DSA Submittal – Phase 3

PROJECT MANUAL // **HMC ARCHITECTS**

PALOMAR COLLEGE -
NORTH EDUCATION CENTER -
PHASE 3 15 CLASSROOM MODULARS

PROJECT NO. 5015019-102// 10.06.2017

PALOMAR COMMUNITY COLLEGE

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PALOMAR COLLEGE - NORTH EDUCATION CENTER
INTERIM VILLAGE - PHASE 3 15 CLASSROOM MODULARS
FALLBROOK, CA

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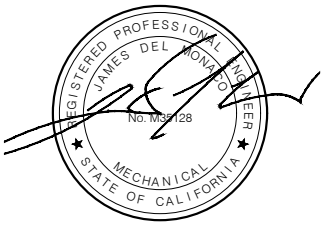
HMC # 5015019-102

HMC ARCHITECTS
Architect



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DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

SECTION 11 51 19

SELF-CHECKOUT AND BOOK THEFT PREVENTION SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:
1. Under this Section, the Contractor is to provide a Book Theft Prevention System (SCBTPS), including procuring, installing, and rendering fully operational all necessary components, conduits, wiring, and any other related or required appurtenance or device, as required for a complete and workable installation which meets or exceeds the project performance specifications, whether or not such components, conduits, wiring or other related or required appurtenance or device are specifically mentioned.
2. Equipment to be provided and installed includes, but is not limited to:
   a. 3M model Bibliotheca RFID Gate - Lane count as required for 36” wide door at each location
   b. 3M model Bibliotheca Self-Check 500
   c. RFID Detection Tags (Owner Provided Contractor Installed)
   d. 3M Bibliotheca System Software
   e. Any other hardware, firmware, or software required for a fully operational system
3. Self-Checkout & Book Theft Prevention Systems shall be capable of being connected to an Owner provided security TCP/IP V-LAN network. Security Contractor shall coordinate said connectivity with the Communications Contractor.
4. The work includes providing all labor, materials, tools, equipment, and documentation required for a complete and working Self-Checkout & Book Theft Prevention System as specified in this document.

B. Related Work Provided by Owner:
1. The Contractor shall coordinate the work with the related work provided by the Owner including but not limited to the following:
   a. Network Conduit and Cabling
   b. Non-data / telecom cabling pathway
   c. Provision of RFID Tags

C. Abbreviations and Acronyms
1. ADA = Americans with Disabilities Act
2. BTPS = Book Theft Prevention System
3. DHCP = Dynamic Host Configuration Protocol
4. DVD = Digital Video Disc
5. EACS = Embedded Access Control System
6. LAN = Local Area Network
7. LED = Light Emitting Diode
8. Mbps = Mega-Bit Per Second
9. RFID = Radio Frequency Identification
10. TCP/IP = Transport Control Protocol / Internet Protocol

11. UPS = Uninterruptable power Supply
12. PVT = Performance Verification Testing
13. V-LAN = Virtual Local Area Network
14. VMS = Video Monitoring System
15. VSS = Video Surveillance System
16. WAN = Wide Area Network
17. WEP = Wired Equivalent Privacy

1.02 RELATED DOCUMENTS

A. Section 27 05 00

B. Section 28 23 00 Video Surveillance System

C. The Specifications and Drawings are intended to be complementary. A specific section, paragraph or heading in a Division may not describe all details concerning work to be done and materials to be furnished. The Drawings are diagrammatic and may not show all the work required or all construction details. Dimensions are shown for critical areas only; all dimensions and actual placements are to be verified in the field. It is to be understood that the best trade practices of the Division will prevail. It remains the responsibility of the Contractor or Subcontractor to provide all items, equipment, construction, and services required to the proper execution and completion of the Work.

D. Reference listings are provided as a convenience to the Contractor or Subcontractor providing the Work of this Section and may not contain all the requirements affecting this Section. It remains the responsibility of the Contractor or Subcontractor to locate and comply with all requirements of the Contract Documents.

E. All related specification sections shall be used in conjunction with this section.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: The manufacturer of all equipment installed as a part of this contract shall meet the following criteria:
   1. Shall be regularly engaged in the manufacture and assembly of similar type equipment for a minimum of five (5) continuous years preceding the date of this document.
   2. Shall have an office staffed with factory trained technicians, fully capable of engineering, supervising installation, system start-up, providing Owner training and supervising of both hardware and software for the all systems installed as a part of this project.

B. Contractor Qualifications: The Contractor shall meet the following qualifications at a minimum:
   1. Shall be an authorized factory trained and certified reseller of all system components installed or interfaced with as a part of this contract.
   2. Contractor shall be regularly engaged in installing similar equipment, and shall have successfully completed 5 systems of a similar size and scope within the preceding 3 years of the date of this document. These systems must be currently in

operation, and the contractor shall supply the following reference information with their proposal:
   a. Name of Client
   b. Type of Facility
   c. System Installed
   d. Date of Substantial Completion
   e. Names of Contractor's Key Personnel on Project
   f. Contact Name, Title, Phone, and Email
3. It is expected by the Owner that the same key personnel will execute this project as completed the referenced work. This would include the Project Manager, the Project Engineer, and the Lead Installer. Resumes will be provided for these personnel. If different key personnel are executing this project than executed the reference projects, resumes for these personnel shall be provided for the Owner's approval with the Contractor's bid package.
4. Sub-contractors shall provide resumes showing qualification for the specific system that the sub-contractor will be installing /configuring.

1.04 SUBMITTALS

A. General:
   1. Prior to installing any material related to or required by this section, submit the following information for review.
      a. Block diagrams of the proposed system and interconnection wiring diagrams showing all connections required between system components.
      b. A materials list with names of manufacturers, model numbers, and technical information on all equipment proposed. Product technical information sheets for each principal component in the proposed system. Include wire/cable specifications and wire/cable marking material. Where the data sheet covers a range of material, the specific part number shall be highlighted
      c. 6 complete sets of operations and maintenance manual for the system products being supplied, provided in 3-ring binders, and 1 complete set submitted in electronic format on DVD. Include complete sets of the equipment operating instructions, installation instructions, and troubleshooting guides.

B. Testing:
   1. PVT Plan to be submitted a minimum of 20 working days prior to planned start of PVT procedure.

C. Close Out:
   1. Within 10 working days of substantial completion and prior to project closeout, the Contractor shall provide to the Owner a complete set of As-Built drawings, showing any deviation from the original plans and specifications, in mounting location, infrastructure pathway, and / or any other substantive change.

1.05 WARRANTY

A. General:
   1. All equipment and system shall be warranted against defects in material and workmanship for a period of one (1) year from the date of startup. Warranty

coverage shall include parts, labor, travel, expenses, and labor to remove/reinstall all products. The warranty document shall be submitted with the Contractor's submittals and shall include details on inclusions and exclusions, deductibles, and availability of extended coverage options, priced for extended coverage in years 2, 3, and 4 past expiration of the original warranty period.

2. Warranty service shall be separated into 2 classes of service, critical item service and non- critical item service.
3. Critical items shall be described as any part or device which if fails would cause major portions (more than 50%) of the system to be inoperable. Critical failures are to be corrected within 24 hours of notification to the Contractor, 7 days per week. Non- critical failures are to be corrected within 7 days of notification to the Contractor.

PART 2 - PRODUCTS

2.01 ACCEPTABLEMANUFACTURERS

A. Self-Checkout System
   1. Bibliotheca Self-Check 500 by 3M This device is being installed as part of an expansion to an existing District system, and in order to assure compatibility as well as simplify maintenance procedures and spare parts procurement, device shall be as specified with no equivalent.

B. Book Theft Prevention System
   1. Bibliotheca RFID Gate by 3M. This device is being installed as part of an expansion to an existing District system, and in order to assure compatibility as well as simplify maintenance procedures and spare parts procurement, device shall be as specified with no equivalent.

PART 3 - EXECUTION

3.01 GENERAL INTENT – It is the intent of the Owner to have a qualified contractor install a complete and fully operational Self-Checkout and Book Theft Prevention System, as shown on the project drawings, which provides a means for self-checkout of library materials and provides an alert to library personnel when un-checked out materials are being removed from the space.

3.02 The contractor shall procure, provide, install, and make fully operational the system as described in this specification and shown on the project drawings. Specific scope items include, but are not limited to:

A. Provision and installation of Self-Checkout and Book Theft Prevention System components as shown on project drawings

B. Provision and installation of Self-Checkout and Book Theft Prevention System software (Owner to provide workstations)

3.03 DELIVERY, STORAGE ANDHANDLING:

A. Product Acceptance, Storage, and Handling Requirements

1. Acceptance – Upon delivery to the project site, Contractor shall inspect all products and materials to assure that all products and material have been received in a new and undamaged state. Acceptance of the shipment, by the Contractor, shall constitute acknowledgement that the Contractor has reviewed the products and material and has found no discrepancies in quantity or condition, and that any products or materials subsequently found to be missing or damaged will be the sole responsibility of the Contractor.
2. Storage and Handling - Store products and materials in the original manufacturer's sealed packaging, in an environmentally controlled area per the manufacturer's specifications.

B. Before Beginning Work
1. Site Verification of Conditions – Contractor shall be responsible for examining the pathway elements intended for cables. Check Owner provided raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions which would affect the project execution. Any such unsatisfactory pathways shall be reported to the Owner.
2. Proceed with installation only after all unsatisfactory issues have been corrected or resolved.

C. General Installation Requirements:
1. Maintain strict site security throughout the course of the project. Rooms housing the equipment and workstations shall be locked up and secure during periods when Contractor personnel are not present.
2. Contractor shall submit to the manufacturer all required planning and locational information required by the manufacturer to finalize design and ship product.
3. Install system per the manufacturer's instructions.
4. The installed system must meet all local, state, and federal codes.
5. Book Theft Prevention System units to be placed as shown on project drawings. Locations are conceptual, and Contractor shall confirm final location with architect before beginning installation.
6. Self-Checkout System units to be placed as shown on project drawings. Locations are conceptual, and Contractor shall confirm final location with architect before beginning installation.
7. Contractor shall verify that all IDF outlets used for powering Self-Checkout and Book Theft Prevention System components are connected to the buildings emergency power UPS.
8. Contractor shall be responsible for providing all conduit, junction boxes, conductors, equipment plugs, terminal strips and labor to install a complete and operational system.
9. All cables within racks and cabinets shall be carefully emplaced and bound or laced with Velcro. All cables shall be identified by wire markers. Wire markers shall be machine printed polyolefin wire markers utilizing heat shrink (Brady Type B-321 or Equivalent). The markings shall clearly indicate the function, source, or destination of all cables and wiring. All cabinets and panels shall be provided with permanently attached lamicoid labels with 1" high white lettering on black background. Labels must contain the text name and alpha- numeric identifier as called out on the single line.

10. Equipment racks shall be seismically bolted to the floor by the Contractor once the Owner determines the final location for each rack. Any mounting brackets attached to walls shall be screwed to studs, not drywall. All rack-mounted equipment shall be able to be serviced within the rack and in the rack's final location. The need to unbolt racking equipment to access or service equipment shall not be acceptable.
11. Cables shall not be spliced in underground enclosures.
12. Splices must be kept to a minimum. Any field splices must be secured in a NEMA box appropriate to the conditions.
13. The use of wire lubricants is highly discouraged. If usage of such lubricant cannot be avoided, Contractor shall procure verification, in writing, from the cable manufacturer stating that the specific lubricant used is acceptable and will not damage or degrade the cable.
14. Cable tray pathways designated for telecom shall not be utilized for support of conduit, conductors, or control wiring of any type. No Book Theft Prevention, Access Control, Surveillance, or Intrusion Detection cabling which is not Category 6A shall be intermingled with such Category 6A or 6 cabling. Non-telecom low voltage cabling shall utilize its own supports and pathways. Security Contractor shall coordinate pathway for said cabling with Electrical Contractor

D. Coordination
1. Contractor shall coordinate all work with any other trades present on the project which will be directly affected by or will affect the execution of this contract.

E. Testing and Commissioning:
1. The Contractor shall be responsible for final system hardware configuration and pre-testing prior to performance verification testing being conducted with the Owner. The Contractor shall pre-test all non-data / telecom cabling to assure cabling is free from interference, opens, grounds, or short circuits.
2. The Contractor shall develop a Performance Verification Testing (PVT) plan. The PVT plan shall identify each new system component included in the project, the intent of testing it, methods and tools required for the testing, and expected result. Each component shall be individually listed with space for noting PASS or FAIL, Contractor / Owner Sign-off, time and date of test, and related comments. The PVT plan shall be submitted to the Owner a minimum of 20 (TWENTY) working days prior to the scheduled beginning of PVT. No testing shall take place until Owner has approved the PVT.
3. As a part of the final system commissioning, Contractor shall submit a listing of all enabled passwords within the system, and shall provide instruction specific to changing the password after the Contractor's departure from the site.
4. Following satisfactory completion of PVT plan, the system shall be operated at normal facility load for a period of 30 calendar days as a burn-in period. If any item or system fails during the burn-in period, the burn-in period shall be suspended until such item or system has been corrected, at which time the test period will recommence. Notice of final System Acceptance will be withheld until burn-in period has been successfully completed.
5. Notice of Final System Completion will not be issued until the following requirements have all been met:
    a. All required submittals accepted.
    b. Delivery of final documentation, including but not limited to As-Builts drawings.

c. Successful PVT & burn-in period
d. Completion of all required training activities.
e. Purging of all Contractor passwords and removal of all Contractor access to the systems.

F. Training and Instruction:
1. Before the system is turned over to the owner, the manufacturer shall provide 16 hours of system operations and maintenance training at the project site using the customer's equipment for up to 10 of the owner's representatives. The Owner shall determine hours to be allocated to each training type.
2. This training shall be conducted during normal business hours of the equipment supplier at a date and time of mutual convenience.
3. This training shall be conducted by a manufacturer certified trainer.
4. Training materials shall not be generic, and shall be specific to the project.

G. Warranty:
1. The system shall be warrantied for a period of 1 year from date of acceptance. Written notification shall be sent to the owner stating the date this warranty period has started.
2. The equipment manufacturer shall provide with their bid package to the owner a maintenance contract proposal to provide a minimum of two inspections and preventative tests per year.
3. The Contractor shall provide with their bid package to the Owner a proposal for an extended parts and labor warranty service, priced for the 1st, 2nd, and 3rd years of post- warranty period operation.

H. Site Clean-up
1. Upon completion of the contract, Contractor shall be responsible for project site cleanup. All installed materials shall be clean, enclosures free of dust and debris, and surfaces wiped free of smudges and fingerprints. The Contractor shall remove all project associated debris and rubbish occasioned by the work from the site. The contractor shall clean all interior spaces dirtied by the work. Remove all temporary protective covers and shrouds from all equipment.

END OF SECTION

SECTION 26 01 00

ELECTRICAL GENERAL PROVISIONS

ARTICLE 1 SUMMARY

1.1 This Division of the specification outlines the provisions of the contract work to be performed under this Division.

1.2 This Section applies to and forms a part of each section of specifications in Division 26 and all work performed under the electrical and communications contracts.

1.3 In addition, work in this Division is governed by the provisions of the bidding requirements, contract forms, general conditions and all sections under general requirements.

1.4 These specifications contain statements which may be more definitive or more restrictive than those contained in the General Conditions. Where these statements occur, they shall take precedence over the General Conditions.

1.5 Where the words 'provide' or 'provision' are used, it shall be definitely interpreted as 'furnishing and installing complete in operating condition'. Where the words 'as indicated' or 'as shown' are used, it shall mean as shown on contract drawings.

1.6 Where items are specified in the singular, this Division shall provide the quantity as shown on drawings plus any spares or extras mentioned on drawings or specifications. All specified and supplied equipment shall be new.

ARTICLE 2 CONTRACTOR QUALIFICATIONS

2.1 The Contractor shall have a current California C-10 Electrical Contractor's license and all individuals working on this project shall have passed the Department of Industrial Relations Division of apprenticeship Standards – "Electrician Certification Program."

ARTICLE 3 CODES, PERMITS AND FEES

3.1 Comply with all applicable laws, ordinances, rules, regulations, codes, or rulings of governmental units having jurisdiction as well as standards of NFPA, and serving utility requirements.

3.2 Obtain permits, fees, inspections, meter and the like, associated with work in each section of this Division.

3.3 Installation procedures, methods and conditions shall comply with the latest requirements of the Federal Occupational Safety and Health Act (OSHA).

ARTICLE 4 EXAMINATION OF PREMISES

4.1 Examine the construction drawings and premises prior to bidding. No allowances will be made for not being knowledgeable of existing conditions.

ARTICLE 5 STANDARDS

5.1 The following standard publications of the latest editions enforced and supplements thereto shall form a part of these specifications. All electrical work must, as a minimum, be in accordance with these standards.

5.1.1 2016 California Electrical Code (CEC), Part 3 Title 24 CCR.
5.1.2 National Fire Protection Association.
5.1.3 Underwriters' Laboratories, Inc. (UL).
5.1.4 Certified Ballast Manufacturers' Association (CBM).
5.1.5 National Electrical Manufacturers' Association (NEMA).
5.1.6 Institution of Electrical & Electronics Engineers (IEEE).
5.1.7 American Society for Testing & Materials (ASTM).
5.1.8 National Board of Fire Underwriters (NBFU).
5.1.9 National Board of Standards (NBS).
5.1.10 American National Standards Institute (ANSI).
5.1.11 Insulated Power Cable Engineers Association (IPECS).
5.1.12 Electrical Testing Laboratories (ETL).
5.1.13 National Electrical Safety Code (NESC).
5.1.14 2016 California Building Code (CBC), Part 2, Title 24 CCR.
5.1.15 2016 California Fire Code (CFC), Part 9, Title 24, CCR.
5.1.16 2016 NFPA 72 with California State Amendments
5.1.17 National Electrical Testing Association (NETA), 2010 or most current

ARTICLE 6 DEFINITIONS

6.1 Concealed: Hidden from sight, as in trenches, chases, hollow construction, or above furred spaces, hung ceilings - acoustical or plastic type, or exposed to view only in tunnels, attics, shafts, crawl spaces, unfinished spaces, or other areas solely for maintenance and repair.

6.2 Exposed, Non-Concealed, Unfinished Space: A room or space that is ordinarily accessible only to building maintenance personnel, a room noted on the 'finish schedule' with exposed and unpainted construction for walls, floors, or ceilings or specifically mentioned as 'unfinished'.

6.3 Finish Space: Any space ordinarily visible, including exterior areas.

ARTICLE 7 WORK AND MATERIALS

7.1 Unless otherwise specified, all materials must be new and of the best quality. Materials previously incorporated into other projects, salvaged, or refurbished are not considered new. Perform all labor in a thorough and workmanlike manner.

7.2 All materials provided under the contract must bear the UL label where normally available. Note that this requirement may be repeated under equipment specifications. In general, such devices as will void the label should be provided in separate enclosures and wired to the labeled unit in proper manner.

ARTICLE 8 SHOP DRAWINGS AND SUBMITTALS

8.1 Submit shop drawings and all data in accordance with Division 1 of these specifications and as noted below for all equipment provided under this Division.

8.2 Shop drawings submittals demonstrate to the Architect that the Contractor understands the design concept. The Contractor demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods of material and equipment he intends to use. If deviations, discrepancies, or conflicts between submittals and specifications are discovered either prior to or after submittals are processed, notify the Architect immediately.

8.3 Manufacturer's data and dimension sheets shall be submitted giving all pertinent physical and engineering data including weights, cross sections and maintenance instructions. Standard items of equipment such as receptacles, switches, plates, etc., which are cataloged items, shall be listed by manufacturer.

8.4 Index all submittals and reference them to these specifications. All submittal items shall be assembled and submitted, one for each specification section. (Multiple specification sections may be grouped together in one common submittal binder, as long as each individual section is clearly identified.) Partial or incomplete submittal sections will not be reviewed.

ARTICLE 9 EQUIPMENT PURCHASES

9.1 Arrange for purchase and delivery of all materials and equipment within 20 days after approval of submittals. All materials and equipment must be ordered in ample quantities for delivery at the proper time. If items are not on the project in time to expedite completion, the Owner may purchase said equipment and materials and deduct the cost from the contract sum.

9.2 Provide all materials of similar class or service by one manufacturer.

ARTICLE 10 COOPERATIVE WORK

10.1 Correct without charge any work requiring alteration due to lack of proper supervision or failure to make proper provision in time. Correct without charge any damage to adjacent work caused by the alteration.

10.2 Cooperative work includes: General supervision and responsibility for proper location and size of work related to this Division, but provided under the other

sections of these specifications, and installation of sleeves, inserts, and anchor bolts for work under each section in this Division.

ARTICLE 11 VERIFICATION OF DIMENSIONS

11.1 Scaled and figured dimensions are approximate only. Before proceeding with work, carefully check and verify dimensions, etc., and be responsible for properly fitting equipment and materials together and to the structure in spaces provided.

11.2 Drawings are essentially diagrammatic, and many offsets, bends, pull boxes, special fittings, and exact locations are not indicated. Carefully study drawings and premises in order to determine best methods, exact location, routes, building obstructions, etc. and install apparatus and equipment in manner and locations to avoid obstructions, preserve headroom, keep openings and passageways clear, and maintain proper clearances.

ARTICLE 12 CUTTING AND PATCHING

12.1 All cutting and patching shall be in accordance with Division 1 of these specifications and as noted below.

12.2 Cut existing work and patch as necessary to properly install new work. As the work progresses, leave necessary openings, holes, chases, etc., in their correct location. If the required openings, holes, chases, etc., are not in their correct locations, make the necessary corrections at no cost to the Owner. Avoid excessive cutting and do not cut structural members including wall framing without the consent of the Architect.

ARTICLE 13 CLOSING-IN OF UNINSPECTED WORK

13.1 Cover no work until inspected, tested, and approved by the Architect. Where work is covered before inspection and test, uncover it and when inspected, tested, and approved, restore all work to original proper condition at no additional cost to Owner.

ARTICLE 14 EXCAVATION AND BACKFILL

14.1 All excavation and backfill shall be in accordance with Division 1 of these specifications and as noted below.

14.2 Perform all necessary excavation, shoring, and backfilling required for the proper laying of all conduits inside the building and premises, and outside as may be necessary.

14.3 Excavate all trenches open cut, keep trench banks as nearly vertical as practicable, and sheet and brace trenches where required for stability and safety. Excavate trenches true to line and make bottoms no wider than necessary to provide ample work room. Grade trench bottoms accurately. Machine grade only to the top line of the conduits, doing the remainder by hand. Do not cut any

trench near or under footings without first consulting the Architect. All trenches shall be done in accordance with OSHA standards and regulations.

14.4 Backfilling shall be done with each layer compacted before another layer is added. No stones or coarse lumps shall be laid directly on a conduit or conduits.

14.5 Trenches shall be filled with the specified material. Sod, if any, shall be removed in cut sections and replaced in same manners.

14.6 Provide pumps and drainage of all open trenches for purposes of installing electrical duct and wiring.

14.7 Perform all backfilling in accordance with the requirements of and under the direction of the Geotechnical Engineer.

14.8 Where new underground trenching is required on sites or in any area where existing underground utilities exist, the Contractor shall provide an independent professional utility locating service to locate exact vertical and horizontal locations of all existing utilities. Where existing utilities are found the Contractor shall hand dig those areas to avoid disruption. The Contractor shall be responsible for immediate repairs to existing underground utilities damaged during construction. The Contractor shall repair all existing asphalt, concrete and landscape surfaces damaged or removed during construction to match their original conditions. Where trenching extends through public streets or roadways, the Contractor shall notify underground service alert in addition to the independent locating service 48 hours before start of construction to determine location of existing utilities by calling (800) 422-4133.

ARTICLE 15 CONCRETE

15.1 Where used for structures to be provided under the contract such as bases, etc., concrete work, and associated reinforcing shall be as specified under Division 3 of these specifications.

15.2 See other sections for additional requirements for underground vaults, cable ducts, etc.

ARTICLE 16 ACCESSIBILITY

16.1 Install all control devices or other specialties requiring reading, adjustment, inspection, repairs, removal, or replacement conveniently and accessibly throughout the finished building.

16.2 All required access doors or panels in walls and ceilings are to be furnished and installed as part of the work under this Section. Refer to Division 1 of these specifications and as noted below.

16.3 Where located in fire rated assemblies, provide doors which match the rating of the assembly and are approved by the jurisdictional authority.

16.4 Refer to 'finish schedule' for types of walls and ceilings in each area and the architectural drawings for rated wall construction.

16.5 Coordinate work of the various sections to locate specialties requiring accessibility with others to avoid unnecessary duplication of access doors.

ARTICLE 17 FLASHING

17.1 Flash and counter flash all conduits penetrating roofing membrane as shown on Architectural drawings. All work shall be in accordance with Division 7 of these specifications.

ARTICLE 18 IDENTIFICATION OF EQUIPMENT

18.1 All electrical equipment shall be labeled, tagged, stamped, or otherwise identified in accordance with the following schedules:

18.1.1 General:

18.1.1.1 In general, the installed laminated nameplates as hereinafter called for shall also clearly indicate its use, areas served, circuit identification, voltage and any other useful data.

18.1.1.2 All auxiliary systems, including communications, shall be labeled to indicate function.

18.1.2 Lighting and Local Panelboards:

18.1.2.1 Panel identification shall be with white and black micarta nameplates. Letters shall be no less than 3/8" high.

18.1.2.2 Circuit directory shall be two column typewritten card set under glass or glass equivalent. Each circuit shall be identified by the room number and/or number of unit and other pertinent data as required.

18.1.3 Distribution Switchboards and Feeders Sections:

18.1.3.1 Identification shall be with 1" x 4" laminated white micarta nameplates with black lettering on each major component, each with name and/or number of unit and other pertinent data as required. Letters shall be no less than 3/8" high.

18.1.3.2 Circuit breakers and switches shall be identified by number and name with 3/8" x 1-1/2" laminated micarta nameplates with 3/16" high letters mounted adjacent to or on circuit breaker or switch.

18.1.4 Disconnect Switches, Motor Starters and Transformers:

18.1.4.1 Identification shall be with white micarta laminated labels and 3/8" high black lettering.

18.1.5 All communication system terminal boxes including T.V., telephone/intercom, security, fire alarm, clock, and computer networking shall be provided with white micarta laminated labels and 3/8" high black lettering.

ARTICLE 19 CONSTRUCTION FACILITIES

19.1 Furnish and maintain from the beginning to the completion all lawful and necessary guards, railings, fences, canopies, lights, warning signs, etc. Take all necessary precautions required by City, State Laws, and OSHA to avoid injury or damage to any persons and property.

19.2 Temporary power and lighting for construction purposes shall be provided under this Section. All work shall be in accordance with Division 1 of these specifications.

ARTICLE 20 GUARANTEE

20.1 Guarantee all material, equipment and workmanship for all sections under this Division in writing to be free from defect of material and workmanship for one year from date of final acceptance, as outlined in the general conditions. Replace without charge any material or equipment proven defective during this period. The guarantee shall include performance of equipment under all site conditions, conditions of load, installing any additional items of control and/or protective devices, as required.

ARTICLE 21 PATENTS

21.1 Refer to the General Conditions for Contractor's responsibilities regarding patents.

ARTICLE 22 PLUMBING (DIVISION 22) / HEATING, VENTILATING, AND AIR CONDTIONING (DIVISION 23) / ELECTRICAL – COORDINATION REQUIREMENTS

22.1 All electrical work performed for this project shall conform to the California Electrical Code, to Local Building Codes and in conformance with Division 22, 23, and 26 of these specifications, whether the work is provided under the “Plumbing”, “Heating, Ventilating, and Air Conditioning”, or the “Electrical” Division of these specifications. Where the Division 22 and/or Division 23 Contractor is required to provide electrical work, he shall arrange for the work to be done by a licensed Division 26 Contractor, using qualified electricians. The Division 22 and/or Division 23 Contractor shall be solely and completely responsible for the correct functioning of all equipment regardless of who provided the electrical work.

22.2 The work under Division 22 and/or Division 23 shall include the following:

22.2.1 All motors required by mechanical equipment.

22.2.2 All starters for mechanical equipment which are not provided under the electrical division as part of a motor control center or otherwise indicated on the electrical drawings.

22.2.3 All wiring interior to packaged equipment furnished as an integral part of the equipment.

22.2.4 All control **wiring and conduit** for mechanical control systems.

22.2.5 All control systems required by mechanical equipment.

22.3 The work under Division 26 shall include the following:

22.3.1 All power wiring and conduit; and conduit only for EMS control conductors between each building and the main control panel.

22.3.2 Electrical disconnects as shown on the electrical drawings.

22.3.3 Starters forming part of a motor control center.

22.4 All power wiring and conduit to equipment furnished under Division 22 and/or Division 23 shall be provided under Division 26. Control wiring and conduit, whether line voltage or low voltage, shall be provided under the division which furnishes the equipment.

22.5 Power wiring shall be defined as all wiring between the panelboard switchboard overcurrent device, motor control center starter or switch, and the safety disconnect switch or control panel serving the equipment. Also, the power wiring between safety disconnect switch and the equipment line terminals.

22.6 Control wiring shall be defined as all wiring, either line voltage or low voltage, required for the control and interlocking of equipment, including but not limited to wiring to motor control stations, solenoid valves, pressure switches, limit switches, flow switches, thermostats, humidistats, safety devices, smoke detectors, and other components required for the proper operation of the equipment.

22.7 All motor starters which are not part of motor control centers and which are required for equipment furnished under this Division shall be furnished and installed by the Division furnishing the equipment and power wiring connected under Division 26. Motor starters and control devices in motor control centers shall be furnished and installed under Division 26.

22.8 Division 26 Contractor shall make all final connections of power wiring to equipment furnished under this Division.

22.9 Wiring diagrams complete with all connection details shall be furnished under each respective Section.

22.10 Motor starters supplied by Plumbing and/or Heating, Ventilating and Air Conditioning shall be fused combination type minimum NEMA Size 1, and conform to appropriate NEMA standards for the service required. Provide NEMA type 3R/12 gasketed enclosures in wet locations. Provide all starters with appropriately sized overload protection and heater strips provided in each phase, hand/off auto switches, a minimum of 2 NO and NC auxiliary contacts as required, and an integral disconnecting means. For ½ horsepower motors and below, when control requirements do not dictate the use of a starter, a manual motor starter switch with overload protection in each phase may be provided. Acceptable manufacturers are Allen Bradley, General Electric, Square D, Furnas and Cutler Hammer.

ARTICLE 23 EQUIPMENT ROUGH-IN

23.1 Rough-in all equipment, fixtures, etc. as designed on the drawings and as specified herein. The drawings indicate only the approximate location of rough-ins. Mounting heights of all switches, receptacles, wall mounted fixtures and such equipment must be coordinated with the Architectural Designs. The Contractor shall obtain all rough-in information before progressing with any work for rough-in connections. Minor changes in the contract drawings shall be anticipated and provided for under this Division of the specifications to comply with rough-in requirements.

ARTICLE 24 OWNER FURNISHED AND OTHER EQUIPMENT

24.1 Rough-in and make final connections to all Owner furnished equipment shown on the drawings and specified, and all equipment furnished under other sections of the specifications.

ARTICLE 25 EQUIPMENT FINAL CONNECTIONS

25.1 Provide all final connections for the following:

25.1.1 All equipment furnished under this Division.

25.1.2 Electrical equipment furnished under other sections of the specification.

25.1.3 Owner furnished equipment as specified under this Division.

ARTICLE 26 INSERTS, ANCHORS, AND MOUNTING SLEEVES

26.1 Inserts and anchors must be:

26.1.1 Furnished and installed for support of work under this Division.

26.1.2 Mounting of equipment that is of such size as to be free standing and that equipment which cannot conveniently be located on walls, such as motor starters, etc., shall be rigidly supported on a framework of galvanized steel angle of Unistrut or B-line systems with all unfinished edges painted.

26.1.3 Furnish and install all sleeves as required for the installation of all work under all Sections of this Division and for all communication systems including any communication systems described in this Section which are bid to the General Contractor. Sleeves through floors, roof, and walls shall be as described in "Conduit and Fittings" Section 26 05 33.

ARTICLE 27 SEISMIC ANCHORING

27.1 All switchgear and other free standing electrical equipment or enclosures shall be anchored to the floor and braced at the top of the equipment to the structure. Where details have not been provided on the drawings, anchorage shall comply with CBC Section 1616A.1.12. The Contractor shall submit drawings signed by the Contractors registered structural Engineer indicating method of compliance prior installation.

27.2 All sound systems, communication, signal or data networking equipment or enclosures shall be anchored to the structure. Where details have not been provided on the drawings, anchorage shall comply with CBC Section 1616A.1.12. The Contractor shall submit drawings signed by the Contractors registered Structural Engineer indicating method of compliance prior to installation.

ARTICLE 28 RUST PROOFING

28.1 Rust proofing must be applied to all ferrous metals and shall be in accordance with Section 05500 of these specifications and as noted below.

28.1.1 Hot-dipped galvanized shall be applied and after forming of angle-iron, bolts, anchors, etc.

28.1.2 Hot-dipped galvanized coating shall be applied after fabrication for junction boxes and pull boxes cast in concrete.

ARTICLE 29 GENERAL WIRING

29.1 Where located adjacent in walls, outlet boxes shall not be placed back to back, nor shall extension rings be used in place of double boxes, all to limit sound transmission between rooms. Provide short horizontal nipple between adjacent outlet boxes, which shall have depth sufficient to maintain wall coverage in rear by masonry wall.

29.2 In those instances where outlet boxes, recessed terminal boxes, or recessed equipment enclosures are installed in a fire rated assembly, provide "Flamesafe FSD 1077" fire stopping pads or approved equal, over the outlet or box.

29.3 Complete rough-in requirements of all equipment to be wired under the contract are not indicated. Coordinate with respective trades furnishing equipment or with the Architect as the case may be for complete and accurate requirements to result in a neat, workmanlike installation.

ARTICLE 30 SEPARATE CONDUIT SYSTEMS

30.1 Each electrical and signal system shall be contained in a separate conduit system as shown on the drawings and as specified herein. This includes each power system, each lighting system, each signal system of whatever nature, telephone, standby system, sound system, control system, fire alarm system, etc.

30.2 Further, each item of building equipment must have its own run of power wiring. Control wiring may be included in properly sized conduit for equipment feeders of #6 AWG and smaller, having separate conduit for larger sizes.

ARTICLE 31 CLEANUP

31.1 In addition to cleanup specified under other sections, thoroughly clean all parts of the equipment. Where exposed parts are to be painted, thoroughly clean off any spattered construction materials and remove all oil and grease spots. Wipe the surface carefully and scrape out all cracks and corners.

31.2 Use steel brushes on exposed metal work to carefully remove rust, etc., and leave smooth and clean.

31.3 During the progress of the work, keep the premises clean and free of debris.

ARTICLE 32 PAINTING

32.1 Paint all unfinished metal as required in accordance with Division 1 of these specifications. (Galvanized and factory painted equipment shall be considered as having a sub-base finish.)

ARTICLE 33 PROJECT CLOSEOUT

33.1 Prior to completion of project, compile a complete equipment maintenance manual for all equipment supplied under sections of this Division, in accordance with Division 1 of these specifications and as described below.

33.2 Equipment Lists and Maintenance Manuals:

33.2.1 Prior to completion of job, Contractor shall compile a complete equipment list and maintenance manuals. The equipment list shall include the following items for every piece of material equipment supplied under this Section of the specifications:

33.2.1.1 Name, model, and manufacturer.

33.2.1.2 Complete parts drawings and lists.

33.2.1.3 Local supply for parts and replacement and telephone number.

33.2.1.4 All tags, inspection slips, instruction packages, etc., removed from equipment as shipped from the factory, properly identified as to the piece of equipment it was taken from.

33.3 Maintenance manuals shall be furnished for each applicable section of the specifications and shall be suitably bound with hard covers and shall include all available manufacturers' operating and maintenance instructions, together with "as-built" drawings to properly operate and maintain the equipment. The equipment lists and maintenance manuals shall be submitted in duplicate to the Architect for approval not less than 10 days prior to the completion of the job. The maintenance manuals shall also include the name, address, and phone numbers of all subcontractors involved in any of the work specified herein. Four copies of the maintenance manuals bound in single volumes shall be provided.

ARTICLE 34 RECORD DRAWINGS

34.1 The Division 26 Contractor shall maintain record drawings as specified in accordance with Division 1 of these specifications, and as noted below.

34.2 Drawings shall show locations of all concealed underground conduit runs, giving the number and size of conduit and wires. Underground ducts shall be shown with cross section elevations and shall be dimensioned in relation to permanent structures to indicate their exact location. Drawing changes shall not be identified only with referencing CORs and RFIs, the drawings shall reflect all of the actual additions or changes made. All as-built drawing information shall be prepared by the contractor in AutoCAD, updating the contract computer files as needed to reflect actual installed conditions for all site plans, lighting, power, communication, networking, audio visual, security or fire alarms systems included in the scope of work for this project.

34.3 One set of these record drawings shall be delivered to the Architect. The engineer will review documents for completeness, and will not be responsible for editing contractor computer files.

ARTICLE 35 CHANGES AND EXTRA WORK

35.1 When **changes** in work are requested, the Division 26 Contractor shall provide unit prices for the work involved in accordance with Division 1 of these specifications, and the following:

35.1.1 The material Costs shall **not exceed** the latest edition of the "Trade Service" end column "C" price list. The materials prices may be higher only where the Contractor can produce invoices to substantiate higher

material costs. The Contractor shall submit a print out copy of the trade service sheets with the change order to substantiate these values.

35.1.2 The labor Costs shall **not exceed** the latest edition of the "NECA Manual of Labor Units" **normal column**.

35.2 When **credits** in work are requested, the Division 26 Contractor shall provide unit prices for the work involved in accordance with Division 1 of these specifications, and the following:

35.2.1 The Material Costs shall **not be less than 80% of** the latest edition of the "Trade Service" end column price list. The materials prices may be lower only where the Contractor can produce invoices to substantiate lower material costs. Restocking fees may also be included in this amount where applicable.

35.2.2 The Labor Costs shall **not be less than 80% of** the latest edition of the "NECA Manual of Labor Units" **normal column**.

35.3 Conduit pricing for conduits of all types sized 3" or smaller.

When changes in the scope of work require the Contractor to estimate conduit Installations, they shall **NOT include labor values (only material cost may be included)** for any of the below items. The labor values for conduit installation represented in the NECA manual are inflated to a point where additional labor for the below items can not be justified.

35.3.1 Couplings.

35.3.2 Set Screw or Compression Fittings, locknuts, Bushings and washers.

35.3.3 Conduit straps and associated screws or nails.

35.3.4 LB fittings or other specialty fittings or specialty mounting hardware may be included where needed.

35.4 Wire pricing for all types and sizes.

When changes in the scope of work require the Contractor to estimate wire installations they shall **NOT include labor values (only material cost may be included)** for any of the below items. The labor values for wire installation represented in the NECA manual are inflated to a point where additional labor for the below items can not be justified.

35.4.1 Locknuts, Bushings, tape, wire markers.

35.5 When changes in the scope of work require other equipment installations such as lighting fixtures, panelboards, switchboards, wiring devices, communications equipment etc. the Contractor shall **NOT include labor values (only material**

cost may be included) for any of the below items. The labor values for these equipment items represented in the NECA manual are inflated to a point where additional labor for the below items can not be justified.

35.5.1 Associated screws, nails, bolts, anchors or supports.

35.5.2 Locknuts, washers, tape.

35.6 The total labor hours for extra work will be required to be calculated as follows:

35.6.1 Change orders with 1 to 30 total labor hours

General Laborer	10%	of total labor hours
Journeyman	10%	of total labor hours
Foreman	80%	of total labor hours

35.6.2 Change orders with 31 to 100 total labor hours

General Laborer	20%	of total labor hours
Journeyman	40%	of total labor hours
Foreman	40%	of total labor hours

35.6.3 Change orders with over 100 total labor hours

General Laborer	30%	of total labor hours
Journeyman	50%	of total labor hours
Foreman	20%	of total labor hours

35.7 When change orders are issued which allow the work to be completed in the normal sequence of construction, the labor rates shall be based on the most current “Prevailing Wage” – straight time total hourly rate. When change orders require the Contractor to work out of sequence the “Prevailing Wage“ – daily overtime hourly rate shall apply. Special condition situations shall be reviewed on an individual basis for alternate hourly rate schedules.

35.8 Costs **will not** be permitted for additional supervision on site or office time for processing any change order other than the 10% overhead allowance as described in Division 1. Cost for special equipment required to install items for an individual change order are permitted and must be individually identified. Lump Sum cost for small tools or any other cost not specifically required for the change order are not permitted.

35.9 Contractor estimates shall be formatted to clearly identify each of the following:

35.9.1 Line item description of each type of material or labor item.

35.9.2 Description of quantity for each item.

35.9.3 Description of (material cost per / quantity).

35.9.4 Description of (labor cost per / quantity).

35.9.5 Description of total labor hour breakdown per Foreman, Journeyman or General Laborer as described above.

ARTICLE 36 ELECTRONIC FILES

36.1 The Contractor shall make a ***written*** request directly to Johnson Consulting Engineers for electronic drawing files. As a part of the written request, please include the following information:

36.1.1 Clearly indicate each drawing sheet needed (i.e., E1.1, E2.1, etc.).

36.1.2 Identify the name, phone number, mailing address and e-mail address of the person to receive the files.

36.1.3 Provide written confirmation and agreement with the requirements described for payment of computer files, as described below.

36.2 Detail or riser diagram sheets, or any other drawings other than floor plans or site plans, ***will not be made available to the Contractor***.

36.3 Files will only be provided in the AutoCAD format in which they were created.

36.4 Requests for files will be processed as soon as possible; a minimum of 7 working days should be the normal processing time. The Contractor shall be completely responsible for requesting the files in time for their use.

END OF SECTION

SECTION 26 05 19

POWER CONDUCTORS

PART 1 – GENERAL

1.1 Furnish and install wire and cable for branch circuits and feeders specified herein and as shown on the electrical drawings.

1.2 Submittals: Submit manufacturers' data for the following items:

1.2.1 All cables and terminations

1.3 <u>Common submittal mistakes which will result in the submittals being rejected:</u>

1.3.1 Not including all items listed in the above itemized description.

1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining, or clouding the items to be reviewed, or crossing out the items which are not applicable.

1.3.3 Not including actual manufacturer's catalog information of proposed products.

1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed

PART 2 – PRODUCTS

2.1 Wire and cable Rated 120 volt to 600 volt.

2.1.1 All wire and cable shall be new, 600 volt insulated copper, of types specified below for each application. All wire and cable shall bear the UL label and shall be brought to the job in unbroken packages. Wire insulation shall be the color as specified herein and shall be type THWN-2. Insulated conductors shall be installed in all exterior exposed raceways. Conductors for branch circuit lighting, receptacle, power and miscellaneous systems shall be a minimum of No. 12 AWG. Increase conductor size to No. 10 AWG for 120 volt circuits greater than 100 feet from the panel to the load and for 277 volt circuits greater than 200 feet from the panel to the load. Circuit home-runs indicated to be larger than No. 12 must be increased the entire length of the circuit, including equipment grounding conductor. Wire sizes No. 14 through No. 10 shall be solid. No. 8 and larger shall be stranded.

2.1.2 Aluminum conductors will be permitted (only where specifically identified on the drawings. See “600 Volt Feeder Schedule”) in sizes 2/0 or larger. Conductors shall be listed by Underwriters Laboratories (UL) and suitable for operation at 600 volts or less, at a maximum operating temperature of 90N C maximum in wet or dry locations. Conductors shall be marked “SUN-RES”. Aluminum alloy conductors shall be compact stranded conductors of STABILOY® (AA-8030) as manufactured by Alcan Cable or Listed equal. AA-8000 Series aluminum alloy conductor material shall be recognized by The Aluminum Association.

2.1.3 MC type armored cable reference Section 26 05 33.

2.2 Wire and cable for systems below120 volts.

2.2.1 All low voltage and communications systems cables routed underground shall be provided with a moisture resistant outer jacket, West Penn “Aquaseal” or equal, unless otherwise specified.

PART 3 - EXECUTION

3.1 Wire and cable shall be pulled into conduits without strain using powdered soapstone, mineralac, or other approved lubricant. In no case shall wire be repulled if same has been pulled out of a conduit run for any purpose. No conductor shall be pulled into conduit until conduit system is complete, including junction boxes, pull boxes, etc.

3.2 All connections of wires shall be made as noted below:

3.2.1 Connections to outlets and switches: Wire formed around binding post of screw.

3.2.2 No. 10 wire and smaller: Circuit wiring connections to lighting fixtures and other hard wired equipment shall be made with pressure type solderless connectors, Buchanan, Scotchlock, Wing Nut, or approved equal. Alternate “WAGO” #773 series or “IDEAL” #32, 33, 34 and 39 series push wire style connectors are also acceptable.

3.3 All wiring shall be continuous without splicing unless where specifically noted on the drawings or where permitted below.

3.3.1 No. 10 wire and smaller above grade: Quantities as needed, connection made with pressure type solderless connectors, Scotchlock or equal.

3.3.2 No. 10 wire and smaller below grade: Quantities as needed, connection made with ‘Raychem’ long barrel compression terminals with crimping tool and quantity of crimps as recommended by manufacturer, provide ‘Raychem’ WCSM-S series in-line heat shrink, sealant coated splice kit. Alternate products must be UL listed for direct burial/submersible and rated to (1000V).

3.3.3 No. 8 wire and larger above grade: Quantities only where indicated, 'Raychem' long barrel compression terminals with crimping tool and quantity of crimps as recommended by manufacturer, provide 'Raychem' WCSM-S series in-line heat shrink, sealant coated splice kit. Alternate products must be UL listed for direct burial/submersible and rated to (1000V).

3.3.4 No. 8 wire and larger below grade: Quantities only where indicated, 'Raychem' long barrel compression terminals with crimping tool and quantity of crimps as recommended by manufacturer, provide 'Raychem' WCSM-S series in-line heat shrink, sealant coated splice kit. Alternate products must be UL listed for direct burial/submersible and rated to (1000V).

3.4 All wiring throughout shall be color coded as follows:

	480 volt system	208 or 240 volt system
A Phase	Brown	Black
B Phase	Orange	Red
C Phase	Yellow	Blue
Neutral	Grey	White
Ground	Green	Green

3.5 Wiring must be color coded throughout its entire length, except feeders may have color coded plastic tape at both ends and any other accessible point.

3.6 All control wiring in a circuit shall be color coded, each phase leg having a separate color, and with all segments of the control circuit, whether in apparatus or conduit, utilizing the same color coding.

3.7 At all terminations of control wiring, the wiring shall have a numbered T&B or Brady plastic wire marker.

3.8 Cables when installed are to be properly trained in junction boxes, etc., and in such a manner as to prevent any forces on the cable which might damage the cable.

