.
- D. Location and label shall be annotated on the as built drawings.

END OF SECTION 27 15 13

SECTION 27 15 43 – COMMUNICATIONS FACEPLATES AND CONNECTORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide all labor, materials, tools, and equipment required for the complete installation of faceplates and operable telecommunications outlets.

1.2 QUALITY ASSURANCE

- A. See Section 27 05 13

PART 2 - PRODUCTS

2.1 CONFIGURATIONS

- A. Camera Locations – locations noted on the drawings as cameras shall be terminated within a single field terminable category 6A plug supported by manufacturer's warranty program.
- B. Approved are:
 - 1. CommScope 760235591 Ceiling Connector and cord assemblies
 - 2. Panduit TX6A™ Category 6A UTP Field Term RJ45 Plug

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install terminations as per manufacturer's instructions.

END OF SECTION 27 15 43

SECTION 27 16 19 – PATCH CORDS

PART 1 - GENERAL REQUIREMENT

1.1 GENERAL

- A. Drawings and general provision of the Contract, including General and other Conditions and other General Requirements sections, apply to the work specified in this section.

1.2 WORK INCLUDED

- A. Supply category 6A patch cords in quantities indicated below.
- B. All patch cords shall be from the same manufacturer that is selected for the structured cable system. Specifically:
 - 1. CommScope, or;
 - 2. Panduit

1.3 QUALITY ASSURANCE

- A. See Section 27 05 13

PART 2 - PRODUCTS

2.1 PATCH CORDS FOR POE CAMERA SYSTEMS

- A. The Contractor shall supply, in the listed percentage of the total camera location count, the patch cords in the lengths listed. Each patch cord is a stranded 8-pin modular plug to an 8-pin modular plug cable. The cable, sheath, and boot shall be green in color and rated Category 6A

Length	<u>3'</u>	<u>5'</u>	<u>7'</u>
Quantity	35%	50%	25%

PART 3 - EXECUTION

3.1 GENERAL

- A. Deliver patch cords to the Owner in unopened packages.

END OF SECTION 27 16 19