

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements governing allowances.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to the Contractor. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
 - 1. Quantity allowances.
- C. Related Sections:
 - 1. Section 012200 "Unit Prices" for procedures for using unit prices.
 - 2. Divisions 02 through 49 Sections for items of Work covered by allowances.

1.3 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect from the designated supplier.

1.4 SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.
- B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- C. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
- D. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 QUANTITY/LUMP-SUM ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner under allowance shall be included as part of the Contract Sum and not part of the allowance.
- C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
 - 1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.7 ADJUSTMENT OF ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
 - 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
 - 3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
 - 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
 - 1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
 - 2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

- A. **Allowance #1: Network Switches:** Include in the Base Bid an allowance to provide twelve (12) network switches as required for camera installation. Provision and installation shall also include all associated cabling and integration. Refer to Section 282000 "Video Surveillance" for additional information.

END OF SECTION 012100

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Sections:
 - 1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.

1.3 DEFINITIONS

- A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

- A. A list of unit prices is included in the Bid Form and/or Bid Packages.

END OF SECTION 012200

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract. No extensions of time shall be granted for accepted alternates.
- D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. **ADD ALTERNATE #1: Security Device Cabling:** Add to the Base Bid the labor, material, and equipment for the provision and installation of cabling of security devices as indicated in the Drawings. Refer to Section 271000 "Structured Cabling System" for additional information.

END OF SECTION 012300

SECTION 27 10 00 - STRUCTURED CABLING SYSTEM**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. The intent of this specification is to ensure a successful installation of an American National Standards Institute (“ANSI”) and Telecommunications Industry Association (“TIA”) Standards-Based Structured Cabling System (“SCS”) throughout the Project.
- B. The SCS is to be constructed and tested to TIA-568 Standards for Category 6A performance. Certification requirements will include a minimum 15 year product and performance warranty.
- C. The SCS provides the physical media for the Project’s Local Area Network (LAN) and, as such, provides connectivity for:
 - 1. Data and telecommunication outlets.
 - 2. Facility Monitoring System network devices, e.g., surveillance cameras.
 - 3. Voice over Internet Protocol (VoIP).
 - 4. Wireless Local Area Network (WLAN).
 - 5. Building Automation System.
- D. The drawings and specifications and requirements between governing Codes and Regulations may vary. The more restrictive requirements shall be followed on this project.
- E. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.
- F. Materials are to be purchased new for this project.
- G. Materials that are listed by UL must bear the UL label. In the event UL has no published standard for a particular item, then other independent testing standards are to apply and the applicable labeling utilized.
- H. Coordinate exact location and installation of equipment, power, grounding and raceway requirements with the Architect.
- I. Provisioning is required for labor, equipment, materials, supplies and plant.
- J. Related Sections:

1. The following list is intended only as a reference for the Contractor's cognizance and may not represent a complete list of divisions of the Project Manual related to this section.
 - a. Division 01: General Requirements.
 - b. Division 08: Openings.
 - c. Division 09: Finishes.
 - d. Division 26: Electrical.
 - e. Division 28: Electronic Safety and Security

- K. The work of this section also includes:
 1. Required licenses, insurance and permits including payment of charges and fees.
 2. Verification of dimensions and conditions at the job site.
 3. Preparation of submittal information.
 4. Installation of Owner Furnished Equipment (OFE) listed in Part 2 of this Section.
 5. Installation in accordance with the contract document, manufacturer's recommendation, and in conformity with applicable codes and the authority having jurisdiction (AHJ).
 6. Coordination of electrical service, including ground, for SCS/IT equipment locations.
 7. Final tests and adjustments, written report, and documentation.
 8. Instruction of system operation to Owner's technical representative.
 9. Provision of manuals.
 10. Maintenance services and warranty.

1.3 REFERENCED CODES AND STANDARDS

- A. Compliance with the following published codes, standards, and tests and recommended methods of trade, industry, or governmental organizations are required for Work in this section. The most recent version/edition of each standard/reference, at the time of project award, should be used.
 1. Telecommunications Industry Association (TIA)
 - a. TIA-568 (series), Telecommunications Cabling Standards.
 - b. TIA-569, Commercial Building Standard for Telecommunications Pathways and Spaces
 - c. TIA-606, Administration Standard for Commercial Telecommunications Infrastructure
 - d. TIA-607, Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

- e. TIA-758, Customer-owned Outside Plant Telecommunications Infrastructure Standard
 - f. TIA-526-7, Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
 - g. TIA-526-14, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
 - h. TIA/TSB-140, Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems
2. Other
- a. National Electrical Manufacturers Association (NEMA), VE-2, Cable Tray Installation Guidelines
 - b. BICSI Telecommunications Distribution Methods Manual (TDMM).
 - c. BICSI Outside Plant Design Reference Manual.
 - d. National Electric Code (NEC).
 - e. Underwriters Laboratory, Inc. (UL)
 - f. Americans with Disabilities Act (ADA)
 - g. Requirements of the local Authority Having Jurisdiction (AHJ).

1.4 DEFINITIONS

- A. In addition to definitions of Division 01, the following list of terms used in this section are defined as follows.
- 1. "Furnish" indicates to purchase, procure, acquire, and deliver complete with related accessories.
 - 2. "Install" indicates to set in place, join, attach, link, set up or otherwise connect together and test until complete before turning over to the Owner, all parts, items, or equipment.
 - 3. "Provide" indicates to furnish and install.
 - 4. Some processes, methods, and procedures, as well as spaces, rooms and structure, may be abbreviated or used interchangeably within this section. The following list is presented to reconcile these differences within this section.
 - a. SCS: Structured Cabling System. A SCS is defined as all required cabling including hardware, termination blocks, cross connect wire or cordage, patch panels, patch cords, telecommunication outlets, work area cords, UTP and fiber optic cable installed and configured to provide computer data and voice connectivity from each data or voice device to the network file server or voice network/switch designated as the service point of the local area network.

- b. TS: Telecommunications Space. A common area used for telecommunications cabling terminations and the location of telecommunications equipment, typically a secure environmentally controlled area
- c. EF: Entrance Facility. A TS is the entrance to a building for both public and private network service cables, including the entrance point at the building wall or floor, and continuing to the entrance room or entrance space.
- d. ER: Equipment Room. This is the TS that contains main electronics of the telecommunications system, such as servers, controllers and phone systems. This room is also often the center of the SCS that connects with all other TSs.
- e. TR: Telecommunications Room. This is typically the TS where cables from workstations terminate. The TR is designated for an exclusive purpose of housing telecommunication communications equipment and related wiring that serves a specific area of the building.
- f. TE: Telecommunication Enclosure. This is a stand-alone wall mounted or floor mounted enclosure that provides the same service as the TR to a specific area of the building.
- g. WAO: Work Area Outlet. The workstation end-point of horizontal distribution cable. An icon legend is provided on the related drawings, and symbols or legends represent the type and quantity of cables terminated at the WAO.
- h. Backbone: The Backbone subsystem links the ER to TRs and TEs. It consists of the fiber optic or copper cables between these locations and the associated connecting hardware terminating this media.
- i. PBB: Primary Bonding Busbar - The common source for bonding telecommunications equipment within the ER and the ER with building ground.
- j. SBB: Secondary Bonding Busbar - The common source for bonding telecommunications equipment within the EF, TR or TE and with the PBB.
- k. TBB: Telecommunications Bonding Backbone: Copper cable that connects the PBB to SBBs throughout the building
- l. TBC: Telecommunications Bonding Conductor: Copper cable that connects the PBB to the main electrical ground

1.5 PROJECT CONDITIONS

- A. Verify dimensions and conditions on the job site applicable to this work. Notify the Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.
- B. The drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the work may be installed.

- C. If a conflict develops between the contract documents and the appropriate codes and is reported to the Architect prior to bid opening, the Architect will prepare the necessary clarification. When a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform work.
- D. During the course of construction, room names and/or room numbers may be changed. For continuity during installation the Contractor shall refer to rooms and spaces by their identities as shown on the technology series drawings. This shall apply to all correspondence, RFI's, proposal requests, and submittal packages pertaining to this Section.
- E. Provide temporary or permanent protection of materials bearing the UL label that risk exposure to conditions that may compromise any portion of the material.

1.6 SCOPE SUMMARY

- A. This entire specification section and the project drawings define the requirements for the installation of a SCS. The following is intended to summarize the Work and clarify design intent and is not an exhaustive description of the SCS.
- B. Coordinate exact location and installation of the following:
 - 1. Conduits, wire-ways, cable trays external to the telecommunication spaces, floor boxes, wall boxes, pull boxes, and junction boxes
 - 2. Slots and sleeves
 - 3. Firestopping products
 - 4. AC power circuits for telecommunications equipment
 - 5. AC power circuits within telecommunications spaces
 - 6. Plywood wall linings within telecommunications spaces
 - 7. Lighting requirements within telecommunications spaces
 - 8. MEP systems and equipment terminating within or intersecting telecommunications spaces
 - 9. Telecommunications grounding and bonding system required for telecommunications spaces
 - 10. Wireless access points with light fixtures, HVAC ductwork, and architectural elements
 - 11. Incoming service provider circuits
- C. Deliver Submittals, Shop Drawings and Cable Test Records as specified herein.
- D. Obtain permits, licenses, or other municipal requirements and pay any fees required for the execution of this Work.
- E. Provide copper or fiber optic cabling for network communication applications homerun from the TR to individual work area outlets or network devices as shown on the related drawings.

