

SECTION 26 00 00 – ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Drawings and General provisions of the Contract including the "General Conditions", "Supplementary Conditions", and "General Requirements" of the Contract as written and referred to here are adopted and made part of Division 26.
- B. The Contract Agreement, Bidding documents, and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the electrical systems.

1.2 SUMMARY

- A. The work under this Division shall consist of all labor, materials, equipment, services and related accessories, etc., necessary and required to complete all work as shown or inferred on the Drawings and in the Specifications (Contract Documents).
- B. Provide fixed electrical equipment, except where specifically noted otherwise.
- C. Provide equipment and/or wiring normally furnished or required for complete electrical systems but not specifically specified on the drawings and/or in specifications, as though specified by both.
- D. All equipment and wiring shall be new, except where specifically shown or specified otherwise.
- E. Provide flexible electrical conduit and conductors having a slack, 90-degree bend or loop in any plane between connections at all vibration isolated equipment and the first attachment to building structure or cabinets, panels or boxes mounted thereon.

1.3 WORK INCLUDED IN THIS DIVISION

- A. Electrical work includes, but is not limited to:
 - 1. Alterations and additions to existing electrical systems.

1.4 REFERENCES

NEC:	National Electrical Code (latest edition adopted by local authorities unless otherwise noted).
NFPA:	National Fire Protection Association.
OSHA:	Occupational Safety and Health Administration.
UL:	Underwriters Laboratories, Inc.
NEMA:	National Electrical Manufacturer's Association.
IEEE:	Institute of Electrical and Electronic Engineers.
ACI:	American Concrete Institute.
ADA:	American Disabilities Act.
ANSI:	American National Standards Institutes.
ASTM:	American Society for Testing Materials.
AWS:	American Welding Society.
FM:	Factory Mutual Insurance Association.
IBC:	International Building Code

IES:	Illumination Engineering Society.
ISA:	Instrument Society of America.
LPI:	Lightning Protection Institute.
NACE:	National Association of Corrosion Engineers.
NETA:	International Electrical Testing Association.
UL:	Underwriters Laboratories.
NECA:	National Electrical Contractors Association
NETA:	National Electrical Testing Association.

1.5 ADOPTED CODES

- A. 2018 International Building Code (IBC) Published by the International Code Council (ICC).
- B. 2017 National Electrical Code (NEC) published by the National Fire Protection Association (NFPA)
- C. 2018 International Fire Code (IFC) published by the International Code Council.
- D. National Fire Codes (NFPA Standards) published by the National Fire Protection Association (NFPA) as referenced in the 2012 International Fire Code.
- E. 2017 International Energy Conservation Code (IECC) published by the International Code Council. ASHRAE/IESNA Standard 90.1-2016 is incorporated by reference.
- F. All applicable provisions of the Nevada Revised Statutes (NRS) and the Nevada Administrative Code (NAC), including those listed below.
- G. The most current regulations of the State Fire Marshal, Nevada Department of Public Safety, Carson City, Nevada (NAC Chapter 477, State Fire Marshal).
- H. The most current edition of the Americans with Disabilities Act (ADA) published by the United States Department of Justice including the Americans with Disabilities Act Accessibility Guidelines (ADAAG)
- I. Other codes, regulations, and standards referenced in the body of this document.
- J. Local codes and ordinances do not apply to projects constructed on state-owned land, except for zoning requirements pursuant to Nevada Revised Statutes Section 278.580.

1.6 DEFINITIONS

Provide:	Furnish, install, connect and test until complete.
Wire:	Furnish all necessary wiring, connect and test until complete.
Install:	Furnish, set in place, wire and test until complete.
Work:	Materials completely installed, connected, and tested until complete.
AWG:	American Wire Gage.
Equal:	Acceptable equal as determined by the Engineer.

1.7 REQUIREMENTS OF REGULATORY AGENCIES

- A. Obtain and pay for all permits and inspections required for the work. Comply with all ordinances pertaining to work described herein. Pay all expenses arising from the procurement of these certificates and include in the base Contract Price.
- B. Install work under this Division per drawings, specifications, latest adopted edition of the National Electrical Code, (NFPA-70) including local amendments and interpretations, Local adopted Building Codes, and any special codes having jurisdiction over specific portions of work within complete installation. In event of conflict, install work per most stringent code requirements determined by Engineer. This does not relieve the Contractor from furnishing and installing work shown or specified which may exceed the requirements of such ordinances, laws, regulations and codes.
- C. All materials, products, devices, fixtures, forms or types of construction included in this project shall meet or exceed the published requirements of National Electrical Code (NEC), American National Standards Institute (ANSI), Institute of Electrical and Electronics Engineers (IEEE) and National Electrical Manufacturers Associations (NEMA). All equipment shall bear the Underwriter's Laboratories (UL) label or equivalent from approved independent testing laboratory.
- D. Arrange, pay fees for and complete work to pass required tests by agencies having authority over work. Deliver to Engineer copies of the Certificates of Inspection and approval issued by authorities and provide original copy of each certificate to Owner.
- E. When required by law or regulations, the governmental agency having jurisdiction for inspections shall be given reasonable notice and opportunity to inspect the work. Any work that is enclosed or covered up before such inspection and test shall be uncovered at the Contractor's expense; after it has been inspected, the Contractor shall restore the work to its original condition at his own expense.

1.8 INSURANCE

- A. The Contractor shall procure and maintain, at his expense, such insurance as required by law and/or specified in the General Conditions.

1.9 DRAWINGS AND SPECIFICATIONS

- A. Drawings and specifications are complementary. Work called for by one is binding as if called for by both. Any discrepancies between drawings and specifications shall be brought to the attention of the Engineer for clarification during the bidding period. No allowance shall subsequently be made to the Contractor by reason of his failure to have brought said discrepancies to the attention of the Consultant during the bidding period or by reason of any error on the Contractor's part.
- B. Drawings are schematic and diagrammatic in nature. Drawings show general run of circuits and approximate location of equipment. The contractor shall review drawings of all trades to assure coordination prior to placement of work. Right is reserved to change location of equipment and devices, and routing of conduits within 10 feet, without extra cost to Owner (prior to rough-in).
- C. Use dimensions in figures, shop drawings, etc. and actual site measurements in preference to scaled dimensions. Do not scale drawings for exact sizes or locations – use dimensioned details or actual field conditions. Verify item mounting heights as required by project conditions prior to rough-in.
- D. The architectural drawings shall take precedence over all other drawings in matters of dimensions. Discrepancies between different drawings or between drawings and

specifications, or regulations and codes governing the installation shall be brought to the attention of the Engineer in writing for determination.

- E. Layout equipment as shown on drawings as close as possible. Verify access requirements for equipment actually furnished, and adjust layout to comply with NEC 110. Right is reserved to change layout within 10 feet without additional cost (prior to rough-in).
- F. All devices, light fixtures, etc. located in ceiling tiles shall be located in the center of the ceiling tile UNLESS specifically noted or approved to do otherwise.
- G. The Contractor is responsible to field measure and confirm the mounting heights and location of electrical equipment with respect to counters, doorways, and other architectural, mechanical or structural work. Do not scale distances off the electrical drawings: Use actual building dimensions.
- H. Execution of Contract is evidence that Contractor has examined all existing conditions, drawings and specifications related to work, and is informed to extent and character of work. Later claims for labor and materials required due to difficulties encountered, which could have been foreseen had examination been made, will not be recognized.
- I. All work called for in this Section of the plans and specifications shall be performed under this Section, regardless of whether such work may also have been called for in other Section(s). Discrepancies in or conflicts among the various parts of the contract drawings shall not relieve Contractor of his obligation to perform.
- J. No attempt has been made to establish the required sections or splits of equipment relative to the size of access into the space, building, etc. Contractor shall establish all said splits, sections, etc. necessary to install equipment complete without undue disassembly of equipment or demolition of building parts at site of work.
- K. Charges for extra work are not allowed unless work is authorized by written order from the Owner's Representative approving charges for work.
- L. Check all door swings so light switches are not located behind doors. Relocate switches as required with the Engineer's review.

PART 2 PRODUCTS

2.1 MATERIALS

- A. All material shall be new, and have a UL label where available. If UL label is not available, material shall be manufactured in accordance with applicable NEMA, IEEE and Federal Standards. Use UL labeled components in assemblies that do not have overall UL label. All equipment shall comply with the terms "listed and labeled" as defined in the NEC 70, Article 100. Submit letter stating compliance with these requirements.
- B. Utilize one of the manufacturers listed to furnish all of the major equipment (i.e., transformers, bus duct, switchgear, circuit breakers, etc.) required for this project.
- C. Basis-of-Design Products: Where Specifications name a product, or refer to a product indicated on Drawings, and include a manufacturer or list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers or a comparable substitution.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Engineer may return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of engineers and owners, if requested.
 5. Samples, if requested.

2.2 ELECTRICAL METALLIC TUBING (EMT)

- A. Product Description: ANSI C80.3; galvanized tubing.
- B. Fittings and Conduit Bodies: NEMA FB 1; use insulated throat galvanized steel, rain tight, compression or set screw type. Compression type must be used in all medical facilities and in damp locations. Provide grounding bushing on 1¼ inch and larger. **Zinc alloy and similar soft metal castings are not allowed.**

2.3 OUTLET/JUNCTION BOXES

- A. Sheet Metal Outlet/Junction Boxes: NEMA OS 1, galvanized steel.
- B. Wall Plates for Finished Areas: White nylon plastic.

2.4 BUILDING WIRE

- A. Product Description: Single conductor insulated wire.
- B. Conductor: Copper.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation Temperature Rating: 90 degrees C.
- E. Insulation Material: Thermoplastic.

2.5 RECEPTACLES

- A. Product Description: NEMA WD 1, Heavy-duty general use receptacle.
- B. Device Body: White or match existing, nylon.
- C. Configuration: NEMA WD 6, type as indicated on Drawings.
- E. Convenience Receptacle: Type 5-20.

PART 3 EXECUTION

3.1 VISIT TO SITE

- A. Visit site, and survey existing conditions affecting work prior to bid. Include necessary materials and labor to accomplish the electrical work, including relocation of existing services and utilities on building site in bid. No consideration shall be given to future claims due to existing conditions. Any discrepancies or interference's shall be reported immediately to the Engineer.

3.2 WORKMANSHIP

- A. All work performed shall be first class work in every aspect. The work shall be performed by mechanics skilled in their respective trades, who shall at all times be under the supervision of competent persons. All work shall be installed to comply with NECA's "Standard of Installation."
- B. Work under this Division shall be first class with emphasis on neatness and workmanship. All work shall be installed square and plumb and concealed where possible. Work that is deficient, defective, poorly laid out, not perfectly aligned, or that is not consistent with the requirements generally accepted in the trade for "first class work" will not be acceptable.
- C. In addition to the materials specified elsewhere, furnish and install all other miscellaneous items necessary for the completion of the work to the extent that all systems are complete and operative.
- D. All work under this Section shall be performed in cooperation with the work performed under all other Sections of the Specifications for the Project in order to avoid interference with other work and to secure the proper installation of all work. Refer the Drawings and Specifications covering the work to be performed under all Sections, so that the relation and extent of the work of this Section with respect to the work of all other Sections is understood. Give right of way to raceways and piping systems installed at a required slope.
- E. Install work using competent mechanics, under supervision of foreman, all duly certified by local authorities. The installation shall be subject to the Engineer's observation, and final acceptance. The Engineer may reject unsuitable work.
- E. Conduit systems must be complete prior to installation of wiring.

3.3 CHANGE ORDERS

- A. Additional work may be required on the project which is outside the scope of the contract. Such additional work will be described in Supplemental Instructions and/or Clarifications, to be estimated and priced by the Contractor, and accepted by the Owner, prior to commencing work. Proposals shall include a list of quantities of all material being used with unit costs broken down into material and labor costs per unit.
- B. Material costs and labor units shall not exceed the latest edition of RS Means Electrical Cost Data.

3.4 GUARANTEE

- A. Furnish the Owner a written guarantee, stating that if workmanship and/or material executed under this Division is proven defective within one (1) year after final acceptance by the Owner, such defects and other work damaged will be repaired and/or replaced. Submit with Operations and Maintenance Manuals.

- B. Obtain from the various manufacturers or vendors guarantees or warranties for their particular equipment or components, and deliver them to the Owner. All guarantees and warranties provided shall be referenced to this project.
- C. In event that systems are placed in operation in several phases at the Owner's request, guarantee will begin on date each system or item of equipment is accepted for service by the Owner. Provide O&M manuals for all equipment when equipment is accepted for service by the Owner.
- D. All guarantees and warranties shall include labor and material at the site of installation for the duration of the guarantee period.

3.5 OBSERVATIONS OF WORK AND DEMONSTRATION OF OPERATION (ACCEPTANCE)

- A. At all observations of work, open panel covers, junction box covers, pull box covers, device covers, and other equipment with removable plates for observation. Provide sufficient personnel to expedite cover removal and replacement.
- B. Contractor to demonstrate operation of new equipment and/or systems to satisfaction of Owner/Engineer. Contractor to have manufacturer available for demonstration of equipment and/or systems where requested by Owner/Engineer. Furnish affidavit signed by Owner's representative indicating that demonstration of operation has been performed.

3.6 COOPERATION AND COORDINATION

- A. Carefully coordinate work with other contractors and subcontractors. Refer conflicts between trades to Engineer. Provide necessary information to other trades for such coordination. Such information shall include Shop Drawings, Product Data and all other required data. **There shall be no additional cost to the owner for any post-bid changes made to the electrical design and/or construction that are generated by changes to the basis-of-design equipment of any discipline. This includes changes made by substituted, alternate or comparable products regardless of manufacturer.**
- B. Whenever such information is not provided in a timely manner or whenever such information is incorrect, this contractor shall bear all costs for providing or correcting affected work of related trades with no change to the Contract Price or Construction Schedule.
- C. Work to be installed as progress of project will allow. Schedule of work determined by General Contractor, Owner, and/or Engineer.

3.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver equipment and materials to job site in original, unopened, labeled container. Products shall be properly identified with names, model numbers, types, grades, compliance labels and other information needed for identification. Store to prevent damage and injury. Store materials to prevent corroding. Store finished materials and equipment to prevent staining and discoloring. Store materials affected by condensation in warm dry areas. Provide heaters. Contractor shall verify the availability of on site storage space, if no on site storage space is available then the contractor shall cover the cost for off site storage. Materials stored at the project site that becomes soiled with construction dirt, concrete, or moisture shall be removed from the site and replaced with new. Do not install soiled material.

- B. Protect work and materials from damage by weather, entrance of water or dirt. Cap and mark conduit during installation.
- C. Avoid damage to materials and equipment in place. Repair, or remove and replace damaged work and materials.
- D. Protection and safekeeping of products stored on premises is responsibility of Contractor supplying products.
- E. Schedule of deliveries and unloading to prevent traffic congestion blocking of access or interference with work. Arrange deliveries to avoid larger accumulations of materials than can be suitably stored at site.
- F. Install equipment per manufacturer's recommendations. Conflicts between contract documents and these recommendations shall be referred to Engineer for remedy.
- G. Electrical or electronic equipment that has been damaged, exposed to weather or is, in the opinion of the Engineer or Architect, otherwise unsuitable because of improper fabrication, storage or installation shall be removed and replaced by this Contractor at his expense.

3.10 ANCHORS

- A. Provide anchors for all equipment, raceways, hangers, etc. to safely support weight of item involved plus 100% for dead loads. Live loads shall be considered in addition to dead loads.
- B. Anchors to consist of expansion type devices similar to "Redhead" or lead expansion anchors. Plastic anchors are not acceptable.
- C. Use preset anchor steel inserts in concrete slabs. Provide preset anchor size and type for anticipated or specified rod/bolt size and live/dead load.

3.11 CLEANING AND PAINTING

- A. Clean equipment furnished in this Division after completion of work. Clean wipe the interior of all conduit, pullboxes, junction boxes, outlet boxes, and panelboard backboxes, soiled with dirt and debris prior to installation of wiring.
- B. Touch-up or re-paint damaged painted finishes as determined by the Engineer.
- C. Remove debris, packing cartons, scrap, etc., from site daily.

3.12 SPARE PARTS

- A. Where spare parts are specified in the Technical Sections, furnish spare parts to Owner with itemized receipt. Contractor is responsible to deliver parts and have receipt signed by Owner's representative. Turn over receipt with as-built documents.

3.13 IDENTIFICATION

- A. Junction, pull and connection boxes shall indicate system voltage and contained circuits on outside of box cover. Use self-adhesive marking tape labels at exposed locations and indelible black marker at concealed boxes.
- B. Branch circuit conductors shall be identified in each junction box and pull box with wire markers to indicate panel/circuit numbers.

- C. Junction box covers in branch circuit wiring shall be labeled with panel and circuit numbers.
- D. Device plates for switches and receptacles shall identify the panelboard and branch circuit number from which served on the front of the device plate with permanent polyester tape. Locate all labels at the bottom of the plate in the same location throughout.

3.14 ONGOING OPERATION

- A. Conduct work to minimize disruption of owner's ongoing operations. Provide barricades, noise abatement and dust containment measures to ensure the safety of staff and workers. Interruptions of existing power, communications or other systems shall be performed only at such times as directed by the owner. Outages shall be momentary in nature. Each such outage shall be scheduled minimum 48 hours in advance.

END OF SECTION 26 00 00

SECTION 27 01 00 – COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

- A. Drawings and general provisions of the Contract, Including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.
- B. Include all labor, materials, tools, transportation, storage costs, excavation, training, equipment, insurance, temporary protection, permits, inspections, taxes and all necessary and related items required to provide a complete and operational communications system as shown on the Drawings and described in the Specifications.

1.02 RELATED SECTIONS

- A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.
- B. Related Sections:
 - 1. Section 27 08 00: Commissioning of Communications
 - 2. Section 27 11 00: Communications Equipment Room Fittings
 - 3. Section 27 15 00: Communications Horizontal Cabling
 - 4. Section 27 13 00: Communications Backbone Cabling
 - 5. Section 28 00 00: Common Work Results for Electronic Safety & Security.
 - 6. Section 28 05 28: Conduits and Backboxes for Electronic Safety and Security.
 - 7. Section 28 28 00: Video Surveillance System
- C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.03 QUALITY ASSURANCE

- A. The Contractor installing communications cabling and termination equipment must have a minimum of (5) years experience installing telecommunications systems of similar size and scope.
- B. The Contractor must be licensed by the Nevada State Contractors Board.
- C. Formal, written evidence of the following may be requested at any point during the Bid or installation processes:
 - 1. The Contractor, including any subcontractor, must have BICSI® Registered Installers and Technicians on staff and assign them to the current Project. The project shall be staffed at all times by Installers and Technicians who, in the role of lead crafts persons, shall be able to provide leadership and technical resources for the remaining crafts persons on the project.
 - 2. If requested, the Contractor, including any subcontractor, shall show proven expertise in the implementation of cabling projects. This expertise can be illustrated through the inclusion of details of at least three projects involving the design and installation of Category 6 unshielded twisted-pair cabling systems and optical fiber cabling systems within the past two year period. Names, addresses, and telephone numbers of references for the three projects shall be included.

3. The Contractor must be certified by Belden/CDT, CommScope or approved equal in order to provide a 20 to 25 system warranty for the horizontal Category 6 cabling. The Contractor shall perform all necessary training from the manufacturer to obtain the manufacturer certification and system warranty.
4. In the event subcontractors are used for any portion of the installation or acceptance testing, the Contractor shall be responsible for any subsequent corrective action required on that portion of the work.

1.04 SUBMITTALS

A. Manufacturer Product Data Sheets

1. Submit product data sheets in electronic PDF (portable document format).
2. Provide table of contents for each submittal indicating the items being submitted. Products listed in the table of contents should be in the same order as they appear in the Specifications.
3. Provide product data sheets for all items listed in each specification section. Partial submittals will not be accepted.
4. Where product data sheets include more than one distinct item, clearly mark data sheet with arrow or other identifying means to indicate the items being submitted for approval. Delete or cross-out all non-applicable data.

B. Cable Test Reports

1. Submit test reports signed and dated by the technician performing the cable testing.

C. Cable Warranty

1. Submit manufacturer cabling warranty at the completion of the project.

1.05 REGULATIONS AND CODE COMPLIANCE

- A. The Contractor will comply with all applicable governmental regulations including Federal, State, City, and Local applicable codes and ordinances.
- B. References to codes and standards called for in the Specifications refer to the latest edition, amendments, and revisions to the codes and standards in effect on the date of these Specifications.
- C. All work and materials shall conform to and be installed, inspected and tested in accordance with the governing rules and regulations of the telecommunications industry, as well as federal, state and local governmental agencies, including, but not limited to the following:

1. ANSI/TIA-568.0-E: Generic Telecommunications Cabling for Customer Premises (Revision E, March 2020).
2. ANSI/TIA-568.1-E: Commercial Building Telecommunications Infrastructure Standard (Revision E, March 2020).
3. ANSI/TIA-568.2-D: Balanced Twisted-Pair Telecommunications Cabling And Components Standards (Revision D, September 2018).
4. ANSI/TIA-568.3-D: Optical Fiber Cabling and Component Standard (Revision D, October 2016).
5. ANSI/TIA-569-E: Telecommunications Pathways and Spaces (Revision E, May 2019)
6. ANSI/TIA-598-D: Optical Fiber Cable Color Coding (Revision D, July 2014).

7. ANSI/TIA-606-D: Administration Standard for Telecommunications Infrastructure (Revision D, October 2021).
8. ANSI/TIA-607-D: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises (Revision D, July 2019).
9. ANSI/TIA-758-B: Customer-Owned Outside Plant Telecommunications Infrastructure Standard (Revision B, March 2012).
10. ANSI TIA-526-7-A: Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant (Revision A, July 2015).
11. ANSI/TIA-1152-A: Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling (Revision A, November 2016).
12. ANSI/NFPA-70, 2017 -- National Electrical Code (NEC).
13. Underwriter's Laboratories, Inc. (UL).
14. Federal Communications Commission (FCC).
15. Americans with Disabilities Act (ADA).