3.9 All conductors to be installed into a common raceway, shall be pulled into the raceway at the same time.

3.10 All conductors shall be installed in such a manner as to not exceed the manufacturers' recommended pulling tension and bending radius. The equipment used for pulling must be specifically designed for the purpose. Motorized vehicles such as pickup trucks, are not acceptable.

END OF SECTION

SECTION 26 05 26

GROUNDING

PART 1 – GENERAL

1.1 Furnish and install grounding and grounding conductors and electrodes as specified herein and as shown on the drawings.

1.2 Submit catalog data for all components.

1.3 **Common submittal mistakes which will result in the submittals being rejected:**

1.3.1 Not including all items listed in the above itemized description.

1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.

1.3.3 Not including actual manufacturer's catalog information of proposed products.

1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – EXECUTION

2.1 Grounding

2.1.1 All panelboard cabinets, equipment, enclosures, and complete conduit system shall be grounded securely in accordance with pertinent sections of CEC Article 250. Conductors shall be copper. All electrically operated equipment shall be bonded to the grounded conduit system. All non-current carrying conductive surfaces that are likely to become energized and subject to personal contact shall be grounded by one or more of the methods detailed in CEC Article 250. All ground connections shall have clean contact surfaces. Install all grounding conductors in conduit and make connections readily accessible for inspection.

2.1.2 Provide an insulated equipment grounding conductor in all branch circuit and feeder raceway systems, sized in accordance with CEC 250-1122.

2.1.3 Provide an additional individual insulated grounding conductor for each circuit which contains an isolated ground receptacle or surge suppression receptacle.

2.1.4 Grounding of metal raceways shall be assured by means of provisions of grounding bushings on feeder conduit terminations at the panelboard, and by means of insulated continuous stranded copper grounding wire extended from the ground bus in the panelboard to the conduit grounding bushings.

2.1.5 Except for connections which access for periodic testing is required, make grounding connections which are buried or otherwise inaccessible by exothermite type process.

2.1.6 The following ohmic values shall be test certified for each item listed. A written report signed and witnessed by the project IOR shall be provided to the engineer. If the ohmic value listed cannot be obtained additional grounding shall be installed to reach the value listed.

2.1.6.1 Service. . . . . .10 ohms.

2.1.6.2 Step down transformers and non-current carrying metal parts . . . . . 25 ohms.

2.1.6.3 Manholes, handholes, etc. . . . . 10 ohms.

END OF SECTION 260526

SECTION 26 05 33

CONDUIT AND FITTINGS

PART 1 – GENERAL

1.1 Furnish and install conduit and fittings as shown on the drawings and as specified herein.

1.2 Submit Manufacturer's data on the following:

1.2.1 Conduit.

1.2.2 Fittings

1.2.3 Fire stopping Material.

1.2.4 Surface Raceways.

1.2.5 Type MC or MC-PCS cable, provide construction details and UL "E" number.

1.3 **Common submittal mistakes which will result in the submittals being rejected:**

1.3.1 Not including all items listed in the above itemized description.

1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.

1.3.3 Not including actual manufacturer's catalog information of proposed products.

1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

2.1 Rigid steel conduit, intermediate metal conduit (IMC), electrical metallic tubing (EMT) and flexible metallic conduit shall be steel, hot dipped galvanized after fabrication.

2.2 PVC conduit shall be Carlon or approved equal.

2.3 Liquid tight flexible metal conduit shall be Anaconda Sealtite type UA or approved equal. Fittings shall be Appleton, Crouse-Hinds, Steel City, T&B, or equivalent.

2.4 MC type armored cable, when utilized, shall be provided with the following:

2.4.1 Comply with UL 1479 and CEC 330

2.4.2 90ºC, copper, THHN conductors.

2.4.3 Minimum #12 insulated grounding conductor.

2.4.4 Conductors sized No. 10 and smaller shall be solid, No. 8 and larger shall be stranded.

2.4.5 Oversized (150%) neutrals or separate neutrals shall be provided.

2.4.6 Increase phase conductors to No. 10 AWG for 120 volt circuits greater than 100 feet from panel to load and for 277 volt circuits greater than 200 feet from panel to load. Where required increase conductor sizes for entire length of circuit.

2.4.7 Interlocked armored **aluminum** sheath.

2.4.8 AC or BX type armored cable shall **not** be substituted in lieu of MC type cable.

2.4.9 Color code cable according to cable type and configuration.

2.4.10 Acceptable manufacturers are AFC and Alflex.

2.5 MC-PCS luminary armored cable , when utilized, shall be provided with the following:

2.5.1 Comply with UL 1479 and CEC 330

2.5.2 90ºC, copper, THHN conductors.

2.5.3 Minimum #12 insulated grounding conductor.

2.5.4 Lighting phase conductors sized No. 10 and smaller shall be solid, lighting control conductors shall be sized no. 16 solid.

2.5.5 Interlocked armored **aluminum** sheath.

2.5.6 AC or BX type armored cable shall **not** be substituted in lieu of MC type cable.

2.5.7 Color code phase cable according to cable type and configuration. color code control conductors purple/gray.

2.5.8 Acceptable manufacturers are AFC and Alflex.

2.6 Fire stopping material shall provide an effective seal against fire, heat, smoke and fire gases. Fire stopping material shall be tested to comply with ASTME 814 and UL 1479. The submittal for this product shall include the UL listed system number and installation requirements for each type of penetration seal required for this project.

2.7 Each length of conduit shall be stamped with the name or trademark of the manufacturer and shall bear the UL label.

2.8 All plastic conduit shall be rigid, schedule 40, heavy wall PVC. All PVC conduit shall be UL listed. Underground utility company conduits shall comply with local utility co. requirements.

2.9 Plastic conduit shall be stored on a flat surface, and protected from the direct rays of the sun.

2.10 Where branch circuit or communication raceways cannot be concealed in ceilings or walls and are required to be exposed in interior spaces, provide nonmetallic surface raceway system sized per the manufacturer capacity requirements. A full complement of nonmetallic fittings must be available and matching device boxes and cover plates must be provided. The color of the raceway system, components and boxes shall be (white). Where data networking cabling is to be installed, all raceway fittings shall meet Category 5 radius requirements. Where specific raceway types have been noted on the drawings they shall be as follows:

2.10.1 System 'SR'	Hubbell	WALLTRAK 1 series
	Wiremold	ECLIPSE PN05series
	Panduit	LD5 series
	Hellerman-Tyton	TSR2 series
2.10.2 System 'SR2'	Hubbell	WALTRAK 22
	Wiremold	2300D Series
	Panduit	D2P10
	Hellerman-Tyton	TSR3 series
2.10.3 System 'SR3'	Hubbell	BASETRAK series
	Wiremold	5400 - series
	Panduit	70 series
	Hellerman-Tyton	MCR Infostream" series

Provide with offset boxes, inline boxes may only be used where specifically shown on the drawings.

PART 3 – FITTINGS

3.1 All metallic fittings, including those for EMT, flexible conduit, or malleable iron. Die cast fittings of any other material are not permitted.

3.2 Locknuts shall be steel or malleable iron with sharp clean cut threads.

3.3 Entrance seals shall be O.Z. type FSK or equivalent.

3.4 Bushings and locknuts: Where conduits enter boxes, panels, cabinets, etc., they shall be rigidly clamped to the box by locknuts on the outside, and a lock nut and plastic bushing on the inside of the box. All conduits shall enter the box squarely.

3.5 Furnish and install insulated bushings as per CEC article No. 300 - 4 (F) on all conduits. The use of insulated bushings does not exclude the use of double locknuts to fasten conduit to the box.

3.6 Transition from plastic to steel conduits shall be with PVC female threaded adaptors.

3.7 Couplings and connectors for rigid steel or IMC conduit must be threaded, or compression type (set screw fittings are not permitted).

3.8 Couplings and connectors for EMT shall be compression, watertight. Set screw connectors are not acceptable, except for systems below 120 volts.

3.9 MC or MC-PCS type armored cable shall be provided with listed clamp type die cast zinc set screw connectors. Anti-short bushings shall be provided at all cable ends.

3.10 Connectors for flexible metal conduit shall be steel or malleable iron with screw provided to clinch the conduit into the adapter body. For sizes up to ¾" a screw-in, "Jake type," fitting may be used.

3.11 Install approved expansion fittings, or liquid tight flex conduit with a minimum 6" slack for conduits passing through all expansion and seismic joints.

PART 4 - EXECUTION

4.1 All branch circuits shall be installed concealed in walls or above ceilings or in concrete floor slabs. PVC conduits installed in concrete floor slabs shall transition to PVC coated rigid steel where conduits penetrate above finished grade or finished floor.

4.2 Conduit sizes for various numbers and sizes of wire shall be as required by the CEC, but not smaller than ½" for power wiring and ¾" for communications and fire alarm systems unless otherwise noted. Conduit in slab or below grade shall be ¾" minimum trade size, unless otherwise identified.

4.3 Conduit size shall be such that the required number and sizes of wires can be easily pulled in and the Contractor shall be responsible for the selection of the conduit sizes to facilitate the ease of pulling. Conduit sizes shown on the drawings are minimum sizes in accordance with appropriate tables in the CEC. If because of bends or elbows a larger conduit size is required, the Contractor shall so furnish without further cost to the Owner.

4.4 The Contractor shall be entirely responsible for the proper protection of this work from the other trades on the job. When conduit becomes bent or holes are punched through same, or outlets moved after being roughed-in, the Contractor shall replace same, without additional cost to the Owner.

4.5 Rigid steel conduit or IMC shall be used as follows:

4.5.1 Exposed exterior locations.

4.5.2 Exposed interior locations below eight feet above floor, except in electrical rooms and closets.

4.5.3 In hazardous or classified areas as required by CEC.

4.6 EMT conduit shall be used for areas as follows:

4.6.1 All interior communications, signal, and data networking systems.

4.6.2 All interior power wiring systems where not required to be in rigid steel, IMC or flexible conduit.

4.7 Flexible conduit shall be used for areas as follows:

4.7.1 To connect motors, transformers, and other equipment subjected to vibration or where specifically detailed on the drawings.

4.7.2 Flexible conduit shall not be used to replace EMT in other locations where the conduit will be exposed.

4.7.3 Flexible metal conduit shall be ferrous. Installation shall be such that considerable slack is realized. The conduit shall contain separate code sized grounding conductor.

4.7.4 Liquid tight flexible conduit shall be used in conformance with CEC in lengths not to exceed 4'. For equipment connections, route the conduit at 90 degrees to the adjacent path for point of connection. The conduit shall contain separate code sized grounding conductor. Use liquid tight flexible conduit for all equipment connections exposed in possible wet, corrosive or oil contaminated areas, e.g., shops and outside areas.

4.8 MC armored cable may be used as follows:

4.8.1 All branch circuit wiring for lighting and power circuits where permitted and installed in compliance with UL 1569 and CEC 330.

4.9 MC-PCS luminary armored cable may be used as follows:

4.9.1 All Lighting branch circuit wiring for lighting circuits where permitted and installed in compliance with UL 1569 and CEC 300-22(c), 330. This cable permits conductors of control circuits to be placed in a cable with lighting power circuits or class 1 circuits.

4.9.2 It shall not be considered an acceptable option to install lighting control class 1 circuits as an open wire installation.

4.10 MC and MC-PCS armored cable shall **not** be used for the following areas:

4.10.1 Any exterior, underground or buried in concrete circuits.

4.10.2 Any circuits feeding HVAC equipment or pumps or any circuit with 30 AMPs or greater overcurrent protection.

4.10.3 Any exposed interior locations except in electrical, communication or mechanical equipment rooms.

4.10.4 Any exposed interior damp/wet locations, kitchens, science classrooms, shop areas, or concealed in science classroom casework, unless provided with approved PVC jacket.

4.10.5 Any hazardous rated area.

4.11 Plastic conduit shall be used for all exterior underground, in slab, and below slab on grade conduit installations. Install bell ends at all conduit terminations in manholes and pull boxes. Where plastic conduit transitions from below grade to above grade, no plastic conduit shall extend above finished exterior grade, or above interior finished floor level.

4.12 Plastic conduit joints shall be made up in accordance with the manufacturer's recommendations for the particular conduit and coupling selected. Conduit joint couplings shall be made watertight. Plastic conduit joints shall be made up by brushing a plastic solvent cement on the inside of a plastic fitting and on the outside of the conduit ends. The conduit and fitting shall then be slipped together with a quick one-quarter turn twist to set the joint tightly.

4.13 All underground conduit depths shall be as detailed on the drawings or a minimum of 30" below finished grade (when not specifically detailed otherwise), for all exterior underground conduits. Where concrete slurry or concrete encasement is provided, include “Red” color dye in mixture.

4.14 All underground conduits for power systems (600v and higher), shall be concrete encased and a minimum of 48” below grade or as detailed on the drawings.

Where concrete slurry or concrete encasement is provided, include “Red” color dye in mixture.

4.15 Conduit shall be continuous from outlet to outlet, cabinet or junction box, and shall be so arranged that wire may be pulled in with the minimum practical number of junction boxes.

4.16 All conduits shall be concealed wherever possible. All conduit runs may be exposed in mechanical equipment rooms, electrical equipment rooms, electrical closets, and in existing or unfinished spaces. No conduit shall be run exposed in finished areas without the specific approval of the Architect.

4.17 All raceways which are not buried or embedded in concrete shall be supported by straps, clamps, or hangers to provide a rigid installation. Exposed conduit shall be run in straight lines at right angles to or parallel with walls, beams, or columns. In no case shall conduit be supported or fastened to other pipes or installed to prevent the ready removal of other trades piping. Wire shall not be used to support conduit.

4.18 It shall be the responsibility of the Contractor to consult the other trades before installing conduit and boxes. Any conflict between the location of conduit and boxes, piping, duct work, or structural steel supports, shall be adjusted before installation. In general, large pipe mains, waste, drain, and steam lines shall be given priority.

4.19 Conduits above lay-in grid type ceilings shall be installed in such a manner that they do not interfere with the "lift-out" feature of the ceiling system. Conduit runs shall be installed to maintain the following minimum spacing wherever practical.

4.19.1 Water and waste piping not less than 3".

4.19.2 Steam and steam condensate lines not less than 12".

4.19.3 Radiation and reheat lines not less than 6".

4.20 Provide all necessary sleeves and chases required where conduits pass through floors or walls as part of the work of this section. Core drilling will only be permitted where approved by the Architect.

4.21 All empty conduits and surface mounted raceways shall be provided with a ¼" polypropylene plastic pull cord and threaded plastic or metal plugs over the ends. Fasten plastic "Dymo" tape label to exposed spare conduit to identify "power" or "communication" system, and to where it goes.

4.22 The ends of all conduits shall be securely plugged, and all boxes temporarily covered to prevent foreign material from entering the conduits during construction. All conduit shall be thoroughly swabbed out with a dry swab to remove moisture and debris before conductors are drawn into place.

4.23 Bending: Changes in direction shall be made by bends in the conduit. These shall be made smooth and even without flattening the pipe or flaking the finish. Bends shall be of as long a radius as possible, and in no case smaller than CEC requirements.

4.23.1 For power conduits for conductors (600v and below), provide minimum 36” radius (vertical) and 72” radius (horizontal) bends.

4.23.2 For power conduits for conductors (greater than 600v), provide minimum 72” radius (vertical) and 72” radius (horizontal) bends.

4.24 Supports: Conduit shall be supported at intervals as required by the California Electrical Code. Where conduits are run individually, they shall be supported by approved conduit straps or beam clamps. Straps shall be secured by means of toggle bolts on hollow masonry, machine screws or bolts on metal surfaces, and wood screws on wood construction. **[No perforated straps or wire hangers of any kind will be permitted. Where individual conduits are routed, or above ceilings, they shall be supported by hanger rods and hangers.]** Conduits installed exposed in damp locations shall be provided with clamp backs under each conduit clamp, to prevent accumulation of moisture around the conduits.

4.25 Where a number of conduits are to be run exposed and parallel, one with another, they shall be grouped and supported by trapeze hangers. Hanger rods shall be fastened to structural steel members with suitable beam clamps or to concrete inserts set flush with surface. A reinforced rod shall be installed through the opening provided in the concrete inserts. Beam clamps shall be suitable for structural members and conditions. Rods shall be galvanized steel 3/8" diameter minimum. Each conduit shall be clamped to the trapeze hanger with conduit clamps.

4.26 All concrete inserts and pipe clamps shall be galvanized. All steel bolts, nuts, washers, and screws shall be galvanized or cadmium plated. Individual hangers, trapeze hangers and rods shall be prime-coated.

4.27 Openings through fire rated floors/walls and/or smoke walls through which conduits pass shall be sealed by Fire stopping material to comply with Division 1 to seal off flame, heat, smoke and fire gases. Sleeves shall be provided for power or communication system cables which are not installed in conduits, and shall be sealed inside and out to comply with manufacturers UL system design details. Where multiple conduits and/or cable tray systems pass thru fire-rated walls at one location, the Contractor shall submit copies of the manufacturers UL system design details proposed for use on this project. All Fire stopping material shall have an hourly fire-rating equal to or higher than the fire rating of the floor or wall through which the conduit, cables, or cable trays pass.

4.28 Provide cap or other sealing type fitting on all spare conduits. Conduits stubbed into buildings from underground where cable only extends to equipment, the conduit/cable end shall be sealed to prevent moisture from entering the room or space.

4.29 All conduits which are part of a paralleled feeder or branch circuit shall be installed underground.

4.30 All conduits which are required as a part of systems specified in Divisions 27 or 28, or any other low voltage communication systems, shall be furnished and installed by the Division 26 Contractor.

4.30.1 The Contractor shall coordinate all conduit requirements with each system supplier prior to bid to determine special conduit system requirements.

4.30.2 The Contractor shall provide a pull rope in all conduits for these systems.

4.30.3 The Contractor shall provide conduit sleeves for all open cable installations thru rated walls or block walls. Provide conduit from each building main termination cabinet or backboard to the nearest accessible ceiling for access into all electrical or communications rooms.

4.31 In addition to the above requirements, the following requirements shall apply to all data networking conduits:

4.31.1 Flexible metal conduit may only be used where required at building seismic and/or expansion joints.

4.31.2 All underground conduits shall be provided with minimum 24" radius elbows (vertical) and 60” (horizontal).

4.31.3 No length of conduit above grade shall be installed to exceed 150 feet between pull boxes, or points of connection, unless where specifically detailed on the drawings.

4.31.4 No length of conduit shall be installed to exceed two 90 degree bends between pull boxes, or points of connection, unless where specifically detailed on the drawings.

4.32 Where surface raceways are installed in interior spaces, the Contractor shall take care to route in straight lines at right angles to or parallel with walls, beams, or columns. All raceways and device boxes shall be securely screwed to the finish surface with zinc screw “Auger” anchors Stk #ZSA1K by Gray Bar Electric or equal. Tape adhesive application will not be permitted.

4.33 The Contractor who installs surface raceway systems shall provide and install complete with wire retention clips, one for every (8) vertical feet or (5) horizontal feet or portion thereof. This Contractor shall also provide <u>each</u> raceway channel with pull strings.

4.34 It shall be the responsibility of the Contractor installing the raceway to coordinate the installation of raceway device plates and inserts with the communications or data contractors.

4.35 MC or MC-PCS cable shall be cut using a specific metallic sheath armor stripping tool. The use of hacksaws, dikes or any other tools not specifically designed to remove the armor sheath will not be permitted.

4.36 MC or MC-PCS cables installed in attic spaces or above lay-in ceilings shall be installed to be protected from physical damage. The cable shall be mounted along the sides or bottom of joists, rafters or studs.

4.37 Support wires used for supporting ceilings, lighting fixtures or other equipment items shall **not** be used to support MC or MC-PCS cables. Conduits, duct work, piping or any other equipment shall not be used to support or mount MC cables.

4.38 MC or MC-PCS cable supports, fasteners and clips shall be designed specifically for use with MC cables. Standard conduit supports, fasteners and clips, nails or other items are not permitted for installing MC cables.

END OF SECTION

SECTION 26 05 34

OUTLET AND JUNCTION BOXES

PART 1 – GENERAL

1.1 Furnish and install electrical wiring boxes as specified and as shown on the electrical drawings.

1.2 Submit manufacturer's data for all items.

1.3 <u>Common submittal mistakes which will result in the submittals being rejected:</u>

1.3.1 Not including all items listed in the above itemized description.

1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.

1.3.3 Not including actual manufacturer's catalog information of proposed products.

1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

2.1 Boxes shall be as manufactured by Steel City, Appleton, Raco, or approved equal.

2.2 All boxes must conform to the provisions of Article 370 of the CEC. All boxes shall be of the proper size to accommodate the quantity of conductors enclosed in the box. Minimum box size shall be 4" square x 1-½" deep.

2.3 Boxes generally shall be hot dipped galvanized steel with knockouts. Boxes on exterior surfaces or in damp locations shall be corrosion resistant, cast feraloy and shall have threaded hubs for rigid conduit and neoprene gaskets for their covers. Boxes shall be Appleton Type FS, Crouse-Hinds, or the approved equal. Conduit bodies shall be corrosion resistant, cast malleable iron. Conduit bodies shall have threaded hubs for rigid conduit and neoprene gaskets for their covers. Conduit bodies shall be Appleton Unilets, Crouse-Hinds, or the approved equal. Where recessed, boxes shall have square cut corners.

2.4 Deep boxes shall be used in wall covered by wainscot or paneling and in walls or glazed tile, brick, or other masonry which will not be covered with plaster.

Through the wall type boxes shall not be used unless specifically called for. All boxes shall be nongangable. Boxes in concrete shall be of a type to allow the placing of conduit without displacing the reinforcing bars. All lighting fixture outlet boxes shall be equipped with the proper fittings to support and attach a light fixture.

2.5 All light, switch, receptacle, fire alarm devices and similar outlets shall be provided with approved boxes, suitable for their function. Back boxes shall be furnished and installed as required for the equipment and/or systems under this contract.

2.6 Pull and junction boxes shall be code gauge boxes with screw covers. Boxes shall be rigid under torsional and deflecting forces and shall be provided with angle from framing where required. Boxes shall be 4" square with a blank cover in unfinished areas and with a plaster ring and blank cover in finished areas. Covers for flush mounted oversize boxes shall extend ¾" past boxes all around. Covers for 4" square boxes shall extend ¼" past box all around.

2.7 All terminal cabinets and junction boxes or equipment back boxes which are required as a part of systems specified in Divisions 27 or 28, or any other low voltage communication systems, shall be furnished and installed by the Division 26 Contractor.

2.7.1 The Division 26 Contractor shall coordinate all box requirements with each system supplier prior to bid to determine special cabinet or back box requirements. The Contractor shall also provide stainless steel blank cover plates for all low voltage systems installed for future equipment.

2.7.2 The Contractor shall provide all plywood backboards indicated on walls or inside equipment enclosures. All backboards shall be a minimum of ¾" thick fire rated type plywood.

2.7.3 The Contractor shall coordinate exact rough in locations and requirements with each system supplier.

2.8 In addition to the above requirements, boxes for data networking wiring and equipment shall comply with the following:

2.8.1 All boxes shall be a minimum of 4-11/16" square x 2-1/8" deep.

2.8.2 Where pull boxes are required on individual conduits 1-¼" or smaller, provide 4-11/16" square x 2-1/8" deep boxes. Where pull boxes are required on conduits larger than 1-¼" for straight pull through, provide eight times the conduit trade size for box length. Where pull boxes are required on conduits larger than 1-¼" for an angle or a U-pull through installation, provide a minimum distance of six times the conduit trade size between the entering and exiting conduit run for each cable.

2.9 Recessed boxes installed in fire rated floors/walls and /or smoke walls shall be sealed by Fire stopping material to comply with Division 1 to seal off flame, heat, smoke and fire gases. The Contractor shall submit copies of the manufacturers UL system design details proposed for use on this project. All Fire stopping material shall have an hourly fire-rating equal to or higher than the fire rating of the floor or wall through which the conduit, cables, or cable trays pass.

PART 3 – EXECUTION

3.1 Boxes shall be installed where required to pull cable or wire, but in finished areas only by approval of the Architect. Boxes shall be rigidly attached to the structure, independent of any conduit support. Boxes shall have their covers accessible. Covers shall be fastened to boxes with machine screws to ensure continuous contact all around. Covers for surface mounted boxes shall line up evenly with the edges of the boxes.

3.2 Outlets are only approximately located on the plans and great care must be used in the actual location of the outlets by consulting the various detailed drawings and specifications. Outlets shall be flush with finished wall or ceiling, boxes installed symmetrically on such trim or fixture. Refer to drawings for location and orientation of all outlet boxes.

3.3 Furnish and install all plaster rings as may be required. Plaster rings shall be installed on all boxes where the boxes are recessed. Plaster rings shall be of a depth to reach the finished surface. Where required, extension rings shall be installed so that the plaster ring is flush with the finished surface.

3.4 All cabinets and boxes shall be secured by means of toggle bolts on hollow masonry; expansion shields and machine screws or standard precast inserts on concrete or solid masonry; machine screws or bolts on metal surfaces and wood screws on wood construction. All wall and ceiling mounted outlet boxes shall be supported by bar supports extending from the studs or channels on either side of the box. Boxes mounted on drywall or plaster shall be secured to wall studs or adequate internal structure.

3.5 Boxes with unused punched-out openings shall have the openings filled with factory-made knockout seals.

3.6 Where standby power and normal power are to be located in the same outlet box or 480V in a switch box, install partition barriers to separate the various systems.

3.7 All device boxes and junction boxes for fire alarm system shall be painted red and shall be 4-11/16” square by 2-1/8” deep. No exceptions.

END OF SECTION

SECTION 26 08 00

COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 – GENERAL

RELATED DOCUMENTS

1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, 27, 28 Specification Sections, apply to this Section.

1.2 Acceptance and start-up testing requirements for electrical power distribution equipment and systems. Contractor shall retain and pay for the services of a recognized, independent testing firm for the purpose of performing inspections and tests as herein specified and as required by code.

1.2.1 The testing firm shall provide all material, equipment, labor, and technical supervision to perform such tests and inspections.

1.2.2 It is the purpose of these tests to assure that all tested electrical equipment is operational and within industry and manufacturers tolerances, and is installed in accordance with design specifications.

1.2.3 The tests and inspections shall determine suitability for start-up and energization.

1.2.4 The following equipment shall be tested and calibrated:

1.2.4.1 Medium voltage cables

1.2.4.2 Medium voltage interrupter switches, fuses, and circuit breakers.

1.2.4.3 Low voltage switches, fuses, and circuit breakers, 100A frame and larger.

1.2.4.4 Low voltage cables and feeders.

1.2.4.5 Motor Control Centers and adjustable frequency drives.

1.2.4.6 Protective relays, instruments, and metering systems.

CODES, STANDARDS, AND REFERENCES

1.3 All inspections and tests shall be in accordance with the following codes and standards except as provided otherwise herein.

1.3.1 ANSI/IEEE C2: National Electrical Safety Code (NESC).

1.3.2 ANSI/NFPA 70: National Electrical Code, with California Amendments (CEC).

1.3.3 ANSI/NFPA 70E: Standard for Electrical Safety in the Workplace.

1.3.4 ANSI/NFPA 78: Lightning Protection Code.

1.3.5 ANSI/NFPA 101: Life Safety Code.

1.3.6 American Society for Testing and Materials – ASTM.

1.3.7 Applicable State and Local Codes, Ordinances and Standards, including City of San Diego, San Diego Gas & Electric, and San Diego Unified School District.

1.3.8 California Code of Regulations (CCR), Title 8, Title 24.

1.3.9 Division 1, Section 019113, “General Commissioning Requirements”.

1.3.10 Institute of Electrical and Electronic Engineers – IEEE.

1.3.11 Insulated Cable Engineers Association – ICEA.

1.3.12 International Electrical Testing Association - NETA Accept: The NETA Acceptance Testing Specifications, latest edition.

1.3.13 National Electrical Manufacturers Association – NEMA.

1.3.14 Occupational Safety and Health Administration (OSHA) – 29 CFR 1910.7: OSHA Occupational Safety and Health Standards.

QUALIFICAITONS OF TESTING FIRM

1.4 All Inspections and tests shall utilize the following references:

1.4.1 Project design specifications.

1.4.2 Project design drawings

1.4.3 Project list of equipment to be inspected and tested

1.4.4 Manufacturer’s instruction manuals applicable to each particular equipment.

1.5 The testing firm shall be an independent testing organization with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1.6 The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations, and systems, with at least five (5) years of documented experience.

1.7 The lead, on-site, technical person shall be currently certified by the International Electrical Association (NETA), or National Institute for Certification in Engineering Technologies (NICET) in electrical power distribution system testing.

1.8 The testing firm shall utilize engineers and technicians who are regularly employed by the firm for testing services.

1.9 The testing firm shall submit proof of the above qualifications with bid documents when requested.

1.10 The terms used herein, such as Testing Agency, Testing Contractor, Testing Laboratory, or Contractor Test Company, shall be construed to mean the testing firm.

SUBMITTALS

1.11 Provide submittals per Division 1, Section 013300, “Submittal Procedures”.

1.12 Qualifications of testing firm and personnel.

1.13 Certified test reports.

1.14 Two copies of blank forms for checklists, test reports, and other related forms for Engineer’s review and approval.

GENERAL REQUIREMENTS

1.15 Routine insulation resistance, continuity, and rotation tests for all distribution and utilization equipment shall be performed prior to and in addition to acceptance tests specified herein.

1.16 The Testing Firm shall notify the Engineer no fewer than 3 working days prior to commencement of any testing.

1.17 Any system, material, or workmanship, which is found defective on the basis of Acceptance Tests shall be reported to the Engineer with recommendations for corrective action.

1.18 The Testing Firm shall maintain a written record of all tests, and upon completion of project, shall assemble and certify a final test report.

1.19 The final Test Report shall be submitted on conclusion of all required tests and corrective measures.

SAFETY AND PRECAUTIONS

1.20 Safety practices shall include, but will not be limited to, compliance with the following requirements:

1.20.1 Occupational Safety and Health Act.

1.20.2 Accident Prevention Manual for Industrial Operations, National Safety Council.

1.20.3 Applicable State and Local safety operating procedures.

1.20.4 Owners' Safety Practices.

1.20.5 National Fire Protection Association – NFPA 70E.

1.20.6 American National Standards for Personnel Protection.

1.21 All tests shall be performed with apparatus de-energized. Exceptions must be thoroughly reviewed to identify safety hazards and adequate safeguards must be devised.

1.22 The Testing Firm shall have a designated safety representative on the project site to supervise the testing operations with respect to safety.

1.23 Test Report:

1.23.1 The test report shall include the following:

1.23.1.1 Summary of Project.

1.23.1.2 List of testing equipment used.

1.23.1.3 Calibration date of testing equipment and due date of next calibration.

1.23.1.4 Ambient temperature and humidity at time of test.

1.23.1.5 Listing of equipment tested.

1.23.1.6 Test results.

1.23.1.7 Recommendations.

1.23.2 Furnish original and four copies of the complete report to the Architect/District in accordance with requirements of Contract Documents.

INSPECTION AND TEST PROCEDURES

1.24 Contractor shall provide the Testing Firm, a copy of related contract documents such as drawings, specifications, engineer-reviewed submittals, coordination study report including all relay settings and other necessary information.

1.25 Contractor shall supply a suitable source of power to each site and location per testing firm requirements.

1.26 Contractor shall notify the testing firm when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling.

1.27 Testing Firm shall review and evaluate all received documents and notify the Contractor and Engineer of any discrepancies in the documents and/or any other requirements immediately.

1.28 Testing Firm shall provide and comply with the following:

1.28.1 Acceptance test procedures for each individual equipment listed in Part 1 of this section for Engineer review and approval prior to any test and after thorough evaluation of the system. Testing shall conform to the International Electrical Testing Association (NETA) specifications and standards for electrical power distribution equipment and systems and manufacturer's instructions.

1.28.2 Refer to each individual specification section for testing requirements and comply.

1.28.3 Inspect installed equipment and report any discrepancy and/or deficiency with respect to the contract documents and governing codes prior to testing.

SYSTEM FUNCTION TEST

1.29 Perform system function test upon completion of equipment tests as defined in this section. It is the purpose of system function tests to verify proper interaction of all sensing, processing, and action devices.

1.30 Implementation.

1.31 Submit manufacturers' data on all items:

1.31.1 Develop test parameters for the purpose of evaluation performance of all integral components and their functioning as a complete unit within design requirements.

1.31.2 Test all interlocking devices.

1.31.3 Record the operation of alarms and indicating devices.

1.32 DEFICIENCIES

1.33 Submit manufacturers' data on all items.

1.33.1 All deficiencies reported by the Testing Firm shall be corrected by the Contractor and Acceptance and System Function Tests shall be repeated to verify conformance with requirements.

PART 2 – PRODUCTS

2.1 Not applicable

PART 3 - EXECUTION

END OF SECTION

SECTION 26 09 24

TIME CLOCKS

PART 1 – GENERAL

1.1 Furnish and install all time clocks that are not specifically called for to be furnished by others.

1.2 Submit manufacturer's data.

1.3 <u>Common submittal mistakes which will result in submittals being rejected:</u>

1.3.1 Not including all items listed in the above itemized description.

1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.

1.3.3 Not including actual manufacturer's catalog information of proposed products.

1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

2.1 Acceptable manufacturers are Tork, Paragon, or Intermatic.

2.2 Contacts shall have a minimum rating of 10 amperes at 120V.

2.3 Controller is to have two channels. Both channels shall be astronomic with 1 to 99 minutes, plus or minus offset from sunrise or sunset.

2.4 Controller shall program in AM/PM or 24-hour format, with one minute resolution, suing two buttons for all basic settings.

2.5 Controller shall be capable of 48 events per channel per week, and separate scheduling for each day of the week.

2.6 Controller shall have the following features:

2.6.1 Scheduling of 16 individual holiday dates, and five holiday blocks.

2.6.2 Automatic leap year compensation, and daylight saving.

2.7 Controller shall have 72-hour memory backup with rechargeable backup.

2.8 Clock shall be housed in a flush enclosure where supply circuits emanate from a flush mounted panelboard and surface enclosure when supply circuits are from a surface mounted panel.

PART 3 – EXECUTION

3.1 Furnish and install time clocks as shown on the drawings and herein specified.

END OF SECTION

SECTION 26 27 26

SWITCHES AND RECEPTACLES

PART 1 – GENERAL

1.1 Furnish and install all wiring devices as shown on drawings and as herein specified. Unless otherwise noted, device and plate numbers shown are Hubbell and shall be considered the minimum standard acceptable. Other acceptable manufacturers are Pass and Seymour, Leviton, General Electric and Bryant.

1.2 Submit manufacturers' data on all items.

1.3 **Common submittal mistakes which will result in the submittals being rejected:**

1.3.1 Not correctly indicating ampacity rating of proposed devices.

1.3.2 Not including all items listed in the above itemized description.

1.3.3 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.

1.3.4 Not including actual manufacturer's catalog information of proposed products.

1.3.5 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

2.1 All switches shall be of the quiet mechanical type, Specification Grade, 20 amp, 120/277 volt AC as follows:

	HUBBELL	LEVITON	PASS & SEYMOUR
Single Pole	CS120	CS1202	CS20AC1
Two Pole	CS1222	CS2202	CSB20AC2
Three-way	CS320	CS3202	CS20AC3
Key Switch	HBL1221L	1221-2L	PS20AC1-L

2.2 All switches shall have the "on" and the "off" position indicated on the handle. If switches of higher ampere ratings are required, they shall be of similar type and quality as those shown above. Groups of switches shown at one location shall be installed under a single plate up to a maximum of six where more than six switches are shown coordinate arrangement with the Architect.

2.3 Dimmer switches for incandescent lamp loads shall be square-law type, slide control dimmer with OFF position, Lutron or Hubbell "Nova-T" Series NT-600 (0-500 watt load), NT-1000 (501-900 watt load), NT-1500 (901-1500 watt load), or equal (no known equal).

2.4 All convenience receptacles and special outlets throughout shall be grounding type. Convenience receptacles shall be side wired, parallel slot, two pole, three wire, 20 amp as follows:

	HUBBELL	LEVITON	PASS & SEYMOUR
Duplex	5352	5362	PS5362
GFCI	GFR5362	7899	2097
Isolated Ground	IG5362	5362IG	IG6300
Tamper Proof		8300SG	TR63H

2.5 All safety or tamper proof receptacles shall have no exposed external current carrying metal parts, and shall have integral wiring leads suitable for two or three wire installations.

2.6 Special receptacles shall be as noted on the drawings.

2.7 Weatherproof plates shall be designed to meet CEC Article 410-57, wet location listed with cover "open." Where weatherproof receptacles have been identified to be provided with locking covers, the cover shall be as manufactured by Pass & Seymour #4600-8 or Cole Lighting 310 Series. Rough-in requirements vary between manufacturers. Contractor to field verify requirements prior to installation.

2.8 All plates throughout shall be stainless steel. Where wiring devices are installed in concrete block walls, provide oversized 3-1/2" x 5" coverplates.

2.9 All devices shall be white unless otherwise noted or a special purpose outlet.

2.10 Unless where specifically detailed on the drawings, floor boxes shall be PVC suitable for concrete poured floors of minimum 3-1/2" depth, with a modular design to gang two or three sections together.

2.10.1 Carlon #E976 series or approved equal

2.10.2 Provide brass cover with brass carpet flange unless otherwise detailed.

PART 3 – EXECUTION

3.1 Switches for room lighting shall be located no more than 12" center line from door jamb at plus 48" center line above finished floor or +46" to top of devices where located over casework, reference CBC Figure 11B-5D.

3.2 All receptacles shall be mounted at plus 18" to center line above finished floor unless noted or shown otherwise. All receptacles shall be installed with the ground pin up, at the top of the receptacle to comply with IEEE 602-1986.

3.3 Furnish and install wall plates for all wiring devices, and outlet boxes, including special outlets, sound, communication, signal, and telephone outlets, etc. as required. All cover plates shall be appropriate for type of device.

END OF SECTION

SECTION 26 51 14

LED LIGHTING FIXTURES AND LAMPS

PART 1 – GENERAL

1.1 Furnish and install all lighting fixtures with lamps as specified and as shown on the drawings. Fixtures shall be complete including canopies, hanger, diffusers, ballasts, etc.

1.2 Submit manufacturer's data for each fixture type including the following:

1.2.1 Lighting fixture catalog data and photometry.
1.2.2 Lamp catalog data for each fixture type.
1.2.3 Driver catalog data for each fixture type.
1.2.4 Fixture warranty.

1.3 <u>Common submittal mistakes which will result in the submittal being rejected:</u>

1.3.1 Not including lamp and driver information for each fixture type.

1.3.2 Not including all items listed in the above itemized description.

1.3.3 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.

1.3.4 Not including actual manufacturer's catalog information of proposed products.

1.3.5 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

PRODUCT SUBSTITUTION

1.4 All substitutions or alternate fixtures to those indicated on the project fixture schedule shall be submitted for approval (7) business days prior to the project bid date. Approvals <u>when</u> accepted will be issued in the form of an addendum. No consideration for substitutions will be provided after the award of the contract.

1.4.1 The substitution request must include a statement indicating the difference in price of both the specified and alternate product, both contractor and list price. The substitution request must include a comparison of the total fixture wattage, total fixture lumens, fixture efficiency and warranty comparison.

1.4.2 When proposing to substitute lighting fixture and/or fixture retrofit, a point by point photometric calculation of a typical application as used in this project shall be included. A calculation of the specified and the proposed alternate shall be included.

PART 2 – PRODUCTS

2.1 All catalog numbers are given for manufacturer's identification and shall not relieve Contractor from responsibility of full conformance to all applicable written description requirements governing material and fabrication, either in the general or specific sections. Where catalog numbers are indicated as modified, no modification will be required if the standard unit fully conforms to descriptive requirements in the Specifications and matches specified ceiling.

2.2 All fixtures of the same type shall be of one manufacturer and of identical finish and appearance. All fixtures and component parts shall bear the UL label.

2.3 All steel parts shall be phosphate treated in multistage power spray system for corrosion resistance and paint adhesion. Final finish shall be electrostatically applied baked white enamel of not less than 87 pct. reflectance on reflecting surfaces.

2.4 Each fixture shall have a continuous light-seal gasket seated in such manner as to prevent any light leak through any portion or around any edge of the trim frame.

2.5 Diffusers shall be framed in a hinged, continuous assembly. Diffuser frame latches shall be spring-loaded or cam-operated.

2.6 All recessed fixtures shall be provided with frames appropriate for the type of ceiling involved. No fixtures shall be ordered until the ceiling construction has been verified by the Contractor.

MINIMUM LUMINARY REQUIREMENTS

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

2.8 Recessed Fixtures: Comply with NEMA LE 4.

2.9 CRI of **minimum 80 CCT of 4100 K**.

2.10 Rated lamp life of 50,000 hours minimum.

2.11 Lamps dimmable from 100 percent to 0 percent of maximum light output.

2.12 Nominal Operating Voltage: **120 V / 277 V ac**

PART 3 – EXECUTION

3.1 All lighting fixtures shall be supported as follows:

3.1.1 From the outlet box by means of a metal strap where its weight is less than five pounds.

3.1.2 From its outlet box by means of a hickey or other threaded connection where its weight is from five to fifty pounds.

3.1.3 Directly from the structural slab or joists where its weight exceeds fifty pounds.

3.1.4 Lighting fixtures shall be supported independent of the ceiling system or additional ceiling support must be added to carry the weight of the lighting fixtures. Recessed lighting fixtures supported from ceiling grid tees shall be furnished with hold down clips in conformance with CEC 410 - 16, spring clips will not be permitted. All fixtures which the manufacturer has not provided UL approved clips, must be attached to the fixture and ceiling grid by metal screws.

3.2 Furnish and install supplementary blocking and support as required to support fixture from structural members. Contractor shall submit proposed blocking method for all suspended lighting fixtures for approval prior to rough in.

3.3 Suspended and/or pendant mounted fixtures shall be provided with four aircraft safety cables extending in opposite directions, attached to the fixture, and supported from a structural member. The contractor shall submit proposed fixture mounting and aircraft cable attachment methods for approval prior to fixture rough in.

3.4 Class 1 wiring to the fixture must be installed either conduit or type MC-PCS cabling no open wiring shall be permitted.

3.5 Chain suspension may be used only where specifically permitted on the drawings. Chain shall be heavy duty, nickel or cadmium plated, suitable for weight of specific fixture.

3.6 Shop drawings shall be furnished for each fixture type. Catalog cuts, illustrating conformance with specifications, will be acceptable for standard units. Shop drawings shall indicate materials, assembly, finish and dimensions.

3.7 Photometric data shall be furnished for any fixture substituted for those listed on the schedule.

3.8 Any driver which produces a greater than normal amount of noise shall be replaced by the contractor. Normal will be determined by the level of sound produced by other similar fixtures operating in the area.

END OF SECTION

SECTION 26 90 90

TESTING

PART 1 – GENERAL

1.1 Upon completion of the electrical work, the entire installation shall be tested by the Contractor, and demonstrated to be operating satisfactorily to the Architect, Engineer, Inspector and Owner.

1.2 All testing and corrections shall be made prior to demonstration of operation to the Architect, Engineer, Inspector and Owner.

1.3 In addition to the demonstration of operation, the Contractor is also required to review the content and quality of instructions provided on items demonstrated with the Architect, Engineer, Inspector and Owner.

PART 2 – EXECUTION

2.1 Wiring shall be tested for continuity, short circuits and/or accidental grounds. All systems shall be entirely free from “grounds,” “short circuits,” and any or all defects.

2.2 Motors shall be operating in proper rotations, and control devices functioning properly. Check all motor controllers to determine that properly sized overload devices are installed, and all other electrical equipment for proper operation.

2.3 Tests and adjustments shall be made prior to acceptance of the electrical installation by the Architect, and a certificate of inspection and acceptance of the electrical installation by local inspection authorities shall be provided.

2.4 All equipment or wiring provided which tests prove to be defective or operating improperly shall be corrected or replaced promptly, at no additional cost to the Owner.

2.5 Test all motor and feeder circuits with a “megger” tester to determine that insulation values conform to Section 110-20, California Electrical Code (CED). Test reports must be submitted and approved by the engineer before final acceptance.

2.6 Test all grounding electrode connections to assure a resistance of no more than 10 ohms is achieved. Augment grounding until the ohmic value stated above is achieved. Provide certified test results to the Architect, Engineer and Inspector.

END OF SECTION

SECTION 27 05 00

REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Provide a standard defining the structured communications cabling systems to be installed within customer facility. The goal is to accomplish this in the most economic and systematic fashion possible, and in a manner compliant with the latest codes, cabling standards and industry best practices.
   2. Scope of Work Compliance.
   3. Sub-contractor Qualifications.
   4. Warranty.
   5. Safety.
   6. Working Conditions.

1.02 GENERAL TERMS AND CONDITIONS.

A. General Contractor is responsible for all required Division 27 scope of work and shall ensure all communication sub-tier sub-contractors adhere to the qualifications set forth in all project Division 27 specifications including project experience and certifications.

B. Prices quoted shall be all-inclusive and represent a complete fully-engineered system installation at the Project site as contemplated by and detailed in the drawing package and in accompanying specifications.

C. Omissions in the specification of any provision herein described shall not be construed as to relieve the sub-contractor of any responsibility or obligation requisite to the complete and satisfactory delivery, installation, operation and support of any and all systems, equipment or services. Correction of any omission on the part of the Sub-contractor, either due to misinterpretation of this specification or any other conditions of the project, shall be the responsibility of the Sub-contractor and shall not result in any contract modification or additional costs to Owner.

D. Where conflicts and/or irregularities occur between project documents, specifications, drawings, and/or applicable codes, rules, regulations, ordinances, standards, guidelines and practices, the more stringent requirement shall apply as reasonably determined by Owner or government agency inspector.

E. This specification represents the design intent for the project communicated by way of narrative descriptions of intended functionality and single line or detail drawings indicating likely equipment connectivity to achieve that functionality. The designs in this specification do not represent fully engineered technical solutions. Sub-contractors are required to review the designs presented in the project documents closely, submit any questions and clarifications regarding the design intent through the RFI process and develop their own engineered solutions representing a fully functional turn-key solution in their bid responses.

F. The scope of this project includes the complete system engineering, procurement, fabrication, installation, programming, testing, training and warranty.

G. Proposed solutions shall be based on the designs communicated in the specifications, but shall include any additional equipment, materials, software, licenses and/or labor required for the sub-contractor to deliver a fully functional turn-key system solution that meets intended operational performance requirements.

H. It is the responsibility of the Sub-contractor awarded this project to ensure that all quantities, materials, labor, licenses, permits, sales taxes and any and all other costs to provide a turnkey project are included in their bid.

I. Floor plans, drawings, elevation drawings, and other drawings received by the Sub-contractor as part of the construction process are hereby incorporated into this document by reference. It is the responsibility of the Sub-contractor to ensure that amounts and lengths of cabling and pathways are correct, and that all materials and labor are included to install the system per the drawings and these specifications.