1. Provide faceplates, surface mount boxes, raceway products, copper and fiber optic inserts, blank inserts, patch panels, termination blocks, and copper and fiber optic patch cables.
 2. Provide surge protection modules as specified and shown on drawings or required to protect circuits from damaging electrical surges.
- F. Provide backbone cabling consisting of twisted pair copper, fiber optic cable, and ground wire as specified and shown on drawings.
1. Twisted pair cable terminations shall include both punch-down blocks and patch panels.
 2. Fiber optic termination shall be fusion spliced, utilizing specified pigtails or connectors.
 3. Ground wire terminations shall utilize irreversible crimp style lugs.
- G. Provide primary and branch pathway distribution systems which may consist of cable tray, conduit, J-hooks, of ladder runway for the support and protection of horizontal and backbone cabling.
- H. Provide racks, cabinets, cable management, and cable runway to route cables and securely house telecommunications equipment and cabling termination panels.
- I. Provide bonding of equipment racks, armored cable sheaths, and cable pathway system in accordance with equipment manufacturer's requirements and TIA-607 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
- J. Provide labeling of the completed systems, components, and cabling in accordance with TIA-606 or Owner's standards. Verify labeling scheme with Owner prior to implementation.
- K. Provide mechanical and non-mechanical firestopping systems as specified or required by code.
- L. Perform tests of the completed SCS installation in accordance with the following:
1. TIA-568.2, for twisted pair cabling
 2. TIA-568.3, for fiber optic cabling
- M. Supply accessories and minor equipment parts required for a complete working system, even if not specifically mentioned in these Specifications or on the drawings, without claim for additional payment.
- N. Provide POE Extenders as specified and shown on drawings.
1. POE Extender solution requires fiber optic switches provided by the Owner. Coordinate with Owner IT for switch requirements.
 2. Size specified DC power supply to support quantity of POE Extenders as shown on drawings.
 3. Coordinate with Owner IT to place DC power supply on the LAN to allow Owner access to management GUI.

- O. Perform installation and testing utilizing trained and certified staff in order to provide the Owner's vendor of choice SCS extended product and application warranty certification. The Contractor shall extend this certification on behalf of the manufacturer.
- P. Provide instructions to the Owner's designated personnel on the system documentation, proper methods of use and maintenance of the system and related components.
- Q. Provide the SCS complete and ready for use by the Owner.

1.7 CONTRACTOR QUALIFICATIONS

- A. Must be a Certified Integrator/Installer factory trained and authorized to provide the Owner's vendor of choice SCS extended warranty covering all network cable and connectivity hardware products comprising this project.
- B. Must submit current manufacturer certification documentation for installation training and ability to provide the manufacturer warranty.
- C. Must maintain a factory trained and certified staff covering the duration of the project.
- D. Must have an on staff Registered Communications Distribution Designer (RCDD®) for the performance of quality control during installation, equipment set-up, and testing.
- E. Must have five plus (5+) years of experience with equipment and systems of the specified types.
- F. Must have completed a minimum of three comparable scaled projects within the last two years.
- G. Must have proven abilities to test and certify telecommunications cabling systems, and to create test records in compliance with the referenced standards of this specification section and in accordance with the calibration requirements as stated by the test equipment manufacturer.
- H. Must maintain a fully staffed and equipped service facility.
- I. Must perform operations necessary to complete the installation of a SCS in accordance with these specifications utilizing related drawings.
- J. At the request of the Architect, the Contractor must demonstrate an adequate staff with commensurate technical experience available.
- K. At the request of the Architect, the Contractor must demonstrate adequate plant and equipment available to complete the work.

1.8 PRE-CONSTRUCTION SUBMITTALS

- A. The pre-construction submittal is required to verify the Contractor will obtain the specified product, understands the processes and procedures, and understands the requirements to install, test, certify and create test record documentation for the SCS.

- B. Requests for substitutions of specified product must be done using procedures specified in Division 01. Requests must be done prior to submittals. Substitutions submitted that have not been approved will be rejected.
- C. The Submittal package is to be delivered for approval prior to commencement of Work.
 - 1. Any submittals beyond the original submittal and one resubmittal may result in charges to the Contractor (charged for third and any subsequent reviews).
 - 2. Additional review fees will be at the prevailing rate in effect at the time that the additional review takes place
- D. The Submittal for this portion of the Work must be assembled and packaged as specified.
- E. Provide submittals in an electronic version in Adobe PDF format as follows:
 - 1. Document set shall be in a folder named as follows:
 - a. "27 10 00 SUBMITTAL – PROJECT NAME – {CONTRACTOR name}".
 - 2. The submittals shall contain information in the following order
 - a. "Project Compliance
 - b. "Certificates"
 - c. "Test Equipment"
 - d. "Materials"
 - e. "Labels & Markings"
 - f. "Shop Drawings"
- F. "Project Compliance" folder shall contain a PDF document that includes:
 - 1. The first page stating the project title, submittal number, and submittal date in the header. This cover sheet must be imprinted with Contractor's stamp, initialed or signed, certifying that the Submittal Package offered is in compliance with the requirements of this Section, and the material is in compliance with this Section of the Project Manual or with approved substitutions.
 - 2. The next page shall state any questions or concerns that might be relevant to clarifying the work
 - 3. Provide a list of 'Approved' substitutions, if any.
- G. "Certificates" folder shall contain a PDF document that includes:
 - 1. Current manufacturer Certification that shows that the Warranty requirement of this Section can be provided by the Contractor.
 - 2. RCDD certificate and any other BICSI certifications called out as a requirement in this Section

- H. "Test Equipment" folder shall contain a PDF document that includes
1. Provide a manufacturers technical data sheet of the test equipment that will be utilized for test and certification of the specified cabling. Include the Manufacturer, make and model.
 2. Submit an example of a test record document containing test records that have been created with the scheduled test equipment for the type of cabling to be tested.

- I. "Materials" folder shall contain a PDF document that includes
1. A complete materials list or Bill of Materials that includes all products specified in this Section or previously approved through the substitution request process in Division 1.
 - a. Present the materials list or Bill of Materials in the order in which the product is specified in Part 2 of this section.
 - b. The column headings for the list must include a product description, manufacturer, part number, quantity of item required, use or location on project, and PDF page number of product data sheet in this document.
 2. Product data sheets shall be combined into (1) PDF document. The PDF page number is the actual number of pages into the document where the product sheet can be found.
 3. Example

Description	Manufacturer	PN	Use	Page
Blue Category 6 jack	Hubbell	HJU6W	Data outlet	15

- a. Immediately following the list, insert the manufacturers' product data sheet (PDS).
 - b. Arrange the sheets in the same sequence and order of the list of Materials.
 - c. The literature must provide sufficient detail to facilitate proper evaluation of the product's suitability for use within the Work.
 - d. Any PDS or literature sheets that provide product options, or sheets that also include items not intended for this work, must be clearly marked with an arrow or other appropriate symbol to indicate the model and/or option being submitted for the work.
- J. "Labels & Markings" folder shall contain a PDF document that includes:
1. Photos or drawings of the proposed labels, tags and markers for cables, patch panels, termination blocks, busbars, fire sleeves, enclosures, racks, outlet faceplates and other components as necessary.
 2. Representative nomenclature for equipment and cable labeling, with labeling as defined in ANSI/TIA-606-B Class 2 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings. Include font sizes and styles, an explanation of

the rationale for the nomenclature, and a Key, which defines the descriptors and designators of the labeling system.

3. Labels shall be permanent and intended to last the life of the system, device, or equipment being labeled.
 4. Product sheets for label materials shall be included in the "Materials" folder
- K. "Shop Drawings" shall contain PDF documents including:
1. Large-sheet drawings;
 - a. Drawing rendered in AutoCAD™ or an AutoCAD™-compatible application.
 - b. Execute drawings at an appropriate scale but no less than 1/8"=1'-0".
 - c. Create drawings using industry-standard graphics and a monochromatic scheme with varied line types and weight so the attributes of the various elements of the image are readily discernable.
 - d. Enlarged floor plans and elevations of each equipment room in the project with equipment and ladder runway(s) placement in the rooms shall be shown to scale.
 - e. The Shop Drawings will be the source document for the As-Built drawings that the Contractor is required to provide at the close of the project.
 2. Floor plan sheets that depict;
 - a. Device symbol legend
 - b. Individual service areas of the facility.
 - c. Equipment room locations.
 - d. Work area faceplate/outlets locations.
 - e. Cable pathways, raceway type, and locations.
 - f. Horizontal cable link length for longest cable lengths based on above routing.
 - g. Location and size of wall penetrations/sleeve pass-thru.
 - h. Quantity of cables passing through each wall penetration/sleeve pass-thru.

1.9 CONTRACT CLOSE-OUT SUBMITTALS

- A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements.
- B. Each submittal shall be provided in a PDF format.
- C. Provide each submittal PDF file with the project title and submittal number.
 1. Transfer media, CD, or memory stick shall be labeled with same information.