1.06 DEFINITIONS

- A. Accessible Ceiling: Space above a ceiling constructed of removable tiles (clipped or unclipped). Acoustical ceiling grid with removal tiles would be considered an accessible ceiling. A gypboard ceiling would not be considered an accessible ceiling.
- B. Approved/Approval: Written permission to use a material or system.
- C. As Called For: Materials, equipment including the execution specified/shown in the Specifications.
- D. Code Requirements: Minimum requirements.
- E. Concealed: Work installed in pipe and duct shafts, chases or recesses, inside walls, above ceilings, in slabs or below grade.
- F. Exposed: Work not identified as concealed.
- G. Final Acceptance: Owner acceptance of the project from the Contractor upon certification by the Owner's Representative.
- H. Furnish: Supply and deliver to installation location.
- I. Furnished by Others: Receive delivery at job site or where called for and install.
- J. Inspection: Visual observations by Owner or Owner's Representative.
- K. Install: Mount and connect equipment and associated materials ready for use.
- L. Listed: Refers to classification by a standards agency.
- M. Or Approved Equal: Approved equal or equivalent as determined by Owner or Owner's Representative.
- N. Owner's Representative: Design professional or Consultant representing the Owner.
- O. Provide: Furnish, install and connect ready for use.
- P. Relocate: Disassemble, disconnect, and transport equipment to new locations: then clean, test, and install ready for use.

- Q. Replace: Remove and provide new item.
- R. Review: A general contractual conformance check of specified products.
- S. Satisfactory: As specified in Specifications.

1.07 INTENT OF DRAWINGS

- A. All drawings are diagrammatic unless otherwise noted as detailed dimensioned drawings. Drawings show approximate locations of equipment and devices. Exact locations are subject to the approval of the Owner or Owner's Representative. The Contractor shall verify dimensions and shall be responsible for their accuracy
- B. Items mentioned in the Specifications and not shown in the Drawings, or shown in the Drawings and not mentioned in the Specifications, shall be of like effect as if shown and mentioned in both. In the case of differences between the Drawings and the Specifications, the stricter provision as determined by the Owner or Owner's Representative shall govern.
- C. Omissions from the Drawings or Specifications, or the incorrect description of details of Work which are necessary to carry out the intent of the Drawings and Specifications, or work which is customarily performed, shall not relieve the Contractor from performing such omitted or incorrectly described work.
- D. No exclusion from, or limitations in, the language used in the Project Documents shall be interpreted as meaning that ancillary or accessory items necessary to complete any required system or item of equipment are to be omitted.

1.08 REVIEW OF SPECIFICATIONS

- A. The Contractor shall carefully study and compare the Drawings and Specifications. Any error, inconsistency or omission discovered shall be immediately reported to the Owner or Owner's Representative. If the Contractor performs any construction activity knowing it involves a recognized error, inconsistency or omission without such notice to the Owner or Owner's Representative, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the cost for any correction.

1.09 EXAMINATION OF THE PREMISES

- A. The Contractor shall visit the Site to become familiar with the local conditions under which the work is to be performed and correlate the observations with the requirements of the Drawings and Specifications. No allowance will be made for claims of concealed conditions which the Contractor learned or should have learned in exercising due diligence in its observations of the site and review of the local conditions.
- B. Before ordering any materials or performing any work, the Contractor shall coordinate the installation with the work of other trades and shall verify all measurements. No extra charge or compensation will be allowed for duplicate work or material required because of an unverified difference between an actual dimension and the measurement indicated in the Drawings. Any discrepancies found shall be submitted in writing to the Owner or Owner's Representative for consideration before proceeding with the work.

1.10 COORDINATION OF TELECOM CABLING PATHWAYS AND TELECOM EQUIPMENT ROOMS

- A. The telecom drawings are diagrammatic in depicting the routing of communications pathways and the layout of communications equipment.

- B. The contractor shall coordinate the installation of all telecom work with the work of other trades including Mechanical, Electrical, Plumbing, Sprinkler, Structural and Architectural.
- C. Prior to the installation of telecom cabling pathways including conduit, j-hooks, sleeves, etc., the contractor shall coordinate the routing of this pathway to avoid conflicts with and provide necessary clearances from the work of other trades. The contractor shall provide all horizontal offsets, vertical offsets and radius bends as necessary to coordinate the routing of the telecom pathway with the work of other trades and building structure.

1.11 WARRANTY

- A. The horizontal Category 6 cabling system including cabling, patch panels, jacks and faceplates shall carry a minimum fifteen (15) year manufacturer warranty from Belden/CDT, Berk-Tek/Leviton, CommScope or approved equal.

PART 2 – PRODUCTS

2.01 EQUIPMENT AND MATERIALS MINIMUM REQUIREMENTS

- A. All materials, unless otherwise specified, shall be new and be the standard products of the manufacturer. Used equipment or damaged material will be rejected.
- B. The listing of a manufacturer as “acceptable” does not indicate acceptance of a standard or cataloged item of equipment. All equipment and systems must conform to the Specifications.

2.02 WORKMANSHIP, SUBSTITUTIONS, WARRANTY

- A. Materials and workmanship shall meet or exceed industry standards and be fully guaranteed for a minimum of one (1) year from the date of final acceptance. Cable integrity and associated terminations shall be thoroughly inspected, fully tested and guaranteed free from defects, transpositions, open shorts, tight kinks, damaged jacket insulation, etc.
- B. Refer to the individual Division 27 Specifications for additional and/or extended warranty requirements.
- C. All labor must be thoroughly competent, skilled and trained, and all work shall be executed in strict accordance with the best practice of the trades.
- D. The Contractor shall be responsible for and make good, without expense to the Owner, any and all defects arising during this warranty period that are due to imperfect materials, improper installation or poor workmanship.
- E. After the Contract is awarded, requests to substitute for specified materials shall be submitted by the Contractor to the Owner or Owner’s Representative within thirty (30) days, complete with reasons for the substitution and savings which accrue to the Owner if the substitutions are approved. Substitutions after Contract award will be considered only if the substitutions are equal or superior to the products specified.
- F. No material substitutions will be allowed except by written acceptance from the Consultant. Specified catalog numbers are used for description of equipment and standard of quality only. Equivalent material will be given consideration only if adequate

comparison data including samples are provided.

- G. Approval of alternate or substitute equipment or material in no way voids the Specification requirements.
- H. Under no circumstances shall the Owner be required to prove that an item proposed for substitution is not equal to the specified item. It shall be mandatory that the Contractor submit to the Owner or Owner's Representative all evidence to support the contention that the item proposed for substitution is equal to the specified item. The Owner's decision as to the equality of substitution shall be final and without further recourse.

2.03 FACTORY ASSEMBLED PRODUCTS

- A. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for the final assembled unit.
 - 1. All components of an assembled unit need not be products of the same manufacturer.
 - 2. Component parts, which are alike, shall be from a single manufacturer.
 - 3. Components shall be compatible with each other and with the total assembly for the intended service.
 - 4. Components of equipment shall bear the manufacturer's name or trademark model number and serial number on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.
- B. Major items of equipment that serve the same function must be the same make and model.
- C. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that a complete and fully operational system will result.
- D. Maximum standardization of components shall be provided to reduce spare part requirements.

PART 3 – EXECUTION

3.01 ROUGH-IN

- A. Before construction work commences, the Contractor shall visit the site and identify the exact routing of horizontal cable pathways.
- B. All equipment locations and cabling pathway shall be coordinated with other trades and existing conditions to eliminate interference with required clearances for equipment maintenance and inspections.
- C. Provide easy, safe and code mandated clearances at equipment racks and enclosures.

3.02 CUTTING, CORING AND PATCHING

- A. The Contractor shall be responsible for all cutting, patching, coring and associated work to complete the communications cabling pathway system.

- B. Protect existing finishes from water damage during core/cutting work and cleanup all related water and debris. Patch adjacent work disturbed by installation of new work including insulation, walls and wall covering, ceiling and floor covering or other finished surfaces.
- C. Contractor to submit all proposed concrete wall or floor penetrations to the Structural Engineer for approval prior to performing the work. Contractor shall locate and avoid cutting concrete reinforcing steel using current x-ray or pachometer equipment.

3.03 FIRESTOPPING

- A. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate fire stop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire stopped.
- B. Firestopping assemblies shall meet or exceed the rating of the wall or floor being penetrated.
- C. Fire stopping References:
 - 1. ASTM E814, Standard Method of Fire Tests of Through-Penetration Fire Stops.
 - 2. ASTM E 119, Fire Tests of Building Construction and Materials (for fire-rated architectural barriers).
 - 3. 2002 NFPA National Electrical Code, Section 800-52, Paragraph 2(b), Spread of Fire and Products of Combustion.

3.04 CONCEALMENT

- A. Telecom cabling pathways including conduit, j-hooks and sleeves shall be concealed above ceilings, in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, or in areas without ceilings, the Owner's Representative shall be notified of the proposed routing prior to starting that portion of the work.
- B. All telecom cabling must be routed concealed above accessible ceilings or in conduit. No exposed telecom cabling is permitted with the exception of telecom cabling routed within the telecom rooms.
- C. All exposed conduit shall be painted to match adjacent surfaces.

3.05 CONDUIT SEALING

- A. The Contractor shall seal all foundation penetrating conduits and all service entrance conduits and sleeves to eliminate the intrusion of moisture, gases and rodents into the building. This requirement also applies to spare conduits.
- B. Spare conduits shall be plugged with expandable plugs.
- C. All service entrance conduits shall be sealed or resealed after cable installation.

3.06 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate ordering and installation of all equipment with long lead times or having a major impact on work by other trades so as not to delay the job or impact the schedule.

- B. Where mounting heights are not dimensioned, install systems, materials and equipment to provide the maximum headroom possible.
- C. Set all equipment to accurate line and grade, level all equipment and align all equipment components.
- D. Provide all scaffolding, rigging, hoisting and services necessary for erection and delivery of equipment and apparatus furnished into the premises.
- E. No equipment shall be hidden or covered up prior to inspection by the Owner's Representative. All work that is determined to be unsatisfactory shall be corrected immediately.
- F. All work shall be installed level and plumb, parallel and perpendicular to other building systems and components.
- G. The Contractor shall replace all ceiling tiles damaged by work performed as part of the communications contract.
- H. Storage and security of material and equipment shall be the responsibility of the Contractor.

END OF SECTION 27 01 00

SECTION 27 08 00 – COMMISSIONING OF COMMUNICATIONS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

- A. Drawings and general provisions of the Contract, Including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.
- B. The Contractor shall provide all equipment, materials, labor, and services necessary to complete the testing, labeling and documentation of the telecom cabling system in compliance with requirements stated or reasonably inferred by the Specifications and the Contract Drawings.
- C. This section includes the minimum requirements for the testing, identification and administration for the telecommunications cabling system, including the following:
 - 1. Testing
 - a. Category 6 Cable Test Equipment and Test Procedures.
 - b. Fiber optic cable test equipment and test procedures.
 - c. Cable test reports.
 - 2. Identification
 - a. Labeling of work area outlet faceplates and jacks.
 - b. Labeling of horizontal CAT 6 data cabling.
 - c. Labeling of Copper CAT 6 Patch Panels.
 - d. Labeling of fiber optic patch panels.
 - e. Labeling of fiber backbone cable.
 - f. Labeling of racks and cabinets.

1.02 RELATED SECTIONS

- A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.
- B. Related Sections:
 - 1. Section 27 01 00: Common Work Results for Communications.
 - 2. Section 27 11 00: Communications Equipment Room Fittings
 - 3. Section 27 15 00: Communications Horizontal Cabling
 - 4. Section 27 13 00: Communications Backbone Cabling
 - 5. Section 28 00 00: Common Work Results for Electronic Safety & Security.
 - 6. Section 28 05 28: Conduits and Backboxes for Electronic Safety and Security.
 - 7. Section 28 28 00: Video Surveillance System
- C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.03 REGULATIONS AND CODE COMPLIANCE

- A. Materials and work specified herein shall comply with the requirements of Specification Section 27 01 00 and in particular the following standards and code requirements:

1. ANSI/TIA-568.0-E: Generic Telecommunications Cabling for Customer Premises (Revision E, March 2020).
2. ANSI/TIA-568.1-E: Commercial Building Telecommunications Infrastructure Standard (Revision E, March 2020).
3. ANSI/TIA-568.2-D: Balanced Twisted-Pair Telecommunications Cabling And Components Standards (Revision D, September 2018).
4. ANSI/TIA-568.3-D: Optical Fiber Cabling and Component Standard (Revision D, October 2016).
5. ANSI/TIA-606-D: Administration Standard for Telecommunications Infrastructure (Revision D, October 2021).
6. ANSI TIA-526-7-A: Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant (Revision A, July 2015).
7. ANSI/TIA-1152-A: Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling (Revision A, November 2016).
8. Underwriter's Laboratories, Inc. (UL).

1.04 SUBMITTALS

- A. Test Equipment: Submit manufacturers' catalog sheets and specifications for the following cable testers
 1. Category 6 cable tester.
 2. Singlemode fiber optic cable tester.
- B. Calibration Reports: Provide calibration reports for all test equipment to be used on the Project. The calibration must have been performed by a manufacturer certified calibration facility and be dated no more than 60 days prior to the start of testing.
- C. Cable Test Reports: Provide test reports in PDF format for all cables signed by the technician performing the cable testing. Include Manufacturers data sheets for the cabling being tested.
- D. Labels: Submit manufacturer's data sheets on the type of labels to be used for each labeling application.

PART 2 – PRODUCTS

2.01 HORIZONTAL CATEGORY 6 UNSHIELDED TWISTED-PAIR CABLE TESTER

- A. Cable tester shall comply with the requirements of ANSI/TIA-1152.
- B. Cable tester shall perform all tests necessary to certify the horizontal Category 6 UTP cabling in accordance with ANSI/TIA 568 C.2.
- C. Shall be a UL certified Level III test set calibrated by a manufacturer certified calibration facility. The calibration shall be dated no more than 60 days prior to the start of testing.
- D. Acceptable Manufacturers
 1. Fluke Networks
 2. Ideal Industries
 3. Agilent Technologies
 4. Or equal.

2.02 SINGLEMODE OPTICAL FIBER CABLE TESTER

- A. Tier 1 certification is defined as the measurement of the total insertion loss, length, and polarity of the optical cable cabling from one end of the link to the other. The test equipment used is a 'combined' optical power meter and light source called an OLTS or Optical Loss Test Set.
- B. Test Reference Cables (TRCs) minimum standards; 2.8-3.0 OD jacketing, zirconia ceramic UPC LC ferrule < 0.25 dB IL (insertion loss) and > 0.50 RL (reflection loss).
- C. Tier 2 optical fiber testing includes Tier 1 OLTS testing and is used to define the graphical precise characterization of the fiber link. The tester used for Tier 2 testing is an OTDR or Optical Time Domain Reflectometer.
- D. When using an OTDR, use only high-quality, low-loss, dual launch boxes having the same optical cable and connectors being tested and are required at both transmit and receiving ends.
- E. Both Tier 1 and Tier 2 testing shall be bi-directional and dual wavelengths (1310 & 1550 nm).
- F. The tester shall be capable of performing the tests required by ANSI/TIA-568.1-E, ANSI/TIA-568.3-D, ANSI/TIA-526-7A and TR 42.11.
- G. The software calibration date shall be current throughout the testing phase of the project and be stated in the test results documentation or by hard copy from the manufacturer.
- H. The tester set-up should include the application to support QSFP28-100GBase-LR4 (IEEE 802.3 bm).
- I. Acceptable Manufacturers
 - 1. Agilent Wirescope
 - 2. AEM
 - 3. AFL
 - 4. EXFO
 - 5. FIS
 - 6. Fluke Networks
 - 7. Fujikura
 - 8. Ideal Industries
 - 9. Jonard
 - 10. Softing/WireXpert
 - 11. VIAVI
 - 12. Or equal.

2.03 LABELS

- A. Labels shall be laser printed and shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.
- B. Acceptable manufacturers
 - 1. Brady
 - 2. Brother
 - 3. HellermannTyton.
 - 4. Panduit

5. Or approved equal

2.04 WORK AREA OUTLET FACEPLATE LABELS

- A. Label each port in each faceplate in accordance with Labeling Scheme identified on the Drawings. Label must be machine printed and inserted in the faceplate label window. Labels shall be provided by the faceplate manufacturer (Belden/CDT, CommScope, or approved equal).

2.05 HORIZONTAL CABLE SHEATH LABELS

- A. Label horizontal cable sheaths at work area outlets and at patch panels with laser printed self laminating wrap around vinyl labels. Labels shall be in accordance with the Labeling Scheme identified on the drawings.
- B. Labels shall be white with black type. Label size shall be 1.0" wide by 1.5" high.
- C. At the Telecom Room, cable labels will be affixed to cable a minimum of 1 inch from the termination on the patch panel, and placed in such a way as to be clearly visible.
- D. At the work area outlet, cable labels shall be affixed to the cable 2 inches from the termination on the jack.
 1. Acceptable Manufacturers:
 - a. Brady
 - b. Brother
 - c. HellermannTyton.
 - d. Panduit
 - e. Or approved equal

2.06 COPPER PATCH PANEL LABELS.

- A. Label each patch panel with a single panel ID label in accordance with the labeling scheme identified on the drawings.
- B. Labels shall be compatible with the patch panels provided for the Project.
- C. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.5" wide by 0.5" high.
 1. Acceptable Manufacturers:
 - a. Brady
 - b. Brother
 - c. HellermannTyton.
 - d. Panduit
 - e. Or approved equal
- D. Label each patch panel port with a laser printed label. Label each port with the room number of the room housing the work area outlet.
- E. Labels shall be compatible with the patch panels provided for the Project.
- F. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.375" high.

1. Acceptable Manufacturers:
 - a. Brady
 - b. Brother
 - c. HellermannTyton.
 - d. Panduit
 - e. Or approved equal

2.07 EQUIPMENT ROOM FIBER OPTIC TERMINATION CABINET LABELS

- A. Label each FiberExpress chassis in accordance with the labeling scheme identified on the drawings. Label with a single panel ID label.
- B. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.5" wide by 0.5" high.
 1. Acceptable Manufacturers:
 - a. Brady
 - b. Brother
 - c. HellermannTyton.
 - d. Panduit
 - e. Or approved equal
- C. Label fiber modules in accordance with the labeling scheme identified on the drawings. Labels shall be affixed to the fiber termination cabinet directly on the Plexiglas front cover so labels will be visible when the cover is closed. Each label will indicate the exact location and position of the cable's far end according to the Backbone Cable Labeling Scheme.
- D. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.5" high.
 1. Acceptable Manufacturers:
 - a. Brady
 - b. Brother
 - c. HellermannTyton.
 - d. Panduit
 - e. Or approved equal
- E. Label each Connector Module with its Slot in accordance with the labeling scheme identified on the drawings.
- F. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.5" wide by 0.5" high.
 1. Acceptable Manufacturers:
 - a. Brady
 - b. Brother
 - c. HellermannTyton.
 - d. Panduit
 - e. Or approved equal

2.08 EQUIPMENT RACK LABELS

- A. Provide labels on the top angle of all equipment racks. Labels shall in accordance with the labeling scheme identified on the drawings.
- B. Racks shall be labeled with Space ID and Rack ID.
- C. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 1.0" high.
 - 1. Acceptable Manufacturers:
 - a. Brady
 - b. Brother
 - c. HellermannTyton.
 - d. Panduit
 - e. Or approved equal

2.09 FIBER BACKBONE CABLE SHEATH LABELS

- A. The backbone cable sheaths in the Telecom rooms and at pull boxes shall be labeled. Labels shall be in accordance with the labeling scheme identified on the drawings.
- B. Labels must be clearly visible at the rear of the rack.
- C. Labels shall be self-laminating vinyl labels and must be compatible with the diameter of the backbone cable. Labels shall be 2.5" high by 1.5" wide.
 - 1. Acceptable Manufacturers:
 - a. Brady
 - b. Brother
 - c. HellermannTyton.
 - d. Panduit
 - e. Or approved equal

PART 3 – EXECUTION

3.01 CABLE TESTING – GENERAL

- A. Visually inspect all cables, cable reels, and shipping cartons to detect cable damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.
- B. Where post-manufacture test data has been provided by the manufacturer on the reel or shipping carton, submit copies to the Owner's Representative as part of the cable test results.
- C. The Owner's Representative reserves the right to observe any or all portions of the cable testing process.
- D. Test results and corrective procedures are to be documented and submitted to the Owner's Representative within five (5) working days of test completion.

3.02 CATEGORY 6 UTP CABLE TESTING

- A. A representative of the end-user shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase 5 business days before testing commences.
- B. Field test measurements shall be made in accordance with Annex I of TIA 568-C.2 unless otherwise noted.
- C. Field test measurements shall be conducted from 1 MHz to 250 MHz.
- D. Field testing shall be conducted using a level III tester. The accuracy of the level III tester shall meet or exceed the requirements of ANSI/TIA-1152. The tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.
- E. Every cabling link shall be tested in accordance with the TIA 568-C.2 Annex C: "Cabling and Component Test Procedures".
- F. The installed twisted-pair horizontal links shall be tested from the patch panel in the telecommunications room to the work area outlet. The cable must pass the "Permanent Link" performance limits specification as defined in TIA 568-C.2 Section 6.3.
- G. 100% of the installed cabling links must be tested and must pass the requirements of the standards mentioned above. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation.
- H. Trained technicians who have successfully attended an appropriate training program shall execute the tests. Appropriate training programs include but are not limited to installation certification programs provided by BICSI or the ACP (Association of Cabling Professionals).
- I. A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester. The field tester manufacturer must provide documentation as an aid to interpret results marked with asterisks. (Reference TIA-568-C.2; Annex I: Section I.2.2).
- J. The Contractor shall provide Category 6, 250 MHz channel test results on all pairs of cable. The following minimum field test parameters are required:
 - 1. Wire map (including cable shield if present).
 - 2. Length.
 - 3. Insertion loss.
 - 4. Near-end crosstalk (NEXT) loss.
 - 5. Power sum near-end crosstalk (PSNEXT) loss.
 - 6. Equal-level far-end crosstalk (ELFEXT).
 - 7. Power-sum equal-level far-end crosstalk (PSELFEXT).
 - 8. Return loss.
 - 9. Propagation delay.
 - 10. Delay skew.
- K. Test results shall be provided in electronic format and printed 8.5" x 11" format signed by the technician performing the testing. The electronic format should be a Microsoft Word .doc file. Along with the above test parameters, the following information must be included for each cable tested:

1. Name of Owner and name of project (building name).
2. Date and time of test.
3. Name of technician performing the field testing.
4. Manufacturer, model number, serial number and software revision of field tester.
5. Cable ID (Telecom Room # - Patch Panel # - Port # / Work Area Room # - Telecom Outlet – Jack #).
6. Overall Pass/Fail result.
7. Manufacturer, category and model number of cable.
8. NVP used to determine cable length.