J. Permits, licenses, applicable sales taxes, insurance requirements, payment/performance bond costs, and other miscellaneous costs are the responsibility of the Sub-contractor and must be included in the contract price and this scope of work. Such items are to be listed separately on pricing sheets, if provided. Copies of all required permits, licenses, insurance requirements and bond(s) are to be delivered to Owner prior to commencement of any work.

K. Installation Schedule and Coordination: Sub-contractor must take the fast-track nature of this project and potential requirement for installation/work schedule adjustments and quick turnarounds into consideration in constructing this project as Owner will NOT entertain or agree to added-cost change orders associated with scheduling changes.

L. Work will need to be closely coordinated with architect, College Personnel, GC, MEP sub-contractors, structural sub-contractor and all low-voltage sub-contractors and each of their respective schedules.

M. This will be a turnkey Project. Any item of the equipment or material not specifically addressed on the drawings, specifications or elsewhere in Division 27 specifications documents, but required to provide complete and functional systems as contemplated and/or specified herein, shall be provided at no additional charge to owner in a quantity and quality consistent with other specified items.

N. Coordination with Project Design Team: The build sub-contractor will be responsible for coordinating all communications cabling infrastructure requirements, including review of existing site conditions, review and coordination of electrical power and grounding requirements, conduits and back boxes, structural support requirements, and coordination.

O. Assembly: The sub-contractor shall procure and assemble all hardware and equipment and any additional materials as required to deliver the completely functioning communications cabling system and/or Audio Visual System.

P. Installation: The sub-contractor shall install all equipment, inter-rack and intra-rack cable, wiring of equipment, connectors, panels, plates, and other material at the Project site.

Q. Testing and Adjustment: The sub-contractor shall perform all tests and adjustments, furnish all test equipment necessary and perform all work required to properly configure the systems and to verify their performance in accordance with the information in this document and the design-build integrator's approved engineered designs.

R. Warranty: The sub-contractor shall warrant the installed system in accordance with the terms of this document and accompanying contractual documents.

1.03 RELATED DOCUMENTS

A. All divisions of the specification and general provisions of the Construction Documents.

B. Architectural, mechanical, electrical, and all technology drawings including but not limited to Telecommunication Drawings.

C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

1.04 REFERENCES

A. Abbreviations and Acronyms:

1.	A/E:	Architect / Engineer (designer)
2.	BICSI:	Building Industry Consulting Service International
3.	EIA:	Electronics Industry Alliance
4.	ELFEXT	Equal Level far End Cross Talk
5.	FTP	Foiled Twisted Pair
6.	IDF:	Intermediate Distribution Facility
7.	ILEC/LEC:	Incumbent Local Exchange Carrier
8.	ISP:	Inside Plant
9.	IT:	Information Technology
10.	MDF:	Main Distribution Facility
11.	MPOE:	Minimum Point of Entry
12.	NEXT	Near End Cross Talk
13.	OSP:	Outside Plant
14.	PSELFEXT:	Power Sum Equal Level far End Cross Talk
15.	PSNEXT:	Power Sum Near End Cross Talk
16.	RCDD:	Registered Communications Distribution Designer
17.	TBD:	To Be Determined
18.	TCIM:	Telecommunication Cabling Installation Manual
19.	TDMM:	Telecommunications Distribution Methods Manual
20.	TIA:	Telecommunications Industry Association
21.	UTP:	Unshielded Twisted Pair
22.	WAP:	Wireless Access Point.

1.05 APPLICABLE REGULATORY REFERENCES

A. Sub-contractor is responsible for knowledge and application of current versions of all applicable Standards and Codes. In cases where listed Standards and Codes have been updated, Sub-contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.

1. ANSI/TIA:

a. TIA-526-7 (OFSTP-7) (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
b. TIA-526-14-B (April 2015) (OFSTP-14) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
c. ANSI/TIA/EIA-598-C (July 2014) Optical Fiber Cable Color Coding
d. ANSI/TIA-568-C.0 (December 2015) Generic Telecommunications Cabling for Customer Premises
e. TIA-568-C.0-1 (September 2012) Generic Telecommunications Cabling for Customer Premises-Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling
f. ANSI/TIA-568-C.1 (February 2012) Commercial Building Telecommunications Cabling Standards
g. TIA-568-C.1-2 (November 2014) Commercial Building Telecommunications Cabling Standard, Addendum 2 General Updates
h. ANSI/TIA-568-C.2 (June 2016) Balanced Twisted Pair Communications Cabling and Components Standards
i. ANSI/TIA-568-C.3 (June 2011) Optical Fiber Cabling Components Standard
j. ANSI/TIA-568-C.3-1 (December 2011) Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors
k. ANSI/TIA-1183 (August 2012) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
l. ANSI/TIA-1183-1 (January 2016) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Addendum 1 – Extending Frequency Capabilities to 2 GHz.
m. ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard
n. ANSI/TIA-942-A (August 2012) Telecommunications Infrastructure Standard for Data Centers
o. ANSI/TIA-942-A-1 (March 2013) Telecommunications Infrastructure Standard for Data Centers, Addendum 1 - Cabling Guidelines for Data Center Fabrics
p. TIA-569-D (April 2015) Telecommunications Pathways and Spaces
q. TIA-569-D-1 (October 2016) Telecommunications Pathways and Spaces Addendum 1- Revised Temperature and Humidity Requirements for Telecommunications Spaces
r. ANSI/TIA-606-B (December 2015) Administration Standard for Telecommunications Infrastructure
s. TIA-607-B (November 2015) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises

t. TIA-607-B-1 (January 2017) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises - External Grounding Addendum
u. TIA-758-B (April 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
v. TIA-1152 (November 2016) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
w. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems.
x. TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
y. TIA-1005-A (June 2012) Industrial Telecommunications Infrastructure Standard for Manufacturing, Process & Refining
z. ANSI/TIA-1005 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises
aa. TIA-1005-1 (May 2012) Telecommunications Infrastructure Standard for Industrial Premises; Addendum 1 - Industrial Pathways and Spaces
bb. TIA-1179 (July 2010) Healthcare Facility Telecommunications Infrastructure Standard.

2. ISO/IEC
   a. ISO 11801 (November 2010) - Generic Cabling for Customer Premises
   b. ISO/IEC TR 14763-2-1:2012 - Information technology -- Implementation and operation of customer premises cabling -- Part 2-1: Planning and installation - Identifiers within administration system.
3. National Electric Codes
   a. National Electrical Code (2017)
   b. ANSI/NFPA 70-2017, National Electrical Code© (NEC©)
   c. ANSI/IEEE C2-207, National Electrical Safety Code®
   d. National Electrical Code (NEC) (NFPA 70)
4. OSHA Standards and Regulations – all applicable
5. Local Codes and Standards – all applicable
6. BICSI
   a. Telecommunications Distribution Methods Manual, 13th Edition
   b. BICSI 004-2012, Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
   c. Information Technology Systems Installation Methods Manual (ITSIMM), 6th Edition
   d. ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices
   e. Network Systems and Commissioning (NSC) reference, 1st Edition
   f. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
   g. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
   h. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
   i. AV Design Reference Manual, 1st Edition
   j. Network Design Reference Manual, 7th Edition
   k. Outside Plant Design Reference Manual, 5th Edition
   l. Wireless Design Reference Manual, 3rd Edition
   m. Electronic Safety and Security Design Reference Manual, 3rd Edition.

7. Anywhere cabling Standards conflict with electrical or safety Codes, Sub-contractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.
8. Knowledge and execution of applicable codes is the sole responsibility of the Sub-contractor.
9. Any code violations committed at the time of installation shall be remedied at the Sub-contractor's expense.

1.06 SCOPE OF WORK

A. General project information:
   1. These Specifications and associated drawings are the governing document for the installation of the telecommunications infrastructure and includes project descriptions, specified and recommended products, installation and project management methods, the scope of work and elevation drawing specifications.
   2. Through this division specification document, Palomar College will be referred to as the owner.
   3. Owner wishes to contract with a General Contractor, who will sub-tier the supplier/sub-contractor ("ICT-Information and Communication Technology and AV-Audio Visual") to provide, install, test and warranty a complete turn-key Cable Infrastructure System and PA System for Owner's new North Education Center (NEC) the "Project" per the scope of work and specifications stated herein. This inquiry implies no obligation on the part of Owner. Sub-contractor shall bear all costs and expenses incurred in preparing a response a Request For Proposal ("RFP") and subsequent award of project, it being understood and agreed that Owner accepts no responsibility for any costs and/or expenses incurred by winning sub-contractor in preparing and submitting such response.
   4. The Owner is developing a new multi-building Classroom village located at 35090 Horse Ranch Creek Road, Fallbrook, CA 92028. The NEC will be a newly developed site with 3 phasesn Phase 2, 3 and 4. Phase 2 will include site utilities/systems and parking lots. Phase 3 and 4 will include four (4) banks of multiple modular buildings. The (4) banks includes modulars consisting of the following:

      a. Phase 3 - Administration modular building with College office space and student shared areas. The Administration Building will house the NEC MPOE/Server Room, supporting the NEC network requirements.
      b. Phase 3 - General Classroom Modulars which will include one of the two village IDF's.
      c. Phase 3 – Lecture, Computer Lab, Library and General Classroom modular buildings. These areas will consist of multiple double wide and single wide modular buildings. This area will include the second of the two village IDF's.
      d. Phase 4 – Science Lab modular buildings with include two science labs and one lab prep room. All cabling from these modular buildings will be ran to IDF located with-in the General Classroom bank of modular buildings. See design drawings for reference.
   5. The scope of work will include a complete AFL Dura-Line fiber optic air blown fiber system and category backbone between each of the IDF's and the main server room. Each building will have a Category 6A cable infrastructure and specialized PA cabling as required.

6. Contractor shall build out each MDF, IDF as shown on drawings. Administration Building will consist of a Main Server Room. Total of 3 communication rooms.
7. Station cable pathway will consist of cable J-hook in accessible ceilings areas or conduit to accessible ceiling areas.
8. Communication Outlet (Split delta) =In areas where cable will be installed in non-exposed format, electrical contractor shall provide 5" square deep junction box inside wall with single gang plaster ring and 1.25" conduit routed to accessible ceiling space. Cabling shall be run to the nearest TR. Outlet shall be mounted + 18" AFF (U.N.O.). Each outlet location shall have three (2) Category 6A, 4-pair cables and three (2) Category 6A, RJ-45 jacks (U.N.O.). Jacks shall be housed in a standard angled four port single gang wall faceplate with matching blanks for used ports. Color to match the wall paint color as close as possible. Wall plate color will be approved by architect prior to installation of faceplate.
9. Communication Outlet (Split delta) w/# =In areas where cable will be installed in non-exposed format, electrical contractor shall provide 5" square deep junction box inside wall with single gang plaster ring and 1.25" conduit routed to accessible ceiling space. Cabling shall be run to the nearest TR. Outlet shall be mounted + 18" AFF (U.N.O.) Each outlet shall have a category 6A, 4-pair cables and a category 6, RJ-45 jacks per the number indicated on the drawings. (#6=6 cables/Jacks) Jacks shall be housed in a standard angled four port single gang wall faceplate with matching blanks for used ports. Color to match the wall paint color as close as possible. Wall plate color will be approved by architect prior to installation of faceplate
10. Flush floor mounted outlet (split delta with-in square) = electrical contractor shall provide two 1-1/4" conduit routed to accessible ceiling space Electrical contractor shall provide floor box with cover flush in the floor, fire sealing, conduit pathway and pull string. Communication contractor shall provide all cable and connectivity hardware. Cabling shall be run to the TR location as indicated on the drawings. Each outlet shall have a category 6A, 4-pair cables and a category 6, RJ-45 jacks per the number indicated on the drawings. For conference room, office locations, or any floor boxes not showing a number next to the symbol, Communication contractor shall provide four (2) Category 6A MTP cables and four (2) Category 6A RJ-45 jacks mounted inside the floor box. Blank off all unused ports. Communication contractor is responsible to provide faceplate inside floor box.
11. Installation of Copper UTP Category 6A cabling as indicated on drawings.
12. Provide fiber optic, category patch cables and copper cross connections for both ends of communication link. Patch cable installation will be part of this scope of work.
13. Install 6 strand Single-Mode optical fiber air-blown backbone cabling backbone cable between MDF and each Building IDF room as indicated on drawings. MDF will act as MPOE.
14. Install Category 6 OSP backbone cabling between MDF and each Building IDF room as indicated on drawings.
15. Sub-contractor shall provide proper slack loops in each communication vault, minimum of 50' and a minimum of 15' in pull boxes, slack loops required only if they will meet manufacturer bend radii requirements.
16. Sub-contractor shall provide/install fire caulk in all conduits with cable as required, UL listed rated fire system where applicable.
17. Sub-contractor shall label all new cable at both termination points, within all communication vaults and/or pull boxes. Cable bundles shall be labeled where ever it is accessible including origin/destination and system information.

B. Purpose:
   1. This specification defines quality standards and practices common to all network cabling for NEC project. In addition, said project will have Requests for Proposals (RFP), associated drawings and requirements pertaining to their specific environments. Such collateral will be referred to in this document as “Project Specific Documentation” or simply “Construction Documents”.
   2. Voice and Data Networks encompass a broad spectrum of technologies and are distributed into project internal spaces. Installed cables will be used for Ethernet, high and low speed data applications, used in analog and digital voice, not to exclude other future Voice/Data technologies. This specification will include indoor/outdoor cable installations, and backbone cabling, telecommunications closet and equipment cabling, equipment hardware as well as routing and support infrastructure.
   3. It is the responsibility of the installing sub-contractor to evaluate these general recommendations and adapt them effectively to actual projects. Sub-contractor is responsible for identifying and bringing to the attention of any design directions that may be in conflict or otherwise improved. All such conflict resolutions shall be in writing from A/E or owner.
   4. Note that while many portions of this global specification are addressed to "The Sub-contractor", these requirements apply equally to anyone doing the network cabling and infrastructure work within, whether those persons are outside sub-contractors or persons directly employed by the owner.
   5. Sub-contractor shall be solely responsible for all parts, labor, testing, documentation and all other associated processes and physical apparatus necessary to turn-over the completed system fully warranted and operational for acceptance by A/E.
   6. This specification includes structured cabling design considerations, product specifications and installation guidelines for low-voltage network systems and associated infrastructure including, but not limited to:
      a. Cabling Sub-system 1 – Horizontal
         1) Category 6A cable
         2) Work area (equipment outlet) appliances and configuration
         3) Horizontal Pathways
         4) Copper Patching
      b. Fiber Backbone Cabling
         1) Interbuilding backbone
         2) Fiber Patching
      c. Telecommunications Spaces
         1) Telecommunications Room Requirements
         2) Racks and Cabinets
         3) Overhead Pathways
      d. Communications Grounding Systems
      e. Communications Labeling and Administration

C. Scheduling:
   1. Contract Documents and the overall construction schedule must be carefully reviewed to determine all required interfacing and timing of the work. All such

documents shall be available through the General Contractor or Construction Manager.

2. New NEC project schedule will include, but are not limited to, the following task sequence:
   a. Conduit infrastructure; including vaults/pullbox install and conduit duct banks.
   b. New MDF, IDF Construction and buildout.
   c. Service provider cabling and equipment installation.
   d. Service provider completion and commissioning.
   e. Individual Building Pathway Installation.
   f. New backbone fiber optic cabling installations; includes install, termination, labeling, testing, as-built and warranty documentation.
   g. Building Category and AV Cable installations; includes install, termination, labeling, testing, as-built and warranty documentation.
   h. Audio Equipment installation.

1.07 SUB-CONTRACTOR QUALIFICATIONS

A. General:
   1. Sub-contractor shall have at least 5 years of experience installing and testing structured cabling systems.
   2. Sub-contractor shall employ at least one BICSI Registered Communication Distribution Designer (RCDD), and the RCDD shall sign-off on all designs offered, including stamping the design with their current BICSI/RCDD stamp.
   3. Sub-contractor shall have the responsibility to obtain any of the necessary permits, licenses, and inspections required for the performance of data, voice, and fiber optic cable installations.
   4. Contactor shall be a current manufacturer Certified Installer certificate. A copy of corporate certificate must be included with quote.
   5. Sub-contractor shall have service facilities within 50 miles of project location.
   6. At least 75 percent of the technicians on the job must have a current manufacturer Certified Copper Technicians certificate to install manufacturer Copper Distribution Systems.
   7. At least 75 percent of the technicians installing any Fiber Distribution Systems must have a current manufacturer Certified Fiber Technicians certificate to install Fiber Distribution Systems.
   8. The Telecommunications sub-contractor must provide a project manager to serve as the single point of contact to manage the installation, speak for the sub-contractor and provide the following functions:
      a. Initiate and coordinate tasks with the Construction Manager and others as specified by the project schedule.
      b. Provide day to day direction and on-site supervision of Sub-contractor personnel.
      c. Ensure conformance with all contract and warranty provisions.
      d. Participate in weekly site project meetings.
      e. This individual will remain project manager for the duration of the project. The sub-contractor may change Project Manager only with the written approval of A/E.

B. References:

1. Communications Sub-contractor shall provide with bid a list of three reference accounts where similar Data, Voice, Fiber Optic Cable, and related migration/cutover equipment installation work was performed within the last year or twelve-month period.

C. Insurance Requirements:
1. Sub-contractor must be insured and shall provide with bid a Certificate of Indemnification, Certificate of Insurance, and meet all required insurance and licensing policies as specified by A/E Risk Management Division and any Federal, State, and local organization pertaining to data, voice and fiber optic cable installation.
2. Sub-contractor's vehicles brought onto project properties, shall comply with all requirements of all Federal, State, and local agencies. Vehicles shall meet current DOT, state and local, safety inspections where required.

D. Termination of Services:
1. Owner or A/E reserves the right to terminate the Communication Sub-contractor's services if at any time the A/E determines the Communication Sub-contractor is not fulfilling their responsibilities as defined within this document.
2. Sub-contractor's appearance and work ethics shall be of a professional manner, dress shall be commensurate with work being performed.
3. Dress displaying lewd or controversial innuendos will strictly be prohibited.
4. Conduct on project property will be professional in nature.
5. Any person in the Sub-contractor's employ working on a project considered by to be incompetent or disorderly, or for any other reason unsatisfactory or undesirable, such person shall be removed from work on the project.
6. The Communications Sub-contractor shall be restricted from the premises and compensated for the percentage of work completed satisfactorily.

E. Other Sub-Contractor Responsibilities
1. Sub-contractor is responsible for the removal and disposal of all installation and construction debris created in the process of the job. All work areas will be cleaned at the conclusion of the workday and no tools or materials shall be left in a manner as to pose a safety hazard.
2. Sub-contractor must remove all abandoned cable per Article 800 of the National Electrical Code and per TIA and BICSI standards, recycling these materials where possible. This is mandatory; Sub-contractors must consider this when placing bids.
3. Sub-contractor shall abide by the regulations set by A/E or Owner Security Department pertaining to access to and conduct while on project property and shall obey speed limits and parking regulations.

1.08 SYSTEM PERFORMANCE WARRANTY

A. General
1. Sub-contractor shall provide a manufacturer System Warranty on all copper and fiber permanent cabling links.
2. This is a system performance warranty guaranteeing for a minimum of 20 years from acceptance that the installed system shall support all data link protocols for which that copper Category or fiber OS designation is engineered to support according to IEEE and TIA standards.

3. The manufacturer System Warranty may be invoked only if the cabling channel links are comprised of manufacturer connectivity and approved by the manufacturer. Patch cords must be same manufacturer of cable.
4. Upon acceptance of Warranty, manufacturer will mail a notification letter to the installer and a notification letter and warranty certificate to A/E.

B. Sub-Contractor Warranty Obligations
1. Installation firm must be a current manufacturer Certified Installer in good standing and shall include a copy of the company certification with the bid.
2. Sub-contractor shall name a supervisor to serve on site as a liaison responsible to inspect and assure all terminations are compliant to factory methods taught in manufacturer Technician Certification Training and according to all Standards cited in the Regulatory References section of this document.
3. Sub-contractor liaison shall have a current, up-to-date manufacturer Certified Technician certificate in both copper and fiber. Copies of the copper and fiber certificates of the manufacturer liaison shall be submitted with the bid.
4. Sub-contractor agrees all components comprising active links shall be of the same copper Category or fiber OS/OM designation as the system being installed. Sub-contractor shall under no circumstances mix different Categories or OS classes of cable or termination devices (connectors) within the same link or system.
5. Sub-contractor shall install all racking and support structures according to cited TIA Standards in such fashion as to maintain both Standards and Manufacturer recommendations for uniform support and protection, segregation of different cable types, maintenance of maximum pulling tensions, minimum bend radius, approved termination methods as well as adhering to industry accepted practices of good workmanship.
6. Sub-contractor is responsible for understanding and submitting to manufacturer all documents required prior to project start to apply for this warranty. These include but are not limited to the project information form and SCS warranty agreement.
7. Sub-contractor is responsible for understanding and submitting to manufacturer all documents required at project end. These include completed warranty forms, passing test reports and drawings of floor plans showing locations of links tested.
8. Test results shall be delivered in the tester native format (not Excel) and represent the full test report. Summaries shall not be accepted. Contact manufacturer for a current list of approved testers, test leads and latest operating systems.
9. The Communications Sub-contractor will correct any problems and malfunctions that are warranty-related issues without additional charge for the entire warranty period. The warranty period shall commence following the acceptance of the project by A/E and written confirmation of Warranty from manufacturer.

1.09 SAFETY

A. General
1. All cabling work being performed on project property or under contract to Technology Department must comply with Rules for safe operations, any state or local safety regulations and meet the requirements of OSHA Safety and Health Standards. The sub-contractor Project Manager will maintain a copy of Rules for Safe Operations for reference. It is the responsibility of the Communications Sub-contractor to immediately correct any unsafe working practices on the part of sub-contractor personnel. Unsafe working environments or conditions created by sub-contractor personnel will be reported immediately to the Construction Manager.

2. Any liability for correction of conditions created by the sub-contractor's personnel rests with the sub-contractor.
3. The Communications Sub-contractor shall be solely and completely responsible for conditions of the job site (as pertaining to the materials and equipment specified), including safety of persons and property during performance of work.
4. No act, service, drawing review or construction observance by any employee, representative or engineer may be construed as a review or approval of the adequacy of the Sub-contractor(s) safety measures, in, on, or near the construction site.

1.10 WORKING CONDITIONS

A. Site Access
1. All cable installations must be pre-approved by the Construction Manager to ensure that the necessary arrangements have been made for proper access to project sites.
2. A twenty-four-hour prior notice shall be submitted to the Construction Manager for any work schedule changes.
3. Communications Sub-contractor shall display badges or passes as mandated by project property Security Department Rules and Regulations.

B. Scheduling
1. Coordination of site surveys and the issue of project owner owned materials and equipment will be the responsibility of the Construction Manager. Once said equipment and materials are in the Sub-contractor's possession, it is the Sub-contractor's to safeguard the material and equipment from damage or theft.
2. Information required by the Sub-contractor to price and complete a defined scope of work will be furnished to the Communications Sub-contractor by the A/E Project Manager in a Scope of Work document and at the time of the site survey (if necessary) and will be maintained by the Communications Sub-contractor until the completion of the job.
3. It is the Sub-contractor's responsibility to begin work promptly according to the Start Dates and to complete work by the Proposed Completion Date listed on the Cable Run Request Form.
4. The Sub-contractor must notify the Construction Manager in writing of any delays; at that time, they shall come up with a mutually agreeable project schedule.
5. The Communications Sub-contractor will coordinate with the Construction Manager working hours and job site access issues.
6. The Communications Sub-contractor will coordinate with the Construction Manager to minimize outages to the existing systems.
7. Any service interruption required by the Communications Sub-contractor must be requested in writing, and scheduled with the Construction Manager.
8. The Communications Sub-contractor shall not proceed with the requested service interruption until written approval is granted by the Construction Manager.
9. All problems, and questions relating to a particular job, will be referred to the Construction Manager and no changes shall be made without his/her written approval.

C. Harmony Clause
1. Sub-contractor shall coordinate and work in harmony with other trades on the project as well as with A/E personnel.

1.11 COORDINATION

A. Coordinate layout and installation of voice, data, and video communication cabling with other sub-contractors and equipment suppliers.
   1. Meet jointly with other sub-contractors, equipment suppliers, and representatives to exchange information and agree on details of equipment arrangements and installation interfaces.
   2. Record agreements reached in meetings and distribute to other participants.
   3. Adjust arrangements and locations of distribution frames, cross-connect and patch panels in equipment rooms and telecommunications rooms to accommodate and optimize arrangement and space requirements of voice and LAN equipment.
   4. When indicated on drawings, sub-contractor shall reuse existing copper and fiber optic backbone cables.
   5. Provide weekly progress reports and crew schedules to project representatives by 5:00 PM, Thursday of each project work week.

1.12 ACTION SUBMITTALS

A. Product Data: For each product indicated.
   1. Submit all product data in accordance with general requirements of the construction documents.
   2. Submit product cut sheets and a detailed list of components a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
   3. Alternate and “Or Equal” designated products must be submitted for review and judgment to the A/E prior to installation. The sub-contractor-proposed alternate products or components must be verified by two (2) independent sources within the past 6 months. This request shall include the two (2) independent sources, the original Product’s specification sheet, the proposed substitute product cut sheet, and a written request to review the substitute product.
   4. Any request of an alternate or substitution must be submitted to the A/E for action no later than fourteen (14) calendar days after release of the original telecommunications bid documents.

1.13 Information & COmmunication Technology (ICT) components

A. The Contract Documents generally outline industry standard components to be installed as part of the project ICT installation requirements. Such identification is intended to be general in nature rather than exhaustive. All stated quantities are subject to validation by ICT Sub-contractor. ICT Sub-contractor is reminded that differences between estimated quantities and those reasonably derived based from the Contract Documents (as well as through bid conferences, job walks, addendums, and other distribution of information) shall be the responsibility of the ICT Sub-contractor. There shall be no additional cost incurred by Palomar College NEC project for not complying with the specifications and requirements of the Contract Documents.

B. Any variance from those components identified on the drawings and/or below shall be submitted to Palomar College NEC project representatives for approval prior to ordering and installation; the risk for all costs incurred by the ICT Sub-contractor for materials ordered prior to such written approval shall be borne entirely by the ICT Sub-contractor. Nonetheless, it is imperative that the ICT Sub-contractor determine the availability of necessary materials and propose equivalent substitutes as necessary to meet all

installation milestones. Delays in ICT installations due to lack of product availability are unacceptable. As catalog numbers change frequently, the ICT Sub-contractor must verify all part numbers prior to ordering materials. Clarifications will be issued in response to written Requests for Information (RFI).

C. All new fiber optic cabling, will be Air-Blown Fiber indoor/outdoor rated. Any unrated cable (such as filled ASP) shall not be installed within the structure except when placed within IMT, PVC or RGS conduit.

D. Throughout this specification, Dura-Line, Berk-Tek, Leviton, Chatsworth Products, Inc. and other manufacturers are cited. These citations are for the purpose of establishing quality, performance, warranty certification criteria and are campus standards.

1.14 DELIVERY AND STORAGE

A. ICT Sub-contractor shall provide a materials schedule prior to the start date of cable installation. Material schedule shall specify all material quantities and their delivery date for this project.

B. ICT Sub-contractor shall provide protection from weather, moisture, dirt, dust and other contaminants for telecommunications cabling and pathway equipment placed in storage.

1.15 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:
   1. Submit all shop drawings in accordance with the general requirements of the construction documents.
   2. Submit shop drawings a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
   3. Shop drawings shall include evidence of grounding and bonding components are coordinated with field conditions and the work of other trades.
   4. This submittal may have a written component and a visual, drawn component for review and action by the A/E prior to installation.

B. Certificates:
   1. Submit management and installation team reference documentation verifying:
      a. The project manager is a RCDD in good standing with BICSI and is qualified to manage the scope of work described in the contract documents and has five (5) years of experience managing similar projects in size and scope. The documentation shall include the RCDD registration number.
      b. The field supervisor is a BICSI trained technician that is qualified to perform and oversee the work described in the contract documents.

C. Qualification Statements:
   1. The sub-contractor shall submit documentation that within the past 12 months, a minimum of 75% of all installation personnel have been trained or certified by the manufacturer of the products they are installing.

1.16 CLOSEOUT SUBMITTALS

A. As-Built Drawings:

1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
2. Submit as-built drawings a minimum of two (2) weeks after completion of all Division- 27 work for A/E and Owner reference.
3. Communication sub-contractor to print, frame and mount approved as-built drawings in MPOE. Coordinate location with A/E.

1.17 QUALITY ASSURANCE

A. Qualifications – Manufacturer
   1. Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.

B. Qualifications – Installer:
   1. At a minimum, seventy-five percent (75%) of the onsite sub-contractor provided field technicians shall be factory certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall be available on site for review at all times for each field technician.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section.

3.02 RE-INSTALLATION

A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components. Scheduling for re- installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work

3.03 CLOSEOUT ACTIVITIES

A. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.

B. Sub-contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner

END OF SECTION

SECTION 27 05 26

GROUNDING BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Specifications for grounding and bonding components utilized to provide proper grounding and bonding for telecommunications cabinets, racks, cable tray, ladder tray, cable and equipment.
   2. Grounding and bonding components with design criteria.

1.02 RELATED DOCUMENTS

A. All divisions of the specification and general provisions of the Construction Documents.

B. Architectural, mechanical, electrical, and all technology drawings.

C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

1.03 REFERENCES

A. Abbreviations and Acronyms:
   1. A/E: Architect / Engineer (designer)
   2. AHJ: Authority Having Jurisdiction
   3. BICSI: Building Industry Consulting Service International
   4. EIA: Electronics Industry Alliance
   5. TDMM: Telecommunications Distribution Methods Manual
   6. TIA: Telecommunications Industry Association
   7. UL: Underwriters Laboratory

1.04 APPLICABLE REGULATORY REFERENCES

A. Sub-contractor is responsible for knowledge and application of current versions of all applicable Standards and Codes. In cases where listed Standards and Codes have been updated, Sub-contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.
   1. ANSI/TIA:
      a. TIA-526-7 (OFSTP-7) (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
      b. TIA-526-14-B (April 2015) (OFSTP-14) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant

c. ANSI/TIA/EIA-598-C (July 2014) Optical Fiber Cable Color Coding
d. ANSI/TIA-568-C.0 (December 2015) Generic Telecommunications Cabling for Customer Premises
e. TIA-568-C.0-1 (September 2012) Generic Telecommunications Cabling for Customer Premises-Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling
f. ANSI/TIA-568-C.1 (February 2012) Commercial Building Telecommunications Cabling Standards
g. TIA-568-C.1-2 (November 2014) Commercial Building Telecommunications Cabling Standard, Addendum 2 General Updates
h. ANSI/TIA-568-C.2 (June 2016) Balanced Twisted Pair Communications Cabling and Components Standards
i. ANSI/TIA-568-C.3 (June 2011) Optical Fiber Cabling Components Standard
j. ANSI/TIA-568-C.3-1 (December 2011) Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors
k. ANSI/TIA-1183 (August 2012) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
l. ANSI/TIA-1183-1 (January 2016) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Addendum 1 – Extending Frequency Capabilities to 2 GHz.
m. ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard
n. ANSI/TIA-942-A (August 2012) Telecommunications Infrastructure Standard for Data Centers
o. ANSI/TIA-942-A-1 (March 2013) Telecommunications Infrastructure Standard for Data Centers, Addendum 1 - Cabling Guidelines for Data Center Fabrics
p. TIA-569-D (April 2015) Telecommunications Pathways and Spaces
q. TIA-569-D-1 (October 2016) Telecommunications Pathways and Spaces Addendum 1- Revised Temperature and Humidity Requirements for Telecommunications Spaces
r. ANSI/TIA-606-B (December 2015) Administration Standard for Telecommunications Infrastructure
s. TIA-607-B (November 2015) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises
t. TIA-607-B-1 (January 2017) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises - External Grounding Addendum
u. TIA-758-B (April 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
v. TIA-1152 (November 2016) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
w. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems.
x. TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
y. TIA-1005-A (June 2012) Industrial Telecommunications Infrastructure Standard for Manufacturing, Process & Refining
z. ANSI/TIA-1005 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises

aa. TIA-1005-1 (May 2012) Telecommunications Infrastructure Standard for Industrial Premises; Addendum 1 - Industrial Pathways and Spaces
bb. TIA-1179 (July 2010) Healthcare Facility Telecommunications Infrastructure Standard.

2. ISO/IEC
   a. ISO 11801 (November 2010) - Generic Cabling for Customer Premises
   b. ISO/IEC TR 14763-2-1:2012 - Information technology -- Implementation and operation of customer premises cabling -- Part 2-1: Planning and installation - Identifiers within administration system.
3. National Electric Codes
   a. National Electrical Code (2017)
   b. ANSI/NFPA 70-2017, National Electrical Code© (NEC©)
   c. ANSI/IEEE C2-207, National Electrical Safety Code®
   d. National Electrical Code (NEC) (NFPA 70)
4. OSHA Standards and Regulations – all applicable
5. Local Codes and Standards – all applicable
6. BICSI
   a. Telecommunications Distribution Methods Manual, 13th Edition
   b. BICSI 004-2012, Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
   c. Information Technology Systems Installation Methods Manual (ITSIMM), 6th Edition
   d. ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices
   e. Network Systems and Commissioning (NSC) reference, 1st Edition
   f. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
   g. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
   h. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
   i. AV Design Reference Manual, 1st Edition
   j. Network Design Reference Manual, 7th Edition
   k. Outside Plant Design Reference Manual, 5th Edition
   l. Wireless Design Reference Manual, 3rd Edition
   m. Electronic Safety and Security Design Reference Manual, 3rd Edition.
7. Anywhere cabling Standards conflict with electrical or safety Codes, Sub-contractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.
8. Knowledge and execution of applicable codes is the sole responsibility of the Sub-contractor.
9. Any code violations committed at the time of installation shall be remedied at the Sub-contractor's expense.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Install and coordinate the telecommunications cabling work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interference in a manner accepted by the architect. Any repairs

or changes made necessary in the contract work, caused by the sub-contractor's neglect, shall be made by the sub-contractor at their own expense.

B. Scheduling:
   1. Contract Documents and the overall construction schedule must be carefully reviewed to determine all required interfacing and timing of the work. All such documents shall be available through the General Contractor or Construction Manager.

1.06 ACTION SUBMITTALS

A. Product Data: For each product indicated.
   1. Submit all product data in accordance with general requirements of the construction documents.
   2. Submit product cut sheets and a detailed list of components a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
   3. Alternate and "Or Equal" designated products must be submitted for review and judgment to the A/E prior to installation. The sub-contractor-proposed alternate products or components must be verified by two (2) independent sources within the past 6 months. This request shall include the two (2) independent sources, the original Product's specification sheet, the proposed substitute product cut sheet, and a written request to review the substitute product.
   4. Any request of an alternate or substitution must be submitted to the A/E for action no later than fourteen (14) calendar days after release of the original telecommunications bid documents.

1.07 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:
   1. Submit all shop drawings in accordance with the general requirements of the construction documents.
   2. Submit shop drawings a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
   3. Shop drawings shall include evidence of grounding and bonding components are coordinated with field conditions and the work of other trades.
   4. This submittal may have a written component and a visual, drawn component for review and action by the A/E prior to installation.

B. Certificates:
   1. Submit management and installation team reference documentation verifying:
      a. The project manager is a RCDD in good standing with BICSI and is qualified to manage the scope of work described in the contract documents and has five (5) years of experience managing similar projects in size and scope. The documentation shall include the RCDD registration number.
      b. The field supervisor is a BICSI trained technician that is qualified to perform and oversee the work described in the contract documents

C. Qualification Statements:

1. The sub-contractor shall submit documentation that within the past 12 months, a minimum of 75% of all installation personnel have been trained or certified by the manufacturer of the products they are installing.

1.08 CLOSEOUT SUBMITTALS

A. As-Built Drawings:
   1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
   2. Submit as-built drawings a minimum of two (2) weeks after completion of all Division- 27 work for A/E and Owner reference:

1.09 QUALITY ASSURANCE

A. Qualifications – Manufacturer
   1. Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.

B. Qualifications – Installer:
   1. At a minimum, seventy-five percent (75%) of the onsite sub-contractor provided field technicians shall be factory certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall be available on site for review at all times for each field technician.

PART 2 - PRODUCTS

2.01 GROUNDING AND BONDING

A. Basis-of-Design Product: Subject to compliance with requirements, provide manufacturer or comparable product by one of the following:
   1. CPI
   2. B-Line
   3. Circa
      a. Part Number 1890ECT1-25
      b. CAT6 604 Series

B. Product Options:
   1. The indicated manufacturers shall be the basis of the design and each component selected shall address the infrastructure requirement.

C. Description:
   1. Sub-contractor is responsible for bonding to ground all newly placed equipment and installed racks or cabinets per the TIA 607-B Standard.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section.

3.02 INSTALLATION

A. Process:
   1. All newly installed racks and cabinets shall have installed a vertical busbar mounted along one equipment rail to serve as a clean, low-resistance bonding place for any equipment not equipped with a designated grounding pad.
   2. Smaller equipment without an integrated grounding pad shall be bonded to the vertical busbar using a thread-forming grounding screw that is anodized green and includes serrations under the head to cut through oxidation or paint on the equipment flange.
   3. Larger equipment (chassis switches) with a designated grounding terminal shall be bonded to the vertical busbar with and EBC (equipment bonding conductor) kit built to that purpose.
   4. All grounding wire shall be a minimum #6 AWG stranded annealed ground wire, PVC sheathed with nylon. Meets UL83 for THHN or THWN and UL1063.
   5. All OSP cabling terminated with-in new campus MDF shall be terminated to a Building Entrance Terminal with gas fuses.
   6. Sub-contractor shall take care to clean (wire brush, scotchbrite pads) any metallic surface to be bonded down to bare metal and apply a film of anti-oxidation paste to the surfaces prior to effecting the bond.
   7. All bonding lugs on racks and busbars shall be of two-hole irreversible compression type. Mechanical lugs and single-hole lugs will not be accepted and shall be removed and replaced at Sub-contractor's expense.
   8. Every rack or cabinet shall have an individual bonding conductor into the grounding network. Serially connecting (daisy-chaining) of racks is expressly forbidden and will not be accepted.
   9. Rack Bonding Conductors (RBC) may tap into an overhead or underfloor aisle ground, or may run to the wall-mounted grounding busbar in smaller Telecommunications rooms containing 5 racks or less.
   10. Armored cables shall be properly bonded to the earthing system with a kit built to that purpose.
   11. All metallic conduit stub-ups shall be grounded, and where multiple stub-ups are made within an equipment enclosure, they shall be equipped with grounding bushings and bonded together and to the enclosure and the enclosure ground bus.
   12. Each metallic raceway, pipe, duct and other metal object entering the buildings shall be bonded together. The Sub-contractor shall use #6 AWG green insulated copper conductors.
   13. Each identified telecommunications space within a building shall have a common signal reference ground. The signal reference ground shall conform to the following:
       a. Within the building, all communication spaces shall be separately bonded to each other and connected to the primary building ground in accordance with the provisions of EIA/TIA 607. The communication ground shall not ground any other equipment or be connected to any potential high voltage source.

All racks, frames, drain wires, and all installed communication equipment shall only be grounded to this common reference ground with a minimum size #6 AWG green insulated copper wire.

b. The Sub-contractor shall provide, as a minimum, a continuous #3/0 AWG copper electrical conductor connected to a 1/4" x 4" x 12" telecommunications grounding bus bar (TGB) 6" AFF on the plywood backboard of each IDF (or telecommunication space) to terminate chassis and other equipment grounds.

c. The ground wires from each individual IDF shall be routed directly to the Building Distribution Frame (BDF), terminated and bonded together via a telecommunications main grounding bus bar (TMGB) of minimum 1/4" x 4" x 20" dimensions. This point of single reference for all closets in a building shall in turn be grounded with a minimum #3/0 AWG ground conductor to the main building ground. If a main building ground is unavailable, the ground wire from the BDF shall be grounded to the nearest electrical panel ground bus bar. The building ground for signal reference shall be the building service entrance ground.

14. Ground Bus Bar Identification.
    a. The master ground bar shall be labeled as such.
    b. Each subsidiary ground bar shall be labeled as such and have a unique identifier.
    c. All ground bars shall have a warning label that states, “If this connector or cable is loose or shall be removed, please call the Telecommunications Manager.” All ground bars will be connected to the building ground with continuous “3/0” AWG wire.
    d. Each ground cable shall be labeled with a unique identifier.

3.03 RE-INSTALLATION

A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components. Scheduling for re- installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work

3.04 CLOSEOUT ACTIVITIES

A. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.

B. Sub-contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner.

END OF SECTION

SECTION 27 05 28

HANGER AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Provides specifications for non-continuous cable support components utilized to provide pathways support to telecommunications cables traveling outside cable trays, conduits, or other continuous cable supports.
   2. Non-continuous cable supports.

1.02 RELATED DOCUMENTS

A. All divisions of the specification and general provisions of the Construction Documents.

B. Architectural, mechanical, electrical, and all technology drawings.

C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

1.03 REFERENCES

A. Abbreviations and Acronyms:
   1. A/E: Architect / Engineer (designer)
   2. AHJ: Authority Having Jurisdiction
   3. BICSI: Building Industry Consulting Service International
   4. EIA: Electronics Industry Alliance
   5. TDMM: Telecommunications Distribution Methods Manual
   6. TIA: Telecommunications Industry Association
   7. UL: Underwriters Laboratory

B. Codes and Regulations: (Note: Reference Division One for specific code versions governing the work in addition to the information noted below.
   1. National Electric Safety Code (NESC) – 2017
   2. National Fire Protection Association (NFPA)
   3. 2017 California Electrical Code
   4. 2017 California Building Code
   5. Local Municipal Codes

1.04 APPLICABLE REGULATORY REFERENCES

A. Sub-contractor is responsible for knowledge and application of current versions of all applicable Standards and Codes. In cases where listed Standards and Codes have been updated, Sub-contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.

1. ANSI/TIA:
   a. TIA-526-7 (OFSTP-7) (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
   b. TIA-526-14-B (April 2015) (OFSTP-14) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
   c. ANSI/TIA/EIA-598-C (July 2014) Optical Fiber Cable Color Coding
   d. ANSI/TIA-568-C.0 (December 2015) Generic Telecommunications Cabling for Customer Premises
   e. TIA-568-C.0-1 (September 2012) Generic Telecommunications Cabling for Customer Premises-Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling
   f. ANSI/TIA-568-C.1 (February 2012) Commercial Building Telecommunications Cabling Standards
   g. TIA-568-C.1-2 (November 2014) Commercial Building Telecommunications Cabling Standard, Addendum 2 General Updates
   h. ANSI/TIA-568-C.2 (June 2016) Balanced Twisted Pair Communications Cabling and Components Standards
   i. ANSI/TIA-568-C.3 (June 2011) Optical Fiber Cabling Components Standard
   j. ANSI/TIA-568-C.3-1 (December 2011) Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors
   k. ANSI/TIA-1183 (August 2012) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
   l. ANSI/TIA-1183-1 (January 2016) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Addendum 1 – Extending Frequency Capabilities to 2 GHz.
   m. ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard
   n. ANSI/TIA-942-A (August 2012) Telecommunications Infrastructure Standard for Data Centers
   o. ANSI/TIA-942-A-1 (March 2013) Telecommunications Infrastructure Standard for Data Centers, Addendum 1 - Cabling Guidelines for Data Center Fabrics
   p. TIA-569-D (April 2015) Telecommunications Pathways and Spaces
   q. TIA-569-D-1 (October 2016) Telecommunications Pathways and Spaces Addendum 1- Revised Temperature and Humidity Requirements for Telecommunications Spaces
   r. ANSI/TIA-606-B (December 2015) Administration Standard for Telecommunications Infrastructure
   s. TIA-607-B (November 2015) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises
   t. TIA-607-B-1 (January 2017) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises - External Grounding Addendum
   u. TIA-758-B (April 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
   v. TIA-1152 (November 2016) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
   w. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems.

x. TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
y. TIA-1005-A (June 2012) Industrial Telecommunications Infrastructure Standard for Manufacturing, Process & Refining
z. ANSI/TIA-1005 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises
aa. TIA-1005-1 (May 2012) Telecommunications Infrastructure Standard for Industrial Premises; Addendum 1 - Industrial Pathways and Spaces
bb. TIA-1179 (July 2010) Healthcare Facility Telecommunications Infrastructure Standard.

2. ISO/IEC
   a. ISO 11801 (November 2010) - Generic Cabling for Customer Premises
   b. ISO/IEC TR 14763-2-1:2011 - Information technology -- Implementation and operation of customer premises cabling -- Part 2-1: Planning and installation - Identifiers within administration system.
3. National Electric Codes
   a. National Electrical Code (2017)
   b. ANSI/NFPA 70-2017, National Electrical Code© (NEC©)
   c. ANSI/IEEE C2-207, National Electrical Safety Code®
   d. National Electrical Code (NEC) (NFPA 70)
4. OSHA Standards and Regulations – all applicable
5. Local Codes and Standards – all applicable
6. BICSI
   a. Telecommunications Distribution Methods Manual, 13th Edition
   b. BICSI 004-2012, Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
   c. Information Transport Systems Installation Methods Manual (ITSIMM), 6th Edition
   d. ANSI/BICSI 002-2011, Data Center Design and Implementation Best Practices
   e. Network Systems and Commissioning (NSC) reference, 1st Edition
   f. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
   g. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
   h. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
   i. AV Design Reference Manual, 1st Edition
   j. Network Design Reference Manual, 7th Edition
   k. Outside Plant Design Reference Manual, 5th Edition
   l. Wireless Design Reference Manual, 3rd Edition
   m. Electronic Safety and Security Design Reference Manual, 3rd Edition.
7. Anywhere cabling Standards conflict with electrical or safety Codes, Sub-contractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.
8. Knowledge and execution of applicable codes is the sole responsibility of the Sub-contractor.
9. Any code violations committed at the time of installation shall be remedied at the Sub-contractor's expense.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Install and coordinate the telecommunications cabling work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interference in a manner accepted by the architect. Any repairs or changes made necessary in the contract work, caused by the sub-contractor's neglect, shall be made by the sub-contractor at their own expense.

B. Scheduling:
   1. Contract Documents and the overall construction schedule must be carefully reviewed to determine all required interfacing and timing of the work. All such documents shall be available through the General Contractor or Construction Manager.

1.06 ACTION SUBMITTALS

A. Product Data: For each product indicated.
   1. Submit all product data in accordance with general requirements of the construction documents.
   2. Submit product cut sheets and a detailed list of components a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
   3. Alternate and "Or Equal" designated products must be submitted for review and judgment to the A/E prior to installation. The sub-contractor-proposed alternate products or components must be verified by two (2) independent sources within the past 6 months. This request shall include the two (2) independent sources, the original Product's specification sheet, the proposed substitute product cut sheet, and a written request to review the substitute product.
   4. Any request of an alternate or substitution must be submitted to the A/E for action no later than fourteen (14) calendar days after release of the original telecommunications bid documents.