- D. Segregate documents into separate folders containing data relevant to operational, maintenance, and warranty issues.
- E. Warranty and Maintenance:
 - 1. Statement of warranty commencement date, length of warranty, and all warranty certificates issued by manufacturer.
 - 2. Provide a list of contact names, telephone numbers, and hours of operation for normal warranty service.
 - 3. Provide a contact name/number for 365/7/24 emergency warranty service with an explanation of limiting conditions if applicable.
 - 4. Include maintenance phone number(s) and hours; maintenance schedule; description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products.
 - 5. Manufacturer data sheets and installation manuals/instructions for equipment installed shall be included.
- F. Test Report CD(s)
 - 1. Results of copper and fiber-optic tests specified in Part 3 of this section of the Project Manual.
 - a. The test records are to be a full test report of individual copper media and fiber optical media test results for each fiber-optic cable strand.
 - b. The test record must include information regarding the building, closet, patch panel and "port" number of the patch panel; the test device type and ID, the name of the test technician performing the test, and the date and time that the test was conducted.
 - 2. The test records are to be placed in a "Test Record" file in ascending sequential order by building, closet and patch panel.
 - 3. Provide an electronic file containing all individual test records and the software required to display and print the test records using a typical personal computer (PC).
- G. As-Built Drawings
 - 1. Provide "as-built" drawings of the completed cabling installation.
 - 2. The as-built drawings must indicate:
 - a. The actual locations of the work area faceplate/outlets
 - b. Pathways and pathway fill
 - c. Media identification information at each faceplate/outlet
 - d. The identity information for each Equipment Room

- e. Revised equipment rack layout detail drawings
- f. All field changes, corrections, modifications, and updates to the shop drawings
- 3. One (1) color/laminated full-size drawing must be attached to the wall of each TR to include the aforementioned information. Only the drop locations served from each particular TR are to be included on each color/laminated drawing for that TR.
- 4. Provide owner copies of “as-built” drawings on CD media in AutoCAD, Revit and PDF format.
- H. Provide Owner any keys to cabinets and/or equipment and special maintenance tools required to repair, maintain, or service the system.
- I. Furnish a list (in excel format) of all data drops listed by TR number, patch panel number, and port number with the associated assigned room number.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Ship product in its original container, to prevent damage or entrance of foreign matter.
- B. Handling and shipping in accordance with manufacturer’s recommendation.
- C. Provide protective covering during construction, to prevent damage or entrance of foreign matter.
- D. Provide warning placards, warning tape or protective barrier systems for temporary protection of products or personnel during installation processes to include but not limited to the following:
 - 1. Cabling subject to foot or vehicle traffic laid on the floor/ground as a service loop.
 - 2. Exothermic welding of telecommunications bonding conductors.
 - 3. Open trench work during cabling installation.
- E. Provide a minimum temperature schedule for cold climate installations of the SCS. Do not install cabling or equipment in climate conditions less than the manufacturer’s recommended minimum temperature.
- F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PRODUCT WARRANTY AND APPLICATION ASSURANCE

- A. The SCS Manufacturer’s Extended Product Warranty and Application Assurance requirements are as follows:
 - 1. Extended Product Warranty
 - 2. Application Assurance
 - 3. Term of Warranty

- a. A minimum of 15 years from the date of substantial completion.
 - b. Moves, additions, or changes are covered by the original registration certificate if performed by an approved installer in compliance with the supplier's SCS design, installation and registration requirements.
- B. Contractor's warranty covering installed products and labor against defects in materials and workmanship for a period of 1 year.
- 1. Within the 1-year warranty period, answer service calls within 4 hours and begin work to correct the deficiency within twenty-four hours.
- C. Manufacturer Warranty starts the date of projects warranty certification issue to the District from the manufacturer.
- D. A manufacturer's Representative shall inspect and certify all work to validate the manufacturer's warranty.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Related Divisions and articles remain applicable to the products specified herein. Any repetition of related specification is for emphasis only.
- B. Products shall be new, free from defects and listed by UL or ETL when an applicable standard exists.
- C. Regardless of the length or completeness of the descriptive paragraph herein, provide product complying with the specified manufacturer's published specifications.
- D. Product not specifically identified within this document, but which is required for the successful implementation of the intended system(s), shall be of the same class and quality as the specified product and equipment.
- E. Products of one type must be from the same manufacturer throughout the entire project.
- F. Products included in this Section are to establish performance requirements to be used on this project; equivalent products are acceptable with Owner approval.
- G. Any materials required in the completion of the cabling infrastructure and make-ready for use by the Owner that is not listed is to be provided as if it were specified.

2.2 COMMUNICATIONS HORIZONTAL UTP CABLING

- A. Products combinations must allow for a long term manufactures warranty required by this Section

- B. Cable selection is based on installation environment. If multiple cable options are shown below for the same "TYPE", it is the responsibility of the contractor to select the cable that is properly rated for the installation environment.
- C. 4 pair Category 6 plenum UTP communications cable (TYPE M):
1. Blue jacket
 2. Approved product
 - a. Belden Part # 2413 D15A1000
 - b. Commscope Part # UN874043014/10
 - c. Hubbell Part # HC6SPB
 - d. Leviton Part #10136226
 - e. Panduit Part # PUP6004BU-WLPZ
- D. 4 pair Category 6 OSP communications cable (TYPE M):
1. Black jacket
 2. Outdoor or Indoor/Outdoor rated
 3. Approved products:
 - a. Belden Part # 2143A
 - b. Commscope Part # CS34P-IO
 - c. Hubbell Part # C6IOSPBK
 - d. Leviton Part # 10139885
 - e. Panduit Part # PUO6C04BL-CGZ
- E. Category 6 RJ-45 jack:
1. 8-position, 8-wire RJ45 receptacle
 2. Blue color
 3. Approved products:
 - a. Belden Part # RV6MJKUBL
 - b. Commscope Part # 760237778
 - c. Hubbell Part # HJU6B
 - d. Leviton Part # 61110-RL6
 - e. Panduit Part # CJ688TGBU
- F. Flush mount workstation faceplates:

1. Verify color with architect prior to purchase
 2. With label window
 3. Approved products:
 - a. Belden
 - 1) 1 port Part # AX102660
 - 2) 2 port Part # AX104197
 - b. Commscope
 - 1) 1 port Part # 760249128
 - 2) 2 port Part # 760249129
 - c. Hubbell
 - 1) 1 port Part # IFP11W
 - 2) 2 port Part # IFP12W
 - d. Leviton
 - 1) 1 port Part # 42080-1WS
 - 2) 2 port Part # 42080-2WS
 - e. Panduit
 - 1) 1 port Part # CFPL1WHY
 - 2) 2 port Part # CFPL2WHY
- G. Surface mount workstation:
1. Verify color with architect prior to purchase
 2. Approved products:
 - a. Belden
 - 1) 1 port Part # AX102651
 - 2) 2 port Part # AX102652
 - b. Commscope
 - 1) 1 port Part # 760248521
 - 2) 2 port Part # 760248525
 - c. Hubbell
 - 1) White 1 port Part # HSB1W

- 2) White 2 port Part # HSB2W
- d. Leviton
 - 1) 1 port Part # 41089-1WP
 - 2) 2 port Part # 41089-2WP
- e. Panduit
 - 1) 1 port Part # CBXQ1AW-A
 - 2) 2 port Part # CBXQ2AW-A
- H. Category 6 patch panel:
 - 1. Modular style panel
 - 2. 24 ports per 1U rack space
 - 3. Blank inserts in unused ports
 - 4. Approved products
 - a. Belden
 - 1) 24 port Part # AX103114
 - 2) 48 port Part # AX103115
 - b. Commscope
 - 1) 24 port Part # 760101220
 - 2) 48 port Part # 760077842
 - c. Hubbell
 - 1) 24 port Part # HPJ24
 - 2) 48 port Part # HPJ48
 - d. Leviton
 - 1) 24 port Part # 49255-H24
 - 2) 48 port Part # 49255-H48
 - e. Panduit
 - 1) 24 port Part # CPP24FMBLY
 - 2) 48 port Part # CPP48FMBLY
- I. Category 6 patch cords:
 - 1. Blue

2. Approved products:
 - a. Belden Part # C601106xxx
 - 1) Replace xxx with length in feet.
 - b. Commscope Part # UNC6-BL-xF
 - 1) Replace x with length in feet.
 - c. Hubbell Part # HCL6Bxx
 - 1) Replace xx with length in feet.
 - d. Leviton Part # 6D460-xL
 - 1) Replace x with length in feet.
 - e. Panduit Part # UTPSPxBUY
 - 1) Replace x with length in feet.
3. Provide the following quantities
 - a. 100% of terminated cables at the patch panel, 5 foot
 - b. 50% of terminated cables at the WAO, 7 foot
 - c. 50% of terminated cables at the WAO, 10 foot
4. Confirm color, length and quantity with owner prior to purchasing

J. Copper In-Line Surge Protector

1. UL497 listed primary protector for communications circuits
2. Self-resetting solid-state circuitry
3. Supports Category 6 performance operating PoE or VoIP
4. 110 connector input, 110 connector output
5. Approved equal:
 - a. Ditek DTK-110C6APOE

2.3 COMMUNICATIONS HORIZONTAL FIBER OPTIC CABLING

- A. Products combinations must allow for a long term manufactures warranty required by this Section.
- B. 2 strand single mode armored outdoor fiber optic cable:
 1. Approved products:
 - a. Corning Part # 002EU4-T4700D20

- b. Substitutions: Under provisions of Division 01
- C. 4 strand single mode armored outdoor fiber optic cable:
 - 1. Approved products:
 - a. Corning Part # 004EU4-T4700D20
 - b. Substitutions: Under provisions of Division 01
- D. 6 strand single mode armored outdoor fiber optic cable:
 - 1. Approved products:
 - a. Corning Part # 006EU4-T4700D20
 - b. Substitutions: Under provisions of Division 01
- E. Armored and shielded cable grounding clamp
 - 1. Approved products
 - a. Corning FDC-CABLE-GRND
 - b. Substitutions: Under provisions of Division 01 in
- F. Single mode LC connector:
 - 1. 900 micro boot
 - 2. Fusion spliced
 - 3. Approved products:
 - a. Corning Part # SOC-LCU-900-SM
 - b. Substitutions: Under provisions of Division 01
- G. Single mode LC adapter panels:
 - 1. fiber panel
 - 2. Aqua adapters
 - 3. Approved products:
 - a. Corning Part # CCH-CP6-A9
 - b. Substitutions: Under provisions of Division 01
- H. Blank adapter panel:
 - 1. Approved products:
 - a. Corning Part # CCH-BLNK
 - b. Substitutions: Under provisions of Division 01

- I. Rack mount fiber enclosure:
 - 1. 1RU
 - 2. Minimum 2 panel
 - 3. Approved products:
 - a. Corning Part # CCH-01
 - b. Substitutions: Under provisions of Division 01

- J. Fiber optic patch cord:
 - 1. LC-LC
 - 2. Yellow
 - 3. Single mode
 - 4. Approved products:
 - a. 1 meter Corning Part # 040402R5120001M
 - b. 2 meter Corning Part # 040402R5120002M
 - c. Substitutions: Under provisions of Division 01
 - 5. Provide cords in a quantity to patch 100% of the used fiber ports, 50% 1 meter, 50% 2 meter. Confirm with owner prior to purchase.