3.03 SINGLEMODE OPTICAL FIBER CABLE TESTING

- A. A representative of the end-user shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase 5 business days before testing commences.
- B. 100% of the installed fiber strands shall be tested and must pass the field test specifications defined by the Telecommunications Industry Association (TIA) standards ANSI/TIA-568.1-E, ANSI/TIA-568.3-D and ANSI/TIA-526-7-A. Any failing fiber strands must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation.
- C. Trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof shall execute the tests. These certificates may have been issued by any of the following organizations or an equivalent organization:
 1. The manufacturer of the fiber optic cable and/or the fiber optic connectors.
 2. The manufacturer of the test equipment used for the field certification tests.
 3. Training organizations authorized by BICSI or by the ACP (Association of Cabling Professionals™) Cabling Business Institute.
- D. Field test instruments for multimode fiber cabling shall meet the requirements of ANSI/TIA-526-7A. The light source shall meet the launch requirements of ANSI/TIA-455-50B, Method A. This launch condition can be achieved either within the field test equipment or by use of an external mandrel wrap (as described in clause 11 of ANSI/TIA-568-1-E) with a Category 1 light source. Field test instruments for singlemode fiber cabling shall meet the requirements of ANSI/TIA-526-7-A.
- E. The tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.
- F. The fiber optic launch cables and adapters must be of high quality and the cables shall not show excessive wear resulting from repetitive coiling and storing of the tester interface adapters. Test Reference Cables (TRCs) minimum standards; 2.8-3.0 OD jacketing, zirconia ceramic UPC LC ferrule < 0.25 dB IL (insertion loss) and >0.50 RL (reflection loss).
- G. A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter.
- H. Performance Test Parameters:

1. Singlemode backbone links shall be tested at 1310 nm and 1550 nm in accordance with ANSI/TIA-526-7-A, Method A.1, One Reference Jumper or equivalent method.
2. The link attenuation shall be calculated by the following formulas specified in ANSI/TIA-568.3-D.

Link Attenuation = Cable Attenuation + Connector Insertion Loss + Splice Insertion Loss

Where:

Cable Attenuation(dB) = Attenuation Coefficient(dB/Km) x Length(km)

Connector Insertion Loss(dB) = # of connector pairs x connector loss(dB)

Splice Insertion loss(dB) = # of splices(S) x splice loss(dB)

The values for the Attenuation Coefficient are listed in the following table below:

Wavelength	OSI (ISP)	OS1A (ISP OS2)	OS2 (OSP)
1310 nm	1.0 dB/km	0.4 dB/km	0.4 dB/km
1310 nm	0.3 dB/Mft	0.12 db/Mft	0.12 dB/Mft
1550 nm	1.0 dB/km	0.4 dB/km	0.4 dB/km
1550 nm	0.3 dB/Mft	0.12 db/Mft	0.12 dB/Mft

3. Maximum insertion loss (IL) per mated pair is 0.35 dB and 0.02 dB per fusion (only) splice.
 - I. The Contractor shall test all fiber optic cables and provide test results in electronic PDF format signed by the technician performing the testing. The following field test documentation shall be provided for each fiber optic strand:
 1. Wavelength of test (1310 nm or 1550 nm for Singlemode)
 2. Length of segment.
 3. Number of splices.
 4. Link attenuation (for each wavelength).
 5. Overall Pass/Fail result.
 6. Margin by which the strand passed the test (difference between the allowable link attenuation and the measured link attenuation).
 7. Name of Owner and name of project (building name).
 8. Date and time of test.
 9. Name of technician performing the field testing.
 10. Manufacturer, model number, serial number and software revision of field tester.
 11. Cable ID (Telecom Room # - Patch Panel # - Port # / Telecom Room # - Patch Panel # - Port #. Telecom Outlet – Jack #).
 12. Manufacturer, model number of cable, type of cable and strand count.

3.04 IDENTIFICATION AND LABELING

- A. The Contractor shall confirm the telecom room and work area room numbers with the Owner or Owner's Representative prior to labeling.
- B. Work Area Outlet Face Plates: Label all faceplates in sequential order in a clockwise manner from the main entrance of the room containing the cable drops starting with the

number one "1". This numbering scheme will reset in each room. For example, Telecom Outlet 2 in Room 102 = "102-2".

- C. Work Area Data and Voice Jacks: Each data and voice jack at the work area outlet shall be labeled. The label shall identify the name of the telecom room from which the drop originated, the letter of the patch panel where the drop is terminated and the patch panel port number. For example, Telecom Room "150", Patch Panel "B", Patch Panel Port 48 = "150-B-48".
- D. Work Area Horizontal Data, Voice and Video Cable: Horizontal cable should be labeled at both ends within 6" of the point of termination. At the workstation outlet, the label shall identify the name of the telecom room from which the drop originated, the letter of the patch panel where the drop is terminated and the patch panel port number. For example, Telecom Room "150", Patch Panel "B", Patch Panel Port 48 = "150-B-48".
- E. Telecom Room Horizontal Data, Voice and Video Cable: At the patch panel, the label shall identify the name of the room in which the drop is terminated, the Outlet number in the room, and the jack number within the telecom outlet plate. For example, Room 102, Telecom Outlet 2, Jack 3 = "102-2-3".
- F. Patch Panels: Each patch panel in the telecom room shall have an alpha label (A-Z) located on the left hand side of the panel. Patch panel "A" shall be located at the top of the first rack in the telecommunications room. Patch panels beneath patch panel "A" shall be labeled B, C, etc. If additional patch panels are present in additional racks in the wiring closet, the patch panels adjacent to the left-most rack (when facing the racks) shall continue the sequential labeling beginning with the patch panel at the top of the next rack. The lettering scheme will reset in each telecom room. For example, Telecom Room 150, Rack 1, Patch Panel B = "B".
- G. Patch Panel Ports: Each port shall be labeled with the name of the room in which the drop is terminated, the outlet number in the room, and the jack number within the telecom outlet plate. For example, Room 102, Telecom Outlet 2, Jack 3 = "102-2-3".
- H. Fiber Termination Cabinets: Each termination cabinet in the telecom rooms shall have an alpha label (A-Z) located on the left hand side of the cabinet. Termination cabinet "A" shall be located at the top of the first rack in the telecommunications room. Termination cabinets beneath cabinet "A" shall be labeled B, C, etc. If additional cabinets are present in additional racks in the telecom room, the cabinets adjacent to the left-most rack (when facing the racks) shall continue the sequential labeling beginning with the cabinet at the top of the next rack. The lettering scheme will reset in each telecom room. For example, Telecom Room 150, Rack 2, Fiber Patch Panel A = "A".
- I. Fiber Termination Cabinets: Each multiport panel or cassette shall be labeled with the name of the telecom room in which the opposite end of the cable is terminated, the letter of the termination cabinet and the port number. For example, telecom room 150, Fiber Patch Panel A, port 10 = "150-A-10".
- J. Backbone Cables: Backbone cables shall be marked at each endpoint and at all intermediate pull/access points, junction boxes or splices. Labels shall indicate origination and destination telecommunications rooms, the pair count and the type of cable (U=UTP, MM=Multimode, SM=Singlemode). For example, 200-pair copper cable from the MDF to telecom room 150 = "MDF-150-200PR-U".
- K. Equipment Racks and Cabinets: Open racks shall be labeled on the top angle. Cabinets shall be labeled at the top of the door. Racks and cabinets shall be numbered sequentially within in each telecom room starting with the number 1. The numbering

February 20, 2023
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Douglas County Judicial Law Enforcement Center & Stateline Jail
Video Surveillance System Upgrade

scheme will reset in each telecom room. Rack 1 will be located in the 1st rack row adjacent to the wall. For example, telecom Room 150, 1st Rack = "RACK 1".

END OF SECTION 27 08 00

SECTION 27 11 00 – COMMUNICATION EQUIPMENT ROOM FITTINGS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

- A. Drawings and general provisions of the Contract, Including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.
- B. The Contractor shall provide all equipment, materials, labor, and services necessary to complete communication equipment rooms and spaces, and to ensure that they are in compliance with requirements stated or reasonably inferred by the Specifications and the Contract Drawings.
- C. Minimum requirements and installation methods are included for the following:
 - 1. Enclosed Floor Standing Equipment Cabinet (45 RU) – Stateline Jail
 - 2. Enclosed Wall Mounted Equipment Cabinet (19 RU) – JLEC Admin Bldg
 - 3. NEMA 4X Outdoor Equipment Cabinet – JLEC Secured Parking Area
 - 4. Concrete Expansion Anchors
 - 5. Category 6 Copper Patch Panels
 - 6. Category 6 Copper Patch Cords
 - 7. Category 6 Entrance Terminals with Primary Protector Modules
 - 8. Rack Mounted Optical Fiber Termination Cabinets
 - 9. Optical Fiber Patch Cords
 - 10. Wall Mounted “Re-closeable” Fiber Optic Cable Storage Rings
 - 11. Velcro Cable Ties
 - 12. Grounding Bars and Ground Conductors
 - 13. 120V Rack Mounted Uninterruptible Power Supplies
 - 14. IP Management Modules for Uninterruptible Power Supplies

1.02 RELATED SECTIONS

- A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.
- B. Related Sections:
 - 1. Section 27 01 00: Common Work Results for Communications.
 - 2. Section 27 08 00: Commissioning of Communications
 - 3. Section 27 15 00: Communications Horizontal Cabling
 - 4. Section 27 13 00: Communications Backbone Cabling
 - 5. Section 28 00 00: Common Work Results for Electronic Safety & Security.
 - 6. Section 28 05 28: Conduits and Backboxes for Electronic Safety and Security.
 - 7. Section 28 28 00: Video Surveillance System
- C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.03 REGULATIONS AND CODE COMPLIANCE

- A. Materials and work specified herein shall comply with the requirements of Specification Section 27 01 00 and in particular the following standards and code requirements:

1. ANSI/TIA-568.0-E: Generic Telecommunications Cabling for Customer Premises (Revision E, March 2020).
2. ANSI/TIA-568.1-E: Commercial Building Telecommunications Infrastructure Standard (Revision E, March 2020).
3. ANSI/TIA-568.2-D: Balanced Twisted-Pair Telecommunications Cabling And Components Standards (Revision D, September 2018).
4. ANSI/TIA-569-E: Telecommunications Pathways and Spaces (Revision E, May 2019)
5. ANSI/TIA-606-D: Administration Standard for Telecommunications Infrastructure (Revision D, October 2021).
6. ANSI/TIA-607-D: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises (Revision D, July 2019).
7. ANSI/NFPA-70, 2017 -- National Electrical Code (NEC).
8. Underwriter's Laboratories, Inc. (UL).

1.04 QUALITY ASSURANCE

- A. All cable, raceways and equipment in the telecom rooms shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the Specifications shall be subject to the control and approval of the Owner's Representative.

1.05 SUBMITTALS

- A. Manufacturer's Data Sheets: Submit manufacturer's data sheets in PDF format for the following items:
 1. Enclosed Floor Standing Equipment Cabinets (45 RU)
 2. Enclosed Wall Mounted Equipment Cabinets (19 RU)
 3. Concrete Expansion Anchors
 4. Category 6 Copper Patch Panels
 5. Category 6 Copper Patch Cords
 6. Category 6 Entrance Terminals with Primary Protector Modules
 7. Rack Mounted Optical Fiber Termination Cabinets
 8. Optical Fiber Patch Cords
 9. Wall Mounted "Re-closeable" Fiber Optic Cable Storage Rings
 10. Velcro Cable Ties
 11. Grounding Bars and Ground Conductors
 12. 120V Rack Mounted Uninterruptible Power Supplies
 13. IP Management Modules for Uninterruptible Power Supplies
 14. 120V Rack Mounted Horizontal Plug Strips

1.06 DELIVERY, STORAGE & HANDLING

- A. Protect all wiring blocks, patch panels, jacks and patch cords from moisture, dust and debris prior to installation.

1.07 GUARANTEE

- A. See Specification Section 27 01 00 1.11 for warranty requirements which apply to the patch panels and cabling specified in this section.

PART 2 – PRODUCTS

2.01 ENCLOSED FLOOR STANDING EQUIPMENT CABINETS (45 RU) – STATELINE JAIL

- A. Provide enclosed equipment mounting cabinet in the Property Storage Room where shown on the drawings.
- B. Enclosed cabinet shall meet the following physical specifications:
 - 1. Approx 82.6" high by 27.6" wide by 43.3" deep.
 - 2. Qty (45) rack mounting spaces (RU).
 - 3. Cabinets and mounting rails shall have black powder coat finish.
 - 4. Perforated lockable front door.
 - 5. Perforated lockable double rear doors.
 - 6. Solid side panels.
 - 7. Solid top panel with openings w/grommets for cabling.
 - 8. 2 sets (front and rear) square punched adjustable equipment mounting rails.
 - 9. 2 sets (front and rear) vertical finger cable managers.
 - 10. Qty (100) cage nuts and #12-24 screws for equipment mounting.
- C. Acceptable Products:
 - 1. Chatsworth Teraframe "F" Series Gen 3 Cabinet (CPI P/N's FF2J-113B-C22-B), Finger Cable Managers (CPI P/N 39112-C14), Cage Nuts/Screws (CPI P/N 12639-001).
 - 2. Or approved equal.

2.02 WALL MOUNTED EQUIPMENT CABINETS (19 RU) – JLEC ADMIN BLDG IDF #2

- A. Furnish and install wall mounted telecom cabinets where shown on the. Wall mounted cabinets shall meet the following physical specifications:
 - 1. UL Listed.
 - 2. Approximate dimensions 36" high x 24" wide x 24" deep.
 - 3. Qty (19) 19" rack mounting spaces (19 RU).
 - 4. Wall mount enclosure with solid lockable front door and swing-out rear access to equipment.
 - 5. All doors keyed alike.
 - 6. Steel construction with black epoxy powder coat finish.
 - 7. Qty (1) 4 1/2" ball bearing fan, vent cover and filter.
 - 8. Vertical fingered cable managers on each side of cabinet.
- B. Secure cabinets to walls with 4 lag bolts or equivalent hardware fasteners. Fasteners shall support the full load capacity of the racks. Install wall mounted plywood backboards as necessary to support racks/cabinets.
- C. Acceptable Products:
 - 1. Chatsworth Cube-It P/N 11840-736, Fan Kit P/N 40972-001, 11RU vertical cabling section (pair) qty (1) P/N 40970-711 and 7RU vertical cabling section (pair) qty (1) P/N 40970-707.
 - 2. Or Approved Equal.

2.03 NEMA 4X OUTDOOR EQUIPMENT CABINET (JLEC COVERED PARKING AREA)

- A. Provide stainless steel NEMA 4X equipment cabinet for mounting of industrial POE+ switch at JLEC covered parking area. Equipment cabinet shall have the following physical characteristics:
 - 1. Approximate dimensions: 16" wide x 20" high x 10" deep.

2. NEMA 4X rated.
3. 14 gauge Type 304 or Type 316L stainless steel bodies and doors.
4. Seams continuously welded and ground smooth.
5. Seamless foam-in-place gasket.
6. Rolled lip around three sides of door.
7. Stainless steel door clamp assembly.
8. Hasp and staple for padlocking.

B. Acceptable Products:

1. Hoffman nVent P/N A20H1610SSLP with stainless steel mounting panel P/N A20P16SS6.
2. Or approved equal.

C. Provide Din rail mounted 3-termination module housing for termination of singlemode fiber optic cabling and CAT 6 cabling. Termination module #1 to have qty (6) duplex LC fiber termination modules. Termination modules #2 and #3 to each have qty (4) keystone CAT 6 jacks.

D. Acceptable Products (provide all of the following part numbers):

1. Modular Industrial Patch Panel: Hirschmann/Belden P/N MIPP/CD/1L9N/CCE4/CCE4.
2. Singlemode Fiber Fusion Splice on Connector: Belden P/N FTSLC900FS01.
3. Or approved equal.

2.04 CONCRETE EXPANSION ANCHORS

A. Secure equipment racks and cabinets to the concrete floor with a minimum of four (4) 1/2" diameter concrete expansion anchors. Expansion anchors shall be manufactured of carbon steel with zinc plating.

B. Anchors shall have a minimum concrete embedment depth of 2 3/4" inches.

C. Expansion anchors shall have a minimum allowable pull out strength of 1,800 lbs and a minimum ultimate pull out strength of 7,000 lbs in 3,000 psi concrete.

1. Acceptable manufacturers
 - a. Hilti.
 - b. Red Head.
 - c. Or approved equal.

2.05 CATEGORY 6 COPPER PATCH PANELS

A. Patch panels must meet the specific manufacturer system warranty requirements listed in Specification Section 27 15 00 1.7.

B. Provide 19" rack mounted 48-port or 24-port Category 6 data patch panels as shown on the drawings.

C. Patch panels shall be constructed of black anodized aluminum or black powder coated steel.

D. Patch panels shall have fixed outlet jacks with 110 IDC connectors on the rear of the panel.

- E. Patch panels shall be wired in accordance with the T568B standard.
- F. The same manufacturer will be used for both the patch panels and workstation outlets throughout the Project.
- G. Patch panels shall conform to the performance requirements of ANSI/TIA/EIA–568-B.2 Addendum 1 as shown below.

Parameter	Worst Case Channel Performance at 100MHz
Specified Frequency Range	1-250 MHz
Attenuation	0.2 dB
NEXT	54.0 dB
Return Loss	24.0 dB

- H. Acceptable Products:
 1. Belden CDT GigaFlex PS6+ Category 6 Patch Panel. Belden/CDT AX101613 (48-port) or AX101611 (24-port).
 2. CommScope Uniprise P/N UNP-6-DM-2U-24 (24-port) or UNP-6-DM-2U-24 (48-port).
 3. Or Approved Equal.

2.06 CATEGORY 6 COPPER PATCH CORDS

- A. The patch cords must meet the specific manufacturer system warranty requirements listed in Specification Section 27 15 00 1.7.
- B. Provide Category 6 UTP patch cords for interconnection of owner furnished switches and patch panels.
- C. Provide one (1) CAT 6 patch cord for each CAT 6 data cable drop.
- D. Provide patch cords of adequate length to avoid excessive slack or tightness in the cable managers. Patch cords shall be a minimum of 3'-0" and a maximum of 715'-0" in length.
- E. Patch cords should be white, made from stranded conductors and have 8-position RJ-45 style plugs on each end. Patch cords shall be snagless with molded strain relief boots.
- F. Cabling used for patch cords shall be manufactured by the same manufacturer as the horizontal cabling and shall be of the same product line. Cable shall conform to the requirements of ANSI/TIA/EIA–568-B.2 Addendum 1. Electrical characteristics and performance of the patch cables shall be nearly identical to the horizontal cable with exceptions given due to differences between solid and stranded conductors as indicated in the following table.

Frequency (MHz)	Stranded Conductor Cable Insertion Loss (dB)
1	2.4
4	4.5
8	6.4
10	7.1

16	9.1
20	10.2
25	11.4
31.25	12.8
62.5	18.5
100	23.8
200	34.8
250	39.4

- G. Patch cords shall be rated for use as communications cable and shall have the designation "CM" or "CMR" printed on the jacket.
- H. Work area patch cords and equipment room patch cords shall be identical in construction. See Specification Section 27 15 00 for workstation cord requirements.
- I. Acceptable Products:
 - 1. Belden/CDT GigaFlex PS6+ Modular Cord P/N C601109002 (2 ft), C601109004 (4ft), C601109007 (7 ft).
 - 2. CommScope Uniprise UNCG P/N UC1BBB2-08F003 (3 ft), UC1BBB2-08F007 (7 ft).
 - 3. Or approved equal.

2.07 CATEGORY 6 ENTRANCE TERMINALS WITH PRIMARY PROTECTOR MODULES

- A. Provide CAT 6 building entrance protectors for cabling to outdoor pole mounted cameras.
- B. Bond entrance protectors to ground bar with #6 AWG green insulated bonding conductor.
- C. Surge Protectors shall have the following physical characteristics:
 - 1. UL 497, UL 497A and UL 497B listed for primary, secondary and isolated loop circuit protection.
 - 2. Ultra low capacitance solid state technology providing protection transparent to frequencies up to 250 MHz.
 - 3. Factory loaded with 65V solid state modules.
 - 4. 110 style terminations.
- D. Acceptable Products:
 - 1. Tii Networks (Formally Porta Systems) P/N 606-65 with LVP65 protection modules.
 - 2. Or Approved Equal.

2.08 RACK MOUNTED OPTICAL FIBER TERMINATION CABINETS & MODULAR CASSETTES

- A. Provide 19" rack mounted optical fiber termination cabinets. See rack elevations for quantity, size and port density of panels.
- B. Provide fiber termination cabinets with the following physical characteristics:
 - 1. 1RU (accepts 2 cassettes)
 - 2. Black smoked Plexiglas front cover.

3. Integral cable strain relief clamps.
4. Panels shall accept factory manufactured modular pigtail cassettes with duplex LC connectors. Fusion splicing will occur within splice trays integral to the fiber cassettes. The fiber cassettes will then snap into the termination cabinets.

C. Acceptable Products

1. Corning Cable Systems Closet Connector Housing P/N CCH-01U.
2. Or approved equal.

D. Provide quantity of duplex LC singlemode and multimode factory pre-terminated pigtail splice cassettes to terminate all backbone fiber optic cabling as shown on the drawings. Provide blank adapter panels over unused ports in fiber termination cabinets. Modular cassettes shall have factory installed LC connectors with fiber pigtails. Connectors and pigtails shall match the type of backbone fiber being terminated.

1. Acceptable Products:

- a. 12-Strand (OS2) Single Mode Fiber Pre-terminated Pigtail Cassettes:
 - (1) Corning Cable Systems P/N CCH-CS12-A9-P00RE.
 - (2) Or approved equal.

2.09 OPTICAL FIBER PATCH CORDS

- A. Provide duplex LC singlemode and multimode fiber optic patch cords for interconnection of owner furnished switches and fiber backbone cabling. Polarization of fiber optic patch cords shall comply with ANSI/TIA/EIA – 568-B.1 Section 10.3.3.
- B. Provide fiber optic patch cords of adequate length to avoid excessive slack and tightness in the cable managers. Provide minimum 2-meter and maximum 5-meter fiber patch cords.
- C. Provide qty (4) fiber patch cords for every owner furnished POE switch. (2) patch cords will be installed at the POE switch and (2) patch cords will be installed at the core fiber switch. See Rack Schedule for quantity of owner furnished POE switches.
- D. Fiber optic cabling shall comply with the requirements of ANSI/TIA/EIA-568-B.3 and ANSI/TIA/EIA-568-B.3 Addendum 1.
- E. Fiber patch cords shall be manufactured of fiber optic cabling meeting the transmission characteristics of the fiber optic backbone cabling. The manufacturer of the fiber patch cord cabling and the fiber backbone cabling shall be identical.
- F. Fiber patch cord connectors shall be duplex LC-type. Cable shall be duplex zipcord. Cable jacket shall be orange in color with black lettering.
- G. Acceptable Products:
 1. Corning Cable Systems P/N 040402R512000xxM (singlemode) or Corning Cable Systems P/N 050502T51200xxM (multimode) where xx = length in meters.
 2. Or Approved Equal.