1.07 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:
   1. Submit all shop drawings in accordance with the general requirements of the construction documents.
   2. Submit shop drawings a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
   3. Shop drawings shall include evidence of grounding and bonding components are coordinated with field conditions and the work of other trades.
   4. This submittal may have a written component and a visual, drawn component for review and action by the A/E prior to installation.

B. Certificates:
   1. Submit management and installation team reference documentation verifying:
      a. The project manager is a RCDD in good standing with BICSI and is qualified to manage the scope of work described in the contract documents and has five (5) years of experience managing similar projects in size and scope. The documentation shall include the RCDD registration number.

b. The field supervisor is a BICSI trained technician that is qualified to perform and oversee the work described in the contract documents

C. Qualification Statements:
1. The sub-contractor shall submit documentation that within the past 12 months, a minimum of 75% of all installation personnel have been trained or certified by the manufacturer of the products they are installing.

1.08 CLOSEOUT SUBMITTALS

A. As-Built Drawings:
1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
2. Submit as-built drawings a minimum of two (2) weeks after completion of all Division- 27 work for A/E and Owner reference:

1.09 QUALITY ASSURANCE

A. Qualifications – Manufacturer
1. Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.

B. Qualifications – Installer:
1. At a minimum, seventy-five percent (75%) of the onsite sub-contractor provided field technicians shall be factory certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall be available on site for review at all times for each field technician.

1.10 WARRANTY

A. Warranty:
1. Sub-contractor shall provide a 25 year System Warranty on all copper and fiber permanent cabling links.
2. This is a system performance warranty guaranteeing for 25 years from acceptance that the installed system shall support all data link protocols for which that copper Category or fiber OM/OS designation is engineered to support according to IEEE and TIA standards.
3. The System Warranty may be invoked only if the cabling channel links are comprised of approved cable infrastructure connectivity and approved cable. Patch cords must be manufactured by same approved cable and/or connectivity system.
4. Upon acceptance of Warranty, manufacturer will mail a notification letter to the installer and a notification letter and warranty certificate to A/E.

PART 2 - PRODUCTS

2.01 NON-CONTINUOUS CABLE SUPPORTS

A. Basis-of-Design Product: Subject to compliance with requirements:
1. Erico – Caddy CableCat Support System

2. Copper/BLine – Cable Hook System
3. CEAS Attachments – Stiffy Series
4. Or Equal

B. Product Options:
1. The indicated manufacturers shall be the basis of the design and each component selected shall address the particular infrastructure requirement.
a. Stiffy Series 200 with comfort cradle Low Voltage supports
b. Four inch (0'4") Cat214z34, two inch (0'2") J-Hook Supports Cat324z34

C. Description:
1. Non-continuous cable supports shall be available in multiple sizes, styles and materials. Rigid supports shall be equipped with flared edges and pre-configured bend radius controls.
2. Provide drop wire supports and threaded rod assemblies in areas where structural mounting surfaces are non-functional or inaccessible.
3. Support assemblies shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance UTP and optical fiber cables.
4. Non-continuous cable supports sized 1 5/16" and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be reusable.
5. Select approved non-continuous cable supports suitable for specific installation environments and/or air handling (plenum) spaces.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section.

3.02 INSTALLATION

A. Process:
1. Follow manufacturer's instructions and recommended industry standards and guidelines.
2. The installed non-continuous support system must be an independent support structure for the voice/data communication system.
3. Draping cables over other structures in the ceiling is unacceptable. Water pipes, ceiling grid, sprinkler system, electrical supports, air ducts or any other in-ceiling structure may not be used for cable support.
4. Sub-contractor installed supports shall be used to supplement the main cable support system when any cabling leaves the main support system or is unsupported for more than three and one half feet (3'-5'-0") feet.
5. Non-continuous supports shall be installed with rod stock or threaded rod secured to the slab above to support the telecommunications cable infrastructure parallel to the slab throughout the cable plant, unless site conditions dictate a non-parallel installation.
6. Cable must be routed to follow existing corridors and parallel or 90 degree angles from all walls and the cable tray whenever possible.

7. All pathways shall avoid electromagnetic interference (EMI). Cable that is distributed in partially-enclosed metallic pathways shall be routed with the following minimum clearances:
   a. Four (4) feet from motors or transformers.
   b. One (1) foot from conduit and cables used for electrical power and distribution.
   c. Five (5) inches from fluorescent lighting.

3.03 RE-INSTALLATION

A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components. Scheduling for re- installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work

3.04 CLOSEOUT ACTIVITIES

A. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.

B. Sub-contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner

END OF SECTION

SECTION 27 05 33

CONDUITS AND BOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Provides specifications for conduit pathways, back boxes and pull box enclosures utilized for the distribution and housing of telecommunications cabling and components:
   2. Telecom EMT conduit and boxes

1.02 RELATED DOCUMENTS

A. All divisions of the specification and general provisions of the Construction Documents.

B. Architectural, mechanical, electrical, and all technology drawings.

C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

1.03 REFERENCES

A. Abbreviations and Acronyms:
   1. A/E: Architect / Engineer (designer)
   2. ANSI: American National Standards Institute
   3. AHJ: Authority Having Jurisdiction
   4. BICSI: Building Industry Consulting Service International
   5. EIA: Electronics Industry Alliance
   6. TDMM: Telecommunications Distribution Methods Manual
   7. TIA: Telecommunications Industry Association
   8. UL: Underwriters Laboratory

B. Codes and Regulations: (Note: Reference Division One for specific code versions governing the work in addition to the information noted below.
   1. National Electric Safety Code (NESC) – 2017
   2. National Fire Protection Association (NFPA)
   3. 2017 California Electrical Code
   4. 2017 California Building Code
   5. Local Municipal Codes

1.04 APPLICABLE REGULATORY REFERENCES

A. Sub-contractor is responsible for knowledge and application of current versions of all applicable Standards and Codes. In cases where listed Standards and Codes have been updated, Sub-contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.

1. ANSI/TIA:
   a. TIA-526-7 (OFSTP-7) (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
   b. TIA-526-14-B (April 2015) (OFSTP-14) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
   c. ANSI/TIA/EIA-598-C (July 2014) Optical Fiber Cable Color Coding
   d. ANSI/TIA-568-C.0 (December 2015) Generic Telecommunications Cabling for Customer Premises
   e. TIA-568-C.0-1 (September 2012) Generic Telecommunications Cabling for Customer Premises-Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling
   f. ANSI/TIA-568-C.1 (February 2012) Commercial Building Telecommunications Cabling Standards
   g. TIA-568-C.1-2 (November 2014) Commercial Building Telecommunications Cabling Standard, Addendum 2 General Updates
   h. ANSI/TIA-568-C.2 (June 2016) Balanced Twisted Pair Communications Cabling and Components Standards
   i. ANSI/TIA-568-C.3 (June 2011) Optical Fiber Cabling Components Standard
   j. ANSI/TIA-568-C.3-1 (December 2011) Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors
   k. ANSI/TIA-1183 (August 2012) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
   l. ANSI/TIA-1183-1 (January 2016) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Addendum 1 – Extending Frequency Capabilities to 2 GHz.
   m. ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard
   n. ANSI/TIA-942-A (August 2012) Telecommunications Infrastructure Standard for Data Centers
   o. ANSI/TIA-942-A-1 (March 2013) Telecommunications Infrastructure Standard for Data Centers, Addendum 1 - Cabling Guidelines for Data Center Fabrics
   p. TIA-569-D (April 2015) Telecommunications Pathways and Spaces
   q. TIA-569-D-1 (October 2016) Telecommunications Pathways and Spaces Addendum 1- Revised Temperature and Humidity Requirements for Telecommunications Spaces
   r. ANSI/TIA-606-B (December 2015) Administration Standard for Telecommunications Infrastructure
   s. TIA-607-B (November 2015) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises
   t. TIA-607-B-1 (January 2017) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises - External Grounding Addendum
   u. TIA-758-B (April 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
   v. TIA-1152 (November 2016) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
   w. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems.

x. TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
y. TIA-1005-A (June 2012) Industrial Telecommunications Infrastructure Standard for Manufacturing, Process & Refining
z. ANSI/TIA-1005 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises
aa. TIA-1005-1 (May 2012) Telecommunications Infrastructure Standard for Industrial Premises; Addendum 1 - Industrial Pathways and Spaces
bb. TIA-1179 (July 2010) Healthcare Facility Telecommunications Infrastructure Standard.

2. ISO/IEC
   a. ISO 11801 (November 2010) - Generic Cabling for Customer Premises
   b. ISO/IEC TR 14763-2-1:2012 - Information technology -- Implementation and operation of customer premises cabling -- Part 2-1: Planning and installation - Identifiers within administration system.
3. National Electric Codes
   a. National Electrical Code (2017)
   b. ANSI/NFPA 70-2017, National Electrical Code© (NEC©)
   c. ANSI/IEEE C2-207, National Electrical Safety Code®
   d. National Electrical Code (NEC) (NFPA 70)
4. OSHA Standards and Regulations – all applicable
5. Local Codes and Standards – all applicable
6. BICSI
   a. Telecommunications Distribution Methods Manual, 13th Edition
   b. BICSI 004-2012, Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
   c. Information Technology Systems Installation Methods Manual (ITSIMM), 6th Edition
   d. ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices
   e. Network Systems and Commissioning (NSC) reference, 1st Edition
   f. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
   g. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
   h. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
   i. AV Design Reference Manual, 1st Edition
   j. Network Design Reference Manual, 7th Edition
   k. Outside Plant Design Reference Manual, 5th Edition
   l. Wireless Design Reference Manual, 3rd Edition
   m. Electronic Safety and Security Design Reference Manual, 3rd Edition.
7. Anywhere cabling Standards conflict with electrical or safety Codes, Sub-contractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.
8. Knowledge and execution of applicable codes is the sole responsibility of the Sub-contractor.
9. Any code violations committed at the time of installation shall be remedied at the Sub-contractor's expense.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Install and coordinate the telecommunications cabling work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interference in a manner accepted by the architect. Any repairs or changes made necessary in the contract work, caused by the sub-contractor's neglect, shall be made by the sub-contractor at their own expense.

B. Scheduling:
1. Contract Documents and the overall construction schedule must be carefully reviewed to determine all required interfacing and timing of the work. All such documents shall be available through the General Contractor or Construction Manager.

1.06 ACTION SUBMITTALS

A. Product Data: For each product indicated.
1. Submit all product data in accordance with general requirements of the construction documents.
2. Submit product cut sheets and a detailed list of components a minimum of six (2) weeks prior to commencement of Division-27 work for A/E review and action.
3. Alternate and "Or Equal" designated products must be submitted for review and judgment to the A/E prior to installation. The sub-contractor-proposed alternate products or components must be verified by two (2) independent sources within the past 6 months. This request shall include the two (2) independent sources, the original Product's specification sheet, the proposed substitute product cut sheet, and a written request to review the substitute product.
4. Any request of an alternate or substitution must be submitted to the A/E for action no later than fourteen (14) calendar days after release of the original telecommunications bid documents.

1.07 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:
1. Submit all shop drawings in accordance with the general requirements of the construction documents.
2. Submit shop drawings a minimum of six (2) weeks prior to commencement of Division-27 work for A/E review and action.
3. Shop drawings shall include evidence of grounding and bonding components are coordinated with field conditions and the work of other trades.
4. This submittal may have a written component and a visual, drawn component for review and action by the A/E prior to installation.

1.08 CLOSEOUT SUBMITTALS

A. As-Built Drawings:
1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
2. Submit as-built drawings a minimum of two (2) weeks after completion of all Division- 27 work for A/E and Owner reference:

PART 2 - PRODUCTS

2.01 CONDUIT AND BACKBOXES

A. EMT conduit
   1. Wheatland Tube
   2. Appleton
   3. Crouse-Hinds
   4. Or equal.

B. PVC conduit
   1. JM Eagle
   2. Electro Flex
   3. Or equal

C. Pull boxes
   1. Hoffman Engineering Co,
   2. Or equal.

D. Back Boxes
   1. Randl Industries – 5 Square Outlet Box- 2.875 Deep with Management
      a. Part Number T-55017

2.02 TELECOMMUNICATIONS CONDUIT AND BACKBOXES

A. Electrical Metallic Galvanized Tubing and Fittings with natural finish for all conduits not exposed: ANSI C80.3 with compression-type fittings.

B. Indoor Pull boxes: Galvanized steel, screw cover pull box. Grey polyester powder coat finish inside and out. NEMA Type 1. Pull boxes to be sized per NEC code to accommodate the number of EMT conduits as shown on Telecom drawings with adequate clearances, access and cable management space.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section.

3.02 INSTALLATION

A. Pull boxes:
   1. Install Pull boxes in easily accessible locations.
   2. Install Horizontal cabling boxes immediately above suspended ceilings.
   3. A pull box should not be used in lieu of a bend.
   4. Conduits that enter the pull box from opposite ends with each other should be aligned.

5. For direct access to a box located above inaccessible ceilings provide a suitable,

Conduit Trade Size	Pull box Width (in.)	Pull box Length (in.)	Pull box Depth (in.)	Pull box Width for Additional Conduit
1	4	16	3	2
1	6	20	3	3
1	8	27	4	4
2	8	36	4	5
2	10	42	5	6
3	12	48	5	6
3	12	54	6	6
4	15	60	8	8

marked, hinged access panel (or equivalent) in the ceiling. This access panel can also serve as the cover for the box.

6. Pull box sizing table:

B. Back Boxes
1. Provide 4-11/16" H X 4-11/16" W X 2-1/8" D outlet back boxes at all telecom outlet locations shown on drawings. Provide (1) 1-1/4" conduit from back box to telecom room or pull box except as otherwise noted. All connectors and couplings shall be zinc-plated steel set screw type. Die cast zinc fittings are not to be used. Provide bushing on ends of all conduits. Provide pull string in all conduits.
2. Provide single gang plaster ring on all communications outlet back boxes, unless indicated otherwise.
3. Provide bonding to cable tray pathways.

C. Conduit support and bracing:
1. Coordinate layout and installation of conduits and pull boxes with other trade conditions to ensure adequate clearances, access and cable management.
2. Install and provide support for EMT conduits and pull boxes in accordance with the latest edition of the NEC code, as well as all state and local codes and requirements. Coordinate installation and location with existing conditions. Notify and get the Owners Representative approval before installing conduits and pull boxes where the location need to deviate from the contract documents.
3. Install conduits above ceilings at height to provide access to pull. Install conduits and pull boxes level and square and at proper elevations. Ensure adequate clearances, access and cable management.
4. Use fittings and support devices compatible with conduits and pull boxes and suitable for use and location. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four.
5. Install individual and multiple trapeze hangers and riser clamps as necessary to support the conduits. Provide U-bolts, clamp attachments and other necessary hardware for hanger assemblies and for securing hanger rods and conduits. Space supports for conduits on maximum 10-foot centers.
6. Provide and install expansion or deflection fittings for conduits runs at all instances at seismic or expansion joints to allow for movement in any direction.

D. Conduit routing, bends and radius guidelines:
1. If the conduit has an internal diameter of 2 inches or less the bend radius must be at least 6 times the internal conduit diameter.

2. If the conduit has an internal diameter of more than 2 inches the bend radius must be at least 10 times the internal conduit diameter.
3. Conduit bends should be smooth, even, and free of kinks or other discontinuities that may have detrimental effects on pulling tension or cable integrity during or after installation.
4. If a conduit run requires more than two 90 degree bends then provide a pull box between sections with two bends or less.
5. If a conduit run requires a reverse bend (between 100 degrees and 180 degrees) then insert a pull point or pull box at each bend having an angle from 100 degrees to 180 degrees.
6. Consider an offset as equivalent to a 90 degree bend.
7. A pullbox shall not be used as a 90 degree bend.
8. Achieve the best direct route with no bend greater than 90 degrees or an aggregate of bends in excess of 180 degrees between pull points or pull boxes.
9. Contain no continuous sections longer than 100 ft.
10. For runs that total more than 100 ft. in length, pull points or pull boxes should be inserted so that no segment between points/boxes exceeds the 100 ft. limit.
11. Withstand the environment to which they will be exposed.
12. Conduits should not be routed through areas in which flammable material may be stored or over or adjacent to boilers, incinerators, hot-water lines and steam lines.
13. Keep conduits at least 6’ away from parallel runs of steam, hot water pipes or mechanical ductwork.

E. Conduit Terminations
1. Join conduits with fittings designed and approved for the purpose. Make the joints tight without protruding lips that can snag cable pulling inside the conduits.
2. Where conduits are terminated with locknuts and bushings align the conduit to enter squarely and install the locknuts with dished part against the box. Use two locknuts, one inside and one outside the box.
3. Ream all conduit ends and fit them with an insulated bushing to eliminate sharp edges that can damage cables during installation or service.
4. Conduits that enter a telecom room should terminate near the corners to allow for proper cable racking.
5. Terminate conduits that protrude through the structural floor 3 inches above the surface.
6. Maintain the integrity of all fire stop barriers for all floor or wall penetrations.

F. Provide grounding and bonding for conduits and pull boxes as indicated by NEC code and instructed by manufacturer.

G. Conduits shall be clearly labeled at both ends designating the opposite locations(s) served. The numbering scheme shall be room number plus a suffix to guarantee uniqueness, e.g., 143-1. Labeling must be machine generated.

H. Conduit Protection:
1. Remove burrs, dirt and construction debris from conduits and pull boxes.
2. Conduits should be left capped for protection.
3. Provide final protection and maintain conditions in a manner acceptable to the Owners Representative to ensure that coatings, finishes and pull boxes are without damage or deterioration at completion. Repair damage to galvanized finishes with zinc-rich paint recommended by the manufacturer.

3.03 ACCEPTANCE

A. All specified conduits and pull boxes indicated on the drawings and specifications shall be complete.

B. Specified shop drawings and product submittals shall have been submitted for review and all review comments and deficiencies shall have been resolved. Final shop drawings and product submittals shall have been submitted, reviewed and found to meet the requirements of the specifications.

C. Issues and deficiencies identified in field reports and punch lists shall have been resolved. Final as-built drawings shall have been submitted, reviewed and found to meet the requirements of the specifications.

D. Sub-contractor shall provide written notice of final completion of the telecom infrastructure. Upon receipt, the Owner's Representative will review/observe the completed installation. Once the Owner's Representative is satisfied that all work is in accordance with the Contract Documents, the Sub-contractor will be notified in writing.

3.04 RE-INSTALLATION

A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components. Scheduling for re- installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work

B. CLOSEOUT ACTIVITIES

C. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.

D. Sub-contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner

END OF SECTION

SECTION 27 05 53

IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Provides specifications information for identification of the various components of the telecommunications infrastructure and pathway system.
   2. Labeling and identification.

1.02 RELATED DOCUMENTS

A. All divisions of the specification and general provisions of the Construction Documents.

B. Architectural, mechanical, electrical, and all technology drawings.

C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

1.03 REFERENCES

A. Abbreviations and Acronyms:
   1. ANSI American National Standards Institute
   2. BICSI: Building Industry Consulting Service International
   3. EIA: Electronics Industry Alliance
   4. IDF: Intermediate Distribution Facility
   5. MDF Main Distribution Facility
   6. RCDD: Registered Communications Distribution Designer
   7. TCIM: Telecommunication Cabling Installation Manual
   8. TDMM: Telecommunications Distribution Methods Manual
   9. TIA: Telecommunications Industry Association

B. Codes and Regulations: (Note: Reference Division One for specific code versions governing the work in addition to the information noted below.
   1. National Electric Safety Code (NESC) – 2017
   2. National Fire Protection Association (NFPA)
   3. 2017 California Electrical Code
   4. 2017 California Building Code
   5. Local Municipal Codes.

1.04 APPLICABLE REGULATORY REFERENCES

A. Sub-contractor is responsible for knowledge and application of current versions of all applicable Standards and Codes. In cases where listed Standards and Codes have been updated, Sub-contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.

1. ANSI/TIA:
   a. TIA-526-7 (OFSTP-7) (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
   b. TIA-526-14-B (April 2015) (OFSTP-14) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
   c. ANSI/TIA/EIA-598-C (July 2014) Optical Fiber Cable Color Coding
   d. ANSI/TIA-568-C.0 (December 2015) Generic Telecommunications Cabling for Customer Premises
   e. TIA-568-C.0-1 (September 2012) Generic Telecommunications Cabling for Customer Premises-Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling
   f. ANSI/TIA-568-C.1 (February 2012) Commercial Building Telecommunications Cabling Standards
   g. TIA-568-C.1-2 (November 2014) Commercial Building Telecommunications Cabling Standard, Addendum 2 General Updates
   h. ANSI/TIA-568-C.2 (June 2016) Balanced Twisted Pair Communications Cabling and Components Standards
   i. ANSI/TIA-568-C.3 (June 2011) Optical Fiber Cabling Components Standard
   j. ANSI/TIA-568-C.3-1 (December 2011) Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors
   k. ANSI/TIA-1183 (August 2012) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
   l. ANSI/TIA-1183-1 (January 2016) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Addendum 1 – Extending Frequency Capabilities to 2 GHz.
   m. ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard
   n. ANSI/TIA-942-A (August 2012) Telecommunications Infrastructure Standard for Data Centers
   o. ANSI/TIA-942-A-1 (March 2013) Telecommunications Infrastructure Standard for Data Centers, Addendum 1 - Cabling Guidelines for Data Center Fabrics
   p. TIA-569-D (April 2015) Telecommunications Pathways and Spaces
   q. TIA-569-D-1 (October 2016) Telecommunications Pathways and Spaces Addendum 1- Revised Temperature and Humidity Requirements for Telecommunications Spaces
   r. ANSI/TIA-606-B (December 2015) Administration Standard for Telecommunications Infrastructure
   s. TIA-607-B (November 2015) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises
   t. TIA-607-B-1 (January 2017) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises - External Grounding Addendum
   u. TIA-758-B (April 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
   v. TIA-1152 (November 2016) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
   w. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems.

x. TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
y. TIA-1005-A (June 2012) Industrial Telecommunications Infrastructure Standard for Manufacturing, Process & Refining
z. ANSI/TIA-1005 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises
aa. TIA-1005-1 (May 2012) Telecommunications Infrastructure Standard for Industrial Premises; Addendum 1 - Industrial Pathways and Spaces
bb. TIA-1179 (July 2010) Healthcare Facility Telecommunications Infrastructure Standard.

2. ISO/IEC
   a. ISO 11801 (November 2010) - Generic Cabling for Customer Premises
   b. ISO/IEC TR 14763-2-1:2012 - Information technology -- Implementation and operation of customer premises cabling -- Part 2-1: Planning and installation - Identifiers within administration system.
3. National Electric Codes
   a. National Electrical Safety Code (2017)
   b. ANSI/NFPA 70-2017, National Electrical Code© (NEC©)
   c. ANSI/IEEE C2-207, National Electrical Safety Code®
   d. National Electrical Code (NEC) (NFPA 70)
4. OSHA Standards and Regulations – all applicable
5. Local Codes and Standards – all applicable
6. BICSI
   a. Telecommunications Distribution Methods Manual, 13th Edition
   b. BICSI 004-2012, Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
   c. Information Technology Systems Installation Methods Manual (ITSIMM), 6th Edition
   d. ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices
   e. Network Systems and Commissioning (NSC) reference, 1st Edition
   f. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
   g. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
   h. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
   i. AV Design Reference Manual, 1st Edition
   j. Network Design Reference Manual, 7th Edition
   k. Outside Plant Design Reference Manual, 5th Edition
   l. Wireless Design Reference Manual, 3rd Edition
   m. Electronic Safety and Security Design Reference Manual, 3rd Edition.
7. Anywhere cabling Standards conflict with electrical or safety Codes, Sub-contractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.
8. Knowledge and execution of applicable codes is the sole responsibility of the Sub-contractor.
9. Any code violations committed at the time of installation shall be remedied at the Sub-contractor's expense.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Install and coordinate the telecommunications cabling work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interference in a manner accepted by the architect. Any repairs or changes made necessary in the contract work, caused by the sub-contractor's neglect, shall be made by the sub-contractor at their own expense.

B. Scheduling:
   1. Contract Documents and the overall construction schedule must be carefully reviewed to determine all required interfacing and timing of the work. All such documents shall be available through the General Contractor or Construction Manager.

1.06 ACTION SUBMITTALS

A. Product Data: For each product indicated.
   1. Submit all product data in accordance with general requirements of the construction documents.
   2. Submit product cut sheets and a detailed list of components a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
   3. Alternate and "Or Equal" designated products must be submitted for review and judgment to the A/E prior to installation. The sub-contractor-proposed alternate products or components must be verified by two (2) independent sources within the past 6 months. This request shall include the two (2) independent sources, the original Product's specification sheet, the proposed substitute product cut sheet, and a written request to review the substitute product.
   4. Any request of an alternate or substitution must be submitted to the A/E for action no later than fourteen (14) calendar days after release of the original telecommunications bid documents.

1.07 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:
   1. Submit all shop drawings in accordance with the general requirements of the construction documents.
   2. Submit shop drawings a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
   3. Shop drawings shall include evidence of grounding and bonding components are coordinated with field conditions and the work of other trades.
   4. This submittal may have a written component and a visual, drawn component for review and action by the A/E prior to installation.

B. Certificates:
   1. Submit management and installation team reference documentation verifying:
      a. The project manager is a RCDD in good standing with BICSI and is qualified to manage the scope of work described in the contract documents and has five (5) years of experience managing similar projects in size and scope. The documentation shall include the RCDD registration number.

b. The field supervisor is a BICSI trained technician that is qualified to perform and oversee the work described in the contract documents.

C. Qualification Statements:
1. The sub-contractor shall submit documentation that within the past 12 months, a minimum of 75% of all installation personnel have been trained or certified by the manufacturer of the products they are installing.

1.08 CLOSEOUT SUBMITTALS

A. As-Built Drawings:
1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
2. Submit as-built drawings a minimum of two (2) weeks after completion of all Division- 27 work for A/E and Owner reference:
3. Communication sub-contractor to print, frame and mount approved as-built drawings in MPOE. Coordinate location with A/E.

1.09 QUALITY ASSURANCE

A. Qualifications – Manufacturer
1. Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.

B. Qualifications – Installer:
1. At a minimum, seventy-five percent (75%) of the onsite sub-contractor provided field technicians shall be factory certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall be available on site for review at all times for each field technician.

PART 2 - PRODUCTS

2.01 IDENTIFICATION LABELS

A. Basis-of-Design Product: Subject to compliance with requirements:
1. Leviton – System
2. Brady Label System
3. Brother Label System
4. Or Equal

B. Product Options:
1. The indicated manufacturers shall be the basis of the design and each component selected shall address the particular infrastructure requirements.

C. Description:
1. In new installations (Greenfield), Sub-contractor shall develop and submit for approval a labeling strategy based on the TIA 606-B Circuit Designation and Labeling Standard.
2. All labels shall be machine-manufactured by a labeling machine. Handwritten labels will not be accepted for final labeling.
3. The intention of the labeling scheme is to be TIA/EIA 606-B compliant.

4. It is the responsibility of the sub-contractor to acquire, understand, and utilize the owner's labeling scheme for all component of the voice data communications system.
5. It is the responsibility of the sub-contractor to provide labels sized to show the Owner's labeling scheme in readable font size while still matching the specified hardware identification dimensions.
6. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

D. Indoor Copper and Fiber optic cables and grounding conductors:
1. The cable sheaths shall be labeled with laser-printed polyester self-laminating wrap around labels sized to fit the Owner's labeling scheme in readable font size.

E. Horizontal cable outlet housings and faceplates:
1. Cable termination connectors at each position on the outlet housing shall be labeled with laser-printed polyester labels inserted into the outlet housing labeling window.

F. Copper patch panels:
1. The patch panels shall be labeled on the front and rear top left corner with a laser-printed polyester self-laminating label sequentially identifying the patch panel.

G. Copper patch termination blocks:
1. The termination blocks shall be labeled on the front rows with the termination block designation strip colored per the BICSI requirements identifying the copper cable pairs.

H. Fiber optic termination panels and housings:
1. The panels and housings shall be labeled on the outside front and rear top left corner with a laser-printed polyester self-laminating label sequentially identifying the panel.
2. Cable termination identifier and fiber positions inside the termination panels shall be made using the manufacturer's provided label card behind the plastic panel.

I. Equipment racks:
1. Bakelite plastic label engraved with rack label scheme attached to front and rear facing top angle bracket.
2. Label shall be adhesive backed for secure placement. Optional mounting with self tapping screws will be at the discretion of owner.

J. Equipment cabinets:
1. Bakelite plastic label engraved with cabinet label scheme attached to top front and rear facing frame of cabinet.
2. Label shall be adhesive backed for secure placement. Optional mounting with self tapping screws will be at the discretion of owner.

K. Indoor Conduits and pullboxes:
1. Each section of conduit shall be labeled on the outside facing and unobstructed view with a laser-printed polyester self-laminating label sequentially identifying the conduit and its origin and termination end (to and from).

2. Each pullbox shall be labeled on the outside door panel facing and unobstructed view with a laser-printed polyester self-laminating label sequentially identifying the pullbox and building location.

PART 3 - EXECUTIONEXAMINATION

A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section.

3.02 INSTALLATION

A. Process:
1. The Owner-provided labeling scheme is intended to comply with TIA/EIA 606-B standard for labeling and administration of a cable plant. It is the responsibility of the sub-contractor to acquire, understand, and utilize the owner's labeling scheme for all component of the voice data communications system including, but not limited to:
2. Indoor Horizontal copper and fiber optic cables (Identify at both ends within 6-inches of termination).
3. Indoor copper and fiber optic backbone cables (Identify at both ends within 12-inches of the point that the cable enters termination panels/blocks, within 12- of the point that the cable enters or exits pullboxes, wall and floor sleeves.
4. Workstation outlets, faceplates and individual outlet connectors.
5. Termination panels.
6. Termination blocks.
7. Racks, cabinets, and equipment enclosures. (front and rear).
8. Indoor conduit pathways and pullboxes.
9. Grounding conductors and ground bars.
10. Label each component with a specified label at an unobstructed view location and where it is accessible for administration.

3.03 RE-INSTALLATION

A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components. Scheduling for re- installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work.

3.04 CLOSEOUT ACTIVITIES

A. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.

B. Sub-contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner.

END OF SECTION

SECTION 27 08 00

COMMISSIONING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Provides specifications information for identification of the various components of the telecommunications infrastructure and pathway system.
2. Copper cable test device.
3. Optical fiber test device.

1.02 RELATED DOCUMENTS

A. All divisions of the specification and general provisions of the Construction Documents.

B. Architectural, mechanical, electrical, and all technology drawings.

1.03 REFERENCES

A. Abbreviations and Acronyms:

1.	ANSI:	American National Standards Institute
2.	BICSI:	Building Industry Consulting Service International
3.	EIA:	Electronics Industry Alliance
4.	ELFEXT:	Equal Level far End Cross Talk
5.	FOTP:	Fiber Optic Test Procedure
6.	IT:	Information Technology
7.	ISP:	Inside Plant
8.	LOMMF:	Laser Optimized Multimode Fiber
9.	MHz:	Megahertz
10.	NEXT:	Near End Cross Talk
11.	OSP:	Outside Plant
12.	OTDR:	Optical Time Domain Reflectometer
13.	PSELFEXT:	Power Sum Equal Level far End Cross Talk
14.	PSNEXT:	Power Sum Near End Cross Talk
15.	RCDD:	Registered Communication Distribution Designer
16.	TCIM:	Telecommunication Cabling Installation Manual
17.	TDMM:	Telecommunication Distribution Methods Manual
18.	TDR:	Time Domain Reflectometer
19.	TIA:	Telecommunications Industry Association
20.	UL:	Underwriters Laboratory
21.	WAP:	Wireless Access Point.

B. Codes and Regulations: (Note: Reference Division One for specific code versions governing the work in addition to the information noted below.

1. National Electric Safety Code (NESC) – 2017
2. National Fire Protection Association (NFPA)

3. 2016 California Electrical Code
4. 2016 California Building Code
5. Local Municipal Codes

1.04 APPLICABLE REGULATORY REFERENCES

A. Sub-contractor is responsible for knowledge and application of current versions of all applicable Standards and Codes. In cases where listed Standards and Codes have been updated, Sub-contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.
   1. ANSI/TIA:
      a. TIA-526-7 (OFSTP-7) (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
      b. TIA-526-14-B (April 2015) (OFSTP-14) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
      c. ANSI/TIA/EIA-598-C (July 2014) Optical Fiber Cable Color Coding
      d. ANSI/TIA-568-C.0 (December 2015) Generic Telecommunications Cabling for Customer Premises
      e. TIA-568-C.0-1 (September 2012) Generic Telecommunications Cabling for Customer Premises-Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling
      f. ANSI/TIA-568-C.1 (February 2012) Commercial Building Telecommunications Cabling Standards
      g. TIA-568-C.1-2 (November 2014) Commercial Building Telecommunications Cabling Standard, Addendum 2 General Updates
      h. ANSI/TIA-568-C.2 (June 2016) Balanced Twisted Pair Communications Cabling and Components Standards
      i. ANSI/TIA-568-C.3 (June 2011) Optical Fiber Cabling Components Standard
      j. ANSI/TIA-568-C.3-1 (December 2011) Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors
      k. ANSI/TIA-1183 (August 2012) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
      l. ANSI/TIA-1183-1 (January 2016) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Addendum 1 – Extending Frequency Capabilities to 2 GHz.
      m. ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard
      n. ANSI/TIA-942-A (August 2012) Telecommunications Infrastructure Standard for Data Centers
      o. ANSI/TIA-942-A-1 (March 2013) Telecommunications Infrastructure Standard for Data Centers, Addendum 1 - Cabling Guidelines for Data Center Fabrics
      p. TIA-569-D (April 2015) Telecommunications Pathways and Spaces
      q. TIA-569-D-1 (October 2016) Telecommunications Pathways and Spaces Addendum 1- Revised Temperature and Humidity Requirements for Telecommunications Spaces
      r. ANSI/TIA-606-B (December 2015) Administration Standard for Telecommunications Infrastructure
      s. TIA-607-B (November 2015) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises

t. TIA-607-B-1 (January 2017) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises - External Grounding Addendum
u. TIA-758-B (April 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
v. TIA-1152 (November 2016) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
w. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems.
x. TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
y. TIA-1005-A (June 2012) Industrial Telecommunications Infrastructure Standard for Manufacturing, Process & Refining
z. ANSI/TIA-1005 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises
aa. TIA-1005-1 (May 2012) Telecommunications Infrastructure Standard for Industrial Premises; Addendum 1 - Industrial Pathways and Spaces
bb. TIA-1179 (July 2010) Healthcare Facility Telecommunications Infrastructure Standard.

2. ISO/IEC
   a. ISO 11801 (November 2010) - Generic Cabling for Customer Premises
   b. ISO/IEC TR 14763-2-1:2012 - Information technology -- Implementation and operation of customer premises cabling -- Part 2-1: Planning and installation - Identifiers within administration system.
3. National Electric Codes
   a. National Electrical Code (2017)
   b. ANSI/NFPA 70-2017, National Electrical Code© (NEC©)
   c. ANSI/IEEE C2-207, National Electrical Safety Code®
   d. National Electrical Code (NEC) (NFPA 70)
4. OSHA Standards and Regulations – all applicable
5. Local Codes and Standards – all applicable
6. BICSI
   a. Telecommunications Distribution Methods Manual, 13th Edition
   b. BICSI 004-2012, Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
   c. Information Technology Systems Installation Methods Manual (ITSIMM), 6th Edition
   d. ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices
   e. Network Systems and Commissioning (NSC) reference, 1st Edition
   f. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
   g. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
   h. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
   i. AV Design Reference Manual, 1st Edition
   j. Network Design Reference Manual, 7th Edition
   k. Outside Plant Design Reference Manual, 5th Edition
   l. Wireless Design Reference Manual, 3rd Edition
   m. Electronic Safety and Security Design Reference Manual, 3rd Edition.

7. Anywhere cabling Standards conflict with electrical or safety Codes, Sub-contractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.
8. Knowledge and execution of applicable codes is the sole responsibility of the Sub-contractor.
9. Any code violations committed at the time of installation shall be remedied at the Sub-contractor's expense.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Install and coordinate the telecommunications cabling work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interference in a manner accepted by the architect. Any repairs or changes made necessary in the contract work, caused by the sub-contractor's neglect, shall be made by the sub-contractor at their own expense.

B. Scheduling:
1. Contract Documents and the overall construction schedule must be carefully reviewed to determine all required interfacing and timing of the work. All such documents shall be available through the General Contractor or Construction Manager.

1.06 ACTION SUBMITTALS

A. Product Data: For each product indicated.
1. Submit all product data in accordance with general requirements of the construction documents.
2. Submit product cut sheets and a detailed list of components a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
3. Alternate and "Or Equal" designated products must be submitted for review and judgment to the A/E prior to installation. The sub-contractor-proposed alternate products or components must be verified by two (2) independent sources within the past 6 months. This request shall include the two (2) independent sources, the original Product's specification sheet, the proposed substitute product cut sheet, and a written request to review the substitute product.
4. Any request of an alternate or substitution must be submitted to the A/E for action no later than fourteen (14) calendar days after release of the original telecommunications bid documents.

1.07 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:
1. Submit all shop drawings in accordance with the general requirements of the construction documents.
2. Submit shop drawings a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
3. Shop drawings shall include evidence of grounding and bonding components are coordinated with field conditions and the work of other trades.
4. This submittal may have a written component and a visual, drawn component for review and action by the A/E prior to installation.

B. Certificates:
   1. Submit management and installation team reference documentation verifying:
      a. The project manager is a RCDD in good standing with BICSI and is qualified to manage the scope of work described in the contract documents and has five (5) years of experience managing similar projects in size and scope. The documentation shall include the RCDD registration number.
      b. The field supervisor is a BICSI trained technician that is qualified to perform and oversee the work described in the contract documents

C. Qualification Statements:
   1. The sub-contractor shall submit documentation that within the past 12 months, a minimum of 75% of all installation personnel have been trained or certified by the manufacturer of the products they are installing.

D. Test Instrument Submittals:
   1. All copper & fiber optic test instruments used on the site shall be capable of storing test data files and downloading these test results as data files. The copper cable number and fiber optic cable/strand number shall be used as the record identifier for each test.
   2. Submit the model number, serial number, manufacturer, last date of calibration/certification as well as a copy of the certificate for each copper & fiber optic test instruments used on the site prior to any testing.

1.08 CLOSEOUT SUBMITTALS

A. Test and Evaluation Reports:
   1. A complete set of test results verifying the installed link and channel performance parameter results for all cable types shall be presented to the A/E and the Owner at least one (1) week before the placement of any active electronics in technology rooms and/or spaces. The test result submittal shall contain the following:
      a. Testing, verification and documentation of all performance specification parameters for voice, data cables in all IT spaces. The trade sub-contractor shall identify the types of cable tester(s) and interface adapters used during testing and certification when presenting the results for each type of cable and each test procedure.
      b. Verification and test results in both paper and electronic formats printed directly from the testing device software application. Paper results must be neatly presented in a three (3) ring binder and sectioned according to floor and cable type; OSP, ISP, Category-6, Category-3, and optical fiber cables (backbone and workstation fiber) must be divided into separate sections for each floor. Electronic results must be presented on CD-Rom disc(s) in the testing device's native file type with a copy of the electronic software used to generate the test results.
      c. Documentation indicating the last calibration/service record of each certification tester device.

1.09 QUALITY ASSURANCE

A. Qualifications – Manufacturer
   1. Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.

B. Qualifications – Installer:
   1. Seventy Five percent (75%) of the onsite sub-contractor-provided field technicians shall be factory certified within 12 months by the manufacturer of the selected telecommunications system testing components being used. Proof of certification shall be available on site for review at all times for each field technician.

PART 2 - PRODUCTS

2.01 COPPER CABLE TESTER

A. Basis-of-Design Product: Subject to compliance with requirements:
   1. Fluke

B. Product Options:
   1. The indicated manufacturers shall be the basis of the design and each component selected shall address the particular infrastructure requirement.
      a. Fluke DTX

C. Description:
   1. Must meet or exceed TIA Level IV compliant network cable-testing device certification by an independent laboratory, such as Intertek, for verification of high speed, TIA/EIA T568 compliant cables.
   2. Copper test equipment must be capable of certifying Category-3, Category-5e, Category-6 and Category-6A UTP links or channels independent of termination hardware configuration (RJ 45 port or 110-style) for each level of performance.
   3. Provide full 2-way Autotest of Category-3, 5E, 6 and 6A twisted pair links.
   4. All test equipment shall be capable of storing full frequency sweep data for all tests and printing color graphical reports for all swept measurements.

D. Accessory Products:
   1. Interface Adapters
   2. TIA Category-3, 5E and 6(A): 100 ohm
   3. Category/Class E permanent link adapters for TIA Cat 3, 5E, 6 and 6A unshielded and shielded cables.
   4. DTX ten (10) Gigabit Kit

2.02 OPTICAL FIBER TESTER

A. Manufacturer List:
   1. Fluke

B. Product Options:
   1. Select analyzer to comprehensively certify each optical fiber connection and record results verifying compliance with TIA/EIA performance standards and manufacturer specifications.
      a. DTX-1800 with Fiber modules

C. Description:
   1. The optical fiber source shall permit full end to end testing of Multimode, Single-mode and LOMMF optical fiber cabling fully compliant with industry standards and manufacturer recommendations.

2. Available source types and wavelengths shall be as follows:
   a. Multimode - 850nm LED and 1300nm LED.
   b. Single-mode – 1310nm FP Laser and 1550nm FP Laser.
   c. LOMMF – 850nm VCSEL and 1310nm FP Laser.
3. The built in power meter shall be calibrated to read 850, 1310 and 1550nm wavelengths.
4. All test equipment shall be capable of storing full frequency sweep data for all tests and printing color graphical reports for all swept measurements.

D. Accessory Products:
   1. Interface Adapters
      a. DTX Fiber Modules including Multimode, Single-mode and LOMMF adapters.

PART 3 - EXECUTIONEXAMINATION

A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section.

B. Verify telecommunications cabling is installed and supported, terminated, mounted in an appropriate housing or terminated on the applicable component and labeled prior to certification testing and documentation.

C. Verify certification tester universal interface adapters and manufacturer patch cords that enable permanent link verification are in new condition not indicating any twisting or kinking resulting from incorrect storage of the tester interface adapters.

D. Optical fiber patch cords shall be inspected to ensure connector surfaces are clean and free of defects that may affect testing results.

3.02 TESTING

A. Process:
   1. Certification test 100% of the installed cabling plant including all backbone and horizontal four (4) pair MTP copper, multi-pair UTP, and optical fiber connections.
   2. Follow manufacturers' instructions and recommended industry standards and guidelines to complete all TIA/EIA 568-C testing procedures to verify performance levels.
   3. All testing will utilize industry standard Method B parameters.
   4. All optical fiber certification testing shall include dual frequency bi-directional reports.
   5. Follow manufacturer requirements for self-calibration procedures.
   6. Update tester software to show specific project information including but not limited to:
   7. Date and time of testing
   8. Project name
   9. Field technicians name
   10. Cable identification number
   11. Cable manufacturer, type and part number

B. Repair:
   1. Any connections failing to meet referenced standards or more stringent performance requirements stated above, must be removed and replaced with connections that prove, in additional testing, to meet or exceed the performance standards set forth.

3.03 CLOSEOUT ACTIVITIES

A. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.

B. Sub-contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner

END OF SECTION

SECTION 27 11 16

CABINETS, RACKS, ENCLOSURES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Provides specifications for network cabinets, racks, and telecommunications enclosure components utilized to house various telecommunications infrastructure components within technology distribution spaces.
   2. Equipment Racks

1.02 RELATED DOCUMENTS

A. All divisions of the specification and general provisions of the Construction Documents.

B. Architectural, mechanical, electrical, and all technology drawings.

C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

1.03 REFERENCES

A. Abbreviations and Acronyms:
   1. ANSI: American National Standards Institute
   2. A/E: Architect / Engineer (designer)
   3. BICSI: Building Industry Consulting Service International
   4. EIA: Electronics Industry Alliance
   5. IDF: Intermediate Distribution Facility
   6. MDF Main Distribution Facility
   7. RCDD: Registered Communications Distribution Designer
   8. TCIM: Telecommunication Cabling Installation Manual
   9. TDMM: Telecommunications Distribution Methods Manual
   10. TIA: Telecommunications Industry Association

B. Codes and Regulations: (Note: Reference Division One for specific code versions governing the work in addition to the information noted below.)
   1. National Electric Code (2017)
   2. National Fire Protection Association (NFPA)
   3. 2017 California Electrical Code
   4. 2017 California Building Code
   5. Local Municipal Codes

1.04 APPLICABLE REGULATORY REFERENCES

A. Sub-contractor is responsible for knowledge and application of current versions of all applicable Standards and Codes. In cases where listed Standards and Codes have

been updated, Sub-contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.

1. ANSI/TIA:
    a. TIA-526-7 (OFSTP-7) (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
    b. TIA-526-14-B (April 2015) (OFSTP-14) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
    c. ANSI/TIA/EIA-598-C (July 2014) Optical Fiber Cable Color Coding
    d. ANSI/TIA-568-C.0 (December 2015) Generic Telecommunications Cabling for Customer Premises
    e. TIA-568-C.0-1 (September 2012) Generic Telecommunications Cabling for Customer Premises-Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling
    f. ANSI/TIA-568-C.1 (February 2012) Commercial Building Telecommunications Cabling Standards
    g. TIA-568-C.1-2 (November 2014) Commercial Building Telecommunications Cabling Standard, Addendum 2 General Updates
    h. ANSI/TIA-568-C.2 (June 2016) Balanced Twisted Pair Communications Cabling and Components Standards
    i. ANSI/TIA-568-C.3 (June 2011) Optical Fiber Cabling Components Standard
    j. ANSI/TIA-568-C.3-1 (December 2011) Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors
    k. ANSI/TIA-1183 (August 2012) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
    l. ANSI/TIA-1183-1 (January 2016) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Addendum 1 – Extending Frequency Capabilities to 2 GHz.
    m. ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard
    n. ANSI/TIA-942-A (August 2012) Telecommunications Infrastructure Standard for Data Centers
    o. ANSI/TIA-942-A-1 (March 2013) Telecommunications Infrastructure Standard for Data Centers, Addendum 1 - Cabling Guidelines for Data Center Fabrics
    p. TIA-569-D (April 2015) Telecommunications Pathways and Spaces
    q. TIA-569-D-1 (October 2016) Telecommunications Pathways and Spaces Addendum 1- Revised Temperature and Humidity Requirements for Telecommunications Spaces
    r. ANSI/TIA-606-B (December 2015) Administration Standard for Telecommunications Infrastructure
    s. TIA-607-B (November 2015) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises
    t. TIA-607-B-1 (January 2017) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises - External Grounding Addendum
    u. TIA-758-B (April 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
    v. TIA-1152 (November 2016) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling

w. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems.
x. TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
y. TIA-1005-A (June 2012) Industrial Telecommunications Infrastructure Standard for Manufacturing, Process & Refining
z. ANSI/TIA-1005 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises
aa. TIA-1005-1 (May 2012) Telecommunications Infrastructure Standard for Industrial Premises; Addendum 1 - Industrial Pathways and Spaces
bb. TIA-1179 (July 2010) Healthcare Facility Telecommunications Infrastructure Standard.