PART 3 - EXECUTION AND SCOPE

3.1 GENERAL

- A. Coordinate incorporation of the Work specified herein with other project work so as to facilitate a cohesive final product.
- B. The installation recommendations contained within TIA-568, TIA-569, and the BICSI Telecommunications Distribution Methods Manual (TDMM), including manufacturer recommended installation methods or practices for a standards-based SCS, are mandatory minimum standards and requirements.
- C. Mount equipment plumb and level. Permanently installed equipment to be firmly and safely held in place. Equipment supports must support loads imposed with a safety factor of at least five.
- D. Each outlet must consist of an outlet box and plate listed on the legend provided on drawings.
- E. Coordinate with Architectural and Electrical drawings for locations of telecommunication outlets, junction boxes, conduits and floor boxes within the project.

- F. Route cables from outlets to the nearest TR unless the drawings designate cables to be routed to specific TR locations. Notify the Owner's representative if any cables are expected to exceed a total of 295 feet termination to termination.
- G. Provide temporary or permanent protection of materials bearing the UL label that risk exposure to conditions that may compromise any portion of the material.
 - 1. Do not paint or allow paint overspray on products bearing a UL label unless specifically approved by the manufacturer.
 - a. Cables exposed to paint or other chemicals are to be replaced.
 - b. Cables will be replaced at no cost to the owner

3.2 CABLE - GENERAL PRACTICES

- A. Confirm conduits have bushings prior to installation.
- B. Confirm firewall penetrations have sleeves or openings that will allow for the fire rating to be restored after cable installation.
- C. Confirm penetrations through acoustically rated walls have sleeves or openings that will allow for the acoustic rating to be restored after cable installation.
- D. Confirm pathways have adequate capacity to support the cable type and quantity.
- E. Cover edges of cable/wire pass-through holes in chassis, housings, boxes, and raceways with insulated grommets
- F. Only install cable in areas it was rated for
 - 1. Do not install outside plant cables (OSP) more than 50 feet inside buildings unless inside of continuous metallic conduit.
 - 2. Do not install riser rated cables (CMR, OFNR, OFCR) in plenum air spaces.
 - 3. Do not install plenum rated cables (CMP, OFNP, OFCP) or riser rated cables (CMR, OFNR, OFCR) in outside plant environments, including conduits below/in slab that maybe exposed to moisture, unless they have a dual rating for outside plant.
- G. Do not install cable in climate condition less than the manufacturer's recommended minimum temperature.
- H. Install the cable so that the tension applied to the cables does not exceed the manufacturer's recommendation for the type and size of cable.
- I. The cable shall not be crushed, deformed, skinned, crimped, twisted, or formed into tight radius bends that could compromise the integrity of the cabling.
- J. Communication cables must not be run loose or lay upon ceiling grid or ceiling tiles.

- K. Communications cable shall not be fastened to or supported by electrical conduits, mechanical ductwork/piping, sprinkler pipes, or routed to obstruct access to doors, utility access panels, or service work areas.
- L. Maintain a 6 inch minimum clearance above accessible ceiling tiles.
- M. Isolate cables and wires of different signals or different levels; and separate, organize, and route to restrict channel crosstalk or feedback oscillation.
- N. Label cables within 12 inches of termination with the specified labeling scheme.
- O. Dress cables neatly where exposed in the telecommunication room, securing cable bundles with hook and loop tie wraps.
- P. Cabling is to remain clean of all paint, or any other construction overspray / material. Contractor to take precautions necessary to ensure this requirement.
 - 1. Damaged or contaminated cables shall be replaced at no cost to the owner.
- Q. Outside plant copper cables that are exposed to potential damaging electrical surges must be terminated on Building Entrance Terminals (BET).

3.3 COMMUNICATIONS HORIZONTAL UTP CABLING

- A. Provide specified Category UTP cables homerun from workstation outlets shown on the drawings to the nearest telecommunications room unless otherwise noted.
 - 1. Install in compliance with manufacturers installation procedures.
 - 2. Do not install cables with a total length greater than 295 feet without written permission from the Owner's representative.
 - 3. Install cable so that the pulling tension applied to the cable does not exceed 25 lbf or the manufacturer's guidelines whichever is lesser.
 - 4. Install cable so that a radius bend of no less than six times the cables outside diameter is maintained during and after installation.
 - 5. Maintain the following distances from sources of electrical interference
 - a. 6 inches from fluorescent lighting
 - b. 6 inches from grounded conduit cable used for electrical power distribution
 - c. 12 inches from unshielded electrical power cables
 - d. 48 inches from electric motors and transformers
 - 6. Support and coil a 10 foot service loop at each workstation above accessible ceiling.
- B. Provide Category rated RJ-45 jacks for various application in the colors called out in this specification and on the drawings.

1. Terminate cables on jacks with a T568B pinout for new building construction.
 - a. Match existing pinout for facilities undergoing remodel or expansion.
 - b. Strip cable jackets and untwist pairs only as much as is required to terminate individual pairs.
 - c. Match cable colors to jack colors called out for specific applications.
 - d. Install jacks at workstations in configurations shown on the drawings
- C. Provide workstation outlet types in locations shown on the drawings
- D. Provide Category rated patch panels to support workstation cables.
 1. Terminate cables on patch panels grouped by applications if shown on the drawings.
 - a. Match existing pinout for facilities undergoing remodel or expansion.
 - b. Strip cable jackets and untwist pairs only as much as is required to terminate individual pairs, following manufacturers installation procedure.
 2. Terminate cables on patch panels matching the 568A or 568B pinout used for the jacks.
 3. Arrange patch panels on racks and in cabinets as shown on the drawings.
- E. Furnish Category rated patch cords in colors, lengths, and quantities as specified or shown on the drawings.
 1. Confirm with owner prior to purchasing.

3.4 COMMUNICATIONS HORIZONTAL FIBER CABLING

- A. Provide fiber optic cables homerun from workstation outlets shown on the drawings to the nearest telecommunications room unless otherwise noted.
 1. Install in compliance with manufacturers installation procedures.
 2. Do not install cables with a total length greater than the transmission distance for the type of fiber installed and expected transmission speed.
 3. Install cable so that the pulling tension applied to the cable does not exceed the manufacturer's guidelines.
 4. Install cable so that a radius bend of no less than 20 times the cables outside diameter is maintained during installation and 10 times the cables outside diameter after installation
 5. Coil a 10 foot service loop at each workstation above accessible ceiling.
- B. Provide connector on each end of the cable as called out on the drawings.
- C. Provide fiber adapter module for each workstation location.
 1. Connect cable to the adapter

2. Install adapter in faceplate
- D. Provide faceplates in locations shown on the drawings
- E. Provide adapter panels for termination in the telecommunications room.
- F. Provide fiber optic enclosures if required and shown on the drawings.
- G. Provide workstation outlet types in locations shown on the drawings.
- H. Furnish fiber patch cords in lengths and quantities as specified or shown on the drawings.
 1. Confirm with owner prior to purchasing.

3.5 LABELING

- A. Provide labeling in accordance with TIA-606-B Level 1 numbering and ID format.
- B. Mechanically print and install in accordance with drawing details.
- C. Labels must be single line all capital letters bold font. Select font size that can be read on the applicable device or cable.
- D. Ensure all surfaces are clean prior to placing labeling products. Follow manufacturer's recommendation for cleaning.
- E. Both ends of telecommunications cables, outlet faceplates, terminal blocks, floor boxes, termination cabinets, patch panels, bonding busbars, ground cables, equipment racks, and equipment rooms must be labeled in accordance with the aforementioned standards.
 1. At locations where outlets are out of sight above ceilings, provide an additional label with ½" lettering below the outlet on the ceiling grid or ceiling access panel.
- F. Labels for cabling shall be self-laminating.
- G. Hand written labels are unacceptable.
- H. Locate the cable designator at the origination and destination of each cable within 12 inches of the point of termination or connection.
- I. Provide machine printed wall plate labels meeting ANSI/TIA 606-B standards inserted behind built-in clear plastic windows.

3.6 TEST AND CERTIFICATION

- A. Pretest notification
 1. Prior to conducting any field-testing of the SCS the Contractor must deliver to the project Architect a written notification of the test commencement date and the sequence of testing.

2. If the Contractor elects to commence testing in a phased approach, prior to completion of cable installation, a test sequence schedule must be provided.
3. Notification must be delivered to the Architect at least three weeks prior to the scheduled test date.
4. Upon receipt of the notification the Architect will arrange for the Owner's technical representative to attend the commencement of testing.
5. The purpose of the Owner's technical representative's attendance will be to observe:
 - a. The type of test equipment being utilized compared to the scheduled test equipment.
 - b. The test equipment can perform the tests to comply with the specified Standards.
 - c. The Contractor's technical personnel are prepared to conduct the tests.
 - d. The Owner's technical representative will make an Observation Report to the Architect
6. Failure to offer notification as specified above will subject the Contractor to re-test any cabling that was tested prior to the OWNER's technical representative review, at no additional cost to the project.