2.10 WALL MOUNTED “RE-CLOSEABLE” STORAGE RINGS FOR BACKBONE CABLING

- A. Provide wall mounted re-closeable storage rings for fiber optic backbone cabling.

- B. Install quantity of storage rings to accommodate all backbone fiber optic cabling.
- C. Storage rings shall be 24 inches in diameter with recloseable Velcro loops.
 - 1. Acceptable Products:
 - a. Leviton P/N 48900-FR.
 - b. Black Box P/N FOSR24.
 - c. Or Approved Equal.

2.11 VELCRO CABLE TIES

- A. Provide Velcro cable ties cut to length from a continuous roll to loosely bundle horizontal cabling in the telecom rooms routed on the ladder rack to the patch panels. Install Velcro cable ties at 1'-0" intervals.
- B. Do not exceed qty (24) cables per bundle.
- C. Do not attach cable bundles to the runway with the Velcro cable ties. Do not use plastic tie-wraps.
- D. Acceptable Products
 - 1. Panduit HLS-15R6.
 - 2. Leviton 43115-075.
 - 3. Or approved equal.

2.12 GROUNDING BARS

- A. The entire telecom grounding system including grounding bars, grounding conductors, lugs, etc shall be installed in accordance with ANSI-J-STD-607 C "Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications".
- B. Provide UL listed copper grounding bars with insulated standoffs and stainless steel mounting brackets. Provide the size and quantity of grounding bars as shown on the drawings.
- C. Telecommunications grounding bus bars (TGB) located in the telecom rooms shall be copper 12" x 2" x 1/4" UON on the Drawings.
- D. Grounding bars shall have BICSI patterned pre-drilled lug mounting holes to accommodate two hole lug attachment. 5/16" hole sets shall be spaced on 5/8" centers. 7/16" hole sets shall be spaced on 1" centers.
 - 1. Acceptable Products:
 - a. Chatsworth 13622-012 (2" high), 40153-020 (4" high).
 - b. Erico TGB-A20L12PT (2" high), TMGB-A20L27PT (4" high).
 - c. Harger GBI14220TGB (2" high), GBI14420TMGB (4" high).
 - d. Or approved equal.
- E. Provide separate green insulated #6 AWG grounding conductors from equipment racks, cabinets, metallic backboards, cable sheaths, metallic strength members, ladder rack, conduits, splice cases and building entrance terminals to the grounding bar in each telecom room. Do not "daisy chain" ground conductors.

- F. Grounding bars (TGB's) located in the telecom rooms shall be bonded to the grounding bar (TMGB) located in the Equipment Room with a telecom bonding backbone (TBB) conductor. The TBB shall be continuous without splices. The minimum TBB conductor size shall be 3/0.
- G. Provide an insulated grounding conductor (#2 AWG minimum) from the ground bar in each room to building steel. The grounding conductor shall be cad welded to the building steel. See grounding riser detail for conductor sizes and additional grounding requirements.
- H. Provide an insulated grounding conductor (#2 AWG minimum) from the ground bar in each telecom room to an approved electrical ground (electrical panel ground serving the telecom room). See grounding riser detail for conductor sizes and additional grounding requirements.
- I. Ground wires shall have solderless, copper, two bolt, two hole long barrel compression lugs placed on both ends. The two bolt lug holes shall be 1/4" and on 3/4" centers.
- J. All grounding conductors shall be green in color. All cables and bus bars shall be identified and labeled in accordance with the recommendations made in ANSI/TIA/EIA-606-A.

2.13 RACK MOUNTED 120V UNINTERRUPTIBLE POWER SUPPLIES

- A. Provide UL listed 1,500VA and 2200VA uninterruptible power supplies as shown on the drawings. Uninterruptible power supplies shall meet the following physical specifications:
 - 1. Output voltage distortion less than 5% at full load.
 - 2. Output frequency 57 to 63 Hz.
 - 3. Crest Factor up to 5 to 1.
 - 4. Output connections: qty (6) NEMA 5-15R, qty (2) NEMA 5-20R.
 - 5. Input connection: NEMA 5-15P (750VA, 1,500VA), NEMA 5-20P (2200VA), NEMA L5-30P (3000VA).
 - 6. Battery type: Maintenance free sealed leakproof lead acid battery with suspended electrolyte or Lithium ION as indicated on drawings.
 - 7. 3 Hour typical recharge time.
 - 8. Computer interface ports, DB-9 RS-232, SmartSlot, USB.
 - 9. LED status display with load and battery bar graphs and on line, on battery, replace battery and overload indicators.
 - 10. Audible alarm when on battery and low battery condition.
 - 11. 480 Joules surge energy rating.
 - 12. Full time multi-pole noise filtering – meets UL 1449.
 - 13. 2-Year mfg warranty.
 - 14. Regulatory approvals: BSMI, CSA, UL 1449, UL 1778, FCC Part 15 Class A.
- B. Provide UPS with adequate cord length to plug into electrical outlets.
 - 1. Acceptable Products – See UPS schedule on drawings.
 - a. 1,500 VA Lithium Ion Shallow Depth 3RU Rack Mount – American Power Conversion Smart UPS P/N SMTL1500RM3UC.
 - b. 2,200 VA 2RU Rack Mount - American Power Conversion Smart UPS SMT2200RM2U (2200VA).
 - c. Or Approved Equal.

2.14 IP MANAGEMENT MODULES FOR UNINTERUPTABLE POWER SUPPLIES

- A. Provide IP based management module with each UPS for remote monitoring. Module shall be capable of being accessed by web browsing software. Modules shall be manufactured by and shall be compatible with the UPS's.
 - 1. Modules shall accept RJ-45 10/100 Base-T Ethernet connection.
 - 2. Module shall accommodate the following network protocols (HTTP, HTTPS, IPv4, IPv6, NTP, SMTP, SNMP v1, SNMP v3, SSH V1, SSH V2, SSL, TCP/IP, Telnet).
 - 3.
 - 4. Module shall accommodate Radius Authentication.
 - 5. Acceptable Products:
 - a. American Power Conversion UPS Network Management Card 3 P/N AP9640.
 - b. Or Approved Equal.

PART 3 – EXECUTION

3.01 FLOOR MOUNTED RACKS AND CABINETS

- A. Floor mounted racks and cabinets shall be secured to structure with a minimum of (4) 1/2" diameter concrete expansion anchors or as required by local codes.
- B. Racks and cabinets shall be placed with a minimum of 36" clearance from the walls on at least three sides (two of which must be front and rear) of the rack. When mounted in a row, maintain a minimum of 36" from the wall behind and in front of the row of racks and from the wall to at least one end of the row.
- C. All racks, free-standing cabinets, and wall-mount cabinets shall be bonded to the ground bar in each room with a separate #6 green insulated grounding conductor.
- D. Rack mount cage nuts/screws not used for installing patch panels and other hardware shall be bagged and left with the rack or cabinet upon completion of the installation.

3.02 WALL MOUNTED RACKS AND CABINETS

- A. Wall mounted racks and cabinets shall be secured to the wall with a minimum of (4) lag bolts or as required by local codes.
- B. Racks and cabinets shall be placed with a minimum of 36" clearance from the walls on at least 2 sides allowing the cabinet to pivot.
- C. Bond racks and cabinets to the ground bar in each room with a separate #6 green insulated grounding conductor.
- D. Rack mount cage nuts/screws not used for installing patch panels and other hardware shall be bagged and left with the rack or cabinet upon completion of the installation.

3.03 PATCH PANELS

- A. Terminate and dress cables on the rear of the patch panels in accordance with manufacturer instructions using the provided rear cable management bar or bracket.

- B. Maintain cable twists within ½” of the patch panel IDC blocks.

3.04 GROUNDING AND BONDING

- A. All components of the Telecommunications system shall be bonded and grounded in accordance with ANSI/TIA-607-C “Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications”.
- B. Bond equipment cabinets, building entrance terminals to the ground bar in each telecom room with #6 AWG ground conductors. Provide a separate ground conductor for each item. Do not daisy chain ground conductors.
- C. Bond the ground bar in each Telecom room to building steel (#2 AWG minimum). Cad weld the grounding conductor to the building steel. See grounding riser diagram for ground conductor sizes.
- D. Bond the ground bar in each Telecom room to the electrical panel serving that Telecom room (#2 AWG minimum). See grounding riser diagram for ground conductor sizes.
- E. Bond the Telecommunications Ground Bar (TGB) in each Telecom room to the Telecommunications Main Ground Bus (TMGB) with a Telecommunications Bonding Backbone (TBB) conductor. The minimum TBB conductor size shall be minimum 3/0. See grounding riser diagram for ground conductor sizes.
- F. Bond the Telecommunications Main Ground Bus (TMGB) to the main electrical building ground (#2 AWG minimum). See grounding riser diagram for ground conductor sizes.
- G. Grounding conductors shall be installed continuous. There shall be no splices or mechanical couplers.
- H. The Electrical Contractor shall test the continuity of all grounding conductors.

END OF SECTION 27 11 00

SECTION 27 13 00 – COMMUNICATIONS BACKBONE CABLING

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. Drawings and general provisions of the Contract, Including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.
- B. The Contractor shall provide all equipment, materials, labor, and services necessary to complete the backbone cabling system, and to ensure that it is in compliance with requirements stated or reasonably inferred by the Specifications and the Contract Drawings.
- C. Backbone cabling includes inter-building (Outside Plant) and intra-building (Premise) copper and fiber optic cabling.
- D. This section includes minimum requirements for the following
 - 1. Singlemode Tight Buffered Plenum Rated Armored Fiber Optic Cabling – Premise
 - 2. Singlemode Tight Buffered Fiber Optic Cabling – Indoor/Outdoor

1.2 RELATED SECTIONS

- A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.
- B. Related Sections:
 - 1. 27 01 00: Common Work Results for Communications.
 - 2. 27 05 28: Interior Communications Pathways.
 - 3. 27 08 00: Commissioning of Communications
 - 4. 27 11 00: Communications Equipment Room Fittings
- C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.3 REGULATIONS AND CODE COMPLIANCE

- A. Materials and work specified herein shall comply with the requirements of Specification Section 27 01 00 and in particular the following standard and code requirements:
 - 1. ANSI/TIA-568.0-E: Generic Telecommunications Cabling for Customer Premises (Revision E, March 2020).
 - 2. ANSI/TIA-568.1-E: Commercial Building Telecommunications Infrastructure Standard (Revision E, March 2020).
 - 3. ANSI/TIA-568.2-D: Balanced Twisted-Pair Telecommunications Cabling And Components Standards (Revision D, September 2018).
 - 4. ANSI/TIA-568.3-D: Optical Fiber Cabling and Component Standard (Revision D, October 2016).
 - 5. ANSI/TIA-569-E: Telecommunications Pathways and Spaces (Revision E, May 2019)
 - 6. ANSI/TIA-606-D: Administration Standard for Telecommunications Infrastructure (Revision D, October 2021).

7. ANSI/TIA-607-D: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises (Revision D, July 2019).
8. ANSI/TIA-758-B: Customer-Owned Outside Plant Telecommunications Infrastructure Standard (Revision B, March 2012).
9. ANSI TIA-526-7-A: Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant (Revision A, July 2015).
10. ANSI/TIA-526-14-C: Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant (Revision C, 2015).
11. ANSI/NFPA-70, 2017 -- National Electrical Code (NEC).
12. Underwriter's Laboratories, Inc. (UL).

1.4 QUALITY ASSURANCE

- A. All materials shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the Specifications shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacturer indicated. The equipment specified is based upon the acceptable manufacturers listed.
- B. All fiber optic cabling and related fiber termination equipment shall be installed by a trained technician with a minimum of (2) years experience in the termination of fiber optic cabling. The technician will have received training through a nationally recognized program offered by BICSI, Corning, AT&T, 3M or equivalent. The contractor shall provide all specialized tools required for proper installation.

1.5 SUBMITTALS

- A. Submit manufacturers' data sheets for the following
 1. Singlemode Tight Buffered Plenum Rated Armored Fiber Optic Cabling – Premise
 2. Singlemode Tight Buffered Fiber Optic Cabling – Indoor/Outdoor
- B. Bill of Materials: Submit a detailed bill-of-materials listing all manufacturers, part numbers, and quantities proposed for use on this project.
- C. Submit all factory test information of cables prior to installation of the product.

1.6 DELIVERY, STORAGE & HANDLING

- A. Visually examine cable spools and boxes for damage after delivery to the jobsite prior to installation. Visibly damaged goods are to be returned to the supplier and replaced at no additional cost to the Owner.

1.7 GUARANTEE

- A. The outside plant (OSP) and premise fiber optic cabling including fiber termination cabinets, fiber connectors, fiber optic patch cords, etc. shall be covered by a 20-year system warranty from Corning Cable Systems or approved equal (see Specification Section 27 01 00 1.9).

PART 2 – PRODUCTS

2.1 ARMORED PLENUM SINGLEMODE TIGHT BUFFERED FIBER OPTIC CABLING – PREMISE

- A. Provide cables with fiber strand counts as shown on the drawings.
 - B. Fiber optic cables shall be tight buffered singlemode OS2 with an interlocking armored plenum rated jacket (color yellow).
 - C. Maximum attenuation characteristics
 - 1. Maximum attenuation 0.80/0.50 dB/Km @ 1310/1550 nm.
 - D. Physical Characteristics
 - 1. Cable will have 900 µm buffer with mechanically strippable PVC jacket.
 - 2. The designation "UL" and either "OFNP" or "OFNR" shall be printed on the jacket with length markings every 2'-0".
 - 3. The cable shall have individual fiber tube colors per TIA/EIA-606 and overall yellow jacket.
 - 4. The cable shall contain an aramid yarn strength member with cables stranded around center.
 - 5. The cable shall be suitable for operating temperatures of -20° to +70° C.
 - E. Acceptable Products:
 - 1. Corning Cable Systems MIC Metallic Interlocking Armored Plenum Cable P/N 012E88-33131-A3 (12-strand), 024E88-33131-A3 (24-strand), 048E88-61131-A3 (48-strand).
 - 2. No Substitutions.
- 2.2 INDOOR/OUTDOOR TIGHT BUFFERED SINGLEMODE FIBER OPTIC CABLING (FOR JLEC COVERED PARKING SWITCH)
- A. Provide 2-strand indoor/outdoor rated singlemode fiber optic cable to light poles where shown on the drawings.
 - B. Fiber cable to be tight buffer indoor/outdoor rated.
 - C. Terminate cable at telecom room in fiber termination cabinet on duplex LC connectors.
 - D. Terminate cable at equipment enclosure on duplex LC connectors.
 - E. Acceptable products:
 - 1. Corning FREEDM Fan-Out Tight-Buffered Cable, Riser P/N 002E6F-31331-29.
 - 2. Or approved equal.

PART 3 – EXECUTION

3.1 BACKBONE CABLING

- A. Twenty feet of cable slack shall be stored in wall mounted "re-closeable" storage rings at the telecom room for every installed backbone cable. Additional fiber cable slack will be installed within the vertical cable managers in a "drip loop" configuration.
- B. No more than 50'-0" of exposed outside plant cabling shall be permitted inside the building. If this is not possible, cable must be routed in rigid conduit or spliced to an indoor cable with identical performance characteristics.

- C. Vertical runs of cable shall be supported to a messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.
- D. Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.
- E. Three feet of fiber slack shall be neatly coiled within the fiber termination enclosure.
- F. Each optical fiber cable shall be individually attached to its enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure. Refer to manufacturer installation instructions.
- G. Each optical fiber cable shall be clearly labeled at the entrance to the fiber termination cabinet. Cables labeled within the bundle where the label is obscured from view shall not be acceptable.
- H. Prior to installation of fiber optic backbone cable, test one fiber strand using an OTDR or light meter to verify continuity of the cable.
- I. All fiber optic cable shall be installed within innerduct. Where the innerduct terminates at the telecom room wall or floor, install riser rated corrugated innerduct from that point to the fiber termination cabinet.

3.2 OPTICAL FIBER CONNECTORS

- A. Adhere to all manufacturer installation guidelines.
- B. Polarization for entire system shall be maintained as described in ANSI/TIA/EIA – 568-B.1 Section 10.3.2.

END OF SECTION 27 13 00

SECTION 27 15 00 – COMMUNICATIONS HORIZONTAL CABLING

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

- A. The Contractor shall provide all equipment, materials, labor, and services necessary to complete the horizontal cabling system, and to ensure that it is in compliance with requirements stated or reasonably inferred by the Specifications and the Contract Drawings.
- B. The horizontal cabling is that portion of the telecommunication cabling system that extends from the work area telecommunications outlet to the patch panel or termination block in the telecommunications room.
- C. This section includes minimum requirements for the following
 - 1. Horizontal Plenum Rated Category 6 Cabling (Indoor Locations).
 - 2. Indoor / Outdoor Rated Category 6 Cabling (For Cabling Routed in Underground Ducts).
 - 3. Category 6 Cable Termination (at Camera Locations).
 - 4. Category 6 8-Position Jacks (at Faceplate Termination).
 - 5. Category 6 Work Area Patch Cords.
 - 6. Work Area 4-Port Plastic Faceplates.
 - 7. Velcro Cable Straps.

1.02 RELATED SECTIONS

- A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.
- B. Related Sections:
 - 1. Section 27 01 00: Common Work Results for Communications.
 - 2. Section 27 08 00: Commissioning of Communications
 - 3. Section 27 11 00: Communications Equipment Room Fittings
 - 4. Section 28 00 00: Common Work Results for Electronic Safety & Security.
 - 5. Section 28 05 28: Conduits and Backboxes for Electronic Safety and Security.
 - 6. Section 28 28 00: Video Surveillance System
- C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.03 REGULATIONS AND CODE COMPLIANCE

- A. Materials and work specified herein shall comply with the requirements of Specification Section 27 01 00 and in particular the following standards and code requirements:
 - 1. ANSI/TIA-568.0-E: Generic Telecommunications Cabling for Customer Premises (Revision E, March 2020).
 - 2. ANSI/TIA-568.1-E: Commercial Building Telecommunications Infrastructure Standard (Revision E, March 2020).
 - 3. ANSI/TIA-568.2-D: Balanced Twisted-Pair Telecommunications Cabling And Components Standards (Revision D, September 2018).

4. ANSI/TIA-569-E: Telecommunications Pathways and Spaces (Revision E, May 2019)
5. ANSI/TIA-606-D: Administration Standard for Telecommunications Infrastructure (Revision D, October 2021).
6. ANSI/NFPA-70, 2017 -- National Electrical Code (NEC).
7. Underwriter's Laboratories, Inc. (UL).

1.04 QUALITY ASSURANCE

- A. All materials shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the Specification shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and the manufacturer indicated. The equipment specified is based upon the acceptable manufacturers listed.
- B. The Contractor shall strictly adhere to all Category 6 installation practices when installing unshielded twisted-pair cabling.

1.05 SUBMITTALS

- A. Manufacturer's Data Sheets: Submit manufacturers data sheets for the following items:
 1. Horizontal Plenum Rated Category 6 Cabling (Indoor Locations).
 2. Indoor / Outdoor Rated Category 6 Cabling (For Cabling Routed in Underground Conduit).
 3. Category 6 Cable Termination (at Camera Locations).
 4. Category 6 8-Position Jacks (at Faceplate Termination).
 5. Category 6 Work Area Patch Cords.
 6. Work Area 4-Port Plastic Faceplates.
 7. Velcro Cable Straps.

1.06 DELIVERY, STORAGE & HANDLING

- A. Visually inspect all cables, cable reels, and shipping cartons to detect possible cable damage incurred during shipping and transport. Visibly damaged goods are to be returned to the supplier and replaced at no additional cost to the Owner.

1.07 GUARANTEE

- A. The Category 6 horizontal data cabling system including work area jacks, horizontal cabling, patch panels and patch cords shall be covered by a minimum fifteen (15) year system warranty from Belden/CDT, CommScope, Berk-Tek/Leviton or approved equal (see Specification Section 27 01 00 1.11).
- B. The Telecom Contractor will be responsible for fulfilling the requirements necessary to obtain one of the 15-year specified product warranties. This may require that the Contractor be a "Certified Installer" by the manufacturer. It may also require manufacturer specialized training, field installation oversight, field test verification, etc.

PART 2 – PRODUCTS

2.01 HORIZONTAL PLENUM CATEGORY 6 CABLE (INDOOR LOCATIONS)

- A. The horizontal cabling must meet the specific manufacturer system warranty requirements listed in Specification Section 27 15 00 1.7.

- B. Horizontal data cabling shall be 4-pair, Category 6 unshielded twisted pair.
- C. Physical Characteristics
 - 1. Category 6 cable shall meet or exceed the requirements of ANSI/TIA/EIA–568-B.2 and ANSI/TIA/EIA–568-B.2 Addendum 1.
 - 2. Cable shall have a listed plenum rated jacket (CMP).
 - 3. The cable jacket must have the following legible markings
 - a. Manufacturer’s name.
 - b. Copper conductor gauge.
 - c. Pair count.
 - d. UL and CSA listing.
 - e. Manufacturer’s trademark.
 - f. Category rating.
 - g. Sequential foot markings, in one foot increments.
 - h. Jacket rating (CMP).
 - 4. Horizontal data cable shall have a blue jacket with black lettering.

D. Transmission Characteristics

- 1. Cable shall conform to ANSI/TIA/EIA–568-B.2 Addendum 1 as shown below.

Frequency (MHz)	Solid Conductor Cable Insertion Loss (dB)	NEXT Loss (dB)	PSNEXT Loss (dB)	ELFEXT Loss (dB)	Power Sum ELFEXT (dB)	Return Loss (dB)
1	2.0	74.3	72.3	67.8	64.8	20.0
4	3.8	65.3	63.3	55.8	52.8	23.0
8	5.3	60.8	58.8	49.7	46.7	24.5
10	6.0	59.3	57.3	47.8	44.8	25.0
16	7.6	56.2	54.2	43.7	40.7	25.0
20	8.5	54.8	52.8	41.8	38.8	25.0
25	9.5	53.3	51.3	39.8	36.8	24.3
31.25	10.7	51.9	49.9	37.9	34.9	23.6
62.5	15.4	47.4	45.4	31.9	28.9	21.5
100	19.8	44.3	42.3	27.8	24.8	20.1
200	29.0	39.8	37.8	21.8	18.8	18.0
250	32.8	38.3	36.3	19.8	16.8	17.3

- 2. Propagation delay skew shall not exceed 45 ns per 100 meters for all frequencies from 1 MHz to 250 MHz.