2. ISO/IEC
   a. ISO 11801 (November 2010) - Generic Cabling for Customer Premises
   b. ISO/IEC TR 14763-2-1:2012 - Information technology -- Implementation and operation of customer premises cabling -- Part 2-1: Planning and installation - Identifiers within administration system.
3. National Electric Codes
   a. National Electrical Code (2017)
   b. ANSI/NFPA 70-2017, National Electrical Code© (NEC©)
   c. ANSI/IEEE C2-207, National Electrical Safety Code®
   d. National Electrical Code (NEC) (NFPA 70)
4. OSHA Standards and Regulations – all applicable
5. Local Codes and Standards – all applicable
6. BICSI
   a. Telecommunications Distribution Methods Manual, 13th Edition
   b. BICSI 004-2012, Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
   c. Information Technology Systems Installation Methods Manual (ITSIMM), 6th Edition
   d. ANSI/BICSI 002-2011, Data Center Design and Implementation Best Practices
   e. Network Systems and Commissioning (NSC) reference, 1st Edition
   f. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
   g. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
   h. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
   i. AV Design Reference Manual, 1st Edition
   j. Network Design Reference Manual, 7th Edition
   k. Outside Plant Design Reference Manual, 5th Edition
   l. Wireless Design Reference Manual, 3rd Edition
   m. Electronic Safety and Security Design Reference Manual, 3rd Edition.
7. Anywhere cabling Standards conflict with electrical or safety Codes, Sub-contractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.
8. Knowledge and execution of applicable codes is the sole responsibility of the Sub-contractor.
9. Any code violations committed at the time of installation shall be remedied at the Sub-contractor's expense.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Install and coordinate the telecommunications cabling work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interference in a manner accepted by the architect. Any repairs or changes made necessary in the contract work, caused by the sub-contractor's neglect, shall be made by the sub-contractor at their own expense.

B. Scheduling:
   1. Contract Documents and the overall construction schedule must be carefully reviewed to determine all required interfacing and timing of the work. All such documents shall be available through the General Contractor or Construction Manager.

1.06 ACTION SUBMITTALS

A. Product Data: For each product indicated.
   1. Submit all product data in accordance with general requirements of the construction documents.
   2. Submit product cut sheets and a detailed list of components a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
   3. Alternate and "Or Equal" designated products must be submitted for review and judgment to the A/E prior to installation. The sub-contractor-proposed alternate products or components must be verified by two (2) independent sources within the past 6 months. This request shall include the two (2) independent sources, the original Product's specification sheet, the proposed substitute product cut sheet, and a written request to review the substitute product.
   4. Any request of an alternate or substitution must be submitted to the A/E for action no later than fourteen (14) calendar days after release of the original telecommunications bid documents.

1.07 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:
   1. Submit all shop drawings in accordance with the general requirements of the construction documents.
   2. Submit shop drawings a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
   3. Shop drawings shall include evidence of grounding and bonding components are coordinated with field conditions and the work of other trades.
   4. This submittal may have a written component and a visual, drawn component for review and action by the A/E prior to installation.

B. Certificates:
   1. Submit management and installation team reference documentation verifying:
      a. The project manager is a RCDD in good standing with BICSI and is qualified to manage the scope of work described in the contract documents and has five (5) years of experience managing similar projects in size and scope. The documentation shall include the RCDD registration number.

b. The field supervisor is a BICSI trained technician that is qualified to perform and oversee the work described in the contract documents

C. Qualification Statements:
1. The sub-contractor shall submit documentation that within the past 12 months, a minimum of 75% of all installation personnel have been trained or certified by the manufacturer of the products they are installing.

1.08 CLOSEOUT SUBMITTALS

A. As-Built Drawings:
1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
2. Submit as-built drawings a minimum of two (2) weeks after completion of all Division- 27 work for A/E and Owner reference:

1.09 QUALITY ASSURANCE

A. Qualifications – Manufacturer
1. Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.

B. Qualifications – Installer:
1. At a minimum, seventy-five percent (75%) of the onsite sub-contractor provided field technicians shall be factory certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall be available on site for review at all times for each field technician.

PART 2 - PRODUCTS

2.01 CABINETS, RACKS, ENCLOSURES

A. Basis-of-Design Product: Subject to compliance with requirements:
1. Owner Furnished / Contractor Installed (OFCI)

B. Product Options:
1. The indicated manufacturers shall be the basis of the design and each component selected shall address the particular infrastructure requirements.

2.02 EQUIPMENT RACKS

A. Basis-of-Design Product: Subject to compliance with requirements:
1. CPI
a. Part # 55053-703

B. Product Options:
1. The indicated manufacturers shall be the basis of the design and each component selected shall address the particular infrastructure requirements.

C. Description:

1. Equipment racks and rack components shall be black in color. Finish shall be powder coat.
2. Universal Free Standing Relay Racks shall be Aluminum 2-Post racks able to support and organize electronic equipment, cross-connection and/or termination hardware for fiber optic cabling, station cabling, riser cabling, or building entrance cabling as may be required by design.
3. The assembled rack will measure 84”H x 20.3”W x 15”D. The sides of the equipment- mounting channels will be punched to allow attachment of vertical cable managers along the sides of the rack or for rack-to-rack baying.
4. Racks shall be manufactured from aluminum and/or steel extrusions.
5. Each rack will have two L-shaped top angles, two L-shaped base angles and two C- shaped equipment-mounting channels. The rack will assemble with bolt hardware. Equipment-mounting channels will be threaded for easy assembly. The base angles will be pre-punched for attachment to the floor.
6. Equipment mounting channels will be 3” deep and punched on the front and rear flange with the EIA-310-D Universal hole pattern to provide 45 rack-mount spaces for equipment. Each mounting space will be marked and numbered on the mounting channel.
7. The rack will be UL Listed.
8. Network equipment will mount on to a network equipment suited cabinet 45u rack units tall.
9. Floor mounted racks shall be permanently attached to the floor using lag bolt and lag shields for masonry type floors or appropriate fastening hardware for other types of flooring as approved by the owner. Racks installed adjacent to each other will be fastened together using proper bolt, nut, and washer combinations.
10. Rated load for equipment cabinets shall be no less than 1000 pounds, equipment evenly distributed along height of rack.
11. Ladder rack shall be fastened using the proper hanging and connecting hardware, secured in a manner consistent with recommended weight load spacing recommendations.
12. Patch panels, wire cable management hardware, and other related passive equipment will be attached to racks and mounting rails with at least two screws per mounting bracket and located in accordance with the Rack Equipment Elevation Form contained in project documentation on a per job basis.
13. All equipment shall be free from imperfections and defects.
14. All racks shall be grounded and bonded to specification of BICSI, Telecommunications Methods Manual and ANSI/TIA 607-B Bonding and Grounding Standard. See grounding section in this document for details.
15. Active equipment shall be positioned in racks to work in accordance of the “hot aisle/cold aisle” configuration of that room.
16. Equipment with intake/exhaust patterns other than front-to-back should be remediated with appropriate passive ducts to correct airflow to front-to-back pattern wherever possible.
17. Any rack/cabinet spaces not used should be filled with blank panels to minimize rogue backflow of air within the facility.
18. All racks and cabinets shall have a minimum of 3 feet clearance in the front, with 4 feet being preferable for the movement and installation of equipment. Some equipment may require more clearance. See project documentation or equipment manufacturer’s guidelines for details.
19. All racks shall have a minimum of 2 feet clearance in the rear, with 3 feet being preferable for the movement and installation of equipment.

20. Equipment Mounting Rails shall be spaced horizontally to support 19" wide EIA-310- D compliant rack-mount equipment. Each RMU will be marked and numbered on the front mounting rails.
21. Attachment points will be threaded with 12-24 roll-formed threads. The rack will include assembly and equipment-mounting hardware. Each rack will include (50) each combination pan head, pilot point mounting screws
22. The cabinet shall be UL Listed. UL Listing will be stated in the manufacturer's product literature.

2.03 POWER REQUIREMENTS

A. Minimum power configuration should be no less than 20 A, 120 Vac power, with 250 Vac where needed. All circuits shall be on the same phase of power. Consult project documentation for details on power needs of specific racks and cabinets.

B. Power circuits should have dedicated neutral and ground conductors and no exposed on/off switch or breaker controls that might cause accidental shut-off.

2.04 SUSPENDED CEILING WIRELESS ACCESS POINT ENCLOSURES

A. Basis-of-Design Product: Subject to compliance with requirements:
   1. Oberon suspended ceiling mount
      a. Part Number - Model 1046-CC0AP3800

B. Product Options:
   1. The indicated manufacturers shall be the basis of the design and each component selected shall address the particular infrastructure requirements.

C. Description:
   1. Economical locking ceiling mount designed specifically for aesthetic, secure mounting of the CISCO 3800i devices wireless access point.
   2. Performance: Designed to meet NEC300-22 and 300-23 for plenum installations. OSHPD approved OPA No. 1638.
   3. Construction: 18 ga. textured white powder coated steel flange, 16 ga. aluminum back box. Patent pending locking mechanism, keyed alike, secures AP into the ceiling mount.
   4. Size: 24 inches by 24 inches by 2-1/4 inches deep (610 mm by 610 mm by 57 mm).
   5. Includes (1) Dual Cable Egress Firestop Kit (1" trade size conduit connector, and firestop grommet)

2.05 OUTDOOR WIRELESS ACCESS POINT ENCLOSURES

A. Basis-of-Design Product: Subject to compliance with requirements:
   1. Ventev/TerraWave Wall Mounted Enclosure
      a. Part Number - CV12106KO-ODO4T
      b. UPC Number - 729198536725

B. Product Options:
   1. The indicated manufacturers shall be the basis of the design and each component selected shall address the particular infrastructure requirements.

C. Description:
   1. Assembled 12" x 10" x 6" NEMA 4X polycarbonate enclosure with a solid door and Key Lock includes mounting feet and 4- RPTNC leads with an integrated outdoor Omni Antenna attached at the bottom of the enclosure. The enclosure also comes with mounting feet for easy installation. Constructed from polycarbontate plastic, this enclosure is durable, extremely affordable and is the lightest weight enclosure solution TerraWave offers.
   2. RoHS compliant
   3. Back panel for CISCO device.
   4. Provide all required attachments for wall mounting on exterior of modular buildings.

PART 3 - **EXECUTION**

3.01 EXAMINATION

A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section.

3.02 INSTALLATION

A. Process:
   1. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section. Examples of work which must be checked include, but are not limited to:
      a. Electrical requirements (conduit installation and capacity).
      b. The telecommunications rooms are the size indicated in the project drawings.
      c. Adequate clearances of doors, riser spaces and ceilings for all component of the telecommunications system.
      d. Examine and compare the telecommunications drawings and specifications with the drawings and specifications of other trades. Report any discrepancies between them to the A/E and obtain written instructions for changes or revisions.
   2. Assemble cabinets according to manufacturer’s instructions. Verify that equipment mounting rails are sized properly for rack-mount equipment before attaching the rack to the floor.
   3. Anchor all racks and cabinets to the concrete floor per the structural requirements and cross brace to the cable runway system above.
   4. Racks shall be grounded to the TGB using appropriate hardware provided by the sub-contractor. The ground will meet local code requirements and will be approved by the Authority Having Jurisdiction (AHJ).
   5. Ladder rack may be attached to the top of the rack to deliver cables to the rack. The rack should not be drilled to attach ladder rack. Use appropriate hardware from the ladder rack manufacturer.

3.03 RE-INSTALLATION

A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components. Scheduling for re- installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work.

3.04 CLOSEOUT ACTIVITIES

A. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.

B. Sub-contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner.

END OF SECTION

SECTION 27 11 19

TERMINATION BLOCKS AND PATCH PANELS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Provides specifications for wall and rack/cabinet-mounted blocks, termination panels and patch panel components utilized to terminate various telecommunications infrastructure cabling and connectivity.
   2. Optical Fiber Termination panels.
   3. Copper horizontal cabling Patch Panels.

1.02 RELATED DOCUMENTS

A. All divisions of the specification and general provisions of the Construction Documents.

B. Architectural, mechanical, electrical, and all technology drawings.

1.03 REFERENCES

A. Abbreviations and Acronyms:
   1. ANSI: American National Standards Institute
   2. A/E: Architect / Engineer (designer)
   3. BICSI: Building Industry Consulting Service International
   4. EIA: Electronics Industry Alliance
   5. IDF: Intermediate Distribution Facility
   6. MDF Main Distribution Facility
   7. RCDD: Registered Communications Distribution Designer
   8. TCIM: Telecommunication Cabling Installation Manual
   9. TDMM: Telecommunications Distribution Methods Manual
   10. TIA: Telecommunications Industry Association

B. Codes and Regulations: (Note: Reference Division One for specific code versions governing the work in addition to the information noted below.)
   1. National Electric Code (2017)
   2. National Fire Protection Association (NFPA)
   3. 2016 California Electrical Code
   4. 2016 California Building Code
   5. Local Municipal Codes

1.04 APPLICABLE REGULATORY REFERENCES

A. Sub-contractor is responsible for knowledge and application of current versions of all applicable Standards and Codes. In cases where listed Standards and Codes have been updated, Sub-contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.
   1. ANSI/TIA:

a. TIA-526-7 (OFSTP-7) (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
b. TIA-526-14-B (April 2015) (OFSTP-14) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
c. ANSI/TIA/EIA-598-C (July 2014) Optical Fiber Cable Color Coding
d. ANSI/TIA-568-C.0 (December 2015) Generic Telecommunications Cabling for Customer Premises
e. TIA-568-C.0-1 (September 2012) Generic Telecommunications Cabling for Customer Premises-Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling
f. ANSI/TIA-568-C.1 (February 2012) Commercial Building Telecommunications Cabling Standards
g. TIA-568-C.1-2 (November 2014) Commercial Building Telecommunications Cabling Standard, Addendum 2 General Updates
h. ANSI/TIA-568-C.2 (June 2016) Balanced Twisted Pair Communications Cabling and Components Standards
i. ANSI/TIA-568-C.3 (June 2011) Optical Fiber Cabling Components Standard
j. ANSI/TIA-568-C.3-1 (December 2011) Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors
k. ANSI/TIA-1183 (August 2012) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
l. ANSI/TIA-1183-1 (January 2016) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Addendum 1 – Extending Frequency Capabilities to 2 GHz.
m. ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard
n. ANSI/TIA-942-A (August 2012) Telecommunications Infrastructure Standard for Data Centers
o. ANSI/TIA-942-A-1 (March 2013) Telecommunications Infrastructure Standard for Data Centers, Addendum 1 - Cabling Guidelines for Data Center Fabrics
p. TIA-569-D (April 2015) Telecommunications Pathways and Spaces
q. TIA-569-D-1 (October 2016) Telecommunications Pathways and Spaces Addendum 1- Revised Temperature and Humidity Requirements for Telecommunications Spaces
r. ANSI/TIA-606-B (December 2015) Administration Standard for Telecommunications Infrastructure
s. TIA-607-B (November 2015) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises
t. TIA-607-B-1 (January 2017) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises - External Grounding Addendum
u. TIA-758-B (April 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
v. TIA-1152 (November 2016) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
w. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems.

x. TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
y. TIA-1005-A (June 2012) Industrial Telecommunications Infrastructure Standard for Manufacturing, Process & Refining
z. ANSI/TIA-1005 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises
aa. TIA-1005-1 (May 2012) Telecommunications Infrastructure Standard for Industrial Premises; Addendum 1 - Industrial Pathways and Spaces
bb. TIA-1179 (July 2010) Healthcare Facility Telecommunications Infrastructure Standard.

2. ISO/IEC
   a. ISO 11801 (November 2010) - Generic Cabling for Customer Premises
   b. ISO/IEC TR 14763-2-1:2012 - Information technology -- Implementation and operation of customer premises cabling -- Part 2-1: Planning and installation - Identifiers within administration system.
3. National Electric Codes
   a. National Electrical Code (2017)
   b. ANSI/NFPA 70-2017, National Electrical Code© (NEC©)
   c. ANSI/IEEE C2-207, National Electrical Safety Code®
   d. National Electrical Code (NEC) (NFPA 70)
4. OSHA Standards and Regulations – all applicable
5. Local Codes and Standards – all applicable
6. BICSI
   a. Telecommunications Distribution Methods Manual, 13th Edition
   b. BICSI 004-2012, Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
   c. Information Technology Systems Installation Methods Manual (ITSIMM), 6th Edition
   d. ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices
   e. Network Systems and Commissioning (NSC) reference, 1st Edition
   f. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
   g. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
   h. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
   i. AV Design Reference Manual, 1st Edition
   j. Network Design Reference Manual, 7th Edition
   k. Outside Plant Design Reference Manual, 5th Edition
   l. Wireless Design Reference Manual, 3rd Edition
   m. Electronic Safety and Security Design Reference Manual, 3rd Edition.
7. Anywhere cabling Standards conflict with electrical or safety Codes, Sub-contractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.
8. Knowledge and execution of applicable codes is the sole responsibility of the Sub-contractor.
9. Any code violations committed at the time of installation shall be remedied at the Sub-contractor’s expense.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Install and coordinate the telecommunications cabling work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interference in a manner accepted by the architect. Any repairs or changes made necessary in the contract work, caused by the sub-contractor's neglect, shall be made by the sub-contractor at their own expense.

B. Scheduling:
   1. Contract Documents and the overall construction schedule must be carefully reviewed to determine all required interfacing and timing of the work. All such documents shall be available through the General Contractor or Construction Manager.

1.06 ACTION SUBMITTALS

A. Product Data: For each product indicated.
   1. Submit all product data in accordance with general requirements of the construction documents.
   2. Submit product cut sheets and a detailed list of components a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
   3. Alternate and "Or Equal" designated products must be submitted for review and judgment to the A/E prior to installation. The sub-contractor-proposed alternate products or components must be verified by two (2) independent sources within the past 6 months. This request shall include the two (2) independent sources, the original Product's specification sheet, the proposed substitute product cut sheet, and a written request to review the substitute product.
   4. Any request of an alternate or substitution must be submitted to the A/E for action no later than fourteen (14) calendar days after release of the original telecommunications bid documents.

1.07 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:
   1. Submit all shop drawings in accordance with the general requirements of the construction documents.
   2. Submit shop drawings a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
   3. Shop drawings shall include evidence of grounding and bonding components are coordinated with field conditions and the work of other trades.
   4. This submittal may have a written component and a visual, drawn component for review and action by the A/E prior to installation.

B. Certificates:
   1. Submit management and installation team reference documentation verifying:
      a. The project manager is a RCDD in good standing with BICSI and is qualified to manage the scope of work described in the contract documents and has five (5) years of experience managing similar projects in size and scope. The documentation shall include the RCDD registration number.

b. The field supervisor is a BICSI trained technician that is qualified to perform and oversee the work described in the contract documents

C. Qualification Statements:
1. The sub-contractor shall submit documentation that within the past 12 months, a minimum of 75% of all installation personnel have been trained or certified by the manufacturer of the products they are installing.

1.08 CLOSEOUT SUBMITTALS

A. As-Built Drawings:
1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
2. Submit as-built drawings a minimum of two (2) weeks after completion of all Division- 27 work for A/E and Owner reference:

1.09 QUALITY ASSURANCE

A. Qualifications – Manufacturer
1. Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.

B. Qualifications – Installer:
1. At a minimum, seventy-five percent (75%) of the onsite sub-contractor provided field technicians shall be factory certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall be available on site for review at all times for each field technician.

PART 2 - PRODUCTS

2.01 OPTICAL FIBER TERMINATION PANELS

A. Basis-of-Design Product: Subject to compliance with requirements:

1. AFL / Dura-Line

B. Product Options:
1. The indicated manufacturers shall be the basis of the design and each component selected shall address the particular infrastructure requirements.

C. Description:
1. 19-inch Rack mountable fiber optic termination shelf with maximum 144-positions with integrated splicing for termination inside Telecom rooms.
2. Minimum 2U rack units' height.
3. Optical fiber termination panel housings shall be provided for cross-connecting or inter-connecting purposes between OSP, Indoor riser backbone, and/or distribution cables and the active network electronic switches, as noted in drawings.

4. Single mode termination: Fusion splice both ends of each single mode fiber optic strand onto factory connectorized single mode pigtails mounted in connector housings assembled by the manufacturer of the single mode fiber optic cable.
   a. Single-Mode splice-on Connector is acceptable.
5. All optical fiber housings shall be complete factory-provided assemblies that contain all components including LC duplex connector adapter panels and internal/external bend radius, strain relief and cable clamp components that are provided in a housing which includes an accessible rear access hatch.
6. All optical fiber patch panel trays and associated bulkhead inserts shall have factory numerical labeling included in the design and presentation to the user side of the panel.
7. The optical fiber patch panel bulkheads that house the terminating modules for the fiber backbone cabling and any horizontal optical fiber cabling shall accept TIA 568-C standard-compliant LC-connectors compatible with the optical fiber strands being terminated.

D. Accessory Products:
   1. Provide any accessory products related to the optical fiber termination panels to provide a complete and functional infrastructure system.

2.02 COPPER HORIZONTAL CABLING PATCH PANELS

A. Manufacturer List:

   1. Leviton
      a. Angled Category 6A 48 Port
         1) Part Number 6A587-U48

B. Product Options:
   1. The indicated manufacturers shall be the basis of the design and each component selected shall address the particular requirements for each situation.

C. Description:
   1. All angled patch panels are to be rack/cabinet mountable within industry standard TIA/EIA 19” mounting rails unless otherwise noted.
   2. All angled patch panels are to provide adequate space for individual port labeling on the front and cable/connector labeling on the back.
   3. All installed station cable patch panels shall be Category 6A twenty-four (24) or forty-eight (48) port flat patch panels
   4. All multi-pair backbone OSP cables terminated in a TR will be terminated on a BEC protection block. Reference Division 270526 specification.
   5. The performance criteria for the patch panels must meet or exceed the performance parameters for frequency, attenuation, near end cross-talk (NEXT), attenuation to cross-talk ratio (ACR), power sum NEXT (PS-NEXT), power sum ACR (PS-ACR), equal level far end cross-talk (ELFEXT), power sum far end cross-talk (PS-FEXT), and return loss (RL) as set forth in TIA/EIA 568-C category standards.

D. Accessory Products:
   1. Provide any accessory products related to the patch panels to provide a complete and functional infrastructure system.

2. Port RJ-45 jack block out device to safely secure access to unused ports and deter vandalism to jacks.
3. Provide complete with all required mounting hardware and fittings and cables needed.

PART 3 - EXECUTIONEXAMINATION

A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section. Examples of work which must be checked include, but are not limited to:
   1. Electrical requirements (conduit installation and capacity)
   2. The telecommunications rooms are the size shown on the project drawings.
   3. Adequate clearances of doors, riser spaces and ceilings for all component of the telecommunications system.
   4. Examine and compare the telecommunications drawings and specifications with the drawings and specifications of other trades. Report any discrepancies between them to the A/E and obtain written instructions for changes or revisions.

3.02 INSTALLATION

A. Process:
   1. Install all optical fiber and category copper termination panels/panels under the guidelines of the manufacturer's recommended instructions and per all TIA/EIA 568-C standards and manufacturer-approved industry practices as shown in the drawings.
   2. The installation and performance parameters of all installed cable termination panels shall be verified by the sub-contractor through TIA/EIA 568-C testing procedures.
   3. Label all cable termination panels to identify each port and each specific panel in accordance with the TIA/EIA 606 labeling scheme approved by the Owner.

B. Installation description:
   1. Sub-contractor shall use existing cabling management pathways and take care to place cable like with like, maintaining original segregation strategies for separating fiber and copper cables as well as any separation necessary between different types of copper cables.
   2. Cables shall be dressed neatly within patch management pathways with care taken to maintain minimum bend radius of not less than 1 times the cord outer diameter for copper and not less than a 1" bend radius for fiber jumpers as per ANSI/TIA 568-C.0
   3. The installation and performance parameters of all installed cable termination panels shall be verified by the sub-contractor through TIA/EIA 568-C testing procedures.
   4. Label all cable termination panels to identify each port and each specific panel in accordance with the TIA/EIA 606 labeling scheme approved by the Owner.

3.03 RE-INSTALLATION

A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components due to

manufacturer defects or sub-contractor poor performance. Scheduling for re-installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work.

3.04 CLOSEOUT ACTIVITIES

A. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.

B. Sub-contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner

END OF SECTION

SECTION 27 11 23

COMMUNICATIONS CABLE MANAGEMENT AND CABLE RUNWAY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Provides specifications for cable management components utilized inside each telecommunications distribution space to support the management of horizontal workstation cabling, backbone cabling, and patch cords.
   2. Vertical Cable Management
   3. Cable Runway System

1.02 RELATED DOCUMENTS

A. All divisions of the specification and general provisions of the Construction Documents.

B. Architectural, mechanical, electrical, and all technology drawings.

C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

1.03 REFERENCES

A. Abbreviations and Acronyms:

1.	ANSI:	American National Standards Institute
2.	A/E:	Architect / Engineer (designer)
3.	BICSI:	Building Industry Consulting Service International
4.	EIA:	Electronics Industry Alliance
5.	IDF:	Intermediate Distribution Facility
6.	MDF	Main Distribution Facility
7.	RCDD:	Registered Communications Distribution Designer
8.	TCIM:	Telecommunication Cabling Installation Manual
9.	TDMM:	Telecommunications Distribution Methods Manual
10.	TIA:	Telecommunications Industry Association

B. Codes and Regulations: (Note: Reference Division One for specific code versions governing the work in addition to the information noted below.)
   1. National Electric Code (2017)
   2. National Fire Protection Association (NFPA)
   3. 2017 California Electrical Code
   4. 2017 California Building Code
   5. Local Municipal Codes

1.04 APPLICABLE REGULATORY REFERENCES

A. Sub-contractor is responsible for knowledge and application of current versions of all applicable Standards and Codes. In cases where listed Standards and Codes have been updated, Sub-contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.
   1. ANSI/TIA:
      a. TIA-526-7 (OFSTP-7) (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
      b. TIA-526-14-B (April 2015) (OFSTP-14) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
      c. ANSI/TIA/EIA-598-C (July 2014) Optical Fiber Cable Color Coding
      d. ANSI/TIA-568-C.0 (December 2015) Generic Telecommunications Cabling for Customer Premises
      e. TIA-568-C.0-1 (September 2012) Generic Telecommunications Cabling for Customer Premises-Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling
      f. ANSI/TIA-568-C.1 (February 2012) Commercial Building Telecommunications Cabling Standards
      g. TIA-568-C.1-2 (November 2014) Commercial Building Telecommunications Cabling Standard, Addendum 2 General Updates
      h. ANSI/TIA-568-C.2 (June 2016) Balanced Twisted Pair Communications Cabling and Components Standards
      i. ANSI/TIA-568-C.3 (June 2011) Optical Fiber Cabling Components Standard
      j. ANSI/TIA-568-C.3-1 (December 2011) Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors
      k. ANSI/TIA-1183 (August 2012) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
      l. ANSI/TIA-1183-1 (January 2016) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Addendum 1 – Extending Frequency Capabilities to 2 GHz.
      m. ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard
      n. ANSI/TIA-942-A (August 2012) Telecommunications Infrastructure Standard for Data Centers
      o. ANSI/TIA-942-A-1 (March 2013) Telecommunications Infrastructure Standard for Data Centers, Addendum 1 - Cabling Guidelines for Data Center Fabrics
      p. TIA-569-D (April 2015) Telecommunications Pathways and Spaces
      q. TIA-569-D-1 (October 2016) Telecommunications Pathways and Spaces Addendum 1- Revised Temperature and Humidity Requirements for Telecommunications Spaces
      r. ANSI/TIA-606-B (December 2015) Administration Standard for Telecommunications Infrastructure
      s. TIA-607-B (November 2015) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises
      t. TIA-607-B-1 (January 2017) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises - External Grounding Addendum

u. TIA-758-B (April 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
v. TIA-1152 (November 2016) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
w. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems.
x. TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
y. TIA-1005-A (June 2012) Industrial Telecommunications Infrastructure Standard for Manufacturing, Process & Refining
z. ANSI/TIA-1005 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises
aa. TIA-1005-1 (May 2012) Telecommunications Infrastructure Standard for Industrial Premises; Addendum 1 - Industrial Pathways and Spaces
bb. TIA-1179 (July 2010) Healthcare Facility Telecommunications Infrastructure Standard.

2. ISO/IEC
   a. ISO 11801 (November 2010)- Generic Cabling for Customer Premises
   b. ISO/IEC TR 14763-2-1:2012 - Information technology -- Implementation and operation of customer premises cabling -- Part 2-1: Planning and installation - Identifiers within administration system.
3. National Electric Codes
   a. National Electrical Code (2017)
   b. ANSI/NFPA 70-2017, National Electrical Code© (NEC©)
   c. ANSI/IEEE C2-207, National Electrical Safety Code®
   d. National Electrical Code (NEC) (NFPA 70)
4. OSHA Standards and Regulations – all applicable
5. Local Codes and Standards – all applicable
6. BICSI
   a. Telecommunications Distribution Methods Manual, 13th Edition
   b. BICSI 004-2012, Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
   c. Information Technology Systems Installation Methods Manual (ITSIMM), 6th Edition
   d. ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices
   e. Network Systems and Commissioning (NSC) reference, 1st Edition
   f. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
   g. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
   h. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
   i. AV Design Reference Manual, 1st Edition
   j. Network Design Reference Manual, 7th Edition
   k. Outside Plant Design Reference Manual, 5th Edition
   l. Wireless Design Reference Manual, 3rd Edition
   m. Electronic Safety and Security Design Reference Manual, 3rd Edition.
7. Anywhere cabling Standards conflict with electrical or safety Codes, Sub-contractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.

8. Knowledge and execution of applicable codes is the sole responsibility of the Sub-contractor.
9. Any code violations committed at the time of installation shall be remedied at the Sub-contractor's expense.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Install and coordinate the telecommunications cabling work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interference in a manner accepted by the architect. Any repairs or changes made necessary in the contract work, caused by the sub-contractor's neglect, shall be made by the sub-contractor at their own expense.

B. Scheduling:
1. Contract Documents and the overall construction schedule must be carefully reviewed to determine all required interfacing and timing of the work. All such documents shall be available through the General Contractor or Construction Manager.

1.06 ACTION SUBMITTALS

A. Product Data: For each product indicated.
1. Submit all product data in accordance with general requirements of the construction documents.
2. Submit product cut sheets and a detailed list of components a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
3. Alternate and "Or Equal" designated products must be submitted for review and judgment to the A/E prior to installation. The sub-contractor-proposed alternate products or components must be verified by two (2) independent sources within the past 6 months. This request shall include the two (2) independent sources, the original Product's specification sheet, the proposed substitute product cut sheet, and a written request to review the substitute product.
4. Any request of an alternate or substitution must be submitted to the A/E for action no later than fourteen (14) calendar days after release of the original telecommunications bid documents.

1.07 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:
1. Submit all shop drawings in accordance with the general requirements of the construction documents.
2. Submit shop drawings a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
3. Shop drawings shall include evidence of grounding and bonding components are coordinated with field conditions and the work of other trades.
4. This submittal may have a written component and a visual, drawn component for review and action by the A/E prior to installation.

B. Certificates:
1. Submit management and installation team reference documentation verifying:

a. The project manager is a RCDD in good standing with BICSI and is qualified to manage the scope of work described in the contract documents and has five (5) years of experience managing similar projects in size and scope. The documentation shall include the RCDD registration number.
b. The field supervisor is a BICSI trained technician that is qualified to perform and oversee the work described in the contract documents

C. Qualification Statements:
1. The sub-contractor shall submit documentation that within the past 12 months, a minimum of 75% of all installation personnel have been trained or certified by the manufacturer of the products they are installing.

1.08 CLOSEOUT SUBMITTALS

A. As-Built Drawings:
1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
2. Submit as-built drawings a minimum of two (2) weeks after completion of all Division- 27 work for A/E and Owner reference:

1.09 QUALITY ASSURANCE

A. Qualifications – Manufacturer
1. Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.

B. Qualifications – Installer:
1. At a minimum, seventy-five percent (75%) of the onsite sub-contractor provided field technicians shall be factory certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall be available on site for review at all times for each field technician.

PART 2 - PRODUCTS

2.01 VERTICAL CABLE MANAGEMENT

A. Basis-of-Design Product: Subject to compliance with requirements:
1. CPI
a. MCS-EFX 2-Post Cable Manager 6”
1) 6” Part Number 40095-703 (Double Sided Locking Swing-gate doors)
2) Requires 2 managers per rack. (when there are multiple racks in an MDF/IDF, a manager cannot be shared between racks)

B. Product Options:
1. The indicated manufacturers shall be the basis of the design and each assembly selected shall address the particular infrastructure requirements.

C. Description:
1. All new MDF/IDF cabinets/Racks shall include vertical cable management as noted in the drawings.

2. All vertical cable management on cabinets/Racks shall be full height of available rack units unless otherwise noted in the LV-series drawings.
3. Vertical cable management shall be placed on left and right side of racks.
4. All components of the cable management system shall be black in color.

D. Accessory Products:
1. Provide any accessory products related to the wire management components to provide a complete and functional infrastructure system.

2.02 LADDER RACK

A. Manufacturer List:
1. CPI
a. Ladder Rack
1) 12” Part Number 11275-712 (Black)
b. Ground Cable Support
1) Part Number 11268-001

B. Product Options:
1. The indicated manufacturers shall be the basis of the design and each assembly selected shall address the particular infrastructure requirements.

C. Description:
1. The ladder rack routing system shall consist of pathway sections, splice connectors, sidewalls, waterfalls, supports, end caps, mounting brackets, and accessories designed to route and manage copper, fiber optic, grounding or power cables.
2. The pathway sections shall be provided in widths: 12” (305 mm).
3. Ladder rack shall be fastened using the proper hanging and connecting hardware, secured in a manner consistent with recommended weight load spacing recommendations.
4. All ladder rack will be connected and supported by ladder rack manufactures splice, junction, wall angle and tri-angle type braces per industry standard and authority having jurisdiction to meet local seismic codes.
5. All overhead ladder tray will be grounded and bonded per TIA standards.
6. Ladder rack sections will be supported every 4 feet, ladder rack spanning over areas that will not attach to a cabinet, rack or wall will be supported by threaded rods ceiling mount kits provided by ladder rack manufacturer.

PART 3 - EXECUTIONEXAMINATION

A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section. Examples of work which must be checked include, but are not limited to:
1. Electrical requirements (conduit installation and capacity)
2. The telecommunications rooms are the size shown on the project drawings.
3. Adequate clearances of doors, riser spaces and ceilings for all component of the telecommunications system.

4. Examine and compare the telecommunications drawings and specifications with the drawings and specifications of other trades. Report any discrepancies between them to the A/E and obtain written instructions for changes or revisions.

3.02 INSTALLATION

A. Process:
   1. Inside telecom spaces the primary cable transport system shall be the overhead cable runway system, as shown in the drawings. Sub-contractor-installed cable runway system shall include all components to complete the installation whether indicated in the contract documents or implied by the design.
   2. Install all vertical and horizontal cable management per the manufacturer's recommended installation instructions, as indicated in the drawings.
   3. All cable bundles inside the telecommunications rooms shall be secured with Velcro™ cable wraps; plastic wire ties are not acceptable.
   4. Cable ties and Velcro™ wraps shall not be pulled tight enough to kink the cable jacket.
   5. Coordinate the cable runway rungs with the vertical cable manager locations to provide for an unobstructed opening above the vertical cable managers or cabinet top openings.
   6. Install radius runway drop-out fittings at all instances of cable runway grids where cable bundles enter or exit the cable runway system. Multiple drop-out fittings need to be placed next to each other to accommodate large cable bundles. Install drop-out wing sections at the ends of the waterfall drop-out fittings to ensure cable radius requirements are met where cables exit or enter the cable runway grid from the sides of the runway stringers.
   7. Install radius runway drop-out fittings at all instances on both sides above front end of vertical cable managers of cable runway to accommodate patch cord routing in both directions.
   8. Install ground cable support fittings to the underside of the upper level cable runway grids to provide a separate pathway for all #6AWG telecom ground cables routed to the telecom ground bars. Neatly bundle ground cables together with Velcro strips and lay inside the ground cable support fitting pathway. Lash ground cable bundles to every second fitting with Velcro strips.
   9. Open ended cable runway sections shall be closed with runway termination kits.
   10. Support vertical cable runway sections (if required) to the plywood backboards with runway hold down clamp kits.
   11. Install all components of the cable runway system under the codes, standards, guidelines, and manufacturer recommendations.
   12. Vertical support to the slab above shall be provided if a cable runway section spans a distance greater than four (4) feet.
   13. Diagonal braces and threaded rod stiffeners shall be installed as additional structural support assembly as required by the Seismic Requirements for Non-Structural Components for all structural bracing and support of telecommunications equipment.

3.03 RE-INSTALLATION

A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components. Scheduling for

re- installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work

3.04 CLOSEOUT ACTIVITIES

A. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.

B. Sub-contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner

END OF SECTION

SECTION 27 13 13

COPPER BACKBONE CABLING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Provides specifications for high pair count UTP copper backbone cabling to distribute network signals between telecommunications distribution spaces.
   2. Category 6 UTP Cable.

1.02 RELATED DOCUMENTS

A. All divisions of the specification and general provisions of the Construction Documents.

B. Architectural, mechanical, electrical, and all technology drawings.

1.03 REFERENCES

A. Abbreviations and Acronyms:

1.	ANSI:	American National Standards Institute
2.	A/E:	Architect / Engineer (designer)
3.	BICSI:	Building Industry Consulting Service International
4.	EIA:	Electronics Industry Alliance
5.	IDF:	Intermediate Distribution Facility
6.	LOMMF:	Laser Optimized Multi-Mode Fiber
7.	MDF	Main Distribution Facility
8.	NEXT:	Near End Cross Talk
9.	PSELFEXT:	Power Sum Equal Level Far End Cross Talk
10.	PSNEXT:	Power Sum Near End Cross Talk
11.	RCDD:	Registered Communications Distribution Designer
12.	SMF:	Single-Mode Fiber
13.	TCIM:	Telecommunication Cabling Installation Manual
14.	TDMM:	Telecommunications Distribution Methods Manual
15.	TIA:	Telecommunications Industry Association

B. Codes and Regulations: (Note: Reference Division One for specific code versions governing the work in addition to the information noted below.)
   1. National Electric Safety Code (NESC) – 2017
   2. National Fire Protection Association (NFPA)
   3. 2016 California Electrical Code
   4. 2016 California Building Code
   5. Local Municipal Codes

1.04 APPLICABLE REGULATORY REFERENCES

A. Sub-contractor is responsible for knowledge and application of current versions of all applicable Standards and Codes. In cases where listed Standards and Codes have

been updated, Sub-contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.

1. ANSI/TIA:
    a. TIA-526-7 (OFSTP-7) (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
    b. TIA-526-14-B (April 2015) (OFSTP-14) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
    c. ANSI/TIA/EIA-598-C (July 2014) Optical Fiber Cable Color Coding
    d. ANSI/TIA-568-C.0 (December 2015) Generic Telecommunications Cabling for Customer Premises
    e. TIA-568-C.0-1 (September 2012) Generic Telecommunications Cabling for Customer Premises-Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling
    f. ANSI/TIA-568-C.1 (February 2012) Commercial Building Telecommunications Cabling Standards
    g. TIA-568-C.1-2 (November 2014) Commercial Building Telecommunications Cabling Standard, Addendum 2 General Updates
    h. ANSI/TIA-568-C.2 (June 2016) Balanced Twisted Pair Communications Cabling and Components Standards
    i. ANSI/TIA-568-C.3 (June 2011) Optical Fiber Cabling Components Standard
    j. ANSI/TIA-568-C.3-1 (December 2011) Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors
    k. ANSI/TIA-1183 (August 2012) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
    l. ANSI/TIA-1183-1 (January 2016) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Addendum 1 – Extending Frequency Capabilities to 2 GHz.
    m. ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard
    n. ANSI/TIA-942-A (August 2012) Telecommunications Infrastructure Standard for Data Centers
    o. ANSI/TIA-942-A-1 (March 2013) Telecommunications Infrastructure Standard for Data Centers, Addendum 1 - Cabling Guidelines for Data Center Fabrics
    p. TIA-569-D (April 2015) Telecommunications Pathways and Spaces
    q. TIA-569-D-1 (October 2016) Telecommunications Pathways and Spaces Addendum 1- Revised Temperature and Humidity Requirements for Telecommunications Spaces
    r. ANSI/TIA-606-B (December 2015) Administration Standard for Telecommunications Infrastructure
    s. TIA-607-B (November 2015) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises
    t. TIA-607-B-1 (January 2017) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises - External Grounding Addendum
    u. TIA-758-B (April 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
    v. TIA-1152 (November 2016) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling

w. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems.
x. TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
y. TIA-1005-A (June 2012) Industrial Telecommunications Infrastructure Standard for Manufacturing, Process & Refining
z. ANSI/TIA-1005 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises
aa. TIA-1005-1 (May 2012) Telecommunications Infrastructure Standard for Industrial Premises; Addendum 1 - Industrial Pathways and Spaces
bb. TIA-1179 (July 2010) Healthcare Facility Telecommunications Infrastructure Standard.

2. ISO/IEC
   a. ISO 11801 (November 2010)- Generic Cabling for Customer Premises
   b. ISO/IEC TR 14763-2-1:2012 - Information technology -- Implementation and operation of customer premises cabling -- Part 2-1: Planning and installation - Identifiers within administration system.
3. National Electric Codes
   a. National Electrical Code (2017)
   b. ANSI/NFPA 70-2017, National Electrical Code© (NEC©)
   c. ANSI/IEEE C2-207, National Electrical Safety Code®
   d. National Electrical Code (NEC) (NFPA 70)
4. OSHA Standards and Regulations – all applicable
5. Local Codes and Standards – all applicable
6. BICSI
   a. Telecommunications Distribution Methods Manual, 13th Edition
   b. BICSI 004-2012, Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
   c. Information Technology Systems Installation Methods Manual (ITSIMM), 6th Edition
   d. ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices
   e. Network Systems and Commissioning (NSC) reference, 1st Edition
   f. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
   g. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
   h. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
   i. AV Design Reference Manual, 1st Edition
   j. Network Design Reference Manual, 7th Edition
   k. Outside Plant Design Reference Manual, 5th Edition
   l. Wireless Design Reference Manual, 3rd Edition
   m. Electronic Safety and Security Design Reference Manual, 3rd Edition.
7. Anywhere cabling Standards conflict with electrical or safety Codes, Sub-contractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.
8. Knowledge and execution of applicable codes is the sole responsibility of the Sub-contractor.
9. Any code violations committed at the time of installation shall be remedied at the Sub-contractor’s expense.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Install and coordinate the telecommunications cabling work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interference in a manner accepted by the architect. Any repairs or changes made necessary in the contract work, caused by the sub-contractor's neglect, shall be made by the sub-contractor at their own expense.

B. Scheduling:
   1. Contract Documents and the overall construction schedule must be carefully reviewed to determine all required interfacing and timing of the work. All such documents shall be available through the General Contractor or Construction Manager.

1.06 ACTION SUBMITTALS

A. Product Data: For each product indicated.
   1. Submit all product data in accordance with general requirements of the construction documents.
   2. Submit product cut sheets and a detailed list of components a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
   3. Alternate and "Or Equal" designated products must be submitted for review and judgment to the A/E prior to installation. The sub-contractor-proposed alternate products or components must be verified by two (2) independent sources within the past 6 months. This request shall include the two (2) independent sources, the original Product's specification sheet, the proposed substitute product cut sheet, and a written request to review the substitute product.
   4. Any request of an alternate or substitution must be submitted to the A/E for action no later than fourteen (14) calendar days after release of the original telecommunications bid documents.

1.07 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:
   1. Submit all shop drawings in accordance with the general requirements of the construction documents.
   2. Submit shop drawings a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
   3. Shop drawings shall include evidence of grounding and bonding components are coordinated with field conditions and the work of other trades.
   4. This submittal may have a written component and a visual, drawn component for review and action by the A/E prior to installation.

B. Certificates:
   1. Submit management and installation team reference documentation verifying:
      a. The project manager is a RCDD in good standing with BICSI and is qualified to manage the scope of work described in the contract documents and has five (5) years of experience managing similar projects in size and scope. The documentation shall include the RCDD registration number.
      b. The field supervisor is a BICSI trained technician that is qualified to perform

and oversee the work described in the contract documents

C. Qualification Statements:
   1. The sub-contractor shall submit documentation that within the past 12 months, a minimum of 75% of all installation personnel have been trained or certified by the manufacturer of the products they are installing.

1.08 CLOSEOUT SUBMITTALS

A. Warranty Documentation:
   1. Submit manufacturers extended warranty certification documentation one (1) week after the warranty acceptance by the manufacturer. It shall be the sub-contractor's responsibility to facilitate the manufacturer-specific warranty requirements

B. As-Built Drawings:
   1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
   2. Submit as-built drawings a minimum of two (2) weeks after completion of all Division- 27 work for A/E and Owner reference:

1.09 QUALITY ASSURANCE

A. Qualifications – Manufacturer
   1. Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.

B. Qualifications – Installer:
   1. At a minimum, seventy-five percent (75%) of the onsite sub-contractor provided field technicians shall be factory certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall be available on site for review at all times for each field technician.

PART 2 - PRODUCTS

2.01 BACKBONE MULTI-PAIR CABLING

A. Basis-of-Design Product: Subject to compliance with requirements:
   1. Berk-Tek – 4 pair-OSP Category 6

B. Product Options:
   1. The indicated manufacturers shall be the basis of the design and each component selected shall address the particular infrastructure requirements.

C. Description:
   1. All voice and data ISP and OSP copper backbone cable is to be rated per the constructed conditions and verified by the sub-contractor prior to installation. Per code, plenum cable is to be installed at all times when a communications cable is exposed in a plenum air space. It is the responsibility of the sub-contractor to bid, purchase, install, and verify the rating of the ISP and OSP cable for the specific

construction conditions.

2. Backbone cables that are exposed to moisture shall contain moisture-blocking materials to prevent moisture damage to cable performance.
3. Backbone multi-pair UTP cable shall be Category-3 copper UTP, twenty-four (24) AWG cable. The total pair count of each category-3 cable shall be relocated as noted in the project drawings.
4. The performance criteria for the UTP backbone cable shall be in accordance with the specific standards for the particular cable's rating. A category-3 rated cable must perform up to, or beyond the current specification parameters for the published category-3 rating by TIA/EIA 568-C.2.
5. Select an appropriate cable construction, including external jacket properties, when installing cables in aerial, outdoor, underground and corrosive environments.