B. Testing equipment and devices

1. Test equipment must be capable of measuring the performance of the installed SCS and comparing the performance to the parameters specified in the applicable ANSI/TIA Standards.
2. Test equipment calibration must be current as defined by the test equipment manufacturer and included on individual test reports. Failure to perform SCS testing with equipment that meets this requirement will require retesting of applicable cabling at no additional cost to the Owner.
3. The following equipment list is provided to define the expected test equipment type. The test equipment is to be available for the entire test period through final inspection.
 - a. Manufacturer – Fluke DSX series
 - 1) The most current software, firmware and appropriate launch cords must be used.

C. Horizontal twisted pair testing

1. The horizontal distribution cable must be tested to perform in accordance with TIA-568. Cables must meet or exceed the requirements for horizontal, twisted pair cabling as specified in TIA-568 for a "PERMANENT LINK" test.
 - a. Include this testing for Category 5e and above cables used for backbone or interconnect cables with distances less than 295 feet.

2. Any cable, which fails any given test, must be corrected or replaced. Such activity must be performed at no additional cost to the Owner.
 - a. Only cables with PASS results will be accepted. Results that show PASS* will be considered a failed test.
 - b. PASS* tests will be accepted if written approval is provided from the manufacturer providing the extended performance warranty on the system stating that these cable segments will be covered by the extended warranty.

D. Fiber cable testing

1. Perform bi-directional field testing of each terminated strand of fiber optic cable listed in this Section for length, loss and polarity. Field testing equipment must include both an optical loss test set (OLTS) and optical time domain reflectometer (OTDR). Testing measurements are required to meet transmission performances listed in TIA-568.3-D/4.2/Table 1 at both 850 nm and 1300 nm for multimode fiber, and both 1310 nm and 1550 nm for single-mode fiber.
2. Submit cable certification reports of the following field testing measurement methods:
 - a. Attenuation
 - b. Length
 - c. Polarity
 - d. OTDR traces
3. Cable certification reports must bear the location/room number and cable identifier for each cable tested. Test results/reports in electronic copies by closet must be delivered to the Project Manager according to the submittal procedures.
4. Deliver an electronic file containing all individual test records and the software required to display and print the test records using a typical personal computer (PC).
 - a. Deliver test results in a PDF format.

3.7 FINAL INSPECTION

- A. Be cognizant of the project schedule and execute work to comply with the Project Schedule for Final Inspection.
- B. Ensure that the project management and the Architect are made aware of any issues that may prevent the completion of work prior to the scheduled final inspection time-frame.
- C. Prior to the scheduled final inspection time-frame the following must be completed:
 1. Complete installation, initial adjustments, tests and measurements
 2. Submit Test Results and As-Built documentation to the Architect.

3. Notification of the Architect, in writing of the date that they will be ready for final inspection and test.
 4. Submit warranty paperwork to the Owner's vendor of choice for the completed SCS.
- D. No earlier than two weeks after receipt of the Contractor's notification the Architect's representative will schedule a final inspection.
- E. During the Final Inspection site-walk make available:
1. A minimum of two people for inspection who are familiar with all aspects of the System.
 2. Ladders and scaffolding necessary to inspect cable in cable trays and ceiling mounted junction boxes.
 3. Test equipment specified and used for testing the SCS.
- F. In the event the need for further adjustment or work becomes evident during the inspection, the Contractor is to continue working until the System is acceptable at no addition to the contract price. If approval is delayed because of defective equipment or failure of equipment or installation to meet specifications, and if any extension of the inspection and testing period is required, the contract price will be reduced for the additional time and expenses of the Owner at the standard rate in effect at that time.
- G. If the Contract Documents, law, ordinances, rules, regulations or orders of any public authority having jurisdiction require any Work to be inspected, tested or approved, the Contractor must give timely notice to the Owner and the Consultant of the readiness and the date arranged so they may observe such inspection, testing or approval procedure. In addition, the Owner or Consultant may require special inspection, testing or approval of material or Work for compliance with the requirements of the Contract Documents. Upon direction by the Owner and the Consultant, the Contractor must promptly arrange for such special testing, inspection or approval procedure. Should the material or Work fail to comply with the requirements of the Contract Documents, the Contractor must bear all costs to replace, fix, and/or re-terminate the failed work.

3.8 INSTRUCTION OF OWNER PERSONNEL

- A. After final completion, instruct the Owner's designated personnel on the use, operation, maintenance, and care of the Systems.

END OF SECTION 27 10 00

SECTION 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SECURITY**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including all General and Supplementary Conditions and Division 1 Specification sections, shall apply to this section and shall be considered as forming an integral part of this Work. These documents are referred to as the Project General Conditions in the remainder of these Specifications.
- B. The Common Work Results for Electronic Security Specification Section shall apply to Work specified in this Section. Where similar requirements headings are listed herein, they are to augment the requirements indicated within the Common Work Results for Electronic Security Specification Section. Nothing herein shall be construed as relieving Contractor from the requirements identified in the Common Work Results for Electronic Security Specification Section.
- C. Not all cables shown within this section will be used on this project.
- D. This Specification Section incorporates general requirements for the following security sections:
 - 1. 28 05 00 Common Work Results for Electronic Security
 - 2. 28 10 00 Access Control
 - 3. 28 20 00 Video Surveillance

1.2 DEFINITIONS

- A. AWG: American Wire Gauge

1.3 REFERENCES

- A. National Electrical Code (NEC)
- B. NFPA 70
- C. UL 294 and UL 1076 as required where applicable
- D. FCC Rules and Regulations
- E. Part 15 Class A or B as applicable
- F. Applicable Federal, State, and Local laws, regulations, and other codes
- G. CE mark, as and where applicable
- H. C-Tick mark, as and where applicable

1.4 SUMMARY OF WORK

- A. Work specified in this Section includes cables used for security systems.

1.5 SUBSTITUTION

- A. Refer to Section 28 05 00 Common Work Results for Electronic Security.

1.6 SUBMITTALS

- A. Refer to Section 28 05 00 Common Work Results for Electronic Security.

PART 2 - PRODUCTS**2.1 GENERAL**

- A. "Or Approved Equal" basis:
1. Products may be listed on an "Or Approved Equal" basis. The known equals to the products specified, if applicable, are listed in each section.
 2. Substitute products not listed in this section may be submitted for approval during the question-and-answer period of the bidding phase. See Action Submittal requirements within 28 05 00 Common Work Results for Electronic Security.
 3. Substitution approvals will be based on the complete functionality, integration, operation, and user interface as compared to the specified product(s).
 4. Products not approved prior to the bidding phase will be deemed non-responsive.
- B. Pathway shall follow structured cabling Division 27 standards.
- C. Provide Wet Rated Cable as required due to project raceways/pathways.

2.2 CABLES AND WIRING

- A. 22 AWG 1 Pair Data Shielded / 18 AWG, 2 Conductor Stranded (Type A) – OSDP
1. Provide Windy City Wire 2ELEM-10-OSDP (Plenum)
 2. Known equals:
 - a. Belden
 - b. West Penn
 3. Wet Rated Cable
 - a. West Penn Wire 2PR485DBBK1000
- B. 18 AWG, 4 Conductor Stranded Unshielded (Type B)
1. Provide Windy City Wire 442380 (Plenum)
 2. Known equals:
 - a. Belden
 - b. West Penn
 3. Wet Rated Cable
 - a. Windy City Wire 727310VNQ
 - b. Or Approved Equal.
- C. 16 AWG, 2 Conductor Stranded Unshielded (Type C)
1. Provide Windy City Wire 441360 (Plenum)
 2. Known equals:
 - a. Belden
 - b. West Penn
 3. Wet Rated Cable
 - a. Windy City Wire 728110VNQ
 - b. Or Approved Equal.
- D. 22 AWG, 4 Conductor Stranded Unshielded (Type E)

1. Provide Windy City Wire 444380 (Plenum)
 2. Known equals:
 - a. Belden
 - b. West Penn
 3. Wet Rated Cable
 - a. Windy City Wire 416310WBT
 - b. Or Approved Equal.
- E. Composite Access Controlled Door Cable (Type F) - OSDP
1. Provide Windy City Wire GCOMP1-OSDP-ETL (Plenum)
 2. Known equals:
 - a. Belden
 - b. West Penn
 3. Wet Rated Cable
 - a. Windy City Wire 4461111WBT
 - b. Or Approved Equal.
- ~~F. Composite Copper Fiber (Type J)~~
- ~~1. Coordinate provisioning of Composite Copper Fiber cable per Owner/Division 27 standards.~~
- ~~G. Network Communication Cable (Type M)~~
- ~~1. Coordinate provisioning of Network Category cable per Owner/Division 27 standards.~~

2.3 COMMUNICATIONS HORIZONTAL UTP CABLING

- A. Products combinations must allow for a long term manufactures warranty required by this Section**
- B. Cable selection is based on installation environment. If multiple cable options are shown below for the same "TYPE", it is the responsibility of the contractor to select the cable that is properly rated for the installation environment.**
- C. 4 pair Category 6 plenum UTP communications cable (TYPE M):**
- 1. Blue jacket**
 - 2. Approved product**
 - a. Belden Part # 2413 D15A1000**
 - b. Commscope Part # UN874043014/10**
 - c. Hubbell Part # HC6SPB**
 - d. Leviton Part #10136226**
 - e. Panduit Part # PUP6004BU-WLPZ**
- D. 4 pair Category 6 OSP communications cable (TYPE M):**
- 1. Black jacket**