E. Acceptable Products:

- 1. Belden/CDT Gigaflex 2400 P/N 24567915 (blue).
- 2. CommScope Uniprise CS34P Plenum Rated P/N UN874049914/10 (blue).

3. Or equal.

2.02 HORIZONTAL INDOOR/OUTDOOR RATED CATEGORY 6 CABLE (FOR CABLING ROUTED IN UNDERGROUND CONDUIT)

- A. Provide 4-pair CAT 6 indoor/outdoor rated cabling where cabling is routed in underground conduit or wet locations.
- B. Cable shall have a listed riser rated jacket (CMR/CMX). Cable shall be suitable for underground duct installation.
- C. Cable jacket marking: Must be legible and shall contain the following information:
 - 1. Manufacturer's name.
 - 2. Copper conductor gauge.
 - 3. Pair count.
 - 4. Manufacturer's trade mark.
 - 5. Sequential foot markings.
- D. Acceptable Products:
 - 1. Belden P/N 2146A.
 - 2. Mohawk VersaLAN P/N M59200.
 - 3. Hitachi DryBit P/N 30315-8-BK3.
 - 4. Or Approved Equal.

2.03 CATEGORY 6 CABLE TERMINATIONS (AT CAMERA LOCATIONS)

- A. Terminate CAT 6 cabling at cameras in a manner that is compatible with the camera and camera mounting. Termination jacks, plugs and/or connecting patch cords must be concealed and protected at the camera location.
- B. Termination method must be approved by the cabling manufacturer and must allow the CAT 6 cabling to be tested and certified. Examples are as follows:
 - 1. CAT 6 field mount plug.
 - 2. CAT 6 jack with CAT 6 patch cord.
- C. Acceptable Products:
 - 1. Belden REVConnect core and flex plug. Belden P/N RV6FFPUBK18-S1.
 - 2. Belden CAT 6A Field Mount Plug. Belden P/N RVAFPUBK-S1.
 - 3. Or approved equal.

2.04 CATEGORY 6 MODULAR JACKS (AT FACEPLATE TERMINATIONS)

- A. The modular jacks must meet the specific manufacturer system warranty requirements listed in Specification Section 27 15 00 1.7.
- B. All modular jacks shall be 8-pin Category 6 and will conform to the requirements of ANSI/TIA/EIA-568-B.2 Addendum 1.
- C. Pin/Pair assignment shall be in accordance with T568B.

- D. Modular jacks shall be manufactured by the same manufacturer as the patch panels in the telecommunication rooms.
- E. Work area jacks for voice and data systems shall have different colors. Data jacks will be blue and voice jacks white.
- F. Modular jacks shall have a 'CAT 6' designation on the face of the jack insert.
- G. Modular jacks shall be "Keystone" style.
- H. Acceptable Products:
 - 1. Belden/CDT Category 6 KeyConnect Modular Jacks P/N AX101320 (color white).
 - 2. CommScope Uniprise UNJ600-WH (color white).
 - 3. Or approved equal.

2.05 CATEGORY 6 WORK AREA PATCH CORDS (AT VIEWING WORKSTATION LOCATIONS)

- A. Provide Category 6 work area patch cords (workstation cords) for interconnection of work area data outlets and computers.
- B. The work area patch cords must meet the specific manufacturer system warranty requirements listed in Specification Section 27 15 00 1.7.
- C. Provide (1) 15'-0" category 6 UTP work area patch cord for every data drops.
- D. Category 6 Work area patch cords shall meet or exceed the requirements of ANSI/TIA/EIA 568-B.2.
- E. Work area patch cords should be white, made from stranded conductors and have 8-position RJ-45 style snagless plugs on each end with molded strain relief boots.
- F. Cabling used for work area patch cords shall be manufactured by the same manufacturer as the horizontal cabling and shall be of the same product line. Electrical characteristics and performance of the patch cables shall be nearly identical to the horizontal cable with exceptions given due to differences between solid and stranded conductors as indicated in the following table.

Frequency (MHz)	Stranded Conductor Cable Insertion Loss (dB)
1	2.4
4	4.5
8	6.4
10	7.1
16	9.1
20	10.2
25	11.4
31.25	12.8
62.5	18.5
100	23.8
200	34.8
250	39.4

- G. Work area patch cords shall be rated for use as communications cable and shall have the designation "CM" or "CMR" printed on the jacket.
- H. Work area patch cords shall be identical in construction to the patch cords in the telecommunications rooms. See Specification Section 27 11 00 for patch cord Acceptable Products.
- I. Acceptable Products:
 - 1. Belden/CDT GigaFlex PS6+ Modular Cord P/N C601109015 (15 ft).
 - 2. CommScope Uniprise UNCG P/N UC1BBB2-08F015 (15 ft).
 - 3. Or approved equal.

2.06 WORK AREA 4-PORT PLASTIC FACEPLATES (AT VIEWING WORKSTATION LOCATIONS)

- A. The faceplates must meet the specific manufacturer system warranty requirements listed in Specification Section 27 15 00 1.6.
- B. Provide UL listed faceplates. Faceplates should be white (verify with Architect), flush mounted and manufactured of high impact thermoplastic.
- C. Faceplates shall have top and bottom label holders with plastic inserts.
- D. Provide faceplates with a minimum of 4 and a maximum of 6 modules. Provide blank inserts in unused openings.
- E. Faceplates shall accept "Keystone" style modular jacks.
- F. Faceplates shall be manufactured by the same manufacturer as the outlet jacks and shall be compatible with the submitted outlet jacks.
- G. Acceptable Products:
 - 1. Belden/CDT 4-Port KeyConnect Faceplate P/N AX102249 (color white).
 - 2. CommScope Uniprise M14L-262 (color white).
 - 3. Or approved equal.

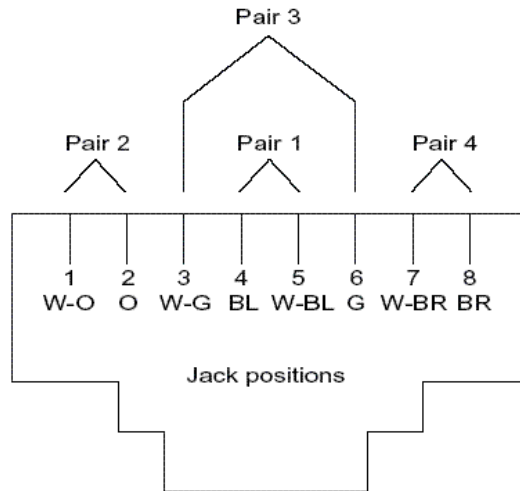
2.07 VELCRO CABLE STRAPS

- A. Loosely bundle horizontal cabling with Velcro tie wraps.
- B. Velcro tie wraps shall ¾" in width and cut from a continuous roll.
- C. Install Velcro cable ties at 2'-0" intervals outside of the telecom rooms and 1'-0" intervals inside the telecom rooms.
- D. Do not exceed qty (24) cables per bundle.
- E. Acceptable Products
 - 1. Panduit TAK-TY HLSP (plenum).
 - 2. Leviton 43115-075.
 - 3. Or equal.

PART 3 – EXECUTION

3.01 HORIZONTAL CABLE ROUTING AND TERMINATION

- A. Ten feet of cable slack shall be stored at the telecom room and three feet of cable slack shall be provided in the ceiling space above the telecom outlet for every installed horizontal cable.
- B. All horizontal cables shall be installed in cable bundles. Cable bundles shall not exceed qty (24) cables per bundle and will be loosely bound with velcro straps. Cables in a bundle should be uncombed until entry into each rack's vertical cable management, where the cables are to be combed and dressed together until terminated on each patch panel.
- C. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points or consolidation points specifically shown on the drawings.
- D. The cable's minimum bend radius and maximum pulling tension shall not be exceeded. Refer to manufacturers requirements and reference documents.
- E. All telecom cables shall be supported by approved telecom pathways having dedicated support systems directly attached to structure (i.e. conduit, j-hooks, cable tray, etc.). Cables shall not be attached to or supported by ceiling grid, ceiling grid support wires, lighting fixture support wires or the work of other mechanical, electrical, plumbing or sprinkler trades.
- F. All telecom cables shall be stored in accordance with the manufacturer's requirements.
- G. Any cable damaged or exceeding the manufacturer's recommended installation parameters during installation shall be replaced by the Contractor prior to final acceptance at no cost to the Owner.
- H. All telecom cables shall be labeled with self-adhesive labels. At the work area outlet, the cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate. At the Telecom Room, each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cable labels located within the bundle or where obscured from view shall not be acceptable.
- I. Cables shall be installed in accordance with the recommendations made in the ANSI/TIA/EIA-568-B standard document, manufacturer's recommendations and installation guides, and best industry practices.
- J. Plastic "zip-ties" shall not be permitted within the Structured Cabling System. "Velcro" type (hook and loop) tie wraps shall be used for the purpose of bundling / managing horizontal and backbone cabling (must be plenum rated if installed within a plenum space).
- K. Horizontal UTP pair untwist at the termination shall not exceed 0.5".
- L. Jack pin/pair assignments shall be T568B for all installed horizontal cabling unless otherwise specified within the Project Documents.
 - 1. T568B Jack pin/pair assignments are as follows:



- M. For horizontal cabling, if a J-hook System is used to support cable bundles, all horizontal cables shall be supported at a maximum of 60" intervals. J-hooks must be secured to the permanent building structure. J-Hooks shall not be attached to ceiling tiles, ceiling grid, ceiling support wires or to the work of other mechanical, electrical, plumbing and sprinkler trades.
- N. The horizontal telecom pathway and pathway support system shall not permit significant lateral or vertical motion. Cable quantities shall not exceed J-Hook System manufacturer recommendations or qty (24) cables, whichever is fewer.
- O. Telecom cables may not rest on acoustic ceiling grids or panels, or be attached to any portion of the building except for dedicated telecom pathway including conduit, innerduct, ladder rack, cable tray and/or J-hooks.
- P. The cable length between the work area outlet and the termination in the telecommunications closet shall not exceed 295 feet. Any horizontal cable runs longer than 295 feet should be brought to the immediate attention of the Owner's Representative prior to installation.
- Q. When placing cable, the Contractor shall maintain the following minimum clearance from sources of electro-magnetic interference (EMI).
 - 1. 6" clear from power conductors.
 - 2. 12" clear from fluorescent lighting fixtures and ballasts.
 - 3. 36" clear from transformers and motors.

3.02 WORK AREA OUTLETS

- A. Work Area outlets and connectors shall be installed in accordance with manufacturer's recommendations and installation guides, and best industry practices.
- B. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B standard document, manufacturer's recommendations and best industry practices.
- C. Pair untwist at the termination shall not exceed 0.5".

- D. Bend radius of the cable in the termination area shall not be less than 4 times the outside diameter of the cable.

END OF SECTION 27 15 00

SECTION 28 00 00 – COMMON WORK RESULTS FOR ELECTRONIC SAFETY & SECURITY

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

- A. Include all labor, materials, tools, transportation, storage costs, excavation, training, equipment, insurance, temporary protection, permits, inspections, taxes and all necessary and related items required to provide complete and operational electronic safety and security systems as shown on the Drawings and described in the Specifications.

1.02 RELATED SECTIONS

- A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.
- B. Related Sections:
 - 1. Section 27 01 00: Common Work Results for Communications
 - 2. Section 27 08 00: Commissioning of Communications
 - 3. Section 27 11 00: Communications Equipment Room Fittings
 - 4. Section 27 15 00: Communications Horizontal Cabling
 - 5. Section 28 05 28: Conduits and Backboxes for Electronic Safety and Security.
 - 6. Section 28 28 00: Video Surveillance System
- C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.03 QUALITY ASSURANCE

- A. The Contractor installing the Electronic Safety and Security systems shall have a minimum of (5) years experience installing commercial security systems of similar size and scope.
- B. See individual Division 28 specifications for additional requirements.

1.04 REGULATIONS AND CODE COMPLIANCE

- A. The Contractor will comply with all applicable governmental regulations including Federal, State, City, and Local applicable codes and ordinances.
- B. References to codes and standards called for in the Specifications refer to the latest edition, amendments, and revisions to the codes and standards in effect on the date of these Specifications.
- C. All work and materials shall conform to and be installed, inspected and tested in accordance with the governing rules and regulations as well as federal, state and local governmental agencies, including, but not limited to the following:
 - 1. NFPA-70, 2011 -- National Electrical Code (NEC).
 - 2. Underwriters Laboratories (UL):
 - a. UL 50 - Enclosures for Electrical Equipment.

- b. UL 294 – Access Control Systems
 - c. UL 365 – Police Station Connected Burglar Alarm Units and Systems
 - d. UL 609 – Local Burglar Alarm Units and Systems
 - e. UL 611 – Central Station Burglar-Alarm Units
 - f. UL 636 – Hold up alarms
 - g. UL 1076 – Proprietary Burglar Alarm Units and Systems
 - h. UL 1610 – Central Station Burglar-Alarm Units
 - i. UL 60950-1 - Information Technology Equipment - Safety.
3. Federal Communications Commission (FCC):
- a. Code of Federal Regulations Title 47 - Part 15 – Radio Frequency Devices.
 - b. Code of Federal Regulations Title 47 - Part 68 – Connection of Terminal Equipment to the Telephone Network.
4. Americans with Disabilities Act (ADA).

1.05 DEFINITIONS

- A. Accessible Ceiling: Space above a ceiling constructed of removable tiles (clipped or unclipped). Acoustical ceiling grid with removal tiles would be considered an accessible ceiling. A gypboard ceiling would not be considered an accessible ceiling.
- B. Approved/Approval: Written permission to use a material or system.
- C. As Called For: Materials, equipment including the execution specified/shown in the Specifications.
- D. Code Requirements: Minimum requirements.
- E. Concealed: Work installed in pipe and duct shafts, chases or recesses, inside walls, above ceilings, in slabs or below grade.
- F. Exposed: Work not identified as concealed.
- G. Final Acceptance: Owner acceptance of the project from the Contractor upon certification by the Owner's Representative.
- H. Furnish: Supply and deliver to installation location.
- I. Furnished by Others: Receive delivery at job site or where called for and install.
- J. Inspection: Visual observations by Owner or Owner's Representative.
- K. Install: Mount and connect equipment and associated materials ready for use.
- L. Listed: Refers to classification by a standards agency.
- M. Or Approved Equal: Approved equal or equivalent as determined by Owner or Owner's Representative.
- N. Owner's Representative: Design professional or Consultant representing the Owner.
- O. Provide: Furnish, install and connect ready for use.

- P. Relocate: Disassemble, disconnect, and transport equipment to new locations: then clean, test, and install ready for use.
- Q. Replace: Remove and provide new item.
- R. Review: A general contractual conformance check of specified products.
- S. Satisfactory: As specified in Specifications.

1.06 INTENT OF DRAWINGS

- A. All drawings are diagrammatic unless otherwise noted as detailed dimensioned drawings. Drawings show approximate locations of equipment and devices. Exact locations are subject to the approval of the Owner or Owner's Representative. The Contractor shall verify dimensions and shall be responsible for their accuracy
- B. Items mentioned in the Specifications and not shown in the Drawings, or shown in the Drawings and not mentioned in the Specifications, shall be of like effect as if shown and mentioned in both. In the case of differences between the Drawings and the Specifications, the stricter provision as determined by the Owner or Owner's Representative shall govern.
- C. Omissions from the Drawings or Specifications, or the incorrect description of details of Work which are necessary to carry out the intent of the Drawings and Specifications, or work which is customarily performed, shall not relieve the Contractor from performing such omitted or incorrectly described work.
- D. No exclusion from, or limitations in, the language used in the Project Documents shall be interpreted as meaning that ancillary or accessory items necessary to complete any required system or item of equipment are to be omitted.

1.07 REVIEW OF SPECIFICATIONS

- A. The Contractor shall carefully study and compare the Drawings and Specifications. Any error, inconsistency or omission discovered shall be immediately reported to the Owner or Owner's Representative. If the Contractor performs any construction activity knowing it involves a recognized error, inconsistency or omission without such notice to the Owner or Owner's Representative, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the cost for any correction.

1.08 EXAMINATION OF THE PREMISES

- A. The Contractor shall visit the Site to become familiar with the local conditions under which the work is to be performed and correlate the observations with the requirements of the Drawings and Specifications. No allowance will be made for claims of concealed conditions which the Contractor learned or should have learned in exercising due diligence in its observations of the site and review of the local conditions.
- B. Before ordering any materials or performing any work, the Contractor shall coordinate the installation with the work of other trades and shall verify all measurements. No extra charge or compensation will be allowed for duplicate work or material required because of an unverified difference between an actual dimension and the measurement indicated in the Drawings. Any discrepancies found shall be submitted in writing to the Owner or Owner's Representative for consideration before proceeding with the work.

1.09 COORDINATION OF CABLING PATHWAYS AND EQUIPMENT ROOMS

- A. Drawings are diagrammatic in depicting the routing of security cabling pathways and the layout of security equipment.
- B. The contractor shall coordinate the installation of all work with other trades including Mechanical, Electrical, Plumbing, Sprinkler, Structural and Architectural.
- C. The contractor shall participate in coordination meetings with other trades prior to the installation of the work. For a specific space/area, the security contractor shall coordinate the routing and installation of all work with all other trades that have work in that specific space/area.
- D. Prior to the installation of security cabling pathway including conduit, sleeves, etc., the contractor shall coordinate the routing of this pathway to avoid conflicts with and provide necessary clearances from the work of other trades. The contractor shall provide all horizontal offsets, vertical offsets and radius bends as necessary to coordinate the routing of the security pathways with the work of other trades and building structure.
- E. Prior to the installation of equipment and/or cabling in the communication rooms, the contractor shall coordinate the layout of all equipment and cable pathways with the Telecom Contractor.

1.10 WARRANTY AND SERVICES

- A. See individual Division 28 Specifications for warranty requirements.

PART 2 – PRODUCTS

2.01 EQUIPMENT AND MATERIALS MINIMUM REQUIREMENTS

- A. Electrical equipment and systems shall meet UL Standards and requirements of the National Electric Code. This listing requirement applies to the entire assembly. Any modifications to equipment to suit the intent of the Specifications shall be performed in accordance with these requirements.
- B. Equipment shall meet all applicable FCC Regulations.
- C. All materials, unless otherwise specified, shall be new and be the standard products of the manufacturer. Used equipment or damaged material will be rejected.
- D. The listing of a manufacturer as “acceptable” does not indicate acceptance of a standard or cataloged item of equipment. All equipment and systems must conform to the Specifications.

2.02 WORKMANSHIP, SUBSTITUTIONS, WARRANTY

- A. Materials and workmanship shall meet or exceed industry standards and be fully guaranteed for a minimum of one (1) year from the date of final acceptance. Cable integrity and associated terminations shall be thoroughly inspected, fully tested and guaranteed free from defects, transpositions, open shorts, tight kinks, damaged jacket insulation, etc.
- B. All labor must be thoroughly competent, skilled and trained, and all work shall be executed in strict accordance with the best practice of the trades.

- C. The Contractor shall be responsible for and make good, without expense to the Owner, any and all defects arising during this warranty period that are due to imperfect materials, improper installation or poor workmanship.
- D. After the Contract is awarded, requests to substitute for specified materials shall be submitted by the Contractor to the Owner or Owner's Representative within thirty (30) days, complete with reasons for the substitution and savings which accrue to the Owner if the substitutions are approved. Substitutions after Contract award will be considered only if the substitutions are equal or superior to the products specified.
- E. No material substitutions will be allowed except by written acceptance from the Consultant. Specified catalog numbers are used for description of equipment and standard of quality only. Equivalent material will be given consideration only if adequate comparison data including samples are provided.
- F. Approval of alternate or substitute equipment or material in no way voids the Specification requirements.
- G. Under no circumstances shall the Owner be required to prove that an item proposed for substitution is not equal to the specified item. It shall be mandatory that the Contractor submit to the Owner or Owner's Representative all evidence to support the contention that the item proposed for substitution is equal to the specified item. The Owner's decision as to the equality of substitution shall be final and without further recourse.

2.03 FACTORY ASSEMBLED PRODUCTS

- A. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for the final assembled unit.
 - 1. All components of an assembled unit need not be products of the same manufacturer.
 - 2. Component parts, which are alike, shall be from a single manufacturer.
 - 3. Components shall be compatible with each other and with the total assembly for the intended service.
 - 4. Components of equipment shall bear the manufacturer's name or trademark model number and serial number on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.
- B. Major items of equipment that serve the same function must be the same make and model.
- C. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that a complete and fully operational system will result.
- D. Maximum standardization of components shall be provided to reduce spare part requirements.

PART 3 – EXECUTION

3.01 ROUGH-IN

- A. Before construction work commences, the Contractor shall visit the site and identify the exact routing of all cable pathways.
- B. All equipment locations and cabling pathway shall be coordinated with other trades and existing conditions to eliminate interference with required clearances for equipment maintenance and inspections.
- C. Coordinate work with other trades and existing conditions to determine exact location of equipment and routing of cable pathways.
- D. Provide easy, safe and code mandated clearances at equipment racks and enclosures.

3.02 CUTTING, CORING AND PATCHING

- A. The Contractor shall be responsible for all cutting, patching, coring and associated work to complete the security cabling pathway system.
- B. Protect existing finishes from water damage during core/cutting work and cleanup all related water and debris. Patch adjacent work disturbed by installation of new work including insulation, walls and wall covering, ceiling and floor covering or other finished surfaces.
- C. Contractor to submit all proposed concrete wall or floor penetrations to the Structural Engineer for approval prior to performing the work. Contractor shall locate and avoid cutting concrete reinforcing steel using current x-ray or pachometer equipment.

3.03 FIRESTOPPING

- A. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate fire stop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire stopped.
- B. Firestopping assemblies shall meet or exceed the rating of the wall or floor being penetrated.
- C. Fire stopping References:
 - 1. ASTM E814, Standard Method of Fire Tests of Through-Penetration Fire Stops.
 - 2. ASTM E 119, Fire Tests of Building Construction and Materials (for fire-rated architectural barriers).
 - 3. 2002 NFPA National Electrical Code, Section 800-52, Paragraph 2(b), Spread of Fire and Products of Combustion.