D. Accessory Products:
   1. Provide any accessory products related to the UTP copper backbone cabling required to provide a complete and functional infrastructure system.

PART 3 - EXECUTIONEXAMINATION

A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section. Examples of work which must be checked include, but are not limited to:
   1. Electrical requirements (conduit installation and capacity)
   2. The telecommunications rooms are the size shown on the project drawings.
   3. Adequate clearances of doors, riser spaces and ceilings for all component of the telecommunications system.
   4. Examine and compare the telecommunications drawings and specifications with the drawings and specifications of other trades. Report any discrepancies between them to the A/E and obtain written instructions for changes or revisions.

3.02 INSTALLATION

A. Process:
   1. Install/relocate all copper backbone/station cable per the manufacturer's recommended installation instructions, under the guidelines of TIA/EIA 568 C and BICSI, and in quantities indicated in the LV series drawings.
   2. Install all cables with proper attention paid to bend radii, pulling method, attachment method, and pulling forces. The cable manufacturer's specifications for each particular cable type shall be followed exactly.
   3. Backbone cable shall be visually inspected for insufficient bend radius during and after pulling. Damaged cables, or those installed under questionable methods and/or circumstances shall be replaced at no additional cost to the owner.
   4. All cable shall be pulled using an appropriate measuring device to ensure that the specified force is not exceeded as noted in BICSI guidelines.
   5. Install backbone cables with attention paid to aesthetic means and methods when routing cabling within IT spaces.
   6. No backbone cable shall be left unsupported for more than three (3) feet vertically or horizontally at any time.
   7. All backbone cables shall be clearly labeled on both ends and in an accessible

location no more than one (1) foot from each cable end.

3.03 RE-INSTALLATION

A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components. Scheduling for re- installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work

3.04 CLOSEOUT ACTIVITIES

A. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.

B. Sub-contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner

END OF SECTION

SECTION 27 13 23

OPTICAL FIBER BACKBONE CABLING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Provides specifications for optical fiber backbone cabling to distribute optical network signals between telecommunications distribution spaces
   2. Backbone Air-Blown Single-mode Optical Fiber Cable

1.02 RELATED DOCUMENTS

A. All divisions of the specification and general provisions of the Construction Documents.

B. Architectural, mechanical, electrical, and all technology drawings.

1.03 REFERENCES

A. Abbreviations and Acronyms:
   1. ANSI: American National Standards Institute
   2. A/E: Architect / Engineer (designer)
   3. BICSI: Building Industry Consulting Service International
   4. EIA: Electronics Industry Alliance
   5. IDF: Intermediate Distribution Facility
   6. MDF Main Distribution Facility
   7. RCDD: Registered Communications Distribution Designer
   8. SMF: Single-Mode Fiber
   9. MM: Multi-Mode Fiber
   10. TCIM: Telecommunication Cabling Installation Manual
   11. TDMM: Telecommunications Distribution Methods Manual
   12. TIA: Telecommunications Industry Association

B. Codes and Regulations: (Note: Reference Division One for specific code versions governing the work in addition to the information noted below.)
   1. National Electric Code (2017)
   2. National Fire Protection Association (NFPA)
   3. 2016 California Electrical Code
   4. 2016 California Building Code
   5. Local Municipal Codes

1.04 APPLICABLE REGULATORY REFERENCES

A. Sub-contractor is responsible for knowledge and application of current versions of all applicable Standards and Codes. In cases where listed Standards and Codes have been updated, Sub-contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.

1. ANSI/TIA:
   a. TIA-526-7 (OFSTP-7) (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
   b. TIA-526-14-B (April 2015) (OFSTP-14) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
   c. ANSI/TIA/EIA-598-C (July 2014) Optical Fiber Cable Color Coding
   d. ANSI/TIA-568-C.0 (December 2015) Generic Telecommunications Cabling for Customer Premises
   e. TIA-568-C.0-1 (September 2012) Generic Telecommunications Cabling for Customer Premises-Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling
   f. ANSI/TIA-568-C.1 (February 2012) Commercial Building Telecommunications Cabling Standards
   g. TIA-568-C.1-2 (November 2014) Commercial Building Telecommunications Cabling Standard, Addendum 2 General Updates
   h. ANSI/TIA-568-C.2 (June 2016) Balanced Twisted Pair Communications Cabling and Components Standards
   i. ANSI/TIA-568-C.3 (June 2011) Optical Fiber Cabling Components Standard
   j. ANSI/TIA-568-C.3-1 (December 2011) Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors
   k. ANSI/TIA-1183 (August 2012) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
   l. ANSI/TIA-1183-1 (January 2016) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Addendum 1 – Extending Frequency Capabilities to 2 GHz.
   m. ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard
   n. ANSI/TIA-942-A (August 2012) Telecommunications Infrastructure Standard for Data Centers
   o. ANSI/TIA-942-A-1 (March 2013) Telecommunications Infrastructure Standard for Data Centers, Addendum 1 - Cabling Guidelines for Data Center Fabrics
   p. TIA-569-D (April 2015) Telecommunications Pathways and Spaces
   q. TIA-569-D-1 (October 2016) Telecommunications Pathways and Spaces Addendum 1- Revised Temperature and Humidity Requirements for Telecommunications Spaces
   r. ANSI/TIA-606-B (December 2015) Administration Standard for Telecommunications Infrastructure
   s. TIA-607-B (November 2015) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises
   t. TIA-607-B-1 (January 2017) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises - External Grounding Addendum
   u. TIA-758-B (April 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
   v. TIA-1152 (November 2016) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
   w. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems.

x. TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
y. TIA-1005-A (June 2012) Industrial Telecommunications Infrastructure Standard for Manufacturing, Process & Refining
z. ANSI/TIA-1005 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises
aa. TIA-1005-1 (May 2012) Telecommunications Infrastructure Standard for Industrial Premises; Addendum 1 - Industrial Pathways and Spaces
bb. TIA-1179 (July 2010) Healthcare Facility Telecommunications Infrastructure Standard.

2. ISO/IEC
   a. ISO 11801 (November 2010)- Generic Cabling for Customer Premises
   b. ISO/IEC TR 14763-2-1:2012 - Information technology -- Implementation and operation of customer premises cabling -- Part 2-1: Planning and installation - Identifiers within administration system.
3. National Electric Codes
   a. National Electrical Code (2017)
   b. ANSI/NFPA 70-2017, National Electrical Code© (NEC©)
   c. ANSI/IEEE C2-207, National Electrical Safety Code®
   d. National Electrical Code (NEC) (NFPA 70)
4. OSHA Standards and Regulations – all applicable
5. Local Codes and Standards – all applicable
6. BICSI
   a. Telecommunications Distribution Methods Manual, 13th Edition
   b. BICSI 004-2012, Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
   c. Information Technology Systems Installation Methods Manual (ITSIMM), 6th Edition
   d. ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices
   e. Network Systems and Commissioning (NSC) reference, 1st Edition
   f. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
   g. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
   h. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
   i. AV Design Reference Manual, 1st Edition
   j. Network Design Reference Manual, 7th Edition
   k. Outside Plant Design Reference Manual, 5th Edition
   l. Wireless Design Reference Manual, 3rd Edition
   m. Electronic Safety and Security Design Reference Manual, 3rd Edition.
7. Anywhere cabling Standards conflict with electrical or safety Codes, Sub-contractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.
8. Knowledge and execution of applicable codes is the sole responsibility of the Sub-contractor.
9. Any code violations committed at the time of installation shall be remedied at the Sub-contractor’s expense.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Install and coordinate the telecommunications cabling work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interference in a manner accepted by the architect. Any repairs or changes made necessary in the contract work, caused by the sub-contractor's neglect, shall be made by the sub-contractor at their own expense.

B. Scheduling:
   1. Contract Documents and the overall construction schedule must be carefully reviewed to determine all required interfacing and timing of the work. All such documents shall be available through the General Contractor or Construction Manager.

1.06 ACTION SUBMITTALS

A. Product Data: For each product indicated.
   1. Submit all product data in accordance with general requirements of the construction documents.
   2. Submit product cut sheets and a detailed list of components a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
   3. Alternate and "Or Equal" designated products must be submitted for review and judgment to the A/E prior to installation. The sub-contractor-proposed alternate products or components must be verified by two (2) independent sources within the past 6 months. This request shall include the two (2) independent sources, the original Product's specification sheet, the proposed substitute product cut sheet, and a written request to review the substitute product.
   4. Any request of an alternate or substitution must be submitted to the A/E for action no later than fourteen (14) calendar days after release of the original telecommunications bid documents.

1.07 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:
   1. Submit all shop drawings in accordance with the general requirements of the construction documents.
   2. Submit shop drawings a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
   3. Shop drawings shall include evidence of grounding and bonding components are coordinated with field conditions and the work of other trades.
   4. This submittal may have a written component and a visual, drawn component for review and action by the A/E prior to installation.

B. Certificates:
   1. Submit management and installation team reference documentation verifying:
      a. The project manager is a RCDD in good standing with BICSI and is qualified to manage the scope of work described in the contract documents and has five (5) years of experience managing similar projects in size and scope. The documentation shall include the RCDD registration number.
      b. The field supervisor is a BICSI trained technician that is qualified to perform

and oversee the work described in the contract documents

C. Qualification Statements:
   1. The sub-contractor shall submit documentation that within the past 12 months, a minimum of 75% of all installation personnel have been trained or certified by the manufacturer of the products they are installing.

1.08 CLOSEOUT SUBMITTALS

A. As-Built Drawings:
   1. Submit all as-built documentation in accordance with the general requirements of the construction documents.
   2. Cabling as-built drawings must contain detailed location and identification information coordinated with the as-built cable schedules.
   3. All cabling must meet or exceed applicable TIA/EIA testing requirements and any additional parameters outlined in the Commissioning of Communications specification section 27 08 00.
   4. Test results must be submitted for owner review and approval adhering to the General Contractor schedule milestones related to the projects active systems integration.

1.09 QUALITY ASSURANCE

A. Qualifications – Manufacturer
   1. Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.

B. Qualifications – Installer:
   1. At a minimum, seventy-five percent (75%) of the onsite sub-contractor provided field technicians shall be factory certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall be available on site for review at all times for each field technician.

PART 2 - PRODUCTS

2.01 BACKBONE SINGLE-MODE OPTICAL CABLING

A. Basis-of-Design Product: Subject to compliance with requirements:
   1. AFL/Dura-Line - Air-Blown Fiber (MDF to IDF)
   2. Berk-Tek – Conventional Single Mode Fiber (Phase 2 Remote Cameras and Emergency Phones)

B. Product Options:
   1. The manufacturers noted above shall be the only manufacturers acceptable to the Owner and A/E. Cable construction shall be a hybrid multi-mode and single-mode fiber stands combined in a single protection jacket as indicated on the project drawings.

C. Description:
   1. All backbone single-mode optical fiber cable shall be capable of 10 Gb/s Ethernet

signal transmission to 10,000 meters in the 1310nm operating window. Maximum attenuation for a single-mode cable shall be no greater than 0.4dB per kilometer using 1310nm and 0.3dB per kilometer using 1550nm wavelengths respectively.

2. Each optical fiber strand shall be sufficiently free of surface imperfections and inclusions to meet the optical, mechanical, and environmental requirements of this specification and all EIA/TIA 568-C.3 and 568-C.3-1 performance parameters.
3. All optical fibers inside each individual cable shall be provided in counts indicated in the drawings and usable to the fullest capacity specified by the manufacturer and meet required specifications at all times.
4. Air-Blown backbone single-mode optical fiber cables shall be:
   a. Individual jacketed, tight buffered fiber type.
   b. Cable construction shall be a single-mode in a single protective outer sheath.
   c. The individual fibers are grouped in jacketed subunits color coded per TIA-598.
5. The optical fiber cables shall be rated per the installation environment as required by the local Authority Having Jurisdiction and/or National Fire Codes. Select an appropriate cable construction, including external jacket properties, when installing optical fiber cables in aerial, outdoor, underground and corrosive environments.
6. All SMF shall meet or exceed TIA compliant network cable-testing device certification by an independent laboratory, such as ETL, for verification of high speed, TIA/EIA T568C-compliant performance.

D. Cable sizes defined in Contract Documents.
1. 6-strand Single-mode – AFL/Dura-Line eABF (IDF Locations)
2. 6-strand Single-mode – Conventional Indoor/Outdoor (Pole Cameras and Emergency Phone Locations)

E. Accessory Products:
1. Provide any accessory products related to the optical fiber backbone cabling required to provide a complete and functional infrastructure system.

2.2 EXTERIOR TUBE-CELL SYSTEMS

A. Description:
1. All tube cable sheath openings that are created for connecting tube cable cells in underground manholes or pull boxes shall be encased in an outside plant splice case designed for copper cables.
2. The water-proof splice enclosure must be approved by the manufacturer for connecting tube cables.
3. All tube cables shall have the proper end plate adapter to provide the necessary watertight seal in the splice enclosure.
4. Tube cable sizes shall be 4- or 2-cell depending on the design on the drawings. The standard tube in conduit shall be eABF DuraLine.
5. All unterminated or unoccupied tubes shall be plugged / capped on both ends with manufacturer specific tube sealing components.
6. All MDF tube cable will transition to 5mm OD clear tubing for routing to the FTU.

B. Products:
   1. AFL/Dura-Line
      a. OSP 4-Cell eABF Futurepath Enterprise
         • Part Number 10004655

PART 3 - EXECUTIONEXAMINATION

A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section. Examples of work which must be checked include, but are not limited to:
   1. Electrical requirements (conduit installation and capacity)
   2. The telecommunications rooms are the size shown on the project drawings.
   3. Adequate clearances of doors, riser spaces and ceilings for all component of the telecommunications system.
   4. Examine and compare the telecommunications drawings and specifications with the drawings and specifications of other trades. Report any discrepancies between them to the A/E and obtain written instructions for changes or revisions.

3.02 INSTALLATION

A. Process:
   1. Install all backbone cable per the manufacturer’s recommended installation instructions, under the guidelines of TIA/EIA 568C and BICSI, and in quantities indicated in the drawings.
   2. Install all cables with proper attention paid to bend radii, pulling method, attachment method, and pulling forces. The cable manufacturer's specifications for each particular cable type shall be followed exactly.
   3. Backbone cable shall be visually inspected for insufficient bend radius during and after pulling. Damaged cables, or those installed under questionable methods and/or circumstances shall be replaced at no additional cost to the owner.
   4. All cable shall be pulled using an appropriate measuring device to ensure that the specified force is not exceeded as noted in BICSI guidelines.
   5. Install backbone cables with attention paid to aesthetic means and methods when routing cabling within IT spaces. No backbone cable shall be left unsupported for more than three (3) feet vertically or horizontally at any time.
   6. Fiber optic cables shall be placed in neat bundles separated from other communications cabling. Fiber optic cables shall be neatly placed and lashed with Velcro ties to the horizontal and vertical cable management and runways at minimum 4-foot intervals, not to exceed every 4th rung, plus all locations where the cables change direction.
   7. Provide radius drop out fittings at all locations where fiber optic cables transition from vertical to horizontal cable management systems.
   8. All backbone cable shall be securely fastened to the termination shelf with a manufacturers strain relief bracket and termination panel cable clamp in a way that does not damage the optical fiber strands or impede the performance of the media. This secure fastening method shall also serve to insure a secure termination environment.
   9. A minimum of three feet (3’-0”) of each optical fiber strand shall be left protected within the termination shelf for any future re-termination of a particular optical fiber strand.

10. All backbone cables shall be clearly labeled on both ends and in an accessible location no more than one (1) foot from each cable end.

3.03 RE-INSTALLATION

A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components. Scheduling for re- installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work

3.04 CLOSEOUT ACTIVITIES

A. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.

B. Sub-contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner

END OF SECTION

SECTION 27 15 13

COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Provides specifications for four-pair UTP copper horizontal workstation cabling to distribute network signals from telecommunications distribution spaces to work area outlet locations.
   2. Category 6A CMP rated, Four-Pair Copper Cabling.

1.02 RELATED DOCUMENTS

A. All divisions of the specification and general provisions of the Construction Documents.

B. Architectural, mechanical, electrical, and all technology drawings.

1.03 REFERENCES

A. Abbreviations and Acronyms:

1.	ANSI:	American National Standards Institute
2.	A/E:	Architect / Engineer (designer)
3.	BICSI:	Building Industry Consulting Service International
4.	EIA:	Electronics Industry Alliance
5.	IDF:	Intermediate Distribution Facility
6.	LOMMF:	Laser Optimized Multi-Mode Fiber
7.	MDF	Main Distribution Facility
8.	NEXT:	Near End Cross Talk
9.	OSP:	Outside Plant
10.	PSELFEXT:	Power Sum Equal Level Far End Cross Talk
11.	PSNEXT:	Power Sum Near End Cross Talk
12.	RCDD:	Registered Communications Distribution Designer
13.	TCIM:	Telecommunication Cabling Installation Manual
14.	TDMM:	Telecommunications Distribution Methods Manual
15.	TIA:	Telecommunications Industry Association

B. Codes and Regulations: (Note: Reference Division One for specific code versions governing the work in addition to the information noted below.)
   1. National Electric Code (2017)
   2. National Fire Protection Association (NFPA)
   3. 2017 California Electrical Code
   4. 2017 California Building Code
   5. Local Municipal Codes

1.04 APPLICABLE REGULATORY REFERENCES

A. Sub-contractor is responsible for knowledge and application of current versions of all

applicable Standards and Codes. In cases where listed Standards and Codes have been updated, Sub-contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.

1. ANSI/TIA:
    a. TIA-526-7 (OFSTP-7) (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
    b. TIA-526-14-B (April 2015) (OFSTP-14) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
    c. ANSI/TIA/EIA-598-C (July 2014) Optical Fiber Cable Color Coding
    d. ANSI/TIA-568-C.0 (December 2015) Generic Telecommunications Cabling for Customer Premises
    e. TIA-568-C.0-1 (September 2012) Generic Telecommunications Cabling for Customer Premises-Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling
    f. ANSI/TIA-568-C.1 (February 2012) Commercial Building Telecommunications Cabling Standards
    g. TIA-568-C.1-2 (November 2014) Commercial Building Telecommunications Cabling Standard, Addendum 2 General Updates
    h. ANSI/TIA-568-C.2 (June 2016) Balanced Twisted Pair Communications Cabling and Components Standards
    i. ANSI/TIA-568-C.3 (June 2011) Optical Fiber Cabling Components Standard
    j. ANSI/TIA-568-C.3-1 (December 2011) Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors
    k. ANSI/TIA-1183 (August 2012) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
    l. ANSI/TIA-1183-1 (January 2016) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Addendum 1 – Extending Frequency Capabilities to 2 GHz.
    m. ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard
    n. ANSI/TIA-942-A (August 2012) Telecommunications Infrastructure Standard for Data Centers
    o. ANSI/TIA-942-A-1 (March 2013) Telecommunications Infrastructure Standard for Data Centers, Addendum 1 - Cabling Guidelines for Data Center Fabrics
    p. TIA-569-D (April 2015) Telecommunications Pathways and Spaces
    q. TIA-569-D-1 (October 2016) Telecommunications Pathways and Spaces Addendum 1- Revised Temperature and Humidity Requirements for Telecommunications Spaces
    r. ANSI/TIA-606-B (December 2015) Administration Standard for Telecommunications Infrastructure
    s. TIA-607-B (November 2015) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises
    t. TIA-607-B-1 (January 2017) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises - External Grounding Addendum
    u. TIA-758-B (April 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard

v. TIA-1152 (November 2016) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
w. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems.
x. TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
y. TIA-1005-A (June 2012) Industrial Telecommunications Infrastructure Standard for Manufacturing, Process & Refining
z. ANSI/TIA-1005 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises
aa. TIA-1005-1 (May 2012) Telecommunications Infrastructure Standard for Industrial Premises; Addendum 1 - Industrial Pathways and Spaces
bb. TIA-1179 (July 2010) Healthcare Facility Telecommunications Infrastructure Standard.

2. ISO/IEC
   a. ISO 11801 (November 2010) - Generic Cabling for Customer Premises
   b. ISO/IEC TR 14763-2-1:2012 - Information technology -- Implementation and operation of customer premises cabling -- Part 2-1: Planning and installation - Identifiers within administration system.
3. National Electric Codes
   a. National Electrical Safety Code (NESC) (IEEE C2-2012)
   b. ANSI/NFPA 70-2014, National Electrical Code© (NEC©)
   c. ANSI/IEEE C2-207, National Electrical Safety Code®
   d. National Electrical Code (NEC) (NFPA 70)
4. OSHA Standards and Regulations – all applicable
5. Local Codes and Standards – all applicable
6. BICSI
   a. Telecommunications Distribution Methods Manual, 13th Edition
   b. BICSI 004-2012, Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
   c. Information Technology Systems Installation Methods Manual (ITSIMM), 6th Edition
   d. ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices
   e. Network Systems and Commissioning (NSC) reference, 1st Edition
   f. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
   g. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
   h. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
   i. AV Design Reference Manual, 1st Edition
   j. Network Design Reference Manual, 7th Edition
   k. Outside Plant Design Reference Manual, 5th Edition
   l. Wireless Design Reference Manual, 3rd Edition
   m. Electronic Safety and Security Design Reference Manual, 3rd Edition.
7. Anywhere cabling Standards conflict with electrical or safety Codes, Sub-contractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.
8. Knowledge and execution of applicable codes is the sole responsibility of the Sub-contractor.

9. Any code violations committed at the time of installation shall be remedied at the Sub-contractor's expense.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Install and coordinate the telecommunications cabling work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interference in a manner accepted by the architect. Any repairs or changes made necessary in the contract work, caused by the sub-contractor's neglect, shall be made by the sub-contractor at their own expense.

B. Scheduling:
   1. Contract Documents and the overall construction schedule must be carefully reviewed to determine all required interfacing and timing of the work. All such documents shall be available through the General Contractor or Construction Manager.

1.06 ACTION SUBMITTALS

A. Product Data: For each product indicated.
   1. Submit all product data in accordance with general requirements of the construction documents.
   2. Submit product cut sheets and a detailed list of components a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
   3. Alternate and "Or Equal" designated products must be submitted for review and judgment to the A/E prior to installation. The sub-contractor-proposed alternate products or components must be verified by two (2) independent sources within the past 6 months. This request shall include the two (2) independent sources, the original Product's specification sheet, the proposed substitute product cut sheet, and a written request to review the substitute product.
   4. Any request of an alternate or substitution must be submitted to the A/E for action no later than fourteen (14) calendar days after release of the original telecommunications bid documents.

1.07 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:
   1. Submit all shop drawings in accordance with the general requirements of the construction documents.
   2. Submit shop drawings a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
   3. Shop drawings shall include evidence of grounding and bonding components are coordinated with field conditions and the work of other trades.
   4. This submittal may have a written component and a visual, drawn component for review and action by the A/E prior to installation.

B. Certificates:
   1. Submit management and installation team reference documentation verifying:
      a. The project manager is a RCDD in good standing with BICSI and is qualified to manage the scope of work described in the contract documents

and has five (5) years of experience managing similar projects in size and scope. The documentation shall include the RCDD registration number.

b. The field supervisor is a BICSI trained technician that is qualified to perform and oversee the work described in the contract documents

C. Qualification Statements:

1. The sub-contractor shall submit documentation that within the past 12 months, a minimum of 75% of all installation personnel have been trained or certified by the manufacturer of the products they are installing.

1.08 CLOSEOUT SUBMITTALS

A. As-Built Drawings:

1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
2. Submit as-built drawings a minimum of two (2) weeks after completion of all Division- 27 work for A/E and Owner reference:
3. All cabling must meet or exceed applicable TIA/EIA testing requirements and any additional parameters outlined in the Commissioning of Communications specification section 27 08 00.
4. Test results must be submitted for owner review and approval adhering to the General Contractor schedule milestones related to the projects active systems integration.

1.09 QUALITY ASSURANCE

A. Qualifications – Manufacturer

1. Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.

B. Qualifications – Installer:

1. At a minimum, seventy-five percent (75%) of the onsite sub-contractor provided field technicians shall be factory certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall be available on site for review at all times for each field technician.

PART 2 - PRODUCTS

2.01 FOUR PAIR CATEGORY 6A CABLING

A. Basis-of-Design Product: Subject to compliance with requirements:

1. Berk-Tek
   a. LANMark-XTP Category 6A CMR Rated
      1) Part Number 11082062

B. Product Options:

1. The indicated manufacturers shall be the basis of the design and each component selected shall address the particular infrastructure requirements.

C. Description:

1. All category-6A performance four (4) pair cable shall consist of eight (8) twenty-four (23) gauge, or greater, thermoplastic insulated solid twisted conductors that utilize the industry standard color code designations.
2. The performance criteria for four (4) pair cable shall be above and beyond specific EIA/TIA 568-C.2 standards for the particular cable's rating and shall show stable performance with documented electrical characterization out to 500 MHz.
3. Four (4) pair cables must perform over and above each of the current specification parameters for the latest published twisted pair, 10Gb performance cable solution.
4. Cables shall be rated per the installation environment as required by the local AHJ and local codes.
5. Select an appropriate cable construction, including external jacket properties, when installing cables in aerial, outdoor, underground and corrosive environments.
6. Cable to be run continuous without splices.

D. Accessory Products:
1. The indicated manufacturers shall be the basis of the design and each component selected shall address the particular infrastructure requirements.

PART 3 - EXECUTIONEXAMINATION

A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section. Examples of work which must be checked include, but are not limited to:
1. Electrical requirements (conduit installation and capacity)
2. The telecommunications rooms are the size shown on the project drawings.
3. Adequate clearances of doors, riser spaces and ceilings for all component of the telecommunications system.
4. Examine and compare the telecommunications drawings and specifications with the drawings and specifications of other trades. Report any discrepancies between them to the A/E and obtain written instructions for changes or revisions.

3.02 INSTALLATION

A. Process:
1. Install all horizontal station cabling per the manufacturer's recommended installation instructions, under the guidelines of TIA/EIA 568C and BICSI, and in quantities indicated in the drawings.
2. Locations requiring horizontal cable shall be, but not limited to, CCTV, work area outlet and WiFi.
3. Install all cables with proper attention paid to bend radii, pulling method, attachment method, and pulling forces. All cable shall be pulled using an appropriate measuring device to ensure that the specified force is not exceeded as noted in BICSI guidelines. Also refer to the cable manufacturer's specifications for exact cable requirements per the particular cable type.
4. All cables shall be visually inspected for insufficient bend radius during and after pulling. Damaged cables, or those installed under questionable methods and/or circumstances shall be replaced at no additional cost to the owner.

5. Sub-contractor shall ensure that all TIA/EIA and industry standards are met with special regards to maximum stripping length of cable jackets. No four (4) pair UTP cables shall have more than three-eight inch (3/8”) of cable jacket removed beyond the termination points.
6. Install the horizontal cabling with attention paid to aesthetic means and methods when routing cabling within IT spaces. All horizontal cabling should terminate in their respective floor serving technology space; specifically cables from floor outlets need to terminate in their corresponding floor telecom room.
7. All cabling distributed horizontally through metal stud framing shall have plastic protective bushings inserted to protect cables prior to installation.
8. All cables shall be clearly labeled on both ends and in an accessible location no more than six inches (0’-6”) from the cable ends.
9. The owner reserves the right to specify a new location for any outlet or equipment without increasing sub-contractor unit cost – providing that the new location is specified prior to roughing-in of technology cable and is not farther than ten (10) feet away from the original location specified.

3.03 RE-INSTALLATION

A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components. Scheduling for re- installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work

3.04 CLOSEOUT ACTIVITIES

A. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.

B. Sub-contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner

END OF SECTION

SECTION 27 15 43

FACEPLATES AND CONNECTORS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Provides specifications for horizontal workstation cable termination components and outlet housing component. Includes wall-mount, floor-mount, and ceiling-mount components to support the various workstation outlets throughout the cabling plant.
   2. Copper Category 6A Connectors
   3. Single-Mode Optical Fiber Pigtail Connector Assemblies/Splice-On Connectors
   4. Outlet Housing Components (faceplates etc.)

1.02 RELATED DOCUMENTS

A. All divisions of the specification and general provisions of the Construction Documents.

B. Architectural, mechanical, electrical, and all technology drawings.

1.03 REFERENCES

A. Abbreviations and Acronyms:

1.	ANSI:	American National Standards Institute
2.	A/E:	Architect / Engineer (designer)
3.	BICSI:	Building Industry Consulting Service International
4.	EIA:	Electronics Industry Alliance
5.	IDF:	Intermediate Distribution Facility
6.	LOMMF:	Laser Optimized Multi-Mode Fiber
7.	MDF	Main Distribution Facility
8.	NEXT:	Near End Cross Talk
9.	PSELFEXT:	Power Sum Equal Level Far End Cross Talk
10.	PSNEXT:	Power Sum Near End Cross Talk
11.	RCDD:	Registered Communications Distribution Designer
12.	SMF:	Single-Mode Fiber
13.	TCIM:	Telecommunication Cabling Installation Manual
14.	TDMM:	Telecommunications Distribution Methods Manual
15.	TIA:	Telecommunications Industry Association

B. Codes and Regulations: (Note: Reference Division One for specific code versions governing the work in addition to the information noted below.)
   1. National Electric Safety Code (2017)
   2. National Fire Protection Association (NFPA)
   3. 2017 California Electrical Code
   4. 2017 California Building Code
   5. Local Municipal Codes

1.04 APPLICABLE REGULATORY REFERENCES

A. Sub-contractor is responsible for knowledge and application of current versions of all applicable Standards and Codes. In cases where listed Standards and Codes have been updated, Sub-contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.

1. ANSI/TIA:
   a. TIA-526-7 (OFSTP-7) (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
   b. TIA-526-14-B (April 2015) (OFSTP-14) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
   c. ANSI/TIA/EIA-598-C (July 2014) Optical Fiber Cable Color Coding
   d. ANSI/TIA-568-C.0 (December 2015) Generic Telecommunications Cabling for Customer Premises
   e. TIA-568-C.0-1 (September 2012) Generic Telecommunications Cabling for Customer Premises-Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling
   f. ANSI/TIA-568-C.1 (February 2012) Commercial Building Telecommunications Cabling Standards
   g. TIA-568-C.1-2 (November 2014) Commercial Building Telecommunications Cabling Standard, Addendum 2 General Updates
   h. ANSI/TIA-568-C.2 (June 2016) Balanced Twisted Pair Communications Cabling and Components Standards
   i. ANSI/TIA-568-C.3 (June 2011) Optical Fiber Cabling Components Standard
   j. ANSI/TIA-568-C.3-1 (December 2011) Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors
   k. ANSI/TIA-1183 (August 2012) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
   l. ANSI/TIA-1183-1 (January 2016) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Addendum 1 – Extending Frequency Capabilities to 2 GHz.
   m. ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard
   n. ANSI/TIA-942-A (August 2012) Telecommunications Infrastructure Standard for Data Centers
   o. ANSI/TIA-942-A-1 (March 2013) Telecommunications Infrastructure Standard for Data Centers, Addendum 1 - Cabling Guidelines for Data Center Fabrics
   p. TIA-569-D (April 2015) Telecommunications Pathways and Spaces
   q. TIA-569-D-1 (October 2016) Telecommunications Pathways and Spaces Addendum 1- Revised Temperature and Humidity Requirements for Telecommunications Spaces
   r. ANSI/TIA-606-B (December 2015) Administration Standard for Telecommunications Infrastructure
   s. TIA-607-B (November 2015) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises
   t. TIA-607-B-1 (January 2017) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises - External Grounding Addendum

u. TIA-758-B (April 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
v. TIA-1152 (November 2016) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
w. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems.
x. TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
y. TIA-1005-A (June 2012) Industrial Telecommunications Infrastructure Standard for Manufacturing, Process & Refining
z. ANSI/TIA-1005 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises
aa. TIA-1005-1 (May 2012) Telecommunications Infrastructure Standard for Industrial Premises; Addendum 1 - Industrial Pathways and Spaces
bb. TIA-1179 (July 2010) Healthcare Facility Telecommunications Infrastructure Standard.

2. ISO/IEC
   a. ISO 11801 (November 2010) - Generic Cabling for Customer Premises
   b. ISO/IEC TR 14763-2-1:2012 - Information technology -- Implementation and operation of customer premises cabling -- Part 2-1: Planning and installation - Identifiers within administration system.
3. National Electric Codes
   a. National Electrical Code (2017)
   b. ANSI/NFPA 70-2017, National Electrical Code© (NEC©)
   c. ANSI/IEEE C2-207, National Electrical Safety Code®
   d. National Electrical Code (NEC) (NFPA 70)
4. OSHA Standards and Regulations – all applicable
5. Local Codes and Standards – all applicable
6. BICSI
   a. Telecommunications Distribution Methods Manual, 13th Edition
   b. BICSI 004-2012, Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
   c. Information Technology Systems Installation Methods Manual (ITSIMM), 6th Edition
   d. ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices
   e. Network Systems and Commissioning (NSC) reference, 1st Edition
   f. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
   g. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
   h. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
   i. AV Design Reference Manual, 1st Edition
   j. Network Design Reference Manual, 7th Edition
   k. Outside Plant Design Reference Manual, 5th Edition
   l. Wireless Design Reference Manual, 3rd Edition
   m. Electronic Safety and Security Design Reference Manual, 3rd Edition.
7. Anywhere cabling Standards conflict with electrical or safety Codes, Contractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.

8. Knowledge and execution of applicable codes is the sole responsibility of the Sub-contractor.
9. Any code violations committed at the time of installation shall be remedied at the Sub-contractor's expense.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Install and coordinate the telecommunications cabling work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interference in a manner accepted by the architect. Any repairs or changes made necessary in the contract work, caused by the sub-contractor's neglect, shall be made by the sub-contractor at their own expense.

B. Scheduling:
1. Contract Documents and the overall construction schedule must be carefully reviewed to determine all required interfacing and timing of the work. All such documents shall be available through the General Contractor or Construction Manager.

1.06 ACTION SUBMITTALS

A. Product Data: For each product indicated.
1. Submit all product data in accordance with general requirements of the construction documents.
2. Submit product cut sheets and a detailed list of components a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
3. Alternate and "Or Equal" designated products must be submitted for review and judgment to the A/E prior to installation. The sub-contractor-proposed alternate products or components must be verified by two (2) independent sources within the past 6 months. This request shall include the two (2) independent sources, the original Product's specification sheet, the proposed substitute product cut sheet, and a written request to review the substitute product.
4. Any request of an alternate or substitution must be submitted to the A/E for action no later than fourteen (14) calendar days after release of the original telecommunications bid documents.

1.07 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:
1. Submit all shop drawings in accordance with the general requirements of the construction documents.
2. Submit shop drawings a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
3. Shop drawings shall include evidence of grounding and bonding components are coordinated with field conditions and the work of other trades.
4. This submittal may have a written component and a visual, drawn component for review and action by the A/E prior to installation.

B. Certificates:
1. Submit management and installation team reference documentation verifying:

a. The project manager is a RCDD in good standing with BICSI and is qualified to manage the scope of work described in the contract documents and has five (5) years of experience managing similar projects in size and scope. The documentation shall include the RCDD registration number.
b. The field supervisor is a BICSI trained technician that is qualified to perform and oversee the work described in the contract documents

C. Qualification Statements:
1. The sub-contractor shall submit documentation that within the past 12 months, a minimum of 75% of all installation personnel have been trained or certified by the manufacturer of the products they are installing.

1.08 CLOSEOUT SUBMITTALS

A. As-Built Drawings:
1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
2. Submit as-built drawings a minimum of two (2) weeks after completion of all Division- 27 work for A/E and Owner reference:

1.09 QUALITY ASSURANCE

A. Qualifications – Manufacturer
1. Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.

B. Qualifications – Installer:
1. At a minimum, seventy-five percent (75%) of the onsite sub-contractor provided field technicians shall be factory certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall be available on site for review at all times for each field technician.

PART 2 - PRODUCTS

2.01 COPPER UTP CONNECTORS

A. Basis-of-Design Product: Subject to compliance with requirements:
1. Leviton: Category UTP Category 6A Connectors.

B. Product Options:
1. The manufacturers noted above shall be the only manufacturers acceptable to the Owner and A/E.

C. Description:
1. All UTP connectors shall be rated to perform at or above current TIA/EIA performance parameters of the UTP cabling it is terminating within the communications system.
2. All UTP connectors shall have an eight (8) position, eight (8)-conductor module that accepts RJ-45 plugs.
3. When utilized as part of a channel or permanent link, all high performance

modular outlet connectors shall not decrease the horizontal cable elevated performance transmission requirements before and after installation as specified in ANSI/TIA/EIA 568-C Commercial Building Telecommunications Cabling Standard (horizontal cable section) in all noted performance parameters.

D. Accessory Products:
   1. Provide any accessory products related to the UTP connectors required to provide a complete and functional infrastructure system.
   2. Port RJ-45 jack block out device to safely secure access to unused ports and deter vandalism to jacks.
   3. Provide complete with all required mounting hardware and fittings and cables needed.

2.02 SINGLE MODE OPTICAL FIBER PIGTAIL CONNECTORS ASSEMBLIES

A. Manufacturer List:
   1. AFL

B. Product Options:
   1. The manufacturers noted above shall be the only manufacturers acceptable to the Owner and A/E.

C. Description:
   1. Singlemode Optical fiber pigtail connector assemblies housed in manufacturers connector panels.
   2. AFL FUSEConnect Splice On Connector is acceptable.
   3. Duplex LC style connectors.
   4. Maximum insertion loss across mated pair shall be less than 0.3 dB, tested per FOTP-171 Method A. Typical Insertion loss should be maximum of 0.15 dB. Minimum return loss shall be less than 60.5 dB, tested per FOTP-171. Typical return loss should be 60 dB.
   5. Pigtails shall have minimum 2 meters of attached cordage.
   6. Pigtails shall be assembled and tested by the connector manufacturer.

D. Accessory Products:
   1. Provide any accessory products and tool kits related to the termination of the optical fiber connectors to provide a complete and functional infrastructure system.

2.03 OUTLET HOUSING COMPONENTS

A. Manufacturer List:
   1. Leviton
      a. Cat6A Connectors Atlas-X1
         1) Part Number 6AUJK-RL6 (L=Blue)
      b. Wall Plates 4-Port Angled Single Gang
         1) Part Number 42081-4Xs (x-Color)

B. Product Options:
   1. The manufacturers noted above shall be the only manufacturers acceptable to the Owner and A/E.

C. Description:
   1. All outlet housings at the various technology outlet locations shall provide the designated number modular insert ports as indicated in the drawings.
   2. All flush-mounted faceplates shall be provided per the port configurations shown on the telecom drawings.
   3. Faceplates for wall-mounted phones shall be one (1) port single gang faceplates that have wall-mount lugs allowing vertical phone mounting.
   4. Faceplates for flush floor mounted outlets shall be coordinated with the floor box or poke thru device that will be selected and installed outside the scope of this section.
   5. System furniture faceplates shall be capable of fitting in the furniture system selected by the Owner. Furniture faceplates shall be provided per the port configurations shown on the telecom drawings. Furniture faceplate extenders shall be used (if required) to maintain proper bend radii within the furniture raceway/pathway.
   6. Surface mounted boxes shall be capable of the quantity of outlet jack requirements at each outlet locations indicted in the drawings.
   7. All outlet-housings shall provide a clear TIA/EIA 606-A labeling location for both the individual outlet port and the entire outlet housing location, unless otherwise indicated in the project drawings.

D. Accessory Products:
   1. Provide any accessory products related to the workstation outlet housing components required to provide a complete and functional infrastructure system.

PART 3 - EXECUTIONEXAMINATION

A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section. Examples of work which must be checked include, but are not limited to:
   1. Electrical requirements (conduit installation and capacity)
   2. The telecommunications rooms are the size shown on the project drawings.
   3. Adequate clearances of doors, riser spaces and ceilings for all component of the telecommunications system.
   4. Examine and compare the telecommunications drawings and specifications with the drawings and specifications of other trades. Report any discrepancies between them to the A/E and obtain written instructions for changes or revisions.

3.02 INSTALLATION

A. Process:
   1. Install all connectors and couplers under the guidelines of the manufacturers' recommended instructions and per all TIA/EIA 568C standards, BICSI guidelines, and manufacturer approved industry practices.
   2. The installation and performance parameters of all installed couplers and connectors shall be verified by the trade sub-contractor through TIA/EIA 568C testing procedures.
   3. Color of all outlet housing components shall be coordinated with the Owner before purchase and installation.
   4. All technology outlets located on walls shall be flush mounted, level and plumb.

5. All technology outlets shall be mounted at right angles and parallel to the floor, unless installation requirements or design dictate otherwise.
6. Install blank inserts in outlet housing spaces that are not being filled with cable termination modules. Blank inserts shall match the workstation housing color, unless otherwise indicated in the drawings.
7. All outlets located in systems furniture may be served from a wall adjacent to the furniture cluster or a floor box. If the cable is exposed prior to entering furniture raceway, install spiral wrap tubing to protect the cable per the manufacturer's recommendations.
8. All outlet housings as well as each individual utilized port must be labeled in accordance with the Owner-approved labeling scheme.

3.03 RE-INSTALLATION

A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components. Scheduling for re- installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work

3.04 CLOSEOUT ACTIVITIES

A. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.

B. Sub-contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner

END OF SECTION

SECTION 27 16 19

COMMUNICATION PATCH CORDS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Provides specifications for Category 6 and optical fiber horizontal cable patching to distribute network signals.
   2. Copper Category 6A Patch Cords.
   3. Optical Fiber Patch Cords.

1.02 RELATED DOCUMENTS

A. All divisions of the specification and general provisions of the Construction Documents.

B. Architectural, mechanical, electrical, and all technology drawings.

1.03 REFERENCES

A. Abbreviations and Acronyms:

1.	ANSI:	American National Standards Institute
2.	A/E:	Architect / Engineer (designer)
3.	BICSI:	Building Industry Consulting Service International
4.	EIA:	Electronics Industry Alliance
5.	IDF:	Intermediate Distribution Facility
6.	LOMMF:	Laser Optimized Multi-Mode Fiber
7.	MDF	Main Distribution Facility
8.	NEXT:	Near End Cross Talk
9.	RCDD:	Registered Communications Distribution Designer
10.	SMF:	Single-Mode Fiber
11.	TCIM:	Telecommunication Cabling Installation Manual
12.	TDMM:	Telecommunications Distribution Methods Manual
13.	TIA:	Telecommunications Industry Association

B. Codes and Regulations: (Note: Reference Division One for specific code versions governing the work in addition to the information noted below.)
   1. National Electric Safety Code (NESC) – 2017
   2. National Fire Protection Association (NFPA)
   3. 2016 California Electrical Code
   4. 2016 California Building Code
   5. Local Municipal Codes

1.04 APPLICABLE REGULATORY REFERENCES

A. Sub-contractor is responsible for knowledge and application of current versions of all applicable Standards and Codes. In cases where listed Standards and Codes have

been updated, Sub-contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.

1. ANSI/TIA:
    a. TIA-526-7 (OFSTP-7) (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
    b. TIA-526-14-B (April 2015) (OFSTP-14) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
    c. ANSI/TIA/EIA-598-C (July 2014) Optical Fiber Cable Color Coding
    d. ANSI/TIA-568-C.0 (December 2015) Generic Telecommunications Cabling for Customer Premises
    e. TIA-568-C.0-1 (September 2012) Generic Telecommunications Cabling for Customer Premises-Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling
    f. ANSI/TIA-568-C.1 (February 2012) Commercial Building Telecommunications Cabling Standards
    g. TIA-568-C.1-2 (November 2014) Commercial Building Telecommunications Cabling Standard, Addendum 2 General Updates
    h. ANSI/TIA-568-C.2 (June 2016) Balanced Twisted Pair Communications Cabling and Components Standards
    i. ANSI/TIA-568-C.3 (June 2011) Optical Fiber Cabling Components Standard
    j. ANSI/TIA-568-C.3-1 (December 2011) Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors
    k. ANSI/TIA-1183 (August 2012) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
    l. ANSI/TIA-1183-1 (January 2016) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Addendum 1 – Extending Frequency Capabilities to 2 GHz.
    m. ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard
    n. ANSI/TIA-942-A (August 2012) Telecommunications Infrastructure Standard for Data Centers
    o. ANSI/TIA-942-A-1 (March 2013) Telecommunications Infrastructure Standard for Data Centers, Addendum 1 - Cabling Guidelines for Data Center Fabrics
    p. TIA-569-D (April 2015) Telecommunications Pathways and Spaces
    q. TIA-569-D-1 (October 2016) Telecommunications Pathways and Spaces Addendum 1- Revised Temperature and Humidity Requirements for Telecommunications Spaces
    r. ANSI/TIA-606-B (December 2015) Administration Standard for Telecommunications Infrastructure
    s. TIA-607-B (November 2015) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises
    t. TIA-607-B-1 (January 2017) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises - External Grounding Addendum
    u. TIA-758-B (April 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
    v. TIA-1152 (November 2016) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling

w. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems.
x. TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
y. TIA-1005-A (June 2012) Industrial Telecommunications Infrastructure Standard for Manufacturing, Process & Refining
z. ANSI/TIA-1005 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises
aa. TIA-1005-1 (May 2012) Telecommunications Infrastructure Standard for Industrial Premises; Addendum 1 - Industrial Pathways and Spaces
bb. TIA-1179 (July 2010) Healthcare Facility Telecommunications Infrastructure Standard.

2. ISO/IEC
   a. ISO 11801 (November 2010) - Generic Cabling for Customer Premises
   b. ISO/IEC TR 14763-2-1:2012 - Information technology -- Implementation and operation of customer premises cabling -- Part 2-1: Planning and installation - Identifiers within administration system.
3. National Electric Codes
   a. National Electrical Safety Code (2017)
   b. ANSI/NFPA 70-2017, National Electrical Code© (NEC©)
   c. ANSI/IEEE C2-207, National Electrical Safety Code®
   d. National Electrical Code (NEC) (NFPA 70)
4. OSHA Standards and Regulations – all applicable
5. Local Codes and Standards – all applicable
6. BICSI
   a. Telecommunications Distribution Methods Manual, 13th Edition
   b. BICSI 004-2012, Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
   c. Information Technology Systems Installation Methods Manual (ITSIMM), 6th Edition
   d. ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices
   e. Network Systems and Commissioning (NSC) reference, 1st Edition
   f. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
   g. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
   h. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
   i. AV Design Reference Manual, 1st Edition
   j. Network Design Reference Manual, 7th Edition
   k. Outside Plant Design Reference Manual, 5th Edition
   l. Wireless Design Reference Manual, 3rd Edition
   m. Electronic Safety and Security Design Reference Manual, 3rd Edition.
7. Anywhere cabling Standards conflict with electrical or safety Codes, Sub-contractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.
8. Knowledge and execution of applicable codes is the sole responsibility of the Sub-contractor.
9. Any code violations committed at the time of installation shall be remedied at the Sub-contractor’s expense.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Install and coordinate the telecommunications cabling work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interference in a manner accepted by the architect. Any repairs or changes made necessary in the contract work, caused by the sub-contractor's neglect, shall be made by the sub-contractor at their own expense.