2. **Outdoor or Indoor/Outdoor rated**
 3. **Approved products:**
 - a. **Belden Part # 2143A**
 - b. **Commscope Part # CS34P-IO**
 - c. **Hubbell Part # C6IOSPBK**
 - d. **Leviton Part # 10139885**
 - e. **Panduit Part # PUO6C04BL-CGZ**
- E. Category 6 RJ-45 jack:**
1. **8-position, 8-wire RJ45 receptacle**
 2. **Blue color**
 3. **Approved products:**
 - a. **Belden Part # RV6MJKUBL**
 - b. **Commscope Part # 760237778**
 - c. **Hubbell Part # HJU6B**
 - d. **Leviton Part # 61110-RL6**
 - e. **Panduit Part # CJ688TGBU**
- F. Flush mount workstation faceplates:**
1. **Verify color with architect prior to purchase**
 2. **With label window**
 3. **Approved products:**
 - a. **Belden**
 - 1) **1 port Part # AX102660**
 - 2) **2 port Part # AX104197**
 - b. **Commscope**
 - 1) **1 port Part # 760249128**
 - 2) **2 port Part # 760249129**
 - c. **Hubbell**
 - 1) **1 port Part # IFP11W**
 - 2) **2 port Part # IFP12W**
 - d. **Leviton**

- 1) 1 port Part # 42080-1WS
 - 2) 2 port Part # 42080-2WS
 - e. Panduit
 - 1) 1 port Part # CFPL1WHY
 - 2) 2 port Part # CFPL2WHY
- G. Surface mount workstation:**
- 1. Verify color with architect prior to purchase
 - 2. Approved products:
 - a. Belden
 - 1) 1 port Part # AX102651
 - 2) 2 port Part # AX102652
 - b. Commscope
 - 1) 1 port Part # 760248521
 - 2) 2 port Part # 760248525
 - c. Hubbell
 - 1) White 1 port Part # HSB1W
 - 2) White 2 port Part # HSB2W
 - d. Leviton
 - 1) 1 port Part # 41089-1WP
 - 2) 2 port Part # 41089-2WP
 - e. Panduit
 - 1) 1 port Part # CBXQ1AW-A
 - 2) 2 port Part # CBXQ2AW-A
- H. Category 6 patch panel:**
- 1. Modular style panel
 - 2. 24 ports per 1U rack space
 - 3. Blank inserts in unused ports
 - 4. Approved products
 - a. Belden
 - 1) 24 port Part # AX103114

- 2) 48 port Part # AX103115
 - b. Commscope
 - 1) 24 port Part # 760101220
 - 2) 48 port Part # 760077842
 - c. Hubbell
 - 1) 24 port Part # HPJ24
 - 2) 48 port Part # HPJ48
 - d. Leviton
 - 1) 24 port Part # 49255-H24
 - 2) 48 port Part # 49255-H48
 - e. Panduit
 - 1) 24 port Part # CPP24FMBLY
 - 2) 48 port Part # CPP48FMBLY
- I. Category 6 patch cords:
 - 1. Blue
 - 2. Approved products:
 - a. Belden Part # C601106xxx
 - 1) Replace xxx with length in feet.
 - b. Commscope Part # UNC6-BL-xF
 - 1) Replace x with length in feet.
 - c. Hubbell Part # HCL6Bxx
 - 1) Replace xx with length in feet.
 - d. Leviton Part # 6D460-xL
 - 1) Replace x with length in feet.
 - e. Panduit Part # UTPSPxBUY
 - 1) Replace x with length in feet.
 - 3. Provide the following quantities
 - a. 100% of terminated cables at the patch panel, 5 foot
 - b. 50% of terminated cables at the WAO, 7 foot
 - c. 50% of terminated cables at the WAO, 10 foot

4. Confirm color, length and quantity with owner prior to purchasing

J. Copper In-Line Surge Protector

1. UL497 listed primary protector for communications circuits
2. Self-resetting solid-state circuitry
3. Supports Category 6 performance operating PoE or VoIP
4. 110 connector input, 110 connector output
5. Approved equal:
 - a. Ditek DTK-110C6APOE

2.4 COMMUNICATIONS HORIZONTAL FIBER OPTIC CABLING (TYPE J)

- A. Products combinations must allow for a long term manufactures warranty required by this Section.
- B. 2 strand single mode armored outdoor fiber optic cable:
 1. Approved products:
 - a. Corning Part # 002EU4-T4700D20
 - b. Substitutions: Under provisions of Division 01
- C. 4 strand single mode armored outdoor fiber optic cable:
 1. Approved products:
 - a. Corning Part # 004EU4-T4700D20
 - b. Substitutions: Under provisions of Division 01
- D. 6 strand single mode armored outdoor fiber optic cable:
 1. Approved products:
 - a. Corning Part # 006EU4-T4700D20
 - b. Substitutions: Under provisions of Division 01
- E. Armored and shielded cable grounding clamp
 1. Approved products
 - a. Corning FDC-CABLE-GRND
 - b. Substitutions: Under provisions of Division 01 in
- F. Single mode LC connector:
 1. 900 micro boot

2. **Fusion spliced**
 3. **Approved products:**
 - a. **Corning Part # SOC-LCU-900-SM**
 - b. **Substitutions: Under provisions of Division 01**
- G. Single mode LC adapter panels:**
1. **Fiber panel**
 2. **Aqua adapters**
 3. **Approved products:**
 - a. **Corning Part # CCH-CP6-A9**
 - b. **Substitutions: Under provisions of Division 01**
- H. Blank adapter panel:**
1. **Approved products:**
 - a. **Corning Part # CCH-BLNK**
 - b. **Substitutions: Under provisions of Division 01**
- I. Rack mount fiber enclosure:**
1. **1RU**
 2. **Minimum 2 panel**
 3. **Approved products:**
 - a. **Corning Part # CCH-01**
 - b. **Substitutions: Under provisions of Division 01**
- J. Fiber optic patch cord:**
1. **LC-LC**
 2. **Yellow**
 3. **Single mode**
 4. **Approved products:**
 - a. **1 meter Corning Part # 040402R5120001M**
 - b. **2 meter Corning Part # 040402R5120002M**
 - c. **Substitutions: Under provisions of Division 01**
 5. **Provide cords in a quantity to patch 100% of the used fiber ports, 50% 1 meter, 50% 2 meter. Confirm with owner prior to purchase.**

PART 3 - EXECUTION**3.1 LABELING**

- A. Provide labeling in accordance with TIA/EIA 606-A Level 2 numbering and ID format.
- B. Mechanically print and install in accordance with manufacturer recommendations and drawing details.
- C. Labels shall be single line, all capital letters, and bold font. Select font size and color that can be easily read on the applicable device or cable during installation, inspection, and for service maintenance.
- D. Ensure all surfaces are clean prior to final placement of labeling products. Follow manufacturer recommendations for cleaning.
- E. Handwritten labels are unacceptable.
- F. Provide machine generated labels for each system associated with the Electronic Security System to include, but not limited to, the following:
 - 1. Access Control cabling
 - a. Locate the cable designator within 2-inches of the end of the cable jacket at the ACP.
 - b. Shall include device designator as shown within provided Shop and As-Built Drawings to match system programming.
 - 2. Horizontal and Backbone cabling
 - a. Coordinate labeling scheme per Owner/Division 27 standards.
 - 3. Conduit pathways including:
 - a. Junction boxes
 - b. Pull boxes
 - c. Horizontal connection points
 - d. Conduit
 - 4. Labels shall match at both ends of cabling.

3.2 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Refer to Section 28 05 00 Common Work Results for Electronic Security.

3.3 SYSTEM TEST AND VERIFICATIONS

- A. Refer to Section 28 05 00 Common Work Results for Electronic Security.

3.4 WARRANTY

- A. Refer to Section 28 05 00 Common Work Results for Electronic Security.

3.5 COORDINATION

- A. Coordinate custom cabling report noting all cabling tested and functional for use. Submit report templates to the Owner's Representative for review and acceptance.

END OF SECTION 28 05 13

SECTION 28 20 00 - VIDEO SURVEILLANCE**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including all General and Supplementary Conditions and Division 1 Specification sections, shall apply to this section and shall be considered as forming an integral part of this Work. These documents are referred to as the Project General Conditions in the remainder of these Specifications.
- B. The Common Work Results for Electronic Security Specification Section shall apply to Work specified in this Section. Where similar requirements headings are listed herein, they are to augment the requirements indicated within the Common Work Results for Electronic Security Specification Section. Nothing herein shall be construed as relieving Contractor from the requirements identified in the Common Work Results for Electronic Security Specification Section.
- C. This Specification Section incorporates general requirements for the following security sections:
 - 1. 28 05 00 Common Work Results for Electronic Security
 - 2. 28 05 13 Conductors and Cables for Electronic Security
 - 3. 28 10 00 Access Control

1.2 DEFINITIONS

- A. ACAMS: Access Control Alarm Management System
- B. CCD: Charged Coupled Device
- C. HD: High Definition
- D. IETF: Internet Engineering Task Force
- E. IP: Internet Protocol
- F. IPS: Images Per Second
- G. ITU: International Telecommunications Union
- H. MP: Megapixel
- I. MPEG: Moving Picture Experts Group
- J. NTSC: National Television System Committee
- K. ONVIF: Open Network Video Interface Forum
- L. PAL: Phase Alternating Line
- M. PTZ: Pan, Tilt and Zoom
- N. RWC: Regional Watch Center
- O. SCC: Security Control Center
- P. SD: Standard Definition

- Q. VMS: Video Management System
- R. WAN: Wide Area Network

1.3 REFERENCES

- A. Electronics Industry Association (EIA) RS-170a standard for analog video
- B. NTSC broadcast video standard
- C. ITU PAL-B broadcast video standard (Referred to herein as simply PAL)
- D. ONVIF standards for IP video interoperability
- E. MPEG standards for video encoding / decoding
- F. ITU-T standards for video encoding / decoding
- G. National Electrical Code (NEC)
- H. NFPA 70
- I. UL 294 and UL 1076 as required where applicable
- J. FCC Rules and Regulations
- K. Part 15 Class A or B, as applicable
- L. Applicable Federal, State, and Local laws, regulations, and other codes
- M. CE mark, as and where applicable
- N. C-Tick mark, as and where applicable