3.04 CONCEALMENT

- A. Security cabling pathways including conduit and sleeves shall be concealed above ceilings, in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, or in areas without ceilings, the Owner's Representative shall be notified of the proposed routing prior to starting that portion of the work.
- B. All CAT 6 cabling must be routed concealed above accessible ceilings or in conduit. No exposed security cabling is permitted with the exception of CAT 6 security cabling routed within the telecom rooms.

- C. All access control and intrusion detection system cabling must be routed in conduit from the field devices to the controllers located in the telecom rooms.

3.05 CONDUIT SEALING

- A. The Contractor shall seal all building penetrations to prevent the intrusion of moisture.

3.06 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate ordering and installation of all equipment with long lead times or having a major impact on work by other trades so as not to delay the job or impact the schedule.
- B. Where mounting heights are not dimensioned, install systems, materials and equipment to provide the maximum headroom possible.
- C. Set all equipment to accurate line and grade, level all equipment and align all equipment components.
- D. Provide all scaffolding, rigging, hoisting and services necessary for erection and delivery of equipment and apparatus furnished into the premises.
- E. No equipment shall be hidden or covered up prior to inspection by the Owner's Representative. All work that is determined to be unsatisfactory shall be corrected immediately.
- F. All work shall be installed level and plumb, parallel and perpendicular to other building systems and components.
- G. The Contractor shall replace all ceiling tiles damaged by work performed as part of the communications contract.
- H. Storage and security of material and equipment shall be the responsibility of the Contractor.

END OF SECTION 28 00 00

SECTION 28 05 28 - CONDUITS AND BACK BOXES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Provide all labor, materials, equipment, tools, transportation, storage costs, testing, training and all necessary and related items required to provide a complete and operational raceway system for the Video Surveillance System Cabling as shown on the Drawings and described in the Specifications.
- B. Provide a complete end-to-end raceway system for the Video Surveillance System including conduit, fittings, back boxes, cover plates, j-boxes, pullboxes, fittings, j-hooks, supports, braces, pull string and firestopping.
- C. Raceway requirements based on cable routing location/condition:
 - 1. Concealed accessible ceiling space: J-Hooks.
 - 2. Outdoor Exposed: Rigid Conduit (RMC or IMC) painted to match adjacent surfaces.
 - 3. Indoor Exposed Inmate Accessible Location: Rigid Conduit (RMC or IMC) painted to match adjacent surfaces.
 - 4. Indoor Exposed Non-Inmate Accessible Location: EMT Conduit painted to match adjacent surfaces.
 - 5. Control Room Raised Floor: J-Hooks.
 - 6. Underground: Schedule 40 PVC.
 - 7. Outdoor Transition from Underground to Above Grade: Vinyl Coated Rigid Steel.
 - 8. Outdoor Exposed connection from outlet box to camera: Liquid Tight Flex Conduit.

1.02 RELATED SECTIONS

- A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.
- B. Related Sections:
 - 1. Section 27 01 00: Common Work Results for Communications
 - 2. Section 27 08 00: Commissioning of Communications
 - 3. Section 27 11 00: Communications Equipment Room Fittings
 - 4. Section 27 15 00: Communications Horizontal Cabling
 - 5. Section 28 00 00: Common Work Results for Electronic Safety & Security.
 - 6. Section 28 28 00: Video Surveillance System
- C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.03 REGULATIONS AND CODE COMPLIANCE

- A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Consider such codes or standards a part of this Specification as though fully repeated herein.

- B. Perform all work in accordance with governing codes, rules and regulations including but not limited to the following:
1. National Electrical Manufacturers Association (NEMA):
 - a. TC-3-04 PVC Fittings for Use with Rigid PVC Conduit and Tubing
 - b. FB1-07 Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
 2. National Fire Protection Association (NFPA):
 - a. 70-11 National Electrical Code (NEC)
 - b. 1-05 Flexible Metal Conduit
 - c. 5-04 Surface Metal Raceway and Fittings
 - d. 6-07 Rigid Metal Conduit
 - e. 50-07 Enclosures for Electrical Equipment
 - f. 360-09 Liquid-Tight Flexible Steel Conduit
 - g. 467-07 Grounding and Bonding Equipment
 - h. 514A-04 Metallic Outlet Boxes
 - i. 514B-04 Fittings for Cable and Conduit
 - j. 514C-02 Nonmetallic Outlet Boxes, Flush-Device Boxes & Covers
 - k. 651-05 Schedule 40 and 80 Rigid PVC Conduit
 - l. 651A-07 Type EB and A Rigid PVC Conduit and HDPE Conduit
 - m. 797-07 Electrical Metallic Tubing
 - n. 1242-06 Intermediate Metal Conduit
 3. ASTM International:
 - a. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - b. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
 - c. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
 - d. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.
 4. Underwriters Laboratories Inc.:
 - a. UL 1479 - Fire Tests of Through-Penetration Firestops.
 - b. UL - Fire Resistance Directory.

1.04 SUBMITTALS

- A. See Specification Section 28 00 00 for additional submittal requirements including quantity and format of submittals.
- B. Product Data: Submit manufacturer's product data sheets for the following items:
1. EMT (Electrical Metallic Tubing) Conduit.
 2. IMC (Intermediate Metal Conduit)
 3. RMC (Rigid Metal Conduit).
 4. Schedule 40 PVC.
 5. Back boxes.
 6. Pull boxes.
 7. Hinged cover enclosures and cabinets.
 8. Fittings.

9. Firestopping.
- C. Shop Drawings: Submit shop drawings indicating the following:
1. Show size and routing of all conduits 2" and larger including the location of pullboxes.
 2. Show the size and location of conduit penetrations through fire rated and smoke partitions.
 3. Show the size and location of penetrations through structural items including beams, columns and floors. Structural penetrations must be reviewed and approved by the Structural Engineer prior to installing.
 4. Show the location of flexible conduit required at expansion joints and seismic joints.

1.05 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

1.06 QUALITY ASSURANCE

- A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage (24.9 Pa) minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
 2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
 - a. Floor Penetrations Within Wall Cavities: T-Rating is not required.
- B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.
1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
 2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.
- C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: [ASTM E1966 or] UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.
- D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage (24.9 Pa) minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.
- E. Surface Burning Characteristics: 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Conduit Size: In accordance with the NEC, but not less than 3/4 inch unless otherwise shown.

2.02 CABLE HANGERS (J-HOOKS) AND SUPPORTS

- A. Provide cable hangers (J-hooks) spaced at 5'-0" centers to support horizontal cable routed concealed in accessible ceiling spaces.
- B. All J-hooks must be routed concealed above accessible ceilings. No exposed j-hooks are permitted. In areas without ceilings, cabling must be routed in conduit.
- C. Hangers shall be prefabricated, zinc coated, carbon steel hangers designed specifically for 4-pair UTP communications cabling installations.
- D. Hangers shall have an open top and rolled edges. Hangers shall have a minimum 2" and maximum 4" diameter loop.
- E. Hangers shall be supported directly from the building structure. The Contractor shall provide anchors, beam clamps, threaded rod, rod fasteners, flange clips and brackets as needed to support the cable hangers from the building structure. Do not attach hangers to ceiling support wires or other support systems installed by other building trades.
- F. J-hooks shall not support more cables than recommended by the manufacturer.
- G. Acceptable Products
 - 1. Erico Caddy CableCat Clips.
 - 2. B-Line Cable Hook System.
 - 3. Panduit J-Pro Cable Support System.
 - 4. Or approved equal.

2.03 CONDUIT

- A. Rigid galvanized steel: Shall Conform to UL 6, ANSI C80.1.
- B. Rigid intermediate steel conduit (IMC): Shall Conform to UL 1242, ANSI C80.6.
- C. Electrical metallic tubing (EMT): Shall Conform to UL 797, ANSI C80.3. Maximum size not to exceed 105 mm (4 inches) and shall be permitted only with cable rated 600 volts or less.
- D. Flexible galvanized steel conduit: Shall Conform to UL 1.
- E. Liquid-tight flexible metal conduit: Shall Conform to UL 360.
- F. Direct burial plastic conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).

2.04 CONDUIT FITTINGS

- A. Rigid steel and IMC conduit fittings:
 - 1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.

2. Standard threaded couplings, locknuts, bushings, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
 3. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
 4. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
 5. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
 6. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.
- B. Rigid aluminum conduit fittings:
1. Standard threaded couplings, locknuts, bushings, and elbows: Malleable iron, steel; Zinc or cadmium plate iron or steel fittings. Locknuts and bushings: As specified for rigid steel and IMC conduit.
 2. Set screw fittings: Not permitted for use.
- C. Electrical metallic tubing fittings:
1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
 2. Only steel or malleable iron materials are acceptable.
 3. Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 2 inches and smaller. Use set screw type couplings with four set screws each for conduit sizes over 2 inches. Use set screws of case-hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.
 4. Indent type connectors or couplings are prohibited.
 5. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
- D. Flexible steel conduit fittings:
1. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
 2. Clamp type, with insulated throat.
- E. Liquid-tight flexible metal conduit fittings:
1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
 2. Only steel or malleable iron materials are acceptable.
 3. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
- F. Direct burial plastic conduit fittings:
1. Fittings shall meet the requirements of UL 514C and NEMA TC3.
 2. As recommended by the conduit manufacturer.

- G. Expansion and deflection couplings:
 - 1. Conform to UL 467 and UL 514B.
 - 2. Accommodate, 0.75 inch deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
 - 3. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.
 - 4. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.

2.05 CONDUIT SUPPORTS

- A. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.
- B. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
- C. Multiple conduit (trapeze) hangers: Not less than 1-1/2 by 1-1/2 inch, 12 gage steel, cold formed, lipped channels; with not less than 3/8 inch diameter steel hanger rods.
- D. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

2.06 OUTLET, JUNCTION, AND PULL BOXES

- A. UL-50 and UL-514A.
- B. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.
- C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- D. Metal Floor Boxes: Cast or sheet metal, semi-adjustable, rectangular.
- E. Sheet metal boxes: Galvanized steel, except where otherwise shown.
- F. Flush mounted wall or ceiling boxes shall be installed with raised covers so that front face of raised cover is flush with the wall. Surface mounted wall or ceiling boxes shall be installed with surface style flat or raised covers.

2.07 CABINETS

- A. NEMA 250, Type 1 or 4, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
- B. Hinged door in front cover with flush latch and concealed hinge.
- C. Key latch to match panelboards.
- D. Metal barriers to separate wiring of different systems and voltage.
- E. Accessory feet where required for freestanding equipment.

2.08 WIREWAYS

- A. Equip with hinged covers, except where removable covers are shown.

2.09 WARNING TAPE

- A. Standard, 4-Mil polyethylene 3 inches wide tape non-detectable type, red with black letters, and imprinted with "CAUTION BURIED ELECTRONIC SAFETY AND SECURITY CABLE BELOW".

2.10 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. Description: Comply with SCTE 77.
 - 1. Color of Frame and Cover: Gray.
 - 2. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.
 - 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 - 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - 5. Cover Legend: Molded lettering, as indicated for each service.
 - 6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 - 7. Handholes 2 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.

2.11 SLEEVES FOR RACEWAYS

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

2.12 FIRESTOPPING

- A. Manufacturers:
 - 1. Dow Corning Corp.
 - 2. 3M fire Protection Products.
 - 3. Specified Technology, Inc.
 - 4. Or Approved Equal.
- B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
 - 1. Silicone Firestopping Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
 - 2. Foam Firestopping Compounds: Single component foam compound.

3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

C. Color: Dark gray.

2.13 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

C. General:

1. Furnish UL listed products.
2. Select products with rating not less than rating of wall or floor being penetrated.

D. Non-Rated Surfaces:

1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 – EXECUTION

3.01 PENETRATIONS

A. Cutting or Holes:

1. Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the Owner prior to drilling, cutting or coring through structural sections.
2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Owner required by limited working space.

B. Fire Stop: Where conduits, wireways, and other electronic safety and security raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases with rock wool fiber or silicone foam sealant only. Completely fill and seal clearances between raceways and openings with the fire stop material.

- C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight.

3.02 INSTALLATION, GENERAL

- A. Install conduit as follows:

1. In complete runs before pulling in cables or wires.
2. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.
3. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
4. Cut square with a hacksaw, ream, remove burrs, and draw up tight.
5. Mechanically continuous.
6. Independently support conduit at 8 foot on center. Do not use other supports i.e., (suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts).
7. Support within 12 inches of changes of direction, and within 12 inches of each enclosure to which connected.
8. Close ends of empty conduit with plugs or caps at the rough-in stage to prevent entry of debris, until wires are pulled in.
9. Secure conduits to cabinets, junction boxes, pull boxes and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
10. Do not use aluminum conduits in wet locations.
11. Unless otherwise indicated on the drawings or specified herein, all conduits shall be installed concealed within finished walls, floors and ceilings.

- B. Conduit Bends:

- 1.
2. Make bends with standard conduit bending machines.
3. Conduit hickey may be used for slight offsets, and for straightening stubbed out conduits.
4. Bending of conduits with a pipe tee or vise is prohibited.

- C. Layout and Homeruns:

1. Install conduit with wiring, including homeruns, as shown.

3.03 CONCEALED WORK INSTALLATION

- A. In Concrete:

1. Conduit: Rigid steel, IMC or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel or vapor barriers.
2. Align and run conduit in direct lines.
3. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to insure low resistance ground continuity through the conduits. Tightening set screws with pliers is prohibited.

- B. Furred or Suspended Ceilings and in Walls:

1. Conduit for conductors 600 volts and below:

- a. Rigid steel, IMC, rigid aluminum, or EMT. Different type conduits mixed indiscriminately in the same system is prohibited.
 2. Align and run conduit parallel or perpendicular to the building lines.
 3. Tightening set screws with pliers is prohibited.
- C. Concealed accessible ceiling spaces and chases (non-inmate accessible):
1. Provide j-hooks spaced at 5'-0" O.C.
 2. J-hooks to be supported directly from existing structure. Do not support j-hooks from the supports/work of other trades.

3.04 EXPOSED WORK INSTALLATION

- A. Unless otherwise indicated on the drawings, exposed conduit is only permitted on the exterior of the building and in mechanical and electrical rooms.
- B. Conduit for Conductors 600 volts and below:
 1. Rigid steel, IMC, or EMT. Different type of conduits mixed indiscriminately in the system is prohibited.
- C. Align and run conduit parallel or perpendicular to the building lines.
- D. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
- E. Support horizontal or vertical runs at not over eight foot intervals.
- F. Surface metal raceways: Use only where shown.
- G. Painting:
 1. Paint exposed conduit to match adjacent surfaces.

3.05 EXPANSION JOINTS

- A. Conduits 3 inches and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.
- B. Provide conduits smaller than 3 inches with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 5 inch vertical drop midway between the ends. Flexible conduit shall have a copper green ground bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for 15 inches and larger conduits are acceptable.
- C. Install expansion and deflection couplings where shown.
- D. Seismic Areas: In seismic areas, provide conduits rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on both sides of the joint. Connect conduits to junction boxes with 15 inches of slack flexible conduit. Flexible conduit shall have a copper green ground bonding jumper installed.

3.06 CONDUIT SUPPORTS, INSTALLATION

- A. Safe working load shall not exceed 1/4 of proof test load of fastening devices.
- B. Use pipe straps or individual conduit hangers for supporting individual conduits.
- C. Maximum distance between supports is 8 foot on center.
- D. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 200 pounds. Attach each conduit with U-bolts or other approved fasteners.
- E. Support conduit independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.
- F. Fasteners and Supports in Solid Masonry and Concrete:
 - 1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
 - 2.
 - 3. Existing Construction:
 - a. Steel expansion anchors not less than 1/4 inch bolt size and not less than 1-1/8 inch embedment.
 - b. Power set fasteners not less than 1/4 inch diameter with depth of penetration not less than 3 inches.
 - c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.
- G. Hollow Masonry: Toggle bolts are permitted.
- H. Bolts supported only by plaster or gypsum wallboard are not acceptable.
- I. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
- J. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
- K. Chain, wire, or perforated strap shall not be used to support or fasten conduit.
- L. Spring steel type supports or fasteners are prohibited for all uses except: Horizontal and vertical supports/fasteners within walls.
- M. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.07 BOX INSTALLATION

- A. Boxes for Concealed Conduits:
 - 1. Flush mounted.
 - 2. Provide raised covers for boxes to suit the wall or ceiling, construction and finish.
- B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.

- C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.
- D. Outlet boxes in the same wall mounted back-to-back are prohibited. A minimum 24 inch, center-to-center lateral spacing shall be maintained between boxes).
- E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 4 inches square by 2-1/8 inches deep, with device covers for the wall material and thickness involved.
- F. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1".
- G. On all Branch Circuit junction box covers, identify the circuits with black marker.

3.08 ELECTRONIC SAFETY AND SECURITY CONDUIT

- A. Contractor shall design and install a complete end-to-end raceway system for the Video Surveillance System.
- B. Minimum conduit size of 3/4 inch, but not less than the size shown on the drawings.
- C. All conduit ends shall be equipped with insulated bushings.
- D. All four inch conduits within buildings shall include pull boxes after every two 90 degree bends. Size boxes per the NEC.
- E. Vertical conduits/sleeves through closets floors shall terminate not less than 3 inches below the floor and not less than 3 inches below the ceiling of the floor below.
- F. Terminate conduit runs to/from a backboard in a closet or interstitial space at the top or bottom of the backboard. Conduits shall enter communication closets next to the wall and be flush with the backboard.
- G. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.
- H. All empty conduits located in communications closets or on backboards shall be sealed with a standard non-hardening duct seal compound to prevent the entrance of moisture and gases and to meet fire resistance requirements.
- I. Conduit runs shall contain no more than four quarter turns (90 degree bends) between pull boxes/backboards. Minimum radius of communication conduit bends shall be as follows (special long radius):

Sizes of Conduit Trade Size	Radius of Conduit Bends mm, Inches
3/4	(6)
1	(9)
1-1/4	(14)
1-1/2	(17)
2	(21)
2-1/2	(25)
3	(31)
3-1/2	(36)
4	(45)

- J. Furnish and install 3/4 inch thick fire retardant plywood specified in on the wall of communication closets where shown on drawings . Mount the plywood with the bottom edge 6 inches above the finished floor.
- K. Furnish and pull wire in all empty conduits. (Sleeves through floor are exceptions).

3.09 INSTALLATION – FIRESTOPPING

- A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.
- B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.
- C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.
- D. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.
- E. Fire Rated Surface:
 - 1. Seal opening at floor, wall, partition, ceiling, and roof as follows:
 - a. Install sleeve through opening and extending beyond minimum of 1 inch (25 mm) on both sides of building element.
 - b. Size sleeve allowing minimum of 1 inch (25 mm) void between sleeve and building element.
 - c. Pack void with backing material.
 - d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
 - 2. Where cable tray, conduit, wireway, and cable penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.
- F. Non-Rated Surfaces:
 - 1. Seal opening through non-fire rated wall, partition, floor, ceiling and roof opening as follows:
 - a. Install sleeve through opening and extending beyond minimum of 1 inch (25 mm) on both sides of building element.

- b. Size sleeve allowing minimum of 1 inch (25 mm) void between sleeve and building element.
 - c. Install type of firestopping material recommended by manufacturer.
2. Install floor plates or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.
4. Interior partitions: Seal pipe penetrations at computer rooms and data rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

END OF SECTION 28 05 28

SECTION 28 20 00 – VIDEO SURVEILLANCE SYSTEM

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

- A. Provide all labor, materials, equipment, tools, transportation, storage costs, testing, training and all necessary and related items required to provide a complete and operational video surveillance system as shown on the Drawings and described in the Specifications.
- B. The Douglas County Stateline Jail has an existing Exacq video surveillance system. The existing system must remain operational until the new camera system is installed, tested and fully operational. After installation of the new camera system, the existing camera system is to be removed in its entirety.
- C. The Douglas County JLEC admin building has an existing video surveillance system. The existing system must remain operational until the new camera system is installed, tested and fully operational. After installation of the new camera system, the existing camera system is to be removed in its entirety.
- D. Douglas County is standardized on Avigilon. All cameras and network video recorders (NVR's) shall be manufactured by Avigilon. The contractor installing the system must be a certified Avigilon dealer/installer.
- E. Install equipment cabinets as shown on the drawing to mount all telecom termination patch panels, network switches, network video recording (NVR) servers and UPS's. See Division 27 Specifications for equipment mounting cabinet, CAT 6 patch panels, uninterruptable power supply (UPS), and grounding requirements.
- F. Install dedicated 20 amp electrical circuits to equipment cabinets as shown on the drawings.
- G. Install cable raceway system. Core existing CMU/concrete walls, install cable supports, conduit, pull boxes and sleeves as required to route CAT 6 cabling to cameras. See Specification Section 28 05 28 for raceway requirements.
- H. Install fiber optic backbone cabling where shown on the drawings.
- I. Install CAT 6 cabling to support video surveillance camera system. See Division 27 Specifications for CAT 6 cabling, installation, termination, testing and certification requirements.
- J. Furnish, install, mount, secure, aim, focus, adjust, connect to the network, assign IP addresses, configure, test, commission and demonstrate all IP video surveillance cameras.
- K. Furnish and install all necessary camera mounts and supports including ceiling mount kits, trim rings, gooseneck supports, corner mounts, pendant mounts, brackets, support arms, pole mounts, back boxes, etc. All exposed screws and fasteners used for camera supports, raceway supports, junction boxes and pull boxes shall be vandal resistant (Torx Pin-Head style).
- L. Install rack mounted 24-port POE+ network switches in the equipment cabinet. POE+ switches shall be connected with manufacturer 10 Gigabit SFP+ stacking cables

- connected to the SFP+ ports on the front of the switches. POE+ switches shall carry a 3-year manufacturer warranty.
- M. Provide CAT 6 patch cords to cross-connect camera patch panel ports to the POE switches. See Division 27 specifications for CAT 6 patch cord requirements.
 - N. Provide CAT 6 lightning protection entrance terminals to terminate cable to pole mounted cameras. See Division 27 specifications for CAT 6 lightning protection requirements.
 - O. Provide rack mounted 120VAC to 12VDC power supplies to power microphones where shown on the drawings.
 - P. Furnish and install rack mounted network video recording (NVR) servers. Recording servers shall be sized to store 60 days of recorded video. Provide Windows 2019 Server operating system (OS) and Avigilon Enterprise Control Center Video Management System (VMS) software on all servers. Servers shall carry a 5-year next business day onsite warranty.
 - Q. Furnish and install enterprise software license for each installed camera. Provide 5-year manufacturer software product maintenance agreement (Avigilon Smart Assurance Plan) with each camera license.
 - R. Furnish and install rack mounted uninterruptible power supplies (UPS's) to backup network switches and network video recording servers. See Division 27 Specifications for equipment cabinet UPS requirements.
 - S. Provide ceiling mounted video monitors in the control rooms. Provide associated ceiling mount plates, support poles and monitor supports.
 - T. Provide video viewing workstations in the control rooms to display camera video on the ceiling mounted monitors. Provide associated HDMI cables from the viewing workstations to the ceiling mounted monitors. Workstations shall carry a 5-year next business day onsite warranty.
 - U. Provide qty (1) video viewing workstation and qty (2) 24" desktop monitors at the security desk at the main entry into the JLEC admin/court building to view camera video.
 - V. Provide video viewing workstations and monitors in the training and personnel offices as shown on the drawings.
 - W. Provide UPS for each video viewing workstation.
 - X. Install video intercom at the Stateline jail vehicle sally port entrance driveway and video intercom master station in the control room. Install related gooseneck mounting pedestal, reinforced concrete pad and concreted filled steel safety bollards. Install video intercom cabling and interface with existing access control system to open vehicle sally port roll-up door.
 - Y. Install video intercom at the Stateline jail covered parking door and video intercom master station at the Parks Services office.
 - Z. Furnish, install, update and configure client video management viewing software on all video viewing workstations and on a minimum of four (4) additional owner furnished client computers as directed by Douglas County. Configure logical camera viewing groups and for each client computer as directed by the Owner.