B. Scheduling:
   1. Contract Documents and the overall construction schedule must be carefully reviewed to determine all required interfacing and timing of the work. All such documents shall be available through the General Contractor or Construction Manager.

1.06 ACTION SUBMITTALS

A. Product Data: For each product indicated.
   1. Submit all product data in accordance with general requirements of the construction documents.
   2. Submit product cut sheets and a detailed list of components a minimum of six (2) weeks prior to commencement of Division-27 work for A/E review and action.
   3. Alternate and "Or Equal" designated products must be submitted for review and judgment to the A/E prior to installation. The sub-contractor-proposed alternate products or components must be verified by two (2) independent sources within the past 6 months. This request shall include the two (2) independent sources, the original Product's specification sheet, the proposed substitute product cut sheet, and a written request to review the substitute product.
   4. Any request of an alternate or substitution must be submitted to the A/E for action no later than fourteen (14) calendar days after release of the original telecommunications bid documents.

B. Samples:

1.07 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:
   1. Submit all shop drawings in accordance with the general requirements of the construction documents.
   2. Submit shop drawings a minimum of six (2) weeks prior to commencement of Division-27 work for A/E review and action.
   3. Shop drawings shall include evidence of grounding and bonding components are coordinated with field conditions and the work of other trades.
   4. This submittal may have a written component and a visual, drawn component for review and action by the A/E prior to installation.

B. Certificates:
   1. Submit management and installation team reference documentation verifying:
      a. The project manager is a RCDD in good standing with BICSI and is qualified to manage the scope of work described in the contract documents

and has five (5) years of experience managing similar projects in size and scope. The documentation shall include the RCDD registration number.

b. The field supervisor is a BICSI trained technician that is qualified to perform and oversee the work described in the contract documents

C. Qualification Statements:

1. The sub-contractor shall submit documentation that within the past 12 months, a minimum of 75% of all installation personnel have been trained or certified by the manufacturer of the products they are installing.

1.08 CLOSEOUT SUBMITTALS

A. As-Built Drawings:

1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
2. Submit as-built drawings a minimum of two (2) weeks after completion of all Division- 27 work for A/E and Owner reference:

1.09 QUALITY ASSURANCE

A. Qualifications – Manufacturer

1. Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.

B. Qualifications – Installer:

1. At a minimum, seventy-five percent (75%) of the onsite sub-contractor provided field technicians shall be factory certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall be available on site for review at all times for each field technician.

PART 2 - PRODUCTS

2.01 COPPER UTP PATCH CORDS

A. Basis-of-Design Product: Subject to compliance with requirements:

1. Leviton:
   a. TR Patch Cords - Atlas-X1 Cat6A Slimline Black
      1) Part Number 6AS10-05E (5') (E=Black)
      2) Part Number 6AS10-07E (7') (E=Black)
   b. Station Patch Cords - Atlas-X1 Cat6A Slimline Blue
      1) Part Number 6AS10-xxL (xx=3,5,7,10,15,20 Feet) (L=Black)

B. Product Options:

1. The indicated manufacturers shall be the basis of the design and each assembly selected shall address the particular infrastructure requirements.

C. Description:

1. Category UTP Copper patch cords for equipment patching (RJ-45 to RJ-45 Cords): Modular RJ45 male plug connector's equipped with (8) eight gold anodized pins shall be factory terminated at each end of the patch cords.

Modular plug connectors will be snag free in design or will utilize a molded plastic boot to cover the modular plug tab. Category 6A UTP cords shall be 26 AWG.

2. All patch cords shall conform to the requirements of the EIA/TIA 568C.2 standard performance parameters and shall also guarantee headroom margin above the minimum EIA/TIA 568C standard NEXT and PSNEXT requirements; and shall provide positive ACR to 5000 MHz-km as part of the connectivity system.
3. All copper UTP patch cords shall have stranded conductors that match the EIA/TIA 568-C performance characteristics of the category cable specified.
4. Patch cord performance levels shall be equal to or greater than the performance level of the installed UTP cabling system.
5. All copper patch cord lengths for patching inside the telecom rooms are to be provided appropriate to patching from network equipment ports to the copper patch panels ports within the Data Center and IDF.

D. Accessory Products:
1. Provide any accessory products related to the UTP connectors required to provide a complete and functional infrastructure system.
2. Port RJ-45 patch cord lock-in device to safely secure access to patched cords and deter accidental removal to network connection.
3. Provide complete with all required mounting hardware and fittings and cables needed.

2.02 OPTICAL FIBER PATCH CORDS

A. Basis-of-Design Product: Subject to compliance with requirements:
1. AFL/Dura-Line

B. Product Options:
1. The indicated manufacturers shall be the basis of the design and each assembly selected shall address the particular infrastructure requirements.

C. Description:
1. All optical fiber patch cords shall conform to the requirements of the EIA/TIA 568C.3- 1 standard performance parameters for the multimode or single-mode optical fiber and shall have the same manufacturer, cable type, connector and polish as noted for the backbone fiber.
2. All optical patch cords shall have push-pull strain relief boot and duplex clip.
3. All optical fiber patch cord lengths are to be provided appropriate to patching from network equipment ports to the optical fiber patch panels ports within the MDF and IDF.
4. It is the responsibility of the Sub-contractor to verify lengths and counts of optical fiber patch cords with the owner prior to purchase.
5. All single-mode patch cord colors are to be industry standard yellow and provided in a duplex configuration.
6. All multi-mode patch cord colors are to be industry standard aqua and provided in a duplex configuration.
7. Any optical fiber patch cords purchased without written authorization by the Owner are purchased at the sub-contractors own risk.

D. Accessory Products:

1. Provide any accessory products related to the optical fiber connectors required to provide a complete and functional infrastructure system.

PART 3 - EXECUTIONEXAMINATION

A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section. Examples of work which must be checked include, but are not limited to:
   1. Electrical requirements (conduit installation and capacity)
   2. The telecommunications rooms are the size shown on the project drawings.
   3. Adequate clearances of doors, riser spaces and ceilings for all component of the telecommunications system.
   4. Examine and compare the telecommunications drawings and specifications with the drawings and specifications of other trades. Report any discrepancies between them to the A/E and obtain written instructions for changes or revisions.

3.02 INSTALLATION

A. Process:
   1. Install all horizontal cable per the manufacturer's recommended installation instructions, under the guidelines of TIA/EIA 568 C and BICSI.
   2. Category 6A equipment Patch cords: Provide (2) copper patch cords (one for each end of the cable termination) for every Category cable installed.
   3. Fiber Optic equipment Patch cords: Provide (2) fiber optic LC duplex patch cords (one for each end of fiber termination) for every pair of fiber strands installed.
   4. All patch cord lengths are to be provided appropriate to patch from rack mounted network equipment ports to the rack mounted horizontal station outlet patch panel ports within the Data Center/IDF and from the workstation outlet to the computer/or other IP end device NIC card/RJ45 port.
   5. Provide new, sealed patch cords in lengths, colors and counts approved in writing by the owner.
   6. It will be the responsibility of the communication sub-contractor to provide install all Category 6A and Fiber patch cords per direction and coordination of owner IT dept.

3.03 RE-INSTALLATION

A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components. Scheduling for re- installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work.

3.04 CLOSEOUT ACTIVITIES

A. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.

B. Sub-contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner.

END OF SECTION

SECTION 27 51 13

PAGING SYSTEMS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The work under this section includes all final design, all labor, material, equipment, supplies, network, control and audio system programming, Speaker Alignment, testing, transportation and accessories required to furnish and install a complete-seamless, integrated Paging System as indicated on the drawings and as specified herein. The AVS shall be defined as all cables, equipment, products, etc, as indicated on the drawings, and mentioned in these specifications.

B. It is the intent of the Drawings and Specifications, which are presented in a "design-build" format, for the Contractor to design, provide and install a complete, fully operational, and tested system.

C. All miscellaneous system components including, but not limited to, plenum cables, speakers, signal converters, interface panels and components, termination equipment, patch panels, backboards, converters, controllers, digital signal processors, amplifiers, pre-amps, custom faceplates, mounting hardware, fasteners, racks, cabinets, and any other related items shall be furnished and installed complete under this section, such that the system shall perform all functions listed herein in compliance with all of the specified requirements.

D. Schedule is paramount to the project's success. With this, the Contractor will have to be a team player, continually working with the team to facilitate expeditious design, procurement, and construction processes.

E. This project will be performed in a phased construction format. Each phase of construction will be completely installed, labeled and tested, to the greatest extent physically possible, before moving to the next phase.

1.02 RELATED WORK, STANDARDS, DOCUMENTS AND PUBLICATIONS

A. Documents affecting work of this section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and sections of all Divisions of these specifications.

B. All applicable portions shall apply to this section as though written herein completely.

C. Contractor is responsible to reference all Architectural, Mechanical, Electrical, and Structural Drawings for additional information about pathways and or obstructions.

1.03 GENERAL REQUIREMENTS

A. Manufacturer: The term "manufacturer" shall be defined as the company, or group of companies, that produces the products meeting the requirements of Section 2 of this

document. The manufacturer shall have a minimum of ten (10) year's experience in manufacturing products of this type and shall be ISO 9001 Certified.

B. Contractor: The term "contractor" shall be defined as the company, or group of companies, that installs the products per Section 3 of this document. The contractor selected to provide the installation of this system shall be certified by the manufacturer in all aspects of design, installation and testing of the products described herein.
   1. The Contractor shall hold a valid State of California C-7 Low-Voltage license, shall have completed at least ten (10) projects of equal scope, shall have been in business of furnishing and installing systems of this scope and magnitude for at least two (2) years, and capable of being bonded to assure the Owner's Project Manager of performance and satisfactory service during the guarantee period.
   2. The Contractor shall hold all other licenses required by the legally constituted authorities having jurisdiction over the work.
   3. All work shall be performed under the supervision of a company accredited by the manufacturer and such accreditation must be presented.
   4. The Contractor shall be a manufacturer's authorized distributor and warrantee station for the equipment offered and shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The Contractor must be certified by the manufacturer a minimum of 180 days prior to bid opening.
   5. The Contractor selected for this Project must adhere to the engineering, installation and testing procedures and utilize the authorized manufacturer components and distribution channels in provisioning this Project.
   6. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of fiber optic cable and Category 6A metallic premise distribution systems and have personnel who are adequately trained in the used of such tools and equipment.
   7. Personnel: Use adequate numbers of skilled workers who are thoroughly trained and experienced with the specified requirements and the methods needed for proper performance of the AV systems installation work specified herein.
   8. Designated Project Engineer: Provide a designated Project Engineer in responsible charge of the Design, CAD, In-House testing and on the on-site commissioning of the Project during all phases of the work of this specification. This Project Engineer shall hold a current InfoComm CTS-D and Biamp Vocia certifications minimum, and shall be the same individual through the execution of the work unless illness, loss of personnel, or other circumstances reasonably beyond the control of the Contractor intervene.
   9. Technicians: shall have at least three (3) years direct experience in similar work. The AVS technicians assigned to this project shall be fully trained, qualified and carry valid and current industry certifications regarding the, installation, operation and testing of audiovisual systems. At least one InfoComm CTS / CTS-I and Biamp Vocia certifications shall be assigned as Lead Technician to the project.
   10. Custom Control System Programmer: Provide at least one (1) full time programmer on staff, capable of on-site custom programming of the custom remote-control system specified herein. Control System Programmer to hold the following certifications: InfoComm CTS, and Biamp Vocia certifications. A programming Sub-Contractor may be used if the Programmer has the certifications as listed above.
   11. Designated Project Manager: Provide a designated Project Manager in responsible charge of the fabrication shop and on the Project Site during all phases

of installation and testing of the work of this specification. The Project Manager shall hold current InfoComm CTS and shall be the same individual through the execution of the work unless illness, loss of personnel, or other circumstances reasonably beyond the control of the Contractor intervene.

1.04 QUALITY ASSURANCE

A. To maintain a high degree of quality assurance, the Contractor shall, without exception, use the parts and supplies as specified on the drawings and in this specification.

B. For any proposed product substitution or when the Contractor intends to include an "or equal" product in the bid pricing, provide a substitution request submittal to the Owner's Project Manager for review no later than fifteen (15) calendar days prior to Bid submittal. This report shall include:
   1. Description of how the proposed product(s) will impact meeting the project completion date, indicate item(s) with lead times and expected delivery date(s).
   2. Itemized cost comparisons between the proposed product(s) and the listed product(s).
   3. Detailed technical analysis of the electrical and mechanical specification differences between the proposed product(s) and the listed product(s).
   4. ETL "Verified" or UL "Verified" test lab documentation for the proposed product(s), component(s) and assemblies.
   5. Proposed product identification, manufacturer literature (specifications and cut sheets).
   6. Name, address and contact information of several similar projects where the proposed product(s) have been used.
   7. Name, address and contact information of the proposed product(s) manufacturer's local representative.
   8. Sample proposed product(s) manufacturer's warranty.

C. The Owner's Design Team/Project Manager must approve any proposed product(s) substitution item in writing. The Owner's Design Team/Project Manager reserves the right to require a complete sample of any proposed product(s) and may request a sample tested by an independent testing consultant to prove equality. The decision of the Owner's Design Team/Project Manager regarding equality of proposed product(s) items will be final.

D. If a proposed product(s) is given final acceptance by the Owner's Project Manager, the Contractor shall reimburse the Owner's Design Team/Project Manager for the costs to review the proposed product(s) substitution(s), and for any additional engineering charges, and shall pay all charges of other trades resulting from this product(s) use, at no cost to the Owner.

E. It is a mandatory requirement that a single Contractor perform the work described in this specification.

1.05 BID SUBMITTAL REQUIREMENTS

A. Pre-Qualification Certificates: Provide current training certificates for design, engineering, installation and testing of the proposed products.

B. Manufacturer Tests: Contractor shall submit all manufacturer test information prior to installation. If equivalent product(s) are substituted, the equivalent product(s) must show demonstrated and documented equivalence to the product(s) specified.

C. Bid Forms: Contractor shall submit completed the detailed bid forms provided with this specification. Lump sum bids will not be accepted.

D. Project Narrative: Contractor shall submit a summary of the scope of work, in Contractor's own words, illustrating a complete and thorough understanding of the project. The narrative shall include, but not be limited to room by room scope of work, project staffing and duration, quality assurance procedures and methodology, problem escalation procedures, and project schedule.

E. Proposed Solution: The Contractor shall provide manufacturers cut-sheets for all the proposed materials that meet the requirements listed / described in Section 2 of this specification. On each cut sheet, provide an indicating arrow next to each part number of proposed material.

F. A resume of qualification shall be submitted with the Contractor's bid indicating the following:
   1. The Contractor shall hold a valid State of California C-7 Low-Voltage license, shall have completed at least ten (10) projects of equal scope, shall have been in business of furnishing and installing systems of this scope and magnitude for at least five (5) years, and capable of being bonded to assure the Owner's Project Manager of performance and satisfactory service during the guarantee period.
   2. The Contractor shall hold all other licenses required by the legally constituted authorities having jurisdiction over the work.
   3. A technical resume of experience for the Contractor's Project Manager who will be assigned to this project. This individual will remain as Project Manager for the duration of the project. The Contractor may change Project Managers only with the Owner's Project Manager's written approval.
   4. All personnel performing work on this project must have successfully completed the manufacturer's installation training course prior to performance of any work on this project. Accreditation will consist of individual employee certifications issued by the manufacturer. Copies of certification of such training must be presented prior to any work performed on this project. A list of technical product installation training attended by the Contractor's personnel within the past two (2) years that will install the Contractor shall be submitted with the response.

G. The Contractor shall furnish a letter from the manufacturer, which certifies that the contractor is the Authorized Distributor and that the equipment shall be installed according to manufacturer intended practices. The Contractor shall also furnish a written guarantee from the manufacturer that they will have a service representative assigned to this area for the life of the equipment.

H. The Contractor shall submit a detailed Bill of Materials developed for the project. The Bill of Materials shall contain a complete list of every component, part or device by part description, manufacturer and manufacturer's part number, quantity and unit of measure. See example format below. Product cut sheets shall be organized to match the order listed in the bill of materials. All cut sheets shall be numbered sequentially with matching page numbers indicated on the Bill of Materials. If more than one-part number appears

on a cut sheet, Contractor shall identify the proposed part with a RED arrow or RED circle.

Description	MFG & Part #	Quantity	Unit of Measure	Price
Speaker	QSC Audio	1	Each	$

I. This information may be used by the Owner to evaluate the Contractor's general understanding of the project scope during the bid evaluation. Errors/Omissions from this bill of material do not relieve the AVS contractor from providing all material, components, labor, etc., as outlined in this specification and on the drawings to provide a complete and useable AVS system.

J. Provide 3 copies of the above information at bid time.

1.06 POST AWARD SUBMITTALS: SUBMIT WITHIN THIRTY (30) DAYS OF AWARD.

A. Submittals shall be in two (2) deliverables, the first submittal shall be equipment cut sheets and equipment index in PDF format. The second submittal shall be electronic reproducible shop drawings including single line block drawings, equipment locations, and mounting details (as pdf).
   1. A statement of sub-contractors, franchises, distributorship, dealerships, arrangements and agreements with manufacturers of equipment to be used for this work.
   2. Complete bill of quantities, including all material, components, devices and equipment required for this work. The bill of quantities shall be tabulated respective of each system as specified, in the order of the specification section 2 below, and shall contain the following information for each item listed:
      a. Quantity
      b. Description
      c. Manufacturer's name and model number
      d. Manufacturer's specification sheet

B. Samples approved by the architect, of all finishes/materials which will be visible to the public. Including at least receptacles and controls with associates trim plate and each type of loudspeaker baffle and/or grille.

C. Functional Diagrams: single-line block diagram showing interconnection of all components, receptacles, terminal blocks, controls, transformers and loudspeakers in addition to the active elements. Include terminal and cable numbers, all system and component labels. Show detailed system component information including but not limited to manufacturer's name, model number, any specialized part number option and all input and output connection information, for each piece of equipment. No drawing codes shall be permitted. Provide one (1) full-scale original or photograph (not blueprint) copy for each system. All shop drawing shall follow The InfoComm standard ANSI-J-STD-710 for audio, video, and control.

D. Equipment rack elevation drawings scaled (1-1/2" = 1'-0" or larger):
   1. Front Elevations: include equipment designation, manufacturer's name, model number, rack location and rack designation.
   2. Rear Elevations: include AC power wire-ways and route of wiring harnesses.

E. Samples for approval by the architect of all finishes/materials that will be visible to the public including at least receptacles and controls with associated trim plate and each type of loudspeaker baffle and/or grille.

F. AV contractor fabricated items, detailed drawings showing all components, devices and equipment, including dimensions, component values, terminal designations, types, locations, manufacturer's name and model number.

1.07 GENERAL SYSTEM PRODUCT, INSTALLATION AND OVERALL SYSTEM WARRANTY

A. Prior to Owner acceptance, the Contractor shall provide to the Owner's Project Manager, a manufacturers product and performance warranty. This will require a submittal of the required pre-job certification registration forms as well as the required project closing information. The Owner will only acknowledge acceptance upon submittal of a valid manufacturer's warranty.

B. Manufacturer's Site Certifications will not be accepted.

C. The warranty shall commence from the date of the Owners final written acceptance of the completed project.

D. All conditions for obtaining the manufacturers warranty shall be the sole responsibility of the Contractor.

E. The Contractor shall maintain a competent service organization and shall, if requested, submit a service maintenance agreement to the Owner after the end of the guarantee period.

F. A typewritten notice shall be posted at the equipment rack that shall indicate the firm, address and telephone number to call when service is necessary. The notice shall be mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside of the door.

1.08 SPECIFIC SYSTEM PRODUCT, INSTALLATION AND OVERALL SYSTEM WARRANTY

A. Prior to Owner acceptance, the Contractor shall provide to the Owner's Project Manager, a manufacturers product and performance warranty. This will require a submittal of the required pre-job certification registration forms as well as the required project closing information. The Owner will only acknowledge acceptance upon submittal of a valid manufacturer's warranty.

B. The warranty shall commence from the date of the Owners final written acceptance of the completed project.

C. All conditions for obtaining the manufacturer's warranty shall be the sole responsibility of the Contractor.

D. The Contractor shall maintain a competent service organization and shall, if requested, submit a service maintenance agreement to the Owner after the end of the guarantee period.

E. A typewritten notice shall be posted at the equipment rack that shall indicate the firm, address and telephone number to call when service is necessary. The notice shall be mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside of the door.

PART 2 - PRODUCTS AND AUDIOVISUAL SYSTEM SCOPE OF WORK

2.01 ACCEPTABLE MANUFACTURERS

A. All equipment listed herein will be by:
   1. Biamp, Extron, Belden, West Penn, or Equal.

B. It is the responsibility of the bidder to ensure that the proposed product meets or exceeds every standard set forth in these specifications and the equipment's technical data sheets.

C. The functions and features specified are vital to the operation of this facility. Therefore, inclusion of a component's manufacturer in the list of acceptable manufacturers does not release the Contractor from strict compliance with the requirements of this specification.

2.02 SYSTEM FUNCTIONS AND CAPABILITIES:

A. The sound equipment will be housed in shared racks. The sound system shall be controlled by an Control System for the system functionality and volume control panels for manual control of the distributed speaker system zones.

B. The AVS shall provide clear, natural sound uniformly distributed throughout the designated areas. The system shall utilize speakers as shown on the plans. These quantities shall be considered as the minimum quantity required. If additional speakers are needed to meet the requirements of section 2.02 sections C thru G below, the AVS Contractor shall include all costs for added speakers in the base bid.

C. The system shall have adequate dynamic range without audible clipping or distortion to accommodate all types of program material. Audio, Digital Signal Processing shall be employed in the designated rooms to insure smooth frequency response, high acoustical gain before feedback. When at maximum level, the system shall operate without audible distortion, rattles and buzzes. All switching shall be silent and without pops and or transients.

D. The system frequency response shall be within +/- 2dB from a curve which is flat from 80Hz to 4kHz and decreasing 3dB per octave from a relative level of 0 dB from 4kHz to 10kHZ. There shall be a minimum 12dB roll-off above 10 kHz and below 63 Hz. Uniformity of coverage of the system at seated ear height (42") shall be within +/- 3dB in the 4kHz 1/3 octave band at any seat location using pink noise as a test signal.

E. System noise shall not exceed an equivalent input noise of -120dB based on a 20KHz-noise bandwidth. The predominant noise component in the system output under any operating condition shall be that of the input stage.

F. The system shall provide clear audio to all areas covered by the system. Each zone shall be wired discretely to the correct zone on the AMP. See AVS drawings for exact location.

2.03 SCOPE OF WORK

A. The emergency paging system shall be networked based. Input source to the system shall be with a network to analog audio interface and a desk top microphone control station. Campus wide paging software used is Informacast by Singlewire and networked desk station microphone. Main paging processor will reside in the MDF Room A06, with processor/amplifier combo unit in IDF's H01 & K03. Speakers have been design in multiple zones however, the paging will take place as one combined zone.

2.04 AUDIOVISUAL SYSTEM PRODUCTS

A. The system shall utilize AV products as shown on the Plans and listed below. These products shall be the minimum quantity, performance, functionality and quality levels. If additional and/or upgraded components are needed to meet the performance requirements of this specification, the AVS Contractor shall include all costs for such added and/or upgraded components in the base bid.

B. Paging Systems Equipment
   1. Audio
      a. SPK1-1 to SPK1-x
         1) 45-Each, QSC ADS-8T, Speaker, YMS8T Yoke Mount kit, and all mounting hardware.
      b. DSP1-1
         1) 1-Each, Biamp Vocia VI-8 Paging Digital Signal Processor.
      c. DSP2-1 & DSP2-2
         1) 2-Each, Biamp Vocia VA43000CV, Paging DSP and Power Amplifier.
      d. INT1-1
         1) 1-Each, Atlas IED ZCM-V2+, IP to Analog Audio Interface.
      e. MIC1-1
         1) 1-Each, Biamp Vocia DS-4, Desktop Paging Station.

2.05 GENERAL PRODUCTS FOR SYSTEMS

A. CABLE – ALL SPACES
   1. Data Network CAT-6, plenum rated, see Section 271000 specifications.
   2. Distributed Loudspeaker 16-2, 16 AWG, 2-conductor Outside Plant Rated (OSP): Belden, or equal.
   3. Analog Microphone/Line Level cable, 2-22 (22 AWG conductor, jacketed, shielded, twisted-pair) plenum rated: Extron, Belden or equal.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. The installation, configuration, and wiring of the system shall be executed in accordance with the drawings and the equipment manufacturer's wiring diagrams. Should any variations in these requirements occur, the Contractor shall notify the Owner's Project Manager before making any changes. It shall be the responsibility of the manufacturer-authorized distributor of the approved equipment to install the equipment and guarantee the system to operate as per plans and specifications.

B. Furnish all conductors, equipment plugs, terminal strips, etc., and labor to install a complete and operable system.

C. The cables within the rack or cabinets shall be labeled/numbered for identification following the InfoComm F51.01:2015 standard unless otherwise directed.

D. Splices of cables in underground pull boxes are not permitted unless otherwise noted on the drawings.

E. The labor employed by the Contractor shall be regularly employed in the installation and repair of audiovisual systems and shall be acceptable to the Owner's Project Manager to engage in the installation and service of this system.

F. The Contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc. The Contractor shall remove all debris and rubbish created while this project. The Contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., caused by the performance of this work.

G. The system must meet all local and other prevailing codes.

H. All cabling installations shall be performed by qualified technicians.

I. All cabling shall be splice free unless otherwise noted on drawings.

J. To ensure the least amount of cable untwisting, it is required that all cables shall be stripped using a special tool.

K. The use of lubricants (i.e. Yellow 77) to facilitate the installation of cables in conduits is highly discouraged. If such a lubricant must be used, the AVS Contractor shall verify the acceptability of the lubricant to be used with the cable manufacturer, prior to using such a lubricant. Lubricants that harden after installation are not allowed.

L. Under no circumstance are "channel locks" or other pliers to be used.

M. Cables may be run exposed above ceilings, provided the cabling is supported independent of other utilities such as conduits, pipes, and the ceiling support systems. The Contractor shall include all costs in base bid for any additional supports/seismic bracing required by the Local Authority having Jurisdiction. The cables shall not be laid

directly on the ceiling panels. The use of hook and loop ties shall be done in accordance with the cable manufacturer's requirements. The cable jacket composition must meet local and all other prevailing fire and safety codes – “Plenum Rated” cable shall be used.

N. All firewalls penetrated by AVS shall be sealed by use of a non-permanent fire blanket or other method in compliance with the current edition of NFPA and the NEC or other prevailing code and must be a system listed by UL. The Contractor must not use concrete or other non-removable substance for fire stopping on cable trays, wire ways or conduits. Contractors who use this method will be required to replace all cables affected and provide the original specified access to each effected area. This requirement also applies to maintaining fire ratings of all floors penetrated by conduits or devices designated for use by voice and data cabling.

O. All equipment racks shall be bolted to the floor by the Contractor in the location shown on drawings. The earthquake mounting brackets that come with each rack kit shall be screwed to studs, not drywall.

P. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor before final acceptance at no cost to the Owner.

Q. The cable’s minimum bend radius and maximum pulling tension shall not be exceeded.

R. Cable raceways, when required, shall not be filled greater than 40% of cross sectional area.

3.02 SPECIFIC SYSTEM INSTALLATION REQUIREMENTS

A. All Audiovisual cabling used throughout this project shall comply with the requirements as outlined in the NEC Articles 725, 760, 770, and 800 and the appropriate local codes. All copper cabling shall bear UL listed type CMP (Plenum Rated). All fiber optic cabling shall bear OFNP (Plenum Rated). AVS contractor is responsible for installing appropriately rated cable for the environment in which it is installed. For cables run outside of a building to outdoor speakers, the cable shall be Outdoor Plant Rated or Direct Burial cable and must be run in conduit point to point. For longer cable runs between buildings fiber optic cable shall be used, the fiber cable shall be run in conduits.

B. Cable Pathways:
   1. In suspended ceiling and raised floor areas where duct, cable trays or conduit are not available, the Contractor shall bundle cabling with half inch hook and loop strips, but not deforming the cable geometry. Cable bundles shall be supported via "J" hooks attached to the existing building structure and framework at a maximum of five (5) foot intervals. Plenum rated hook and loop ties will be used in all appropriate areas. The Contractor shall adhere to the manufacturers’ requirements for bending radius and pulling tension of all cables.
   2. Cables or J hooks shall not be attached to lift out ceiling grid supports or laid directly on the ceiling grid.
   3. Cables or J hooks shall not be attached to or supported by fire sprinkler heads or delivery systems or any environmental sensor located in the ceiling air space.
   4. Where additional conduit(s)/sleeve(s) are required, but not provided by the electrical contractor, the Contractor shall be responsible to provide such

conduit(s)/sleeve(s). Conduit(s) and sleeve(s) shall be of suitable material, sized, installed, fire-stopped, and grounded as required by the NEC, ANSI/TIA/EIA standards and all other applicable codes and standards. Any conduit(s) and sleeve(s) added by the Contractor shall be approved by the Owner's Project Manager prior to rough-in.

C. The Contractor shall be responsible for damage to any surfaces or work disrupted because of his work. Repair of surfaces, including painting, shall be included as necessary.

D. Rack mounted equipment shall be grounded via the chassis, in accordance with manufacturer's instructions. The equipment chassis shall be bonded to the rack/cabinet using one of the following methods:
   1. If the equipment has a separate grounding hole or stud, use a # 6 AWG ground wire from the chassis ground hole/stud to the rack grounding bus if required.
   2. If the manufacturer suggests grounding via the chassis mounting flanges, use tri-lobular thread-forming screws (not self-tapping or sheet metal screws) to attach the equipment to the rack/cabinet rails. If the equipment mounting flanges are painted, remove the paint and apply an anti-oxidant, or use tri-lobular thread-forming screws and two (2) "Type B" internal-external tooth lock washers to safely ground equipment to the rack.
   3. All equipment racks shall be grounded to the AC outlet box or building ground by a # 6 AWG Green ground wire attached to the Grounding lug in the rack.

3.03 GENERAL INSTALLATION DESCRIPTION

A. The labor employed by the AVS Contractor shall be regularly employed in the installation and repair of communication systems and shall be acceptable to the owner and architect to engage in the installation and service of this system.

B. The Contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc., The Contractor shall remove all debris and rubbish occasioned by the work from the site. The Contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., Caused by the performance of this work.

C. Labeling
   1. Wiring Labels: At all connection points for all types of cable & wiring, a label strip shall be attached at both ends of the cable following the InfoComm F51.01:2015 standard unless otherwise directed, indicating the name/number of that cable or wire as follows:
      a. At internal locations (inside racks, cabinets, or boxes), a pressure sensitive label shall be used.
      b. At external locations, a printed label covered with clear shrink wrap or approved labeling system shall be used.
   2. Equipment Labels: All active components shall have labels at the front and rear.
      a. Labels shall be applied plumb and neat and shall not cover any equipment lights, recessed controls, or control labels.
      b. Front labels shall indicate functional use of equipment.
      c. Rear labels shall indicate system schematic reference designation.

3. AVS Contractor Label: Contractor name plate shall be attached to a blank panel inside each equipment rack or group of racks.
    a. Name plate shall be printed, self-adhesive type and shall be no larger than 1-3/4" high by 6" wide. Alternatively, name plate may be preprinted onto a 1RU blank panel.
    b. Name plate shall contain Consultant's name & city/state address and AVS Contractor's name, city/state address and phone number.

D. Equipment Rack and Equipment Testing and Adjusting Procedures: Conduct procedures in fabrication shop following the ANSI/InfoComm 10:2013 Audiovisual Systems Performance Verification procedure. Verify safe and proper operation of all components, devices, or equipment, establish nominal signal levels within the systems and verify the absence of extraneous or degrading signals. Make all preliminary adjustments and document the setting of all controls, parameters of all corrective networks, voltages at key system interconnection points, gains and losses, as applicable. Submit test report with color photographs of each equipment rack, front and back. Perform at least the following procedures:
    1. Preliminary: Verify:
        a. Grounding of devices and equipment. Integrity of signal and electrical system ground connections.
        b. Proper provision of power to devices and equipment.
        c. Integrity of all insulation, shield terminations and connections.
        d. Integrity of soldered connections. Absence of solder splatter, solder bridges.
        e. Absence of debris of any kind, tools, etc.
        f. Routing and dressing of wire and cable.
        g. All wiring, including polarity and continuity, including conformance with wire designations on running sheets, field and shop drawings.
        h. Mechanical integrity of all support provisions.
        i. All wiring in racks on horizontal lacing bars and vertical cable paths shall have Velcro cable wraps, no Zip Ties shall be allowed. If Zip Ties are used they shall be replaced at the Contractor’s expense.
    2. Rig temporary power and grounding: Comply with all applicable Codes, regulations and ordinances.
    3. All equipment racks shall be bolted to the floor by the Contractor (unless noted) once the Owner determines the exact location for each rack. The earthquake mounting brackets that come with each rack kit shall be screwed to studs, not drywall. All equipment shall be serviceable in the racks final location – the need to unbolt racking equipment to access or service equipment is not acceptable.

3.04 PROJECT DIRECTION

A. Single Point of Contact: Contractor will provide an English proficient, single point of contact, i.e., Project Manager, to speak for the Contractor and to provide the following functions:
    1. Initiate and coordinate tasks with Owner’s Project Manager, and others as specified by Owner’s Project Manager.
    2. Provide day-to-day direction and on-site supervision of Contractor personnel.
    3. Ensure conformance with all Contract provisions.
    4. Participate in weekly site project meetings.

5. This individual will remain as Project Manager for the duration of the project. The Contractor may change Project Managers only with the Owner's Project Manager's written approval.

3.05 PLANNING, ENGINEERING AND SUBMITTALS

A. Planning meetings and schedule: Within thirty (30) calendar days after the date of award of the Contract, an initial planning meeting will be held with the successful bidder to clarify all requirements (systems, services, distribution methods, etc.), identify responsibilities, and schedule the events that will transpire during the implementation of the project. Within one (1) week of this initial meeting, the contractor shall provide a written report and project schedule to clearly document the events and responsibilities associated with the project.

B. Within Thirty (30) calendar days after the date of award of the Contract, the Contractor shall submit three copies of the complete submission to the Owner's Project Manager for review. The submission shall consist of four major sections with each section separated with index tabs. Each page in the submission shall be numbered chronologically and shall be summarized in the index.
   1. The first section shall be the "index" which shall include the project title and address, name of the firm submitting the bid and name of the Owner.
   2. The second section shall contain the comparative specification listing, including a complete listing of the characteristics of the equipment to be furnished next to all the specified equipment's features and functions as stated in the specifications and data sheets.
   3. The third section shall contain an original manufacturer data sheet for every component listed in the drawings or specifications.
   4. The fourth section shall contain a designation schedule for each system component location and complete "E" size (30" x 42"), unless otherwise specified, bond drawings, showing system wiring plans. The drawings shall be professionally drafted, generated on AutoDesk AutoCAD 2010 computer design software. These drawings shall also include:

C. As-Built/Closeout Documentation: Within fifteen (15) days after the completion of work (signed off by Owner), the Contractor shall provide a complete Contractor-provided set of professionally drafted "E" size (30" x 42"), unless otherwise noted, reproducible bond as-built drawings, generated on AutoDesk AutoCAD 2014 computer design software. Contractor will supply to Owner one set of CDs containing all as-builts.

D. As-Built Documentation Display in each equipment rack location: Within fifteen (15) days after the completion of work, the Contractor shall install a complete Contractor-provided, professionally drafted as-built floor plan in color in each equipment rack room mounting frame. Each floor plan, generated on AutoDesk AutoCAD 2014 computer design software and printed in black and white, shall depict all audiovisual jack locations in each room with an audiovisual system and all other areas. The Contractor will provide to Owner one set of CDs containing all as-built.

E. Controls: Adjust all controls to achieve the specified performance. Provide security covers for all level controls, as appropriate to prevent unauthorized gain changes. Contractor will confirm that all control system operations are properly programmed and repeatable.

F. Testing Report: Provide a letter/report documenting the results of these preliminary tests, including amplifier gain/level settings, crossover filter settings, and AV equalization curves for review by the Owner and the AV Design Consultant.

G. Qualification for Acceptance: After completing preliminary testing, the Contractor shall furnish the Construction Manager with the letter/report documenting the results of the preliminary tests and five (5) copies of "as-built" wiring diagrams of the entire system including the connection numbers, and their locations. The receipt of this documentation will constitute the Contractor's acknowledgment that the installation is complete and conforms to this specification, and is ready to be reviewed and tested by the Owner and the AV Design Consultant.

H. Acceptance Test: The Consultant, Owner's Representative and/or Construction Manager will be present during the acceptance testing and require the assistance and cooperation of the Contractor. Provide personnel who participated in the actual installation and preliminary testing and adjustment of the audiovisual systems.
   1. Equipment cabinet keys and any tamper-proof fastener tools must be available to the Owner and the AV Design Consultant. Delays associated with failure to access the equipment will be back-charged to the Contractor at the AV Design Consultant's current hourly rates.
   2. Each major component shall be demonstrated to function, as specified.
   3. Measurements: Further electrical and acoustical measurements may be performed at the discretion of the Owner and/or Owner’s Representatives. Acoustical test equipment will be supplied by the Contractor. Such measurements may include sound pressure levels, uniformity of coverage, distortion, or other pertinent characteristics.
   4. The Contractor shall provide a laptop with all manufacturer supplied configuration software necessary for communicating with DSP Audio Matrix Mixers. A review of system settings may be required for either of the programmable units at the Owner and the AV Design Consultant’s request, and settings may be adjusted if necessary.

I. Such tests may be performed on any piece of equipment or system. If any test shows the equipment or system is defective or does not comply with the specifications, the Contractor shall perform any remedies at his expense and pay the subsequent expenses of any retesting required.

J. Delays: If the acceptance of the system is delayed because it does not meet the specification requirements, the Contractor shall reimburse the Owner for all expenses of consultants retained to represent the Owner during the final acceptance testing. This will include costs associated with travel to the site, and include reimbursable business travel expenses.

3.06 INSTALLATION

A. All installation shall be done in conformance with ANSI/TIA/EIA and InfoComm standards and manufacturers installation guidelines. The Contractor shall ensure that the maximum pulling tensions of the specified distribution cables are not exceeded and cable bends maintain the proper radius during the placement of the facilities. Failure to follow the appropriate guidelines will require the Contractor to provide, in a timely fashion, any additional material and labor necessary to properly rectify the situation to the satisfaction

and written approval of the Owner's Project Manager. This shall also apply to all damages sustained to the cables by the Contractor during the implementation.

1. Bonding and Grounding: The Contractor shall be responsible for providing an approved ground at all racks. The Contractor shall also be responsible for ensuring ground continuity by properly bonding all appropriate cabling, closures, cabinets, service boxes, and racks. All grounds shall consist of #6 AWG copper wire and shall be supplied from an approved building ground and bonded to the main electrical ground. Grounding must be in accordance with the NEC, NFPA, ANSI-J-STD-607-A and all local codes and practices.
2. Power Separation: The Contractor shall not place any low voltage and speaker cabling alongside power lines, or share the same conduit, channel or sleeve with in racks.
3. Miscellaneous Equipment: The Contractor shall provide any necessary screws, anchors, clamps, hook & loop ties, distribution rings, wire molding, miscellaneous grounding and support hardware, etc., necessary to facilitate the installation of the System.
4. Special Equipment and Tools: It shall be the responsibility of the Contractor to furnish any special installation equipment or tools necessary to properly complete the System. This may include, but is not limited to, tools for terminating cables, testing and splicing equipment for copper/fiber cables, communication devices, jack stands for cable reels, or cable winches.
5. Labeling: The Contractor shall be responsible for printed labels for all cables and cords, distribution frames, and outlet locations, according to the specifications. No labels are to be written by hand. The labeling shall follow the InfoComm F51.01:2015 standard unless otherwise directed.

3.07 DAMAGES

A. The Contractor will be held responsible for all damages to portions of the building caused by it, its employees or subcontractors; including but not limited to:
   1. Damage to any portion of the building caused by the movement of tools, materials or equipment.
   2. Damage to any component of the construction of spaces.
   3. Damage to the electrical distribution system.
   4. Damage to the electrical, mechanical and/or life safety or other systems caused by inappropriate operation or connections made by the Contractor or other actions of Contractor.
   5. Damage to the materials, tools and / or equipment of the Owner, its consultants, agents and leases tenants.

3.08 PENETRATIONS OF WALLS FLOORS AND CEILINGS

A. Unless specifically shown on the drawings, the Contractor shall make no penetration of floors, walls or ceiling without the prior written approval of the Owner's Project Manager.

B. Any penetrations through acoustical walls or other walls for cable pathways shall be sleeved by the Contractor. Sleeves shall consist of metallic conduit deburred and grommetted on both ends, with flanges or other means to prevent the sleeve from slipping or falling out of the partition. Sleeves shall extend a minimum of 6" on both sides of the partition. Outside perimeter of sleeves shall be sealed against sound, air, heat, or as required by partition design. Inside of sleeve shall be sealed similarly after installation

of all cabling. Cables shall be independently supported on either side of the sleeve. Sleeves shall not be used as cable supports. Additional requirements in compliance with applicable code shall apply.

C. Any penetrations through fire-rated walls for cable pathways/cables shall be sealed by the Contractor as required by code and as directed by Owner's Project Manager. The Contractor shall be required to work together with the General Contractor and the Electrical Contractor to coordinate and develop all fire stopping methods prior to any cable installation. The Contractor shall also, prior to the commencement of on-site activities, submit to Owner's Project Manager, details of any special systems to be used.

3.09 TESTING/WARRANTY

A. The Contractor shall provide competent, factory-trained engineers and/or technicians, authorized by the manufacturer of the AVS, to technically supervise and participate during all tests for the systems. All performance testing shall follow the ANSI/InfoComm 10:2013 Audiovisual Systems Performance Verification procedure.

3.10 COMPLETION OF WORK

A. At the completion of the System, the Contractor shall restore to its former condition, all aspects of the project site and daily, shall remove all waste and excess materials, rubbish debris, tools and equipment resulting from or used in the services provided under this Contract. All clean up, restoration, and removal noted above shall be by the Contractor and at no cost to Owner. If the Contractor fails in its duties under this paragraph, Owner may upon notice to the Contractor perform the necessary clean up and deduct the costs thereof from any amounts due or to become due to the Contractor. It shall be the Contractor's responsibility to remove trash from the areas it is working in and bring trash and debris to the Contractor provided dumpster.

3.11 INSPECTION

A. On-going inspections shall be performed during construction by the Owner's Project Manager. All work shall be performed in a quality manner and the overall appearance shall be clean, neat and orderly.

3.12 MISCELLANEOUS PROJECT REQUIREMENTS SYSTEM DOCUMENTATION, TRAINING, AND FIELD SUPPORT

A. Operation and Maintenance Manuals: As part of the "Close Out" documents, for each system, provide five (5) copies of system manuals per system. Manuals shall be in adequately sized three-ring binders, clearly labeled on spine. Manuals shall contain the following:
   1. Service Reference Cover Sheet: Provide a cover sheet with Audiovisual AVS Contractor name, address, Email, WEB Address, telephone and Fax numbers.
   2. System Operation Instructions: Step-by-step operating instructions based on the control system touch panel (if applicable) for the basic day-to-day use of the system including power activation, connection of source devices, adjustment of volume levels, selection of sources, etc. Include illustrations and references to individual equipment manuals as necessary.

3. Equipment Manuals: Include copies of individual equipment operation manuals separated by tabbed dividers. Order the manuals in nominal signal path order (i.e. sources first, amplifiers/loudspeakers last), followed by control system manuals, followed by miscellaneous manuals.
4. Equipment List: List all system equipment including, connectors and specialty hardware, by manufacturer and model and serial number.
    a. As-built Drawings: Provide reduced 11”x17” foldout "as built" functional diagrams in clear plastic binder sleeves. Fold and insert drawings so that drawing title is clearly visible at the front of the sleeve. Five (5) half or full-size drawing sets are also to be provided for clearer system reference.
    b. Provide software programmable device configuration files to the Owner for all control system interfaces and computer-based files, and the DSP Audio Matrix Mixer. Store files on site in the system documentation binders in disk sleeves. Provide the files on CD-ROM.

B. Training: Provide as needed system training to operator(s) designated by the Owner. Training time is to be non-contiguous, in multiple separate sessions. Training sessions are to be videotaped upon Owner request.

3.13 MISCELLANEOUS SUPPORT REQUIREMENTS

A. Upon approval of shop drawings and equipment submittals, Contractor shall immediately place orders for all required materials, components, and supplies especially long lead items. In addition, Contractor shall secure and forward written confirmations (including orders and shipping dates) direct from each manufacturer/vendor to the Owner’s Project Manager.

B. Contractor shall expedite shipment of all materials, components and supplies, as necessary to ensure the successful completion of the Project by the date required. All costs for expediting shall be included within Contractor’s pricing as provided below.

C. The system/network cost herein shall include administration/maintenance training for at least ten Owner’s representatives with a minimum allotment of sixteen hours. All training shall include written and/or video materials that shall remain the property of Owner. If materials are written, they shall be provided in quantities sufficient for each person trained; if materials are video, one copy of each will be required. The administration/maintenance training shall include, but not be limited to, the following:
    1. Review of as-built documentation, including a site demonstration.
    2. All warranty information.

3.14 AV SYSTEM AND/OR NETWORK TESTING

A. Upon completion of installation, Contractor shall execute all the required tests as summarized in this specification. When all such tests have been completed to Owner’s satisfaction and Manufacturer’s specifications, Contractor shall give the Owner written notice thereof.

B. Contractor must assume responsibility of assuring that the AV system and/or network installed operates properly, including any required coordination with other suppliers.

3.15 FINAL ACCEPTANCE

A. The Owner or Owner's representative may visit the site during the installation of the system to ensure that correct installation practices are being followed.

B. The Owner or Owner's representative will conduct a final job review once the Contractor has finished the job. This review will take place within one week after the Contractor notifies the owner.

C. Two copies of all certification data and drawings for all identifications shall be provided to the Owner before the owner's review.

D. The Owner or Owner's representative will review the installation and certification data prior to the system acceptance.

E. The Owner or Owner's representative may test some of the systems features to ensure that the certification data is correct. If a substantial discrepancy is found, the Owner reserves the right to have an independent consultant perform a certification of the entire system. If such a procedure is undertaken, the cost of the testing will be billed back to the Contractor.

F. If repairs or adjustments are necessary, the AVS Contractor shall make these repairs at his own expense. All repairs shall be completed within 5 days from the time they are discovered.