1.4 SUMMARY OF WORK

- A. This project is to provide a new IP-based video surveillance system. The Contractor shall provide new head-end and end-of-line equipment, software integrations, licenses, and necessary programming to provide a fully functional video surveillance system as specified.
- B. Work consists of providing new video surveillance cameras as noted on the ES-series drawings.
- C. Work specified in this Section includes systems used for visual monitoring and recording of activities within the scene of view of attached cameras and associated features and functions, and equipment as necessary to support this capability.
- D. Systems shall consist of:
 - 1. Software
 - 2. Recording servers
 - 3. Management server
 - 4. Recording storage
 - 5. Client Workstations
 - 6. Cameras
 - 7. Network video encoders
 - 8. Camera housings and mounts
 - 9. Video analytics software/firmware

- E. The VMS shall provide the following functions:
 - 1. Video display as necessary for live monitoring and assessment of security incidents
 - 2. Recording of, and retrieval from, video to digital storage media for historical record
 - 3. Graphical map creation
 - 4. System administration
 - 5. Reports generation
- F. The VMS shall consist of a collection of devices by different manufacturers that are seamlessly managed by a single software package over an IP-based communications network. Video generated natively in digital IP format, as well as analog video digitized by an IP encoder, shall both be supported by the VMS.
- G. The VMS shall have the capability to integrate with intelligent video analysis products for monitoring of specific activities or behaviors that occur within the scene of view of the associated camera.
- H. Multiple disparate video surveillance systems shall have the ability to be linked together in a centralized architecture, allowing cameras from any system to be viewed on any other system. The centralized architecture shall be configured and managed in a hierarchical manner.
- I. The VMS shall incorporate security measures, including advanced authentication measures, and encryption of data.
- J. The VMS shall provide for redundancy of video storage using local storage at camera locations where critical or essential as indicated in the Construction Documents. Upon loss of recording server or network connectivity, the camera shall automatically buffer video to local storage, then automatically upload that video to the recording server upon restoration.
- K. Components of the VMS that use proprietary digital technologies shall have an associated software developer's kit (SDK) that is published, regularly updated, and available for other manufacturers / software vendors to write to.
- L. Contractor shall provide video analytics programming of no less than ten (10) rules for the system and shall include the camera programming and licenses to activate these analytics. Coordinate specific rules to be provided with Owner during system programming and initialization.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Unless otherwise noted, all materials and equipment shall be new, of the type, capacity, and quality specified and free from defects. Material shall bear the label of, or be listed by, the appropriate local listing agency unless of a type for which label or listing service is not provided.
- B. Where multiple items of a similar kind are provided, all shall be identical and of the same manufacturer.
- C. The Contract Documents indicate major system components and may not show every component, connector, module, or other accessory that may be required for a complete and operational system. It is the Contractor's responsibility to identify and provide each component necessary for a complete and operational system in accordance with the Contract Documents.
- D. "Or Approved Equal" basis:

1. Products may be listed on an "Or Approved Equal" basis. The known equals to the products specified, if applicable, are listed in this section.
2. Substitute products not listed in this section may be submitted for approval during the question-and-answer period of the bidding phase. See Action Submittal requirements within 28 05 00 Common Work Results for Electronic Security.
3. Substitution approvals will be based on the complete functionality, integration, operation, and user interface as compared to the specified product(s).
4. Products not approved prior to the bidding phase will be deemed non-responsive.

2.2 VIDEO SURVEILLANCE SYSTEM

- A. The Contractor shall provide licenses for all devices and storage requirements for this project, plus five (5) extra licenses.
 1. Shall be: Genetec Omnicast, latest version.
 - a. No Substitutions.

2.3 IP CAMERAS

- A. All IP cameras shall be compatible with the selected VMS.
- B. All IP cameras shall have the following mounting types. Mounts shall be as recommended by the individual manufacturer for each mounting type:
 1. Type G: Goose Neck / Parapet Mount
 2. Type L: Pole Mount
 3. Type R: Recessed / Flush Mount
 4. Type S: Surface Mount
 5. Type W: Wall Mount
 6. Type P: Pendant Mount
- C. Type 5: Fixed 5MP Dome with IR
 1. Shall be the latest version:
 - a. Basis of Design:
 - 1) Hanwha Vision XND-C8083RV (indoor)
 - 2) Hanwha Vision XNV-C8083R (outdoor)
 - b. Known equals:
 - 1) Axis P3267-LV (indoor)
 - 2) Axis P3267-LVE (outdoor)
- D. Type 9: Fixed 4K/8MP Bullet with IR
 1. Shall be the latest version.
 - a. Basis of Design:
 - 1) Hanwha Vision PNO-A9311R
 - b. Known equals:
 - 1) Axis Q1808-LE
- E. Type 10: Fixed 180 Panoramic
 1. Shall be the latest version.
 - a. Basis of Design:
 - 1) Hanwha Vision PNM-C9022RV
 - b. Known equals:
 - 1) Axis P3818-PVE

- F. Type 11: Fixed 180 Dual-Head
 - 1. Shall be the latest version.
 - a. Basis of Design:
 - 1) Hanwha Vision PNM-C12083RVD
 - b. Known equals:
 - 1) Axis P4707-PLVE
- G. Type 20: Fixed 360 Multi-Imager
 - 1. Shall be the latest version.
 - a. Basis of Design:
 - 1) Hanwha Vision PNM-C16083RVQ (indoor)
 - 2) Hanwha Vision PNM-C32083RVQ (outdoor)
 - b. Known equals:
 - 1) Axis P3737-PLE (indoor)
 - 2) Axis P3738-PLE (outdoor)
- H. Type 40: PTZ
 - 1. Shall be the latest version.
 - a. Basis of Design:
 - 1) Hanwha Vision XNP-C9253R
 - b. Known equals:
 - 1) Axis Q6355-LE

2.4 CABLES AND WIRING

- A. All structured cabling supporting the camera and system connectivity are listed in ~~Division 27~~ **28 05 13** specifications as structured cabling.
- B. Cable shall carry appropriate fire rating (e.g., CMR, CMP, OFNR, OFNP, etc.) on jacket of cable.
- C. Where cables are routed through cable tray, provide tray rated cable of equal specification.

2.5 MISCELLANEOUS EQUIPMENT

- A. Power Supply
 - 1. Power Over Ethernet (PoE, PoE+, PoE++) power sources provided by Owner.
- B. Provide PoE injectors if conditions require.
- C. **Network Switches**
 - 1. **Each Access switch shall be installed with the following capabilities:**
 - a. **Each access switch must be able to support stacking of additional switches.**
 - b. **Access switch switching capacity must be able to meet or exceed 1 Tbps.**
 - c. **Per-port broadcast, multicast and unicast storm control prevents faulty end stations from degrading overall system performance.**
 - d. **Hot swappable redundant power supplies and fans.**
 - e. **802.3bt Power over Ethernet to power POE endpoints.**
 - f. **Access switch power supplies must be designed so that a 48-port switch can supply Power over Ethernet to all devices that require it.**

- g. Support for 802.1D (STP), 802.1w (RSTP) and per-VLAN spanning tree (PVST+).**
- h. Full-duplex operation on all copper multigigabit ports, delivering up to 5 Gbps to each port.**
- i. Support for IEEE 802.3bz Multirate 1/2.5/5 Gbps specification where required and configured specifically for the edge device.**
- j. Support for a minimum of 4,000 VLAN's.**
- k. Support for IGMP v2 and v3 snooping.**
- l. Capable of supporting 1000 Gbps or greater switching fabric per switch:**
- m. Capable of supporting 1400 Mpps minimum forwarding rate.**
- n. Capable of supporting both IPv4 and IPv6.**
- o. Each access switch must be able to do multicast routing including PIM Sparse Mode, PIM Dense Mode, PIM Source Specific Multicast, and PIM Bidirectional.**
- p. Each access switch and stack must have advanced QOS features.**
- q. Each access switch must be able to support sFlow RFC3176 or equivalent features and reporting.**
- r. Each access switch shall be fully populated in DRAM and Flash.**
- s. Each access switch shall have the capability to be upgraded with downtime limited to time needed to reboot the switch or stack.**
- t. Each access switch shall support uninterrupted POE+ power to endpoints during a switch reboot.**
- u. Each access switch shall include advanced operating system licensing to provide full layer 3 functionality.**
- v. Each access switch will ship with a Limited lifetime warranty.**
- w. Access switches shall support multiple user administrative access with distinctive privilege levels.**
- x. Provision, configuration, and installation 25 gigabit per second uplinks (or greater) from each access layer switch stack to the core switch in the MDF.**
- y. Access switches must be able to support all 48 ports simultaneously using Multirate (IEEE 802.3bz) speeds at 2.5 Gbps and 5 Gbps where required.**
- z. Each access switch shall comply with the following standards and functionality:**
 - 1) IEEE 802.3ae 10Gig Ethernet specification**
 - 2) IEEE 802.3ab 1000BASE-T specification**
 - 3) IEEE 802.3z 1000BASE-X specification**
 - 4) IEEE 802.3bm-2015 standard**
 - 5) IEEE 802.3bz Multirate 2.5/5G**
 - 6) IEEE 802.3ad LACP**
 - 7) IEEE 802.1ax Link Aggregation**
 - 8) IEEE 802.3af POE**
 - 9) IEEE 802.3at POE Plus**
 - 10) IEEE 802.3bt POE over 4 pairs**
 - 11) IEEE 802.3x Flow Control**
 - 12) IEEE 802.1ba AV Bridging**
 - 13) IEEE 802.1D Spanning-Tree Protocol and IEEE 802.1w Rapid spanning tree or equivalent**
 - 14) IEEE 802.1p QoS prioritization**
 - 15) IEEE 802.1Q VLAN**
 - 16) IEEE 802.1x Security and Authentication**
 - 17) IEEE 802.1ab LLDP**
 - 18) IEEE 1588-2008 PTP v2**
 - 19) IETF RFC 7348 VXLAN**
 - 20) SNMP v1, v2c and v3 support**
 - 21) RMON I and II standards**
 - 22) IGMPv2 and IGMPv3**