- AA. Test, commission and demonstrate the entire IP video surveillance system and video intercom system in the presence of the Owner's Representative.
- BB. Provide a minimum of eight (8) hours training to the Owner on the usage and operation of the IP video surveillance cameras, video recording server management software and client video viewing software.
- CC. Turn over extra stock cameras to the owner.
- DD. Demo existing camera system in its entirety including cameras, camera supports, cabling, network video recorders and related equipment. Patch holes in walls and ceilings at removed camera locations. Provide blank cover plates over abandoned outlet boxes and junction boxes.

1.02 RELATED SECTIONS

- A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.
- B. Related Sections:
 - 1. Section 27 01 00: Common Work Results for Communications.
 - 2. Section 27 08 00: Commissioning of Communications
 - 3. Section 27 11 00: Communications Equipment Room Fittings
 - 4. Section 27 15 00: Communications Horizontal Cabling
 - 5. Section 28 00 00: Common Work Results for Electronic Safety & Security.
 - 6. Section 28 05 28: Conduits and Backboxes for Electronic Safety and Security.
- C. Division 1 Specifications, General and Supplementary Conditions apply to this Specification Section.

1.03 QUALITY ASSURANCE

- A. The Contractor installing the IP video surveillance cameras and video recording software must have a minimum of (5) years experience installing video surveillance systems of similar size and scope.
- B. The Contractor installing the IP video surveillance system must be a firm normally engaged in the design, installation and maintenance of integrated security systems including access control, intrusion detection and video surveillance.
- C. The contractor installing the Category 6 cabling to the cameras must comply with the qualification requirements and installation requirements listed in the Division 27 Specifications.
- D. The Contractor must be licensed by the Nevada State Contractors Board.
- E. Formal, written evidence of the following may be requested at any point during the Bid or installation processes:
 - 1. If requested, the Contractor, including any subcontractor, shall show proven expertise in the implementation of video surveillance projects. This expertise can be illustrated through the inclusion of details of at least three (3) projects involving the design and installation of video surveillance systems within the past

three-year period of similar size and scope. Names, addresses, and telephone numbers of references for the three projects shall be included.

2. In the event subcontractors are used for any portion of the installation or acceptance testing, the Contractor shall be responsible for any subsequent corrective action required on that portion of the work.

1.04 SUBMITTALS

A. Manufacturer Product Data Sheets

1. Submit product data sheets in electronic PDF (portable document format).
2. Provide a table of contents for each submittal indicating the items being submitted. Products listed in the table of contents should be in the same order as they appear in the Specifications.
3. Provide product data sheets for all items listed in each specification section. Partial submittals will not be accepted.
4. Where product data sheets include more than one distinct item, clearly mark data sheet with arrow or other identifying means to clearly indicate the items being submitted for approval. Delete or cross-out non-applicable data.
5. Provide manufacturer data sheets for the following equipment and software:
 - a. Indoor 2MP Dome Cameras.
 - b. Indoor 3MP Anti-Ligature Ceiling Corner Mount Cameras.
 - c. Indoor 4MP Dome Cameras.
 - d. Indoor 9MP 3-Sensor Dome Cameras.
 - e. Indoor 12MP 4-Sensor Dome Cameras.
 - f. Outdoor 4MP Dome Cameras.
 - g. Outdoor 9MP 3-Sensor Dome Cameras with IR.
 - h. Outdoor 12MP 4-Sensor Dome Cameras with IR.
 - i. Camera mounts.
 - j. Camera microphones.
 - k. 120VAC to 12VDC rack mounted power supplies for microphones.
 - l. 60 Watt POE++ injectors.
 - m. Network video recording servers and 10G SFP network cables.
 - n. POE+ network switches and 10G SFP stacking cables.
 - o. Industrial POE+ network switch and Power supply (for JLEC covered parking area cameras).
 - p. Video Viewing Workstations.
 - q. Video Viewing Workstation Monitors.
 - r. Video Viewing Workstation uninterruptible power supplies.
 - s. Video management system software, licenses and software support.
 - t. Video Intercom System.
 - u. 12'-0" Tapered Steel Aluminum Camera Pole

1.05 REGULATIONS AND CODE COMPLIANCE

- A. The Contractor will comply with all applicable governmental regulations including Federal, State, City, and local applicable codes and ordinances.
- B. References to codes and standards called for in the Specifications refer to the latest edition, amendments, and revisions to the codes and standards in effect on the date of these Specifications.
- C. All work and materials shall conform to and be installed, inspected and tested in accordance with federal, state and local governmental agencies, including, but not limited to the following:

1. ANSI/NFPA-70, 2017 -- National Electrical Code (NEC).
2. Underwriter's Laboratories, Inc. (UL).
3. Federal Communications Commission (FCC).
4. Americans with Disabilities Act (ADA).

1.06 INTENT OF DRAWINGS

- A. All drawings are diagrammatic unless otherwise noted as detailed dimensioned drawings. Drawings show approximate locations of equipment and devices. Exact locations are subject to the approval of the Owner or Owner's Representative. The Contractor shall verify dimensions and shall be responsible for their accuracy
- B. Items mentioned in the Specifications and not shown in the Drawings, or shown in the Drawings and not mentioned in the Specifications, shall be of like effect as if shown and mentioned in both. In the case of differences between the Drawings and the Specifications, the stricter provision as determined by the Owner or Owner's Representative shall govern.
- C. Omissions from the Drawings or Specifications, or the incorrect description of details of Work which are necessary to carry out the intent of the Drawings and Specifications, or work which is customarily performed, shall not relieve the Contractor from performing such omitted or incorrectly described work.
- D. No exclusion from, or limitations in, the language used in the Project Documents shall be interpreted as meaning that ancillary or accessory items necessary to complete any required system or item of equipment are to be omitted.

1.07 REVIEW OF SPECIFICATIONS

- A. Prior to submitting a bid for the Project, the Contractor shall carefully study and compare the Drawings and Specifications and shall at once report to the Owner or Owner's Representative any error, inconsistency or omission discovered. During construction, if the Contractor performs any construction activity knowing it involves a recognized error, inconsistency or omission in the Specifications without such notice to the Owner or Owner's Representative, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the cost for any correction.
- B. The Contractor shall not deviate from the specified scope of work as indicated in the Project Documents. Deviations include (but are not limited to):
 1. Alteration of video surveillance camera locations from those specified in Plans.
 2. Installation of horizontal cables to a different Telecom Room than indicated on the Plans.

1.08 EXAMINATION OF THE PREMISES

- A. The Contractor shall visit the Site(s) to become familiar with the local conditions under which the work is to be performed and correlate his observations with the requirements of the Drawings and Specifications. No allowance will be made for claims of concealed conditions which the Contractor learned or should have learned in exercising due diligence in its observations of the site and review of the local conditions.
- B. Before ordering any materials or performing any work, the Contractor shall verify all measurements and be responsible for correctness of same. No extra charge or compensation will be allowed for duplicate work or material required because of an

unverified difference between an actual dimension and the measurement indicated in the Drawings. Any discrepancies found shall be submitted in writing to the Owner or Owner's Representative for consideration before proceeding with the work.

1.09 DELIVERY, STORAGE AND HANDLING

- A. All items to be installed as a component of the IP video surveillance system for the Project shall be stored according to manufacturer's recommendations. In addition, all items must be stored in a location protected from vandalism and weather. Items shall not be stored outside. If air temperature at the storage location shall be below 40 degrees F, the equipment shall be moved to a heated 50 degrees F (minimum) location. If necessary, equipment shall be stored off site at The Contractor's expense.

1.10 WARRANTY

- A. See Division 1 Specifications and General Conditions regarding Guarantee and Warranty requirements which apply to this Specification Section.
- B. The Contractor shall provide the following warranty for the Video Surveillance System described in this specification section:
1. Warranty Start Date: The warranty period will begin after substantial completion of the project.
 2. Complete System Warranty: The complete Video Surveillance System including all devices, equipment, cabling, software and programming shall be guaranteed to be free from defects in workmanship and materials for a minimum period of one (1) year from date of substantial completion. Promptly remedy such defects and any subsequent damage caused by the defects or repair thereof at no expense to the Owner.
 3. Labor Warranty: Contractor to provide all labor as necessary to complete warranty repairs for a period of one (1) year from the date of substantial completion. During this labor warranty period, all services including equipment, labor, travel, expenses, etc., shall be provided during normal working hours at no cost to the Owner. The Contractor shall provide the Owner with a phone number for service. The Contractor shall respond within one (1) business day of receipt of a service call. The Contractor shall provide an on-site response time of two (2) business day for repair of critical system items during normal business hours.
 4. Warranty Exclusions: The guarantee shall exclude acts of God, vandalism, physical abuse or operator misuse.
 5. Routine Site Visits During Warranty Period: Provide one routine maintenance visit at the end of the one (1) year labor warranty period at a time coordinated with the Owner. Adjust and replace defective parts and components with original manufacturer's replacement parts, components, and supplies.
 6. Labor Warranty and Maintenance Service Renewal: No later than 60 days prior to the expiration of the one (1) year labor warranty period, deliver to the Owner a proposal to provide contract maintenance and repair services for an additional one-year term. The Owner will be under no obligation to accept maintenance service proposal.
 7. Extended Warranties: Contractor to provide the following equipment with extended warranties:

- a. Network video recorders: 5-year next business day onsite warranty.
- b. Control room video wall viewing workstations: 5-year next business day onsite warranty.
- c. Video Management System Software Maintenance Agreement: 5-Years.
- d. Cameras: 3-Year Warranty.
- e. Control Room video monitors: 3-Year Warranty.
- f. POE Network Switches: 3-Year Warranty.

1.11 FINAL ACCEPTANCE

A. General

1. All cameras mounted in accordance with the drawings.
2. All CAT 6 cables installed, terminated, labeled and tested. Certified test reports submitted to the Owner.
3. All cameras connected to the network and assigned IP addresses (Owner to provide IP address scheme). Contractor to provide list of camera locations, hardware MAC addresses and IP addresses to the Owner.
4. All cameras communicating and recording to the video "Recording" server.
5. All cameras properly aimed and focused for both day and night operation.
6. All cameras configured for proper aspect ratio, resolution, frame rate and video recording size.
7. Video "Recording" software installed, updated and configured on the video recording server at each project location.
8. Device licenses for each camera installed on the server.
9. Client viewing and configuration software installed, updated and configured on a minimum of (4) client computers.
10. Configure permissions on the recording servers to allow specific users to view live and recorded video.
11. Entire video surveillance system tested and commissioned in the presence of the Owner's Representative.
12. All Punchlist items identified during the testing and commissioning corrected to the satisfaction of the Owner's Representative.
13. Extra stock items turned over to the Owner.
14. Operation and Maintenance manuals turned over to the Owner.
15. Owner training completed.

PART 2 – PRODUCTS

2.01 FIXED INDOOR VANDAL RESISTANT 2MP DOME CAMERAS

A. Provide cameras meeting the following requirements:

1. The camera shall be of manufacturer's official product line, designed for commercial/industrial 24/7/365 use.
2. The camera shall be based upon standard components and proven technology using open and published protocols.
3. Minimum 2MP, 1920x1080 Resolution.
4. Lens aperture adjustment 3.3mm to 9mm.
5. RJ-45 Ethernet Connector. 10/100 Base-T.
6. IEEE 802.3af Compliant.
7. Mini-Dome.
8. Auto Zoom and Focus via Web Browser.
9. Vandal Resistant IK10 Rated.

10. H.264 video compression at 30fps.
11. 3-Year Warranty.

B. Acceptable Products:

1. Avigilon P/N 2.0C-H5A-D1 with smoked lens.
2. Provide microphones and microphone cable where shown on drawings. Avigilon P/N ACC-MIC.
3. No substitutions.

2.02 FIXED INDOOR VANDAL RESISTANT 4MP DOME CAMERAS

A. Provide cameras meeting the following requirements:

1. The camera shall be of manufacturer's official product line, designed for commercial/industrial 24/7/365 use.
2. The camera shall be based upon standard components and proven technology using open and published protocols.
3. Minimum 4MP, 2560x1440 Resolution.
4. Lens aperture adjustment 3.3mm to 9mm.
5. RJ-45 Ethernet Connector. 10/100 Base-T.
6. IEEE 802.3af Compliant.
7. Mini-Dome.
8. Auto Zoom and Focus via Web Browser.
9. Vandal Resistant IK10 Rated.
10. H.264 video compression at 30fps.
11. 3-Year Warranty.

B. Acceptable Products:

1. Avigilon P/N 4.0C-H5A-D1 with clear lens P/N H4A-DD-CLER1.
2. No substitutions.

2.03 FIXED INDOOR VANDAL RESISTANT 3MP ANTI-LIGATURE CEILING CORNER MOUNT CAMERAS

A. Provide cameras meeting the following requirements:

1. The camera shall be of manufacturer's official product line, designed for commercial/industrial 24/7/365 use.
2. The camera shall be based upon standard components and proven technology using open and published protocols.
3. Minimum 3MP, 2048 x 1536 Resolution.
4. Lens aperture adjustment 3.3mm to 9mm.
5. RJ-45 Ethernet Connector. 10/100 Base-T.
6. IEEE 802.3af Compliant.
7. Stainless steel anti-ligature corner mount with built-in IR.
8. Vandal resistant IK10 rated.
9. Water resistant IP67 and NEMA 4X rated.
10. H.264 video compression at 15fps.
11. 3-Year Warranty.

B. Acceptable Products

1. Avigilon P/N 3.0C-H5A-CR1-IR-SS.
2. No substitutions.

2.04 FIXED OUTDOOR RATED VANDAL RESISTANT 2MP DOME CAMERAS

- A. Provide cameras meeting the following requirements:
1. The camera shall be of manufacturer's official product line, designed for commercial/industrial 24/7/365 use.
 2. The camera shall be based upon standard components and proven technology using open and published protocols.
 3. Minimum 2MP, 1920x1080 Resolution.
 4. Lens aperture adjustment 3.3mm to 9mm.
 5. RJ-45 Ethernet Connector. 10/100 Base-T.
 6. IEEE 802.3af Compliant.
 7. Mini-Dome.
 8. Auto Zoom and Focus via Web Browser.
 9. Vandal Resistant IK10 Rated.
 10. Water resistant IP66 and IP67 rated.
 11. H.264 video compression at 30fps.
 12. 3-Year Warranty.
- B. Acceptable Products:
1. Outdoor surface mount:
 - a. Avigilon P/N 2.0C-H5A-D01-IR with clear lens.
 - b. No substitutions.
 2. Outdoor wall mount:
 - a. Avigilon P/N 2.0C-H5A-DP1-IR with clear lens and pendant wall mount P/N H4A-MT-WALL1.
 - b. No substitutions.

2.05 FIXED OUTDOOR RATED VANDAL RESISTANT 4MP DOME CAMERAS

- A. Provide cameras meeting the following requirements:
1. The camera shall be of manufacturer's official product line, designed for commercial/industrial 24/7/365 use.
 2. The camera shall be based upon standard components and proven technology using open and published protocols.
 3. Minimum 4MP, 2560x1440 Resolution.
 4. Lens aperture adjustment 3.3mm to 9mm.
 5. RJ-45 Ethernet Connector. 10/100 Base-T.
 6. IEEE 802.3af Compliant.
 7. Mini-Dome.
 8. Auto Zoom and Focus via Web Browser.
 9. Vandal Resistant IK10 Rated.
 10. Water resistant IP66 and IP67 rated.
 11. H.264 video compression at 30fps.
 12. 3-Year Warranty.
- B. Acceptable Products:
1. Outdoor surface mount:

- a. Avigilon P/N 4.0C-H5A-D01-IR with clear lens.
 - b. No substitutions.
2. Outdoor wall mount:
- a. Avigilon P/N 4.0C-H5A-DP1-IR with clear lens and pendant wall mount P/N H4A-MT-WALL1.
 - b. No substitutions.

2.06 FIXED MULTIPLE IMAGE SENSOR VANDAL RESISTANT DOME CAMERAS

- A. Provide cameras meeting the following requirements:
1. Camera will consist of 3 or 4 individual 3MP fixed cameras installed in a single vandal resistant dome.
 2. Each of the 3 or 4 cameras within the dome shall be capable of being repositioned within the dome by moving it around the perimeter of a circular support track.
 3. Each of the 3 or 4 cameras within the dome shall be capable of being independently aimed up and down, side to side.
 4. Each of the 4 cameras within the dome shall be capable of being remotely focused over the IP network via a web browser.
 5. Each of the 3 or 4 cameras will have a minimum 3MP Resolution.
 6. Wide Dynamic Range.
 7. Dual encoder (H.264 and MJPEG).
 8. The entire camera assembly will one RJ-45 Ethernet Connector, 10/100 Base-T.
 9. The entire camera assembly will require 1 software camera license within the VMS software.
 10. POE+ 30 Watts - IEEE 802.3at Compliant (no IR).
 11. POE++ 60 Watts (with IR).
 12. Vandal Resistant and IK10 Rated.
 13. IP 66 Ingress and Weather Rated.
 14. Video frame rate (up to) 20FPS.
 15. 3-Year Warranty.
- B. Provide corner mount kit, gooseneck support arm and shroud to mount cameras on exterior corners of buildings as shown on the drawings. Provide additional mounting plates, adapters and accessories as necessary for a vandal resistant and weatherproof installation.
- C. Provide pole mount, back box, gooseneck support arm and shroud to mount cameras on light poles as needed. Provide additional mounting plates, adapters and accessories as necessary for a vandal resistant and weatherproof installation.
- D. Acceptable Products:
1. 4-sensor 4 x 3MP 360 degree camera:
 - a. Avigilon P/N 12C-H4A-4MH-360.
 - b. No substitutions.
 2. 3-sensor 3 x 3MP 270 degree camera:
 - a. Avigilon P/N 9C-H4A-3MH-270
 - b. No substitutions.

3. 3-Sensor 3 x 3MP 180 degree camera:
 - a. Avigilon P/N 9C-H4A-3MH-180
 - b. No substitutions.
4. 3-Sensor 3 x 5MP 180 degree camera:
 - a. Avigilon P/N 15C-H4A-3MH-180
 - b. No substitutions.
5. Provide the following accessories with each camera as indicated on the camera schedule:
 - a. Outdoor pendant mount: Avigilon P/N H4AMH-AD-PEND1 and IRPTZ-MNT-WALL1.
 - b. Outdoor pole mount: Avigilon P/N H4-MT-POLE1.
 - c. Outdoor corner mount: Avigilon P/N H4-MT-CRNR1.
 - d. Clear lens cover: Avigilon P/N H4AMH-DO-COVR1.
 - e. IR Illuminator: Avigilon P/N H4AMH-AD-IRIL1.
 - f. 60W POE++ Injector (for cameras with IR Illuminator): Avigilon P/N POE-INJ2-60W-NA.
 - g. No Substitutions.

2.07 FIXED 1-SENSOR 8MP FISHEYE 360 DEGREE DOME CAMERA

- A. Provide cameras meeting the following requirements:
 1. Camera will consist of single 8MP fixed camera installed in a vandal resistant dome.
 2. Wide Dynamic Range.
 3. Dual encoder (H.264 and MJPEG).
 4. The entire camera assembly will one RJ-45 Ethernet Connector, 10/100 Base-T.
 5. The entire camera assembly will require 1 software camera license within the VMS software.
 6. POE+ 30 Watts - IEEE 802.3at Compliant (with IR).
 7. Vandal Resistant and IK10 Rated.
 8. IP 66 Ingress and Weather Rated.
 9. Video frame rate (up to) 20FPS.
 10. 3-Year Warranty.
- B. Provide pendant mount kit as shown on the drawings. Provide additional mounting plates, adapters and accessories as necessary for a vandal resistant and weatherproof installation.
- C. Acceptable Products:
 1. 1-sensor 8MP 360 degree fisheye camera:
 - a. Avigilon P/N 8.0C-H5A-FE-D01-IR.
 - b. No substitutions.

2.08 4MP OUTDOOR PAN TILT ZOOM (PTZ) CAMERA

- A. Provide cameras meeting the following requirements:
 1. The camera shall be of manufacturer's official product line, designed for commercial/industrial 24/7/365 use.

2. The camera shall be based upon standard components and proven technology using open and published protocols.
3. Minimum 4MP, 2560x1440 Resolution.
4. Lens aperture adjustment 3.3mm to 9mm.
5. RJ-45 Ethernet Connector. 10/100 Base-T.
6. IEEE 802.3af Compliant.
7. Dome.
8. Pan, Tilt Zoom via mouse controls.
9. 36x Zoom.
10. Water resistant IP66 and IP67 rated.
11. H.264 video compression at 30fps.
12. 3-Year Warranty.

B. Acceptable Products:

1. Outdoor pendant mount – Provide all of the following part numbers:
 - a. PTZ Camera: Avigilon P/N 2.0C-H5A-PTZ-DP36.
 - b. Dome Cover: Avigilon P/N PTZH5A-CLER1.
 - c. Wall Mount: Avigilon P/N IRPTZ-MNT-WALL1.
 - d. Pendant Mount: Avigilon P/N IRPTZ-MNT-NPTA1.
 - e. 60W Injector: Avigilon P/N POE-INJ-BT-60W-NA.
 - f. No substitutions.

2.09 CEILING MICROPHONES

- A. Provide flush ceiling mounted microphones where shown on the drawings.
- B. Provide 4-wire microphone cable to connect microphones to the line level mini-stereo audio input jack on the cameras.
- C. Provide 18/2 plenum rated cabling to connect microphones to 12VDC power supplies mounted in the equipment cabinet.
- D. Configure VMS software to record audio from microphones.
- E. Acceptable Products:
 1. Avigilon microphone P/N ACC-MIC and cable P/N CM-AC-AVIO1.
 2. No Substitutions.

2.10 120VAC TO 12VDC RACK MOUNTED POWER SUPPLIES FOR MICROPHONES

- A. Provide 1RU rack mounted 120VAC to 12VDC power supplies to power the microphones.
- B. Provide power supplies with 8 or 16 outputs as shown on the drawings.
- C. Install 18/2 plenum cabling from power supplies to each microphone location.
- D. Acceptable Products:
 1. Power Supplies: Altronix P/N Vertiline3D (8 output) and Vertiline33D (16 output).
 2. Cabling: Belden 6300UE
 3. Or approved equal.

2.11 NETWORK VIDEO RECORDING SERVERS

- A. The VMS server components (processor(s), memory, hard drives, RAID controllers, drive partitions, operating system, etc.) must be sized and specified properly such that the recorded and live video can be viewed without delay, blur, jitter or missing frames.
- B. The VMS Recording server shall be sized to store 60 days of recorded video.
- C. VMS Recording server(s) shall meet the following minimum requirements:
 - 1. 2RU Rack mounted. Provide mounting rails as necessary for mounting in 4-post server rack.
 - 2. Dual (redundant) hot-swappable power supplies.
 - 3. Windows 2019 Server.
 - 4. Avigilon Control Center.
 - 5. Xeon Processor.
 - 6. 64GB DDR4 RAM.
 - 7. Qty (2) M.2 SSD Drives in RAID 1 Config for Operating System.
 - 8. 288TB of storage (360TB Raw Storage).
 - 9. Dual 10GbE Nics.
 - 10. 5-Year Onsite Next Business Day Warranty. In the event of a hard drive failure, a new hard drive is sent out and the owner keeps the failed hard drive.
- D. Acceptable Products:
 - 1. Avigilon P/N NVR5-PRM-288TB-S19 and 10G SFP copper network cable P/N NVR5-SFPPLUS-DA.
 - 2. No Substitutions.

2.12 VIDEO MANAGEMENT SYSTEM SOFTWARE, LICENSING AND SOFTWARE SUPPORT

- A. Provide latest version of VMS Enterprise software on servers and viewing workstations.
- B. Provide qty (1) camera license per camera.
- C. Provide 5-year software maintenance agreement with each camera license. During the 5-year period, the software manufacturer will provide software updates and product support free of charge.
- D. Acceptable Products:
 - 1. Server Software: Avigilon Enterprise Control Center Server Software Version 7.xx (latest version).
 - 2. Client Software: Avigilon Control Center Client Software Version 7.xx (latest version).
 - 3. Camera Licenses: Avigilon Enterprise Camera License P/N ACC7-ENT. Provide qty (1) license for each installed camera.
 - 4. 5-Year Software Maintenance Agreement: Avigilon Smart Assurance Plan P/N ACC-ENT-SMART-5YR. Provide 5-year product maintenance agreement for each camera license.
 - 5. No substitutions.

2.13 24-PORT POE+ NETWORK SWITCHES & STACKING CABLES

- A. Provide 24-port POE+ network switches. Switches shall have the following physical characteristics:

1. Qty (24) 10/100/1000 POE+ (30W POE) network ports with 382W total power budget. Qty (8) of the (24) switch ports support POE++ (60W POE).
 2. Qty (4) 10 Gigabit Ethernet ports. Includes qty (2) 10GBase-T/SFP+ combo ports and qty (2) SFP+ ports.
 3. Qty (3) + (1) redundant fans.
 4. 3-Year Warranty.
- B. Provide qty (1) 1 meter 10G SFP+ stacking cable per switch.
- C. Provide qty (1) 3 meter 10G SFP+ stacking cable for top level switch to complete switch stack.
- D. Provide qty (2) 10GbE fiber SFP modules to uplink IDF #2 switch stack to property storage room B44 switch stack.
- E. Acceptable Products (Provide all of the following):
1. Cisco SG550X-24MP-K9-NA.
 2. Provide qty (1) 1 meter 10 Gigabit SFP+ stacking cable with each switch. Cisco P/N SFP-H10GB-CU1M.
 3. Provide qty (1) 3-meter 10 Gigabit SFP+ stacking cable for top level switch. Cisco P/N SFP-H10GB-CU3M.
 4. Provide qty (2) 10GbE fiber SFP modules P/N SFP-10G-LR.
 5. No Substitutions.
- 2.14 8-PORT INDUSTRIAL POE+ SWITCH (JLEC COVERED PARKING)
- A. Provide 8-port POE+ industrial network switch. Switch shall have the following physical characteristics:
1. Din rail mounted switch and power supply.
 2. Qty (8) 10/100/1000 POE+ (30W POE) network ports with 240W total power budget.
 3. Qty (2) 1 Gigabit SFP ports.
 4. 120VAC to 24VDC din rail mounted power supply.
 5. 3-Year Warranty.
- B. Provide qty (2) rugged fiber SFP modules to uplink switch to property storage room B44 switch stack.
- C. Acceptable Products:
1. Cisco P/N IE-3200-8P2S-E switch, P/N PWR-IE240W-PCAC-L power supply and P/N GLC-LX-SM-RGD sfp modules..
 2. Or approved equal.
- 2.15 JLEC AND STATELINE CONTROL ROOM CEILING MOUNTED FLAT PANEL DISPLAYS
- A. See plans for monitor sizes. Provide flat panel displays, ceiling mounts and 1.5" diam NPT support poles.
- B. Displays shall have 4K resolution.
- C. Displays shall be commercial rated for continuous 24x7x365 use with 3-Year Warranty.

- D. Provide HDMI cable of sufficient length to connect displays to video viewing workstations. Provide power cord of sufficient length to connect displays to existing power outlets.
- E. Provide ceiling anchors to secure monitor mounting plate to ceiling.
- F. Acceptable products:
 - 1. Samsung P/N QB43R and QB50R (see plans for sizes).
 - 2. Provide ceiling mount assembly with each flat panel. Chief P/N's LCM1U (monitor mount bracket), CMS012018 (pipe column) and CMA115 (ceiling plate).
 - 3. Or Approved Equal.

2.16 JLEC BRIEFING AND PATROL WRITING ROOM WALL MOUNTED FLAT PANEL DISPLAYS

- G. See plans for monitor sizes. Provide flat panel displays and wall mounts.
- H. Displays shall have 4K resolution.
- I. Displays shall be commercial rated for continuous 24x7x365 use with 3-Year Warranty.
- J. Provide HDMI cable of sufficient length to connect displays to video viewing workstations. Provide power cord of sufficient length to connect displays to existing power outlets.
- K. Acceptable products:
 - 1. Samsung P/N QB55R.
 - 2. Provide wall mount for each flat panel. Chief P/N's LSM1U.
 - 3. Or Approved Equal.

2.17 JLEC SECURITY DESK FLAT PANEL DISPLAYS

- A. Provide 24" diagonal desktop mounted flat panel displays.
- B. Provide HDMI or display port cable of sufficient length to connect displays to video viewing workstation.
- C. Coordinate mounting location on existing control room desk with Douglas County Jail staff.
- D. Acceptable Products:
 - 1. Dell P/N P2422H.
 - 2. Or Approved Equal.

2.18 VIDEO VIEWING WORKSTATIONS

- A. Provide video viewing workstations as shown on the drawings. Connect workstations to the viewing monitors and network.
- B. 5-Year Onsite Next Business Day Warranty.
- C. Workstations shall have adequate resources to display 16 cameras per monitor (32 cameras total) without video lag or jitter.
- D. Acceptable Products:

1. Avigilon (Dell OEM) P/N RM6-WKS-4MN-NA and RM6-WKS-2MN-NA.
2. Provide 2-year extended warranty with each workstation. Avigilon (Dell OEM) P/N NVR-WKS-WARR-EXTEND-2YR.
3. No Substitutions.

2.1 VIDEO VIEWING WORKSTATION UNINTERRUPTIBLE POWER SUPPLIES

- A. Provide UL listed 1,00VA uninterruptible power supplies as shown on the drawings. Uninterruptible power supplies shall meet the following physical specifications:
1. Output voltage distortion less than 5% at full load.
 2. Output frequency 57 to 63 Hz.
 3. Crest Factor up to 5 to 1.
 4. Output connections: qty (6) NEMA 5-15R.
 5. Input connection: NEMA 5-15P.
 6. Battery type: Maintenance free sealed leakproof lead acid battery with suspended electrolyte.
 7. 3 Hour typical recharge time.
 8. Computer interface ports, DB-9 RS-232, SmartSlot, USB.
 9. LED status display with load and battery bar graphs and on line, on battery, replace battery and overload indicators.
 10. Audible alarm when on battery and low battery condition.
 11. 480 Joules surge energy rating.
 12. Full time multi-pole noise filtering – meets UL 1449.
 13. 2-Year mfg warranty.
 14. Regulatory approvals: BSMI, CSA, UL 1449, UL 1778, FCC Part 15 Class A.
- B. Provide UPS with adequate cord length to plug into electrical outlets.
1. Acceptable Products – See UPS schedule on drawings.
 - a. 1,000 VA Tower Mount – American Power Conversion Smart UPS P/N SMC1000IC.

2.19 VIDEO INTERCOM SYSTEM (STATELINE VEHICLE SALLY PORT DRIVEWAY & COVERED PARKING ENTRY)

- A. Provide video intercom system at the Stateline Jail vehicle sally port entry driveway including video/intercom station, tube steel pedestal, reinforced concrete pad, remote video/intercom admin console, cabling and door relay module.
- B. Provide video intercom system at the Stateline Jail exterior door to covered parking including video/intercom station, remote video/intercom admin console and cabling.
- C. Video intercom stations shall be surface mounted, vandal resistant and constructed of stainless steel. Video intercom stations shall have call button, microphone, speaker and camera.
- D. Remote admin console shall be desk mounted. Provide power supply as required. Admin console shall have an unlock button and associated output to existing door access control system to activate the vehicle sally port roll-up door.
- E. Provide conduit and wiring as shown on the drawings and as required for a complete and operable system.
- F. Acceptable Products:

1. Vandal Resistant Vehicle Video Intercom Station with surface back box with integral rain hood:
 - a. Aiphone P/N JP-DVF and IP65 rated surface backbox p/n SBX-DVF.
 - b. Or Approved Equal.
2. Admin Console:
 - a. Aiphone P/N JP-4MED.
 - b. Or Approved Equal.
3. Admin Console desk stand:
 - a. Aiphone P/N MCS-S/A.
 - b. Or Approved Equal.
4. 3-Door Relay Module (where required for roll-up door activation).
 - a. Aiphone P/N RY-3DL.
 - b. Or Approved Equal.
5. Power Supplies:
 - a. Aiphone P/N PS2420UL.
 - b. Or Approved Equal.
6. Tube Steel Mounting Pedestal (at vehicle sally port).
 - a. Pedestal Pro P/N 42-3-12.
 - b. Or Approved Equal.

2.20 12'-0" TAPERED STEEL DEDICATED CAMERA POLE (JLEC WEST ENTRANCE)

- A. Provide 12'-0" high round tapered steel camera pole where shown on the drawings.
- B. Provide reinforced concrete pole base as shown on the drawings.
- C. Tapered steel pole shall have the following physical characteristics:
 1. 12'-0" nominal height.
 2. Shall conform to ASTM A595 Grade A.
 3. Pole shall have a constant linear taper of 0.14 in/ft.
 4. Top of pole shall be 3" O.D.
 5. Handhole with cover shall be provided at base of pole.
 6. Anchor base plate complying with ASTM A36.
 7. $\frac{3}{4}$ " diameter x 17" long "L" shaped anchor bolts complying with ASTM F1554 Grade 55. Anchor bolts shall be provided with hex nut, acorn nut and washers.
 8. Provide pole cap.
 9. All hardware and fasteners shall be galvanized or zinc-plated.
 10. Pole shall be finish painted – color DARK BRONZE.
 11. Provide square base cover.
- D. Acceptable Products:
 1. Valmont Structures P/N DS200-468A120-PC-FP-DB-2T-AB.

2. Or approved equal.

PART 3 – EXECUTION

3.01 ROUGH-IN

- A. Before construction work commences, the Contractor shall visit the site and identify the exact location and mounting of all cameras.
- B. Camera mounting locations shall be coordinated with other ceiling/wall mounted items including HVAC grills, lights, switches, exit signs, fire sprinklers, smoke detectors, etc. Cameras, mounts, raceway and cabling shall be installed so as not to interfere with required clearances for maintenance and inspection of existing equipment.
- C. Notify the Owner's Representative of any obstructions that may block the camera views shown on the Drawings.
- D. The contractor shall minimize the amount of exposed conduit and boxes exposed to view. All exterior conduit shall be rigid RMC with water tight boxes and fittings.
- E. All exposed screws and fasteners used for camera mounting hardware, conduit supports, j-boxes and pull boxes shall be vandal resistant (Torx Pin-Head Style).
- F. All exposed conduit shall be painted to match adjacent surfaces.

3.02 CUTTING AND PATCHING

- A. The Contractor shall be responsible for all cutting, patching, coring and associated work to complete the camera installation. Patch adjacent work disturbed or damaged by installation of new work including insulation, walls and wall covering, ceiling and floor covering or other finished surfaces.
- B. The contractor shall be responsible for repairing any ceiling tile, ceiling grid, ceiling supports or adjacent surfaces damaged during the installation of the cameras.
- C. All penetrations through the building envelope shall be sealed and made water tight.
- D. All penetrations through fire rated walls, floors and ceilings shall be fire stopped with a UL listed fire stop system meeting or exceeding the rating of the assembly being penetrated.
- E. No roof penetrations are permitted.

3.03 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate ordering and installation of all equipment with long lead times or having a major impact on work by other trades so as not to delay the job or impact the schedule.
- B. Set all cameras and associated supports to accurate line and grade, level all equipment and align all equipment components.
- C. Provide all scaffolding, rigging, hoisting and services necessary for installation of equipment.
- D. Storage and security of material and equipment prior to installation shall be the responsibility of the Contractor.

3.04 CEILING DOME CAMERA MOUNTING AND NETWORK CONNECTION

- A. Install ceiling mounted dome cameras and support brackets in accordance with the Manufacturer's instructions.
- B. Verify ceiling mounted camera locations shown on the drawings. The contractor shall verify that adequate clearances exist above the camera to allow installation at the locations shown. The contractor shall make minor adjustments to the camera locations to avoid clearance conflicts.
- C. Secure cameras to structure with mount kit called out in the camera schedule.
- D. Furnish, install and terminate Category 6 cabling from the IP camera to the telecom equipment cabinet identified on the Drawings.
- E. Terminate CAT 6 cable at the camera on CAT 6 Field Mount Plug and connect directly to the camera.
- F. The contractor shall assign static IP addresses to the camera with the IP address scheme specified by the Owner.
- G. Verify that the camera has the most current firmware version. If not, download and install the latest firmware version from the manufacturer's website.
- H. Logon to the camera and set the date and time. Set the time to Pacific Standard Time and configure the camera to automatically adjust to daylight savings time. Configure the camera to connect to a Network Time Protocol (NTP) server once every 24 hours and synchronize the time. Verify IP address of NTP server with the Owner.
- I. Add the camera to the database on the VMS "Recording Server" and load the appropriate drivers for the camera.
- J. Configure camera ID, description and date/time stamping. The camera ID should follow the following naming convention: "Camera # - Area - Location". For example, Camera 3 at main entry would be named: "3 - Main Entrance".
- K. Change the default logon password on the IP camera web interface as directed by the Owner.

3.05 EXTERIOR GOOSENECK CAMERA MOUNTING AND NETWORK CONNECTION

- A. Notify the Owner's representative where obstructions exist that may block the view from the camera prior to installing the camera.
- B. Install fixed dome cameras, corner mount kits, gooseneck supports and shrouds in accordance with the Manufacturer's instructions.
- C. Core drill exterior building and install rigid conduit to feed the camera via the support bracket.
- D. Route conduit to minimize the amount of conduit exposed to view. Install rigid (RMC) conduit at all exterior locations.
- E. Paint exposed conduit to match existing surfaces.

- F. Securely anchor corner mount kit and/or gooseneck support bracket to structure.
- G. Install camera shroud and connect camera to shroud.
- H. Verify that camera and mounts are level and plumb.
- I. Verify that all components are secure to prevent vibrating or unstable images caused by wind or vibration.
- J. All exposed screws and fasteners shall be vandal resistant (Torx Pin-Head Style).
- K. Furnish, install and terminate Category 6 cabling from the IP camera to the telecom equipment cabinet identified on the Drawings.
- L. Terminate CAT 6 cable at the camera on CAT 6 Field Mount Plug and connect directly to the camera.
- M. The contractor shall assign static IP addresses to the camera with the IP address scheme specified by the Owner.
- N. Verify that the camera has the most current firmware version. If not, download and install the latest firmware version from the manufacturer's website.
- O. Logon to the camera and set the date and time. Set the time to Pacific Standard Time and configure the camera to automatically adjust to daylight savings time. Configure the camera to connect to a Network Time Protocol (NTP) server once every 24 hours and synchronize the time. Verify IP address of NTP server with the Owner.
- P. Add the camera to the database on the VMS "Recording Server" and load the appropriate drivers for the camera.
- Q. Configure camera ID, description and date/time stamping. The camera ID should follow the following naming convention: "Camera # - Area - Location". For example, Camera 3 at main entry would be named: "3 - Main Entrance".
- R. Change the default logon password on the IP camera web interface as directed by the Owner.

3.06 FIXED CAMERA SETUP, FOCUSING AND ADJUSTMENT

- A. Configure the resolution on the cameras to the maximum setting 1920x1080 or 2048x1536 as applicable for each camera.
- B. Aim the camera with the horizontal field of view shown on the drawings. Cameras set to a wider field of view than shown on the drawings or in a "fish-eye" configuration will be required to be re-adjusted by the contractor.
- C. Adjust the vertical field of view so that the ceiling is not visible. For outdoor cameras, adjust the vertical field of view so that the sky is not visible. Secure the camera lens per the manufacturer's instructions.
- D. Use the camera's web interface to focus the camera based on the field of view set above. Adjust the focus as necessary to provide a clear field of view.
- E. Adjust the image quality settings on the camera to provide the clearest picture quality for all lighting conditions. The cameras have several settings that affect the image quality.

The contractor shall consult with the camera manufacturer and shall adjust these settings to provide optimum image quality depending on the particular "scene" viewed by the camera.

- F. Configure the cameras to automatically switch to daytime color and nighttime black & white mode as applicable for the lighting conditions.
- G. Configure camera frame rate, compression and stream rate as follows:
 - 1. 2MP Indoor Fixed Dome Cameras:
 - a. Frame Rate – 15 fps.
 - b. Compression – H.264.
 - c. Bit Rate: 3mbps.
 - d. Motion Detection: Off – Record 24x7.
 - 2. 3MP Indoor Fixed Dome Cameras:
 - a. Frame Rate – 15 fps.
 - b. Compression – H.264.
 - c. Bit Rate: 4mbps.
 - d. Motion Detection: Off – Record 24x7.
 - 3. 4MP to 8MP Fixed Dome Cameras:
 - a. Frame Rate – 15 fps.
 - b. Compression – H.264.
 - c. Bit Rate: 5mbps.
 - d. Motion Detection: Off – Record 24x7.
 - 4. Multi-sensor Cameras:
 - a. Frame Rate – 15 fps.
 - b. Compression – H.264.
 - c. Bit Rate: 3-4mbps for each sensor (depending on size of view area).
 - d. Motion Detection: Off – Record 24x7.

3.07 TESTING AND COMMISSIONING

- A. After completion of the project, the contractor shall test and commission the IP Video Surveillance System including all cameras and video management software in the presence of the Owner's Representative. The contractor shall notify the Owner's Representative a minimum of (1) week prior to testing.
- B. At a minimum, the following tests shall be performed.
 - 1. Verify physical mounting of all cameras.
 - 2. Verify network connectivity to all cameras.
 - 3. Verify aim and focus of all cameras.
 - 4. Verify that cameras have been properly focused for both daytime and nighttime use.
 - 5. Verify frame rate and image recording settings on all cameras.
 - 6. Verify privacy masking of camera views where applicable.
 - 7. Verify proper motion sensitivity adjustment of cameras.
 - 8. Verify archiving settings.
 - 9. Verify that camera licenses have been installed on the recording server(s).

10. Verify proper installation and configuration of the digital video recording software.
 11. Verify proper installation and configuration of the client software including permissions.
- C. After completion of the commissioning, the Owner's Representative shall prepare a Punchlist of all items to be corrected. After the contractor has completed the Punchlist items to the satisfaction of the Owner's Representative, the Project will be considered "substantially complete" at which time the warranty period will begin.

3.08 TRAINING

- A. After completion of the camera installation, software installation, testing and commissioning, the contractor shall provide a minimum of eight (8) hours training to the Owner. Training shall cover usage and operation of the cameras, video recording server software and client software.

END OF SECTION 282000

PROJECT MANUAL

VIDEO SURVEILLANCE CAMERA SYSTEM UPGRADE

**DOUGLAS COUNTY
JUDICIAL LAW ENFORCEMENT CENTER
And
STATELINE JAIL**

**1038 BUCKEYE ROAD
MINDEN, NV 89423**

100% Owner Review Set

**DESIGN CONSULTANT
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DATE: February 27, 2023

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TABLE OF CONTENTS

Project Identification

Project Name: Douglas County Judicial Law Enforcement Center
Video Surveillance System Upgrade
Project Address: 1038 Buckeye Road, Minden, NV 89423

DIVISION 26 – ELECTRICAL

26 00 00 Electrical Requirements

DIVISION 27 – COMMUNICATIONS

27 01 00 Common Work Results for Communications
27 08 00 Commissioning of Communications
27 11 00 Communications Equipment Room Fittings
27 13 00 Communications Backbone Cabling
27 15 00 Communications Horizontal Cabling

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

28 00 00 Common Work Results for Electronic Safety & Security
28 05 28 Conduits and Backboxes for Electronic Safety and Security
28 28 00 Video Surveillance System