- 23) Multiple VRF's including VRF Lite
 - 24) OSPF v2 and v3 with graceful restart
 - 25) DHCP snooping, server and relay
 - 26) IP source guard
 - 27) Dynamic ARP inspection
 - 28) Access Control Lists
 - 29) IPv4 and IPv6 support
 - aa. Support for real time protocols such as SCCP, SIP, DSCP, RTSP, and MGCP.
 - bb. Support for all audio network protocols such as Audinate Dante, Dante Domain Manager, QSC Q-LAN, Q-Sys, CobraNet and Harman HiQnet control.
 - cc. Support for all video protocols such as H.264, H.265, MPEG 2 and 4, AVI, HLS, etc.
 - dd. Support for authentication, authorization, and accounting systems (i.e., RADIUS, etc.).
 - ee. Access switches must be able to support IEEE 802.1AE (MACsec) for network security purposes.
 - 2. Acceptable Manufacturers:
 - a. Cisco Systems
 - b. Extreme Networks
 - c. HPE/Aruba Networks
 - d. Netgear Systems
- D. Multipoint Wireless Bridge Kit**
- 1. Shall be: EtherWAN
 - a. No Substitutions.
 - 1) Receivers:
 - EasyLink-PRO-US-MP-06
 - EasyLink-PRO-US-MP-04
 - 2) Wireless Transmitter Kit:
 - EASYPOE4P-PMT
 - 3) Hardened PoE Surge Protection:
 - PD1044
 - 4) Universal Antenna Mount
 - Jpole18
 - b. Contractor shall coordinate with manufacturer to perform on-site spectrum analysis prior to ordering any equipment.

2.6 FIBER OPTIC TRANSCEIVER LINK

- A. Provide fiber optic transceivers for cameras that are over 90 meters from the MDF/IDF/IT rooms.
- B. Provide NEMA 4 housing for transceiver to be mounted in near camera.
- C. Provide NEMA 12 housing for mounting transceivers within IDF rooms.
- D. Provide DIN Rail mounting of devices in the enclosures.
- E. Provide 48 VDC @ 0.85 A at transceiver per transceiver power supply in the IDF room. Power the transceiver next to the camera over composite cable (1) pair 12 AWG, (1) pair fiber copper cable with no splices from IDF.
- F. Acceptable Product:

1. (2) Comnet CNMCSFPPOE with Comnet SFP6 for single mode fiber or with SFP2 for multimode fiber. (FOT Type 1).
2. (1) Comnet CNGE2FE8MSPOE2 with CNMC[2]SFP[POE][M] and Comnet SFP-6 Module for single mode or with SFP 2 for multimode fiber. (FOT Type 2).
3. (1) Comnet PS-DRA240-48A (Adjust voltage at field transceiver to 48 VDC output 0.85A).

2.7 TECHNICAL REQUIREMENTS

A. Video Management Software

1. Shall support all features defined within the section above entitled "Summary of Work".
2. Video management software shall be scalable up to an unlimited number of connected IP cameras, encoders, and other system devices.
3. Video management software shall be hardware-agnostic and shall support industry-standard hardware devices such as servers, Client Workstations, storage, and other devices from standard industry sources.

B. Server Hardware General

1. Provide operating system for the system server(s) as per VMS manufacturer requirements. Where multiple system server operating systems are supported by the VMS manufacturer, MS Windows® products shall be used.
2. System server(s) shall comply with all relevant Owner IT requirements.
3. Where the Owner IT requirements do not provide specific direction, the system server and its individual components shall not be proprietary to a specific manufacturer.
4. Minimum specifications for the system server shall be as per the published minimum specifications of the VMS manufacturer. Confirm specific requirements with the VMS manufacturer based on Project capacity and project requirements.

C. Video Management / Recording / Storage Servers

1. Video Management Server
 - a. The video management server shall provide for central management of all video recording servers, client workstations, cameras, and other system devices.
2. Video Recording and Storage Server
 - a. The video recording and storage servers shall receive video streams from associated cameras, record the video data from these streams to the system database and attached storage, and serve live video to monitoring client workstations.
 - b. The video and recording servers shall incorporate RAID Level 6 redundant storage technology or approved equivalent. Redundant disks shall be hot-swappable, shall be accessible from the front of the server unit and shall provide a visual indication of disk status on the front of each disk.
 - c. Provide a video storage device that can store all the video from all cameras on the project for thirty (30) days, at a minimum.
 - 1) Upon motion activation, recorded video shall capture full resolution, full motion, and full available frame rate for each camera within the project.
 - d. Video recording and storage servers shall be populated such that no more than seventy-five percent (75%) of the recording disc space is utilized for each server.
 - e. Acceptable Product:
 - 1) Streamvault SV-4000E
 - 2) BCD Video BCD212X-SAN

D. Client Workstation (WS)

1. The Client Workstation shall provide for operator interface to the system, including all management, monitoring, and control activities.
 2. Provide operating system for the client workstation as per ACS/VMS manufacturer requirements. Where multiple client workstations operation systems are supported by the VMS manufacturer, MS Windows® products shall be used.
 3. Provide Client Workstation software and hardware configuration in accordance with manufacturer requirements.
 4. The minimum specifications for the Client Workstation shall be as per the published minimum specifications of the ACS/VMS manufacturer. Confirm specific requirements with the ACS/VMS manufacturer on the Project capacity requirements.
 5. The Client Workstation shall comply with all relevant Owner IT requirements.
 6. Where Owner IT requirements do not provide specific direction, the Client Workstation and its individual components shall not be proprietary to a specific manufacturer.
 7. Coordination installation of two (2) 27" LED monitor connected to each workstation (WS) at locations shown on ES-series drawings.
 8. Contractor shall provide the video surveillance workstation client software and system programming to accommodate command and control from computer workstations and locations noted on the drawings.
 9. Contractor shall integrate the access control system, video management system, and intercom system to work as one integrated system on the security workstations.
- E. Network transmission hardware: Coordinate with the Owner's IT/Telecom group for equipment requirements, including switches, Power over Ethernet injectors, and any other network equipment specified within the Construction Documents.

PART 3 - EXECUTION

3.1 GENERAL

- A. Coordinate incorporation of the Work specified herein with other project work so as to facilitate a cohesive final Product.
- B. Mount equipment and enclosures plumb and level.
- C. Permanently installed equipment to be firmly and safely held in place. Design equipment supports to support loads imposed with a safety factor of at least five. Seismic bracing shall be installed on appropriate equipment where local codes require such installation.
- D. Verify all locations of equipment in all rooms with Owner's Representative, Owner, and Consultant.

3.2 PROGRAMMING

- A. Provide all initial system programming and setup of the VMS system including, but not limited to the following:
 1. Enrollment of all cameras, encoders, and other devices into the VMS software. Provide all necessary configuration of each device, including IP address, MAC address, name, description, frame rate, compression ratio, resolution, and other required settings.
 2. Configuration of all rules-based actions within the system including setup of initiating events, camera analytics, and all resulting actions.
 3. Initial setup for the interface with the ACAMS. The interface shall provide for automatic VMS camera selection upon alarms within the ACAMS as specified herein and as indicated in the Contract Documents. Coordinate automatic VMS camera selection, real-

- time record initialization, and VMS record status alarm annunciation requirements with the Owner prior to programming.
4. VMS software graphical maps and icons. Coordinate with the Owner's Representative to obtain AutoCAD architectural backgrounds for implementation as graphical maps. Import all AutoCAD background information provided by the Owner's Representative and produce a complete set of graphical maps depicting all VMS points.
 5. Automatic selection of a VMS camera adjacent to applicable card readers upon an invalid card use. Coordinate automatic camera selection requirements with the Owner prior to system programming.
 6. Automatic selection of a VMS camera adjacent to applicable door position monitored openings upon a "Door Forced/Door Propped" condition. Coordinate automatic camera selection requirements with the Owner prior to system programming.
 7. Cameras shall be programmed into the VMS in a logical format and with a naming structure that permits monitoring locations to easily track and individual from one camera view to the next.
 - a. Naming structure shall be coordinated with Ownership.

3.3 LABELING OF EQUIPMENT

- A. Provide labeling in accordance with TIA/EIA 606-A Level 2 numbering and ID format.
- B. Mechanically print and install labels in accordance with manufacturer recommendations and drawing details.
- C. Labels shall be single line, all capital letters, and bold font. Select appropriate font size and color that can be easily read on the applicable device or cable during installation, inspection, and for service maintenance.
- D. Ensure all surfaces are clean prior to final placement of labeling products. Follow manufacturer recommendations for cleaning the applicable device or cable prior to final placement.
- E. Handwritten labels are unacceptable.
- F. Provide labeling materials designed for a lifetime equivalent to the system, component, or cable being identified.
- G. Provide machine generated labels for each component associated with the Electronic Security System to include, but not limited to, the following:
 1. Horizontal and Backbone cabling
 - a. Coordinate labeling scheme per Owner/Division 27 standatds.
 2. Surveillance Cameras
 3. Security Client Workstation(s)
 4. Server(s)

3.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Refer to Section 28 05 00 Common Work Results for Electronic Security.

3.5 SYSTEM TEST AND VERIFICATIONS

- A. Refer to Section 28 05 00 Common Work Results for Electronic Security.

3.6 OWNER PERSONNEL TRAINING

- A. Refer to Section 28 05 00 Common Work Results for Electronic Security.

3.7 WARRANTY

- A. Refer to Section 28 05 00 Common Work Results for Electronic Security.

END OF SECTION 28 20 00