G. The Contractor shall hand to the owner a copy of any applicable installation specific software configurations in CD format.

END OF SECTION

SECTION 27 51 27

EMERGENCY COMMUNICATION STATIONS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:
   1. Under this Section, the Contractor is to provide Wall Mounted Emergency Communications Stations (ECS), including procuring, installing, and rendering fully operational all necessary hardware, software, firmware, conduits, wiring, and any other related or required appurtenance or device, as required for a complete and workable installation which meets or exceeds the project performance specifications, whether or not any such component, conduit, wiring, or other related or required appurtenance or device is specifically listed or called out.
   2. Equipment to be provided and installed includes, but is not limited to:
      a. Wall Mounted Emergency Communication Stations
      b. Any required or associated device, component, hardware, software, or firmware
      c. Power and Data Cabling, Conduit, and Infrastructure as required for a completely operable system which meets or exceeds all performance specifications
   3. The work includes providing all labor, materials, tools, equipment, and documentation required for a complete and working Emergency Communications System as specified in this document.

B. Abbreviations and Acronyms
   1. ADA = Americans with Disabilities Act
   2. ECS = Emergency Communications Station
   3. EEPROM = Electrically Erasable Read Only Memory
   4. PBX = Private Branch Exchange
   5. LED = Light Emitting Diode
   6. UPS = Uninterruptable Power Supply
   7. PVT = Performance Verification Testing

C. Definitions
   1. Emergency Communications System – Panic button type emergency phones, which allow for rapid establishment of emergency communications with responding authorities.

1.02 RELATED DOCUMENTS

A. Section 27 05 00 – Common Work Results for Communications

B. The Specifications and Drawings are intended to be complementary. A specific section, paragraph or heading in a Division may not describe all details concerning work to be done and materials to be furnished. The Drawings are diagrammatic and may not show all of the work required or all construction details. Dimensions are shown for critical areas only; all dimensions and actual placements are to be verified in the field. It is to be

understood that the best trade practices of the Division will prevail. It remains the responsibility of the Contractor or Subcontractor to provide all items, equipment, construction, and services required to the proper execution and completion of the Work.

C. Reference listings are provided as a convenience to the Contractor or Subcontractor providing the Work of this Section and may not contain all the requirements affecting this Section. It remains the responsibility of the Contractor or Subcontractor to locate and comply with all requirements of the Contract Documents.

D. All related specification sections shall be used in conjunction with this section.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: The manufacturer of all equipment installed as a part of this contract shall meet the following criteria:
   1. Shall be regularly engaged in the manufacture and assembly of similar type equipment for a minimum of five (5) continuous years preceding the date of this document.
   2. Shall have an office staffed with factory trained technicians, fully capable of engineering, supervising installation, system start-up, providing Owner training and supervising of both hardware and software for the all systems installed as a part of this project.

B. Contractor Qualifications: The Contractor shall meet the following qualifications at a minimum:
   1. Shall be an authorized factory trained and certified reseller of all system components installed or interfaced with as a part of this contract.
   2. Contractor shall be regularly engaged in installing similar equipment, and shall have successfully completed 3 systems of a similar size and scope within the preceding 3 years of the date of this document. These systems must be currently in operation, and the contractor shall supply the following reference information with their proposal:
      a. Name of Client
      b. Type of Facility
      c. System Installed
      d. Date of Substantial Completion
      e. Names of Contractor's Key Personnel on Project
      f. Contact Name, Title, Phone, and Email
   3. It is expected by the Owner that the same key personnel will execute this project as completed the referenced work. This would include the Project Manager, the Project Engineer, and the Lead Installer. Resumes will be provided for these personnel. If different key personnel are executing this project than executed the reference projects, resumes for these personnel shall be provided for the Owner's approval with the Contractor's bid package.
   4. Sub-contractors shall provide resumes showing qualification for the specific system that the sub-contractor will be installing / configuring.
   5. Contractor shall be certified with BerkTek Cabling Solutions, and project installation staff shall be similarly and independently certified

1.04 SUBMITTALS

A. General:
   1. Prior to installing any material related to or required by this section, submit the following information for review.
      a. Block diagrams of the proposed system and interconnection wiring diagrams showing all connections required between system components.
      b. A materials list with names of manufacturers, model numbers, and technical information on all equipment proposed. Product technical information sheets for each principal component in the proposed system. Include wire/cable specifications and wire/cable marking material. Where the data sheet covers a range of material, the specific part number shall be highlighted
      c. 6 complete sets of operations and maintenance manual for the system products being supplied, provided in 3-ring binders, and 1 complete set submitted in electronic format on DVD. Include complete sets of the equipment operating instructions, installation instructions, and troubleshooting guides.

B. Testing:
   1. PVT Plan to be submitted a minimum of 20 working days prior to planned start of PVT procedure.

C. Close Out:
   1. Within 10 working days of substantial completion and prior to project closeout, the Contractor shall provide to the Owner a complete set of As-Built drawings, showing any deviation from the original plans and specifications, in mounting location, infrastructure pathway, or any other substantive change.

1.05 WARRANTY

A. General:
   1. All equipment and system shall be warranted against defects in material and workmanship for a period of one (1) year from the date of startup. Warranty coverage shall include parts, labor, travel, expenses, and labor to remove/reinstall all products. The warranty document shall be submitted with the Contractor's submittals and shall include details on inclusions and exclusions, deductibles, and availability of extended coverage options, priced for extended coverage in years 2, 3, and 4 past expiration of the original warranty period.
   2. Warranty service shall be separated into 2 classes of service, critical item service and non-critical item service.
   3. Critical items shall be described as any part or device which if fails would cause spaces to be inaccessible to any authorized person, for example, card reader failure. Critical failures are to be corrected within 24 hours of notification to the Contractor, 7 days per week. Non-critical failures are to be corrected within 7 days of notification to the Contractor.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS AND MODEL NUMBERS

A. Cabling shall be CAT 6A as manufactured by BerkTek in order to provide a 20-Year Warranty.

B. Emergency Phones: Talk-a-Phone, Niles Illinois

Model ETP-400 / ETP-WM with no equivalent

2.02 PERFORMANCE SPECIFICATIONS

A. The Emergency Communications Stations shall have the following features and functionally at a minimum:
   1. General Description – The Emergency Communications Station shall consist of a vandal-resistant, hands-free speakerphone communications device with a stainless-steel faceplate and metal button.
   2. The ECS shall have one anodized aluminum tactile button labeled “EMERGENCY”, and one 0.375” diameter red LED labeled “LIGHT ON INDICATES PHONE CALL RECEIVED”.
   3. The ECS shall be mounted in the appropriate wall mount enclosure, vandal resistant with a lighted faceplate and a blue strobe which provides a minimum light output of 209 Lumens.
   4. The ECS shall be programmable from a remote location and have a two-number dialing capability, reverting to the second number if the first is busy, or does not answer. The unit shall be totally hands-free on both sides after initial activation either on site or by responding authorities. The unit shall be phone-line powered, and shall require external power only for the strobe light.

PART 3 - EXECUTION

3.01 General Intent – It is the intent of the owner to have a qualified contractor install a complete and fully operational Emergency Communications System, as shown on the project drawings which provides the means for personnel transiting the campus to summon help or assistance.

3.02 The contractor shall procure, provide, install, and make fully operational the system as described in this specification and shown on the project drawings. Specific scope items include, but are not limited to:

A. Provision and installation of Emergency Communications Station components as shown on project drawings

B. Provision and installation of Emergency Communications System headend controllers and software (Owner to provide workstations and servers)

3.03 DELIVERY, STORAGE AND HANDLING:

A. Intent – It is the intent of the Owner to have a qualified contractor procure, provide, install, and render fully operational ECS components as shown on the project drawings, in order

to provide an Emergency Communications System which allows personnel on the campus to have a ready means of contacting responding authorities in times of emergency.

B. Product Acceptance, Storage, and Handling Requirements
   1. Acceptance – Upon delivery to the project site, Contractor shall inspect all products and materials to assure that all products and material have been received in a new and undamaged state. Acceptance of the shipment, by the Contractor, shall constitute acknowledgement that the Contractor has reviewed the products and material and has found no discrepancies in quantity or condition, and that any products or materials subsequently found to be missing or damaged will be the sole responsibility of the Contractor.
   2. Storage and Handling - Store products and materials in the original manufacturer's sealed packaging, in an environmentally controlled area per the manufacturer's specifications.

C. Before Beginning Work
   1. Site Verification of Conditions – Contractor shall be responsible for examining the pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions which would affect the project execution. Any such unsatisfactory pathways shall be reported to the Owner.
   2. Proceed with installation only after all unsatisfactory issues have been corrected or resolved.

D. General Installation Requirements:
   1. ECS locations as shown on drawings are conceptual in nature, and Contractor shall verify final placement with the Owner before beginning any work.
   2. Maintain strict site security throughout the course of the project. Rooms housing the equipment and workstations shall be locked up and secure during periods when Contractor personnel are not present.
   3. Utilize protective cover, fenders, and barriers to ensure all equipment remains in an undamaged and new condition until notice of substantial completion.
   4. Install system per the manufacturer's instructions.
   5. The installed system must meet all local, state, and federal codes.
   6. Contractor shall verify that all power feeds for powering the system strobe lights are connected to the buildings emergency power UPS.
   7. Contractor shall be responsible for providing all conduit, junction boxes, conductors, equipment plugs, terminal strips and labor to install a complete and operational system.
   8. Equipment racks shall be seismically bolted to the floor by the Contractor once the Owner determines the final location for each rack. Any mounting brackets attached to walls shall be screwed to studs, not drywall. All rack-mounted equipment shall be able to be serviced within the rack and in the rack's final location. The need to unbolt racking equipment to access or service equipment shall not be acceptable.
   9. Cables shall not be spliced in underground enclosures.
   10. Splices must be kept to a minimum. Any field splices must be secured in a NEMA box appropriate to the conditions.
   11. The use of wire lubricants is highly discouraged. If usage of such lubricant cannot be avoided, Contractor shall procure verification, in writing, from the cable

manufacturer stating that the specific lubricant used is acceptable and will not damage or degrade the cable.

Cable tray pathways designated for telecom shall not be utilized for support of conduit, conductors, or control wiring of any type, except as specified in this section. No Access Control, Surveillance, or Intrusion Detection cabling which is not Category 5 or 6 shall be intermingled with such Category 5 or 6 cabling. Non-telecom low voltage cabling shall be segregated to one side of the cable pathway and kept separated from telecom cabling through utilization of cable management.

12. All firewalls penetrated by Access Control, Surveillance, or Intrusion Detection cabling shall be sealed by the Contractor. A non-permanent method of sealing shall be utilized, such as fire blanketing or other approved method in compliance with the current edition of National Fire Protection Association (NFPA), the National Electric Code (NEC), and any other applicable code. Method and material utilized must be a system listed by Underwriter's Laboratory (UL) for that purpose. The Contractor shall not utilize concrete or other non-removable substance for fire stopping on cable trays, raceways, or conduit. If the Contractor uses permanent substances, the Contractor will be required to replace all cables and pathways affected as to provide the original specified access to each area at the Contractor's own expense.

E. Coordination
   1. Contractor shall coordinate all work with any other trades present on the project which will be directly affected by the execution of this contract.
   2. Contractor shall coordinate all work with the Owner as to avoid impacting any student activities or classes to the greatest extent possible.

F. Testing and Commissioning:
   1. The Contractor shall be responsible for final system hardware hook up and checkout prior to performance verification testing being conducted with the Owner. The Contractor shall pre-test all cabling to assure cabling is free from interference, opens, grounds, or short circuits.
   2. The Contractor shall develop a Performance Verification Testing (PVT) plan. The PVT plan shall identify each new system component included in the project, the intent of testing it, methods and tools required for the testing, and expected result. Each component shall be individually listed with space for noting PASS or FAIL, Contractor / Owner Sign-off, time and date of test, and related comments. The PVT plan shall be submitted to the Owner a minimum of 20 (TWENTY) working days prior to the scheduled beginning of PVT. No testing shall take place until Owner has approved the PVT.
   3. As a part of the final system commissioning, Contractor shall submit a listing of all enabled passwords within the system, and shall provide instruction specific to changing the password after the Contractor's departure from the site.
   4. Following satisfactory completion of PVT plan, the system shall be operated at normal facility load for a period of 30 calendar days as a burn-in period. If any item or system fails during the burn-in period, the burn-in period shall be suspended until such item or system has been corrected, at which time the test period will recommence. Notice of final System Acceptance will be withheld until burn-in period has been successfully completed.
   5. Notice of Final System Completion will not be issued until the following requirements have all been met:
      a. All required submittals accepted.

b. Delivery of final documentation, including but not limited to As-Builts drawings.
c. Successful PVT & burn-in period
d. Completion of all required training activities.
e. Purging of all Contractor passwords and removal of all Contractor access to the systems.

G. Training and Instruction:
1. Before the system is turned over to the owner, the manufacturer shall provide 16 hours of system operations and maintenance training at the project site using the customer's equipment for up to 10 of the owner's representatives. The Owner shall determine hours to be allocated to each training type.
2. This training shall be conducted during normal business hours of the equipment supplier at a date and time of mutual convenience.
3. This training shall be conducted by a manufacturer certified trainer.
4. Training materials shall not be generic, and shall be specific to the project.

H. Warranty:
1. The system shall be warrantied for a period of 1 year from date of acceptance. Written notification shall be sent to the owner stating the date this warranty period has started.
2. The equipment manufacturer shall provide with their bid package to the owner a maintenance contract proposal to provide a minimum of two inspections and preventative tests per year.
3. The Contractor shall provide with their bid package to the Owner a proposal for an extended parts and labor warranty service, priced for the 1st, 2nd, and 3rd years of post-warranty period operation.

I. Site Clean-up
1. Upon completion of the contract, Contractor shall be responsible for project site cleanup. All installed materials shall be clean, enclosures free of dust and debris, and surfaces wiped free of smudges and fingerprints. The Contractor shall remove all project associated debris and rubbish occasioned by the work from the site. The contractor shall clean all interior spaces dirtied by the work. Remove all temporary protective covers and shrouds from all equipment.

END OF SECTION

SECTION 28 01 00

ELECTRONIC SAFETY AND SECURITY
GENERAL PROVISIONS

ARTICLE 1 - SUMMARY

1.1 This Division of the specifications outlines the provisions of the contract work to be performed as a sub contract under the Division 26 scope of work. Reference the Division 26 Electrical General Provisions for scope of work and general requirements.

1.2 In addition, work in this Division is governed by the provisions of the bidding requirements, contract forms, general conditions and all sections under Division 1 requirements.

END OF SECTION

SECTION 28 10 00

ACCESS CONTROL – SECURITY ALARM SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:
1. Under this Section, the Contractor is to provide an Access Control and Intrusion System, including procuring, installing, and rendering fully operational all necessary components as required for a complete and workable installation which meets or exceeds the project performance specifications.
2. Equipment to be provided and installed includes, but is not limited to:
   a. Access Control Software.
   b. Access Control Hardware.
   c. Intrusion Detection Control Panel.
   d. Intrusion Detection Keypad / Control Station.
   e. Access Control Card Readers, REX Sensors, and supporting equipment.
   f. Intrusion Sensors.
   g. System specific cabling other than data / telecom
   h. Any other hardware, firmware, or software required for a fully operational system.
3. Access Control and Intrusion Control panels shall be capable of being connected to an Owner provided security TCP/IP V-LAN network. Coordinate with Communications Contractor
4. The work includes providing all labor, materials, tools, equipment, and documentation required for a complete and working access control security alarm system as specified in this document.

B. Related Work Provided by Owner:
1. The Contractor shall coordinate the work with the related work provided by the Owner including but not limited to the following:
   a. Network
   b. Data/Telecom Cabling
   c. Conduit, boxes, fittings

C. Abbreviations and Acronyms
1. ACS = Access Control System
2. CCTV = Closed Circuit Television
3. DVD = Digital Video Disc
4. EACS = Embedded Access Control System
5. LAN = Local Area Network
6. LED = Light Emitting Diode
7. TCP/IP = Transport Control Protocol / Internet Protocol
8. UPS = Uninterruptable power Supply
9. PVT = Performance Verification Testing
10. V-LAN = Virtual Local Area Network

D. Definitions

1. 24-Hour Zone – A function in which a given IDS point will cause activation of notification appliances and central station reporting whether or not the IDS is in an armed state
2. Access Control System – Electronic system which controls physical access to the premise through credentialed identification of authorized system users.
3. Access Groups – Segregating PACS users into groupings of users with similar characteristics such as authorized spaces and times.
4. Anti-Passback – The ability of a PACS to deny entry to a credential, after the credential has previously logged in to the facility and has not yet logged back out.
5. Door Left Ajar – The ability of a PACS to notify the system operator(s) that a credential authorized entry point was not secured after the entry transaction.
6. Duress Code – A means for an authorized user who is entering a disarming code to indicate that they are being forced to disarm the system and help should be sent. There shall be no audible nor visible indication that a duress code has been entered.
7. Entry / Exit Zone – Doorways which trigger a time-delay before activating the Intrusion Detection System (IDS) in order to allow authorized personnel to enter the disarming code on a keypad.
8. Forced Door – The ability of the PACS to send an alert to the system operator(s) that a door has been forced open without a credential being presented. PACS controlled doors are 24-Hour type points on the IDS, and this shall cause audible / visual appliances to activate, and the system to notify the central station.
9. Intrusion Detection System (IDS) – Electronic system monitoring various sensors to detect unauthorized entry into building spaces
10. Lockdown Activation – The capability of a door's locking mechanism to be engaged and locked down against standard credential access with an activation switch, either via a control point(s) in authorized locations or on the locking mechanism itself.
11. Pass-Through – An authorization added to a ACS user's credential which allows that user to open a door even while it is in a lock-down state.
12. Perimeter Zone – Any door, window, motion detector, or other device which, when triggered, instantly activates the IDS audible / visual appliances and causes the system to report to the central station.
13. Proximity Card Readers / Card – Reader and card designed to validate when an authorized card is presented to the reader.
14. Smart Card – Contact or Contactless Credential having additional memory and capabilities for 2-way communications between card and reader.
15. Strong Authentication – The ability to enable one or more secondary means of identifying a credential holder before granting access, typically a Personal Identification Number (PIN) or a biometric component such as fingerprints.
16. Two-Man Rule – The ability of a PACS to deny a single credential from entering access controlled spaces unless a second credential is present.

1.02 RELATED DOCUMENTS

A. Section 27 05 00 – Common Work Results for Communications

B. The Specifications and Drawings are intended to be complementary. A specific section, paragraph or heading in a Division may not describe all details concerning work to be done and materials to be furnished. The Drawings are diagrammatic and may not show all of the work required or all construction details. Dimensions are shown for critical areas

only; all dimensions and actual placements are to be verified in the field. It is to be understood that the best trade practices of the Division will prevail. It remains the responsibility of the Contractor or Subcontractor to provide all items, equipment, construction, and services required to the proper execution and completion of the Work.

C. Reference listings are provided as a convenience to the Contractor or Subcontractor providing the Work of this Section and may not contain all the requirements affecting this Section. It remains the responsibility of the Contractor or Subcontractor to locate and comply with all requirements of the Contract Documents.

D. All related specification sections shall be used in conjunction with this section.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: The manufacturer of all equipment installed as a part of this contract shall meet the following criteria:
   1. Shall be regularly engaged in the manufacture and assembly of similar type equipment for a minimum of five (5) continuous years preceding the date of this document.
   2. Shall have an office staffed with factory trained technicians, fully capable of engineering, supervising installation, system start-up, providing Owner training and supervising of both hardware and software for the all systems installed as a part of this project.

B. Contractor Qualifications: The Contractor shall meet the following qualifications at a minimum:
   1. Shall be an authorized factory trained and certified reseller of all system components installed or interfaced with as a part of this contract.
   2. Contractor shall be regularly engaged in installing similar equipment, and shall have successfully completed 3 systems of a similar size and scope within the preceding 3 years of the date of this document. These systems must be currently in operation, and the contractor shall supply the following reference information with their proposal:
      a. Name of Client
      b. Type of Facility
      c. System Installed
      d. Date of Substantial Completion
      e. Names of Contractor's Key Personnel on Project
      f. Contact Name, Title, Phone, and Email
   3. It is expected by the Owner that the same key personnel will execute this project as completed the referenced work. This would include the Project Manager, the Project Engineer, and the Lead Installer. Resumes will be provided for these personnel. If different key personnel are executing this project than executed the reference projects, resumes for these personnel shall be provided for the Owner's approval with the Contractor's bid package.
   4. Sub-contractors shall provide resumes showing qualification for the specific system that the sub-contractor will be installing / configuring.

1.04 SUBMITTALS

A. General:

1. Prior to installing any material related to or required by this section, submit the following information for review.
   a. Block diagrams of the proposed system and interconnection wiring diagrams showing all connections required between system components.
   b. A materials list with names of manufacturers, model numbers, and technical information on all equipment proposed. Product technical information sheets for each principal component in the proposed system. Include wire/cable specifications and wire/cable marking material. Where the data sheet covers a range of material, the specific part number shall be highlighted
   c. 6 complete sets of operations and maintenance manual for the system products being supplied, provided in 3-ring binders, and 1 complete set submitted in electronic format on DVD. Include complete sets of the equipment operating instructions, installation instructions, and troubleshooting guides.

B. Testing:
   1. PVT Plan to be submitted a minimum of 20 working days prior to planned start of PVT procedure.

C. Close Out:
   1. Within 10 working days of substantial completion and prior to project closeout, the Contractor shall provide to the Owner a complete set of As-Built drawings, showing any deviation from the original drawings and specifications, in mounting location, infrastructure pathway, and / or any other substantive change.

1.05 WARRANTY

A. General:
   1. All equipment and system shall be warranted against defects in material and workmanship for a period of one (1) year from the date of startup. Warranty coverage shall include parts, labor, travel, expenses, and labor to remove/reinstall all products. The warranty document shall be submitted with the Contractor's submittals and shall include details on inclusions and exclusions, deductibles, and availability of extended coverage options, priced for extended coverage in years 2, 3, and 4 past expiration of the original warranty period.
   2. Warranty service shall be separated into 2 classes of service, critical item service and non-critical item service.
   3. Critical items shall be described as any part or device which if fails would cause spaces to be inaccessible to any authorized person, for example, card reader failure. Critical failures are to be corrected within 24 hours of notification to the Contractor, 7 days per week. Non-critical failures are to be corrected within 7 days of notification to the Contractor.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. PC's, Servers, Workstations
   1. Shall be provided by the Owner.

B. Access Control System Hardware:
   1. SMS software as manufactured by Vanderbilt with no equivalent.
   2. SPRE-SVR-5 Premier 5 Client Software and PC Server as manufactured by Schlage Electronics with no equivalent.
   3. SRCNX-R Reader Controller as manufactured by Schlage Electronics with no equivalent.
   4. SRINX Reader Interface Module as manufactured by Schlage Electronics with no equivalent.
   5. SIONX-8 Expansion Board w/8 single pole double throw (SPDT) relay outputs as manufactured by Schlage Electronics with no equivalent.
   6. MT15 Multi-Technology Card Reader as manufactured by Schlage Electronics with no equivalent.
   7. SXF7510 Proximity Card as manufactured by Schlage Electronics with no equivalent.
   8. SXF7610 Proximity Keyfob as manufactured by Schlage Electronics with no equivalent.
   9. Scan 2 Request-to-Exit sensor as manufactured by Schlage Electronics with no equivalent.
   10. PS-900 Series Power Supplies as manufactured by Schlage Electronics with no equivalent.
   11. 1076C-W 3/4” Wide Gap Door Position Sensor as manufactured by GE with no equivalent.
   12. 1277-W 3/8” Winged Door Position Sensor as manufactured by Interlogix with no equivalent.
   13. 1078C-W 1” Wide Gap Door Position Sensor as manufactured by Interlogix with no equivalent.
   14. Interlogix 1078C-W Wide Gap Door Position Switch with 1835 Magnet as manufactured by Interlogix with no equivalent.
   15. Any other door position switch required which is not listed above shall be submitted to the Owner for approval before installation takes place.

C. Access Control Door Locks
   1. Per Division 8

D. Security Alarm System Hardware
   1. B9512G Series Intrusion Control Panel as manufactured by Bosch Security Systems with no equivalent. Contractor shall select panel which accommodates all system alarm points with capacity to accommodate a doubling of system alarm points.
   2. Keypad / Control Station which is fully compatible with the selected control panel, as manufactured by Bosch Security Systems with no equivalent. Note: Contractor shall verify Keypad / Control Station color with Architect before installation.
   3. D8125 Addressable Expansion Module as manufactured by Bosch Security Systems with no equivalent.
   4. 9127 Popex point Identification Device as manufactured by Bosch Security Systems with no equivalent.
   5. DS 9370 Ceiling Mount Motion Detectors as manufactured by Bosch with no equivalent.

E. Cables & Conductors

1. Non-telecom cabling shall be provided and installed by the Security Contractor
2. Security Contractor shall coordinate cabling installation and pathway with the Communications Contractor
3. Security system specific non-data / telecom cabling shall be Belden

PART 3 - EXECUTION

3.01 General Intent – It is the intent of the owner to have a qualified contractor install a complete and fully operational Physical Access Control and Intrusion System, as shown on the project drawings which controls access to the building while also alerting responsible personnel to security violations and breaches.

3.02 The contractor shall procure, provide, install, and make fully operational the system as described in this specification and shown on the project drawings. Specific scope items include, but are not limited to:

A. Provision and installation of PACS components as shown on project drawings

B. Provision and installation of PACS headend controllers and software (Owner to provide workstations and servers)

C. Provision and installation of IDS detection components as shown on project drawings

D. Provision and installation of IDS headend and keypads as shown on project drawings

E. Provision and installation of all required cabling, connectors, and any other required or associated appurtenance needed for a fully functional system, whether or not such appurtenance is specifically called out

F. PACS shall be integrated with IDS in such a fashion as to allow arming and disarming of the IDS with an authorized credential

3.03 DELIVERY, STORAGE AND HANDLING:

A. Product Acceptance, Storage, and Handling Requirements
   1. Acceptance – Upon delivery to the project site, Contractor shall inspect all products and materials to assure that all products and material have been received in a new and undamaged state. Acceptance of the shipment, by the Contractor, shall constitute acknowledgement that the Contractor has reviewed the products and material and has found no discrepancies in quantity or condition, and that any products or materials subsequently found to be missing or damaged will be the sole responsibility of the Contractor.
   2. Storage and Handling - Store products and materials in the original manufacturer's sealed packaging, in an environmentally controlled area per the manufacturer's specifications.

B. Before Beginning Work
   1. Site Verification of Conditions – Contractor shall be responsible for examining the pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to

cable installation, and other conditions which would affect the project execution. Any such unsatisfactory pathways shall be reported to the Owner.

2. Proceed with installation only after all unsatisfactory issues have been corrected or resolved.

C. General Installation Requirements:

1. Maintain strict site security throughout the course of the project. Rooms housing the equipment and workstations shall be locked up and secure during periods when Contractor personnel are not present.
2. Utilize protective cover, fenders, and barriers to ensure all equipment remains in an undamaged and new condition until notice of substantial completion.
3. Contractor shall repair / replace all fire-stopping / fire-proofing materials damaged by construction activities.
4. Contractor shall Install system per the manufacturer's instructions.
5. The installed system must meet all local, state, and federal codes, including but not limited to California State Fire Marshal (CSFM) and local Authority Having Jurisdiction (AHJ) requirements concerning FACP / PACS integration requirements.
6. If required by the Access Control manufacturer, the locking devices supplier shall include electronic suppression and be rated for continuous duty operation.
7. All locking device wiring shall be run separate from all other system wiring except wire specifically permitted by the Access Control supplier.
8. Contractor shall verify that all IDF outlets used for powering Access Control / Security System components are connected to the buildings emergency power UPS.
9. Contractor shall be responsible for providing all conduit, junction boxes, conductors, equipment plugs, terminal strips and labor to install a complete and operational system.
10. Any backboards required shall be provided by the contractor and shall be fireproof.
11. All cables within racks and cabinets shall be carefully emplaced and bound or laced with Velcro. All cables shall be identified by wire markers. Wire markers shall be machine printed polyolefin wire markers utilizing heat shrink (Brady Type B-321 or Equivalent). The markings shall clearly indicate the function, source, or destination of all cables and wiring. All cabinets and panels shall be provided with permanently attached lamicoid labels with 1" high white lettering on black background. Labels must contain the text name and alpha-numeric identifier as called out on the single line.
12. Equipment racks shall be seismically bolted to the floor by the Contractor once the Owner determines the final location for each rack. Any mounting brackets attached to walls shall be screwed to studs, not drywall. All rack-mounted equipment shall be able to be serviced within the rack and in the rack's final location. The need to unbolt racking equipment to access or service equipment shall not be acceptable.
13. Cables shall not be spliced in underground enclosures.
14. Splices must be kept to a minimum. Any field splices must be secured in a NEMA box appropriate to the conditions.
15. The use of wire lubricants is highly discouraged. If usage of such lubricant cannot be avoided, Contractor shall procure verification, in writing, from the cable manufacturer stating that the specific lubricant used is acceptable and will not damage or degrade the cable.
16. Cable tray pathways designated for telecom shall not be utilized for support of conduit, conductors, or control wiring of any type. No Access Control, Surveillance,

or Intrusion Detection cabling which is not Category 6A shall be intermingled with such 6A cabling.

D. Coordination
   1. Contractor shall coordinate all door work with Division 8 Door Hardware. This section shall specify specific hardware to be installed by the Division 8 contractor on each type of door.
   2. Contractor shall coordinate all work with any other trades present on the project which will be directly affected by the execution of this contract.
   3. Contractor shall coordinate all work with the Owner as to avoid impacting any student activities or classes to the greatest extent possible.
   4. Contractor shall coordinate with the Owner the gathering of all personnel information to be input into the new system, including, but not limited to:
      a. Personnel / Staff information.
      b. Access Groups for all personnel / staff.
      c. Holiday Definition
      d. Special Access Privileges
      e. Lockdown / Pass-through Authorizations

E. Testing and Commissioning:
   1. The Contractor shall be responsible for final system hardware hook up and checkout prior to performance verification testing being conducted with the Owner. The Contractor shall pre-test all cabling to assure cabling is free from interference, opens, grounds, or short circuits.
   2. The Contractor shall develop a Performance Verification Testing (PVT) plan. The PVT plan shall identify each new system component included in the project, the intent of testing it, methods and tools required for the testing, and expected result. Each component shall be individually listed with space for noting PASS or FAIL, Contractor / Owner Sign-off, time and date of test, and related comments. The PVT plan shall be submitted to the Owner a minimum of 20 (TWENTY) working days prior to the scheduled beginning of PVT. No testing shall take place until Owner has approved the PVT.
   3. As a part of the final system commissioning, Contractor shall submit a listing of all enabled passwords within the system, and shall provide instruction specific to changing the password after the Contractor's departure from the site.
   4. Following satisfactory completion of PVT plan, the system shall be operated at normal facility load for a period of 30 calendar days as a burn-in period. If any item or system fails during the burn-in period, the burn-in period shall be suspended until such item or system has been corrected, at which time the test period will recommence. Notice of final System Acceptance will be withheld until burn-in period has been successfully completed.
   5. Notice of Final System Completion will not be issued until the following requirements have all been met:
      a. All required submittals accepted.
      b. Delivery of final documentation, including but not limited to As-Builts drawings.
      c. Successful PVT & burn-in period
      d. Completion of all required training activities.
      e. Purging of all Contractor passwords and removal of all Contractor access to the systems.

F. Training and Instruction:
   1. Before the system is turned over to the owner, the manufacturer shall provide 16 hours of system operations and maintenance training at the project site using the customer's equipment for up to 10 of the owner's representatives. The Owner shall determine hours to be allocated to each training type.
   2. This training shall be conducted during normal business hours of the equipment supplier at a date and time of mutual convenience.
   3. This training shall be conducted by a manufacturer certified trainer.
   4. Training materials shall not be generic, and shall be specific to the project.
   5. Training for the Access Control System shall be equivalent to Schlage Part Number SEUADMIN, and shall be performed on-site by a factory trained instructor.

G. Warranty:
   1. The system shall be warrantied for a period of 1 year from date of acceptance. Written notification shall be sent to the owner stating the date this warranty period has started.
   2. The equipment manufacturer shall provide with their bid package to the owner a maintenance contract proposal to provide a minimum of two inspections and preventative tests per year.
   3. The Contractor shall provide with their bid package to the Owner a proposal for an extended parts and labor warranty service, priced for the 1st, 2nd, and 3rd years of post-warranty period operation.
   4. Warranty service shall be separated into 2 classes of service, critical item service and non-critical item service.
   5. Critical items shall be described as any part or device, included as a part of this contract which if fails would cause major parts of the system (more than 30% of the cameras) to be inoperable. Critical failures are to be corrected within 24 hours of notification to the Contractor, 7 days per week. Non-critical failures are to be corrected within 7 days of notification to the Contractor.

H. Site Clean-up
   1. Upon completion of the contract, Contractor shall be responsible for project site cleanup. All installed materials shall be clean, enclosures free of dust and debris, and surfaces wiped free of smudges and fingerprints. The Contractor shall remove all project associated debris and rubbish occasioned by the work from the site. The contractor shall clean all interior spaces dirtied by the work. Remove all temporary protective covers and shrouds from all equipment.

END OF SECTION

SECTION 28 20 00

VIDEO SURVEILLANCE SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:
1. Under this Section, the Contractor is to provide Video Surveillance System, including procuring, installing, and rendering fully operational all necessary surveillance system components required for a complete and workable installation which meets or exceeds the project performance specifications.
2. Equipment to be provided and installed includes, but is not limited to:
   a. Fixed Pole Mount Mini-dome Type Megapixel Cameras
   b. Fixed Pole Mount ALPR Cameras
   c. Power and Data Cabling, Conduit, and Infrastructure to be provided, installed and terminated by the communications contractor
3. The work includes providing all labor, materials, tools, equipment, and documentation required for a complete and working surveillance system as specified in this document, unless some portion is specifically noted otherwise.

B. Related Work Provided by Owner:
1. The Contractor shall coordinate the work with the related work provided by the Owner including but not limited to the following:
   a. Network from local patch panel / switch serving as termination point for the cameras back to the VMS server
   b. All cabling, cabling terminations, and conduit/boxes/fittings

C. Abbreviations and Acronyms
1. ACS = Access Control System
2. ALPR = Automatic License Plate Reader
3. CCD = Charge Coupled Device
4. CMOS = Complimentary Metal-Oxide Semi-Conductor
5. CPU = Central Processing Unit
6. DSP = Digital Signal Processor
7. DVD = Digital Video Disc
8. DVRMS = Digital Video Recording and Management System
9. GB = Gigabyte
10. GUI = Graphical User Interface
11. HDD = Hard Disk Drive
12. IR = Infrared
13. IPS = Images per Second
14. JPEG = Joint Photographic Experts Group
15. MB = Megabyte
16. MPEG = Moving Pictures Experts Group
17. NAS = Network Attached Storage
18. LAN = Local Area Network
19. LED = Light Emitting Diode
20. RAID = Redundant Array of Independent Disks

21. RAM = Random Access Memory
22. TCP/IP = Transport Control Protocol / Internet Protocol
23. UPS = Uninterruptable Power Supply
24. POE = Power Over Ethernet
25. PVT = Performance Verification Testing
26. V-LAN = Virtual Local Area Network
27. VMS = See DVRMS
28. VSS = Video Surveillance System
29. WAN = Wide Area Network
30. WDR = Wide Dynamic Range

D. Definitions
1. Surveillance System – IP-based electronic system which provides visual surveillance and recording of selected areas.

1.02 RELATED DOCUMENTS

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

B. The Specifications and Drawings are intended to be complementary. A specific section, paragraph or heading in a Division may not describe all details concerning work to be done and materials to be furnished. The Drawings are diagrammatic and may not show all of the work required or all construction details. Dimensions are shown for critical areas only; all dimensions and actual placements are to be verified in the field. It is to be understood that the best trade practices of the Division will prevail. It remains the responsibility of the Contractor or Subcontractor to provide all items, equipment, construction, and services required to the proper execution and completion of the Work.

C. Reference listings are provided as a convenience to the Contractor or Subcontractor providing the Work of this Section and may not contain all the requirements affecting this Section. It remains the responsibility of the Contractor or Subcontractor to locate and comply with all requirements of the Contract Documents.

D. All related specification sections shall be used in conjunction with this section.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: The manufacturer of all equipment installed as a part of this contract shall meet the following criteria:
1. Shall be regularly engaged in the manufacture and assembly of similar type equipment for a minimum of five (5) continuous years preceding the date of this document.
2. Shall have an office staffed with factory trained technicians, fully capable of engineering, supervising installation, system start-up, providing Owner training and supervising of both hardware and software for the all systems installed as a part of this project.

B. Contractor Qualifications: The Contractor shall meet the following qualifications at a minimum:

1. Shall be an authorized factory trained and certified reseller of all system components installed or interfaced with as a part of this contract.
2. Contractor shall be regularly engaged in installing similar equipment, and shall have successfully completed 3 systems of a comparable size and scope within the preceding 3 years of the date of this document. These systems must be currently in operation, and the contractor shall supply the following reference information with their proposal:
   a. Name of Client
   b. Type of Facility
   c. System Installed
   d. Date of Substantial Completion
   e. Names of Contractor's Key Personnel on Project
   f. Contact Name, Title, Phone, and Email
3. It is expected by the Owner that the same key personnel will execute this project as completed the referenced work. This would include the Project Manager, the Project Engineer, and the Lead Installer. Resumes will be provided for these personnel. If different key personnel are executing this project than executed the reference projects, resumes for these personnel shall be provided for the Owner's approval with the Contractor's bid package.
4. Sub-contractors shall provide resumes showing qualification for the specific system that the sub-contractor will be installing / configuring.
5. In order to assure system cable plant is warrantied for 20-Years, Contractor shall be certified in the installation of BerkTek Cabling systems. Project installation staff shall be similarly and independently certified as required by the manufacturer..

1.04 SUBMITTALS

A. General:
   1. Prior to installing any material related to or required by this section, submit the following information for review.
      a. Block diagrams of the proposed system and interconnection wiring diagrams showing all connections required between system components.
      b. A materials list with names of manufacturers, model numbers, and technical information on all equipment proposed. Product technical information sheets for each principal component in the proposed system. Where the data sheet covers a range of material, the specific part number shall be highlighted
      c. 6 complete sets of operations and maintenance manual for the system products being supplied, provided in 3-ring binders, and 1 complete set submitted in electronic format on DVD. Include complete sets of the equipment operating instructions, installation instructions, and troubleshooting guides.

B. Testing:
   1. PVT Plan to be submitted a minimum of 20 working days prior to planned start of PVT procedure.

C. Close Out:
   1. Within 10 working days of substantial completion and prior to project closeout, the Contractor shall provide to the Owner a complete set of As-Built drawings, showing any deviation from the original plans and specifications, in mounting location, infrastructure pathway, or any other substantive change.

1.05 WARRANTY

A. General:
1. All equipment and system shall be warranted against defects in material and workmanship for a period of one (1) year from the date of startup. Warranty coverage shall include parts, labor, travel, expenses, and labor to remove/reinstall all products. The warranty document shall be submitted with the Contractor's submittals and shall include details on inclusions and exclusions, deductibles, and availability of extended coverage options, priced for extended coverage in years 2, 3, and 4 past expiration of the original warranty period.
2. Warranty service shall be separated into 2 classes of service, critical item service and non-critical item service.
3. Critical items shall be described as any part or device, included as a part of this contract which if fails would cause major parts of the system (more than 30% of the cameras) to be inoperable. Critical failures are to be corrected within 24 hours of notification to the Contractor, 7 days per week. Non-critical failures are to be corrected within 7 days of notification to the Contractor.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Video Surveillance System Equipment:
1. WV-S2531LN Exterior Rated 1080p Resolution Dome Camera as manufactured by Panasonic. This device is being installed as part of an expansion to an existing District system, and in order to assure compatibility as well as simplify maintenance procedures and spare parts procurement, device shall be as specified with no equivalent.
2. Ocularis VMS Software by ONSSI. Security Contractor shall coordinate software version with the Owner. This software is being installed as part of an expansion to an existing District system, and in order to assure compatibility as well as simplify maintenance procedures and spare parts procurement, software shall be as specified with no equivalent.
3. All servers, workstations, and storage hardware shall be provided by the Owner. All software shall be provided, installed, and configured by the Contractor.
4. Network Switch / Patch Panel at termination point shall be provided by the Owner.
5. All cabling and cabling terminations shall be provided by the communications contractor.

PART 3 - EXECUTION

3.01 General Intent – It is the intent of the owner to have a qualified contractor install a complete and fully operational Video Surveillance System, as shown on the project drawings provides the ability to remotely view and record select areas of the campus as indicated on the project drawings.

3.02 The contractor shall procure, provide, install, and make fully operational the system as described in this specification and shown on the project drawings. Specific scope items include, but are not limited to:

A. Provision, installation, and configuration of surveillance system components as shown on project drawings

B. Provision and installation of surveillance system software (Owner to provide workstations and servers)

3.03 DELIVERY, STORAGE AND HANDLING:

A. Product Acceptance, Storage, and Handling Requirements
   1. Acceptance – Upon delivery to the project site, Contractor shall inspect all products and materials to assure that all products and material have been received in a new and undamaged state. Acceptance of the shipment, by the Contractor, shall constitute acknowledgement that the Contractor has reviewed the products and material and has found no discrepancies in quantity or condition, and that any products or materials subsequently found to be missing or damaged will be the sole responsibility of the Contractor.
   2. Storage and Handling - Store products and materials in the original manufacturer's sealed packaging, in an environmentally controlled area per the manufacturer's specifications.

B. Before Beginning Work
   1. Verification of Conditions – Security Contractor shall coordinate with Communications Contractor to assure all installed copper and fiber optic cabling being utilized as a part of the surveillance system is tested and completely operational and that cabling is free from interference, opens, grounds, or short circuits. Any unsatisfactory cabling shall be reported to the Owner.
   2. Proceed with installation only after all unsatisfactory issues have been corrected or resolved.

C. General Installation Requirements:
   1. Maintain strict site security throughout the course of the project. Rooms housing the equipment and workstations shall be locked up and secure during periods when Contractor personnel are not present.
   2. Utilize protective cover, fenders, and barriers to ensure all equipment remains in an undamaged and new condition until notice of substantial completion.
   3. Install system per the manufacturer's instructions.
   4. The installed system must meet all local, state, and federal codes.
   5. Contractor shall verify that all IDF outlets used for powering video surveillance system components are connected to the buildings emergency power UPS.

6. Camera locations shown on drawings are preliminary in nature and Contractor shall verify final placement of all cameras with the Owner before any installation takes place.

D. Coordination
   1. Contractor shall coordinate all work with any other trades present on the project which will be directly affected by the execution of this contract.
   2. Contractor shall coordinate all work with the Owner as to avoid impacting any student activities or classes to the greatest extent possible.

E. Testing and Commissioning:
   1. The Contractor shall be responsible for final system hardware installation, configuration and checkout prior to performance verification testing being conducted with the Owner.
   2. The Contractor shall develop a Performance Verification Testing (PVT) plan. The PVT plan shall identify each new system component included in the project, the intent of testing it, methods and tools required for the testing, and expected result. Each component shall be individually listed with space for noting PASS or FAIL, Contractor / Owner Sign-off, time and date of test, and related comments. The PVT plan shall be submitted to the Owner a minimum of 20 (TWENTY) working days prior to the scheduled beginning of PVT. No testing shall take place until Owner has approved the PVT.
   3. As a part of the final system commissioning, Contractor shall submit a listing of all enabled passwords within the system, and shall provide instruction specific to changing the password after the Contractor's departure from the site.
   4. Following satisfactory completion of PVT plan, the system shall be operated at normal facility load for a period of 30 calendar days as a burn-in period. If any item or system fails during the burn-in period, the burn-in period shall be suspended until such item or system has been corrected, at which time the test period will recommence. Notice of final System Acceptance will be withheld until burn-in period has been successfully completed.
   5. Notice of Final System Completion will not be issued until the following requirements have all been met:
      a. All required submittals accepted.
      b. Delivery of final documentation, including but not limited to As-Builts drawings.
      c. Successful PVT & burn-in period
      d. Completion of all required training activities.
      e. Purging of all Contractor passwords and removal of all Contractor access to the systems.

F. Training and Instruction:
   1. Before the system is turned over to the owner, the manufacturer shall provide 16 hours of system operations and maintenance training at the project site using the customer's equipment for up to 10 of the owner's representatives. The Owner shall determine hours to be allocated to each training type.
   2. This training shall be conducted during normal business hours of the equipment supplier at a date and time of mutual convenience.
   3. This training shall be conducted by a manufacturer certified trainer.
   4. Training materials shall not be generic, and shall be specific to the project.

G. Warranty:
   1. The system shall be warrantied for a period of 1 year from date of acceptance. Written notification shall be sent to the owner stating the date this warranty period has started.
   2. The equipment manufacturer shall provide with their bid package to the owner a maintenance contract proposal to provide a minimum of two inspections and preventative tests per year.
   3. The Contractor shall provide with their bid package to the Owner a proposal for an extended parts and labor warranty service, priced for the 1st, 2nd, and 3rd years of post-warranty period operation.

H. Site Clean-up
   1. Upon completion of the contract, Contractor shall be responsible for project site cleanup. All installed materials shall be clean, enclosures free of dust and debris, and surfaces wiped free of smudges and fingerprints. The Contractor shall remove all project associated debris and rubbish occasioned by the work from the site. The contractor shall clean all interior spaces dirtied by the work. Remove all temporary protective covers and shrouds from all equipment.

END OF SECTION

SECTION 28 30 00

FIRE ALARM SYSTEM

PART 1 – GENERAL

1.1 Work Included:

1.1.1 Furnish and install all equipment, accessories, and materials in accordance with these specifications and drawings to provide a complete and operating fire alarm system.

1.2 Related Work:

1.2.1 Division 26 01 00: Electrical General Provisions

1.2.2 Division 26 05 33: Conduit and Fittings
1.2.3 Division 26 05 34: Outlet and Junction Boxes

1.3 The equipment and installation shall comply with the current applicable provisions of the following standards:

NFPA 72-2016. . . . . National Fire Alarm Code with California Amendments.
CBC - 2016. . . . . .California Building Code (CBC), Part 2, Title 24, CCR.
CEC - 2016. . . . . .California Electrical Code, (CEC), Part 3, Title 24, CCR.
CFC - 2016. . . . . .California Fire Code (CFC), Part 9, Title 24, CCR.

1.4 The system and all components shall be listed by Underwriters Laboratories, Inc. for use in Fire Protective Signaling Systems under the following standards as applicable:

UL 38 . . . . . .Manually Actuated Signaling Boxes.
UL 50 . . . . . .Cabinets and Boxes.
UL 268 . . . . . .Smoke Detectors for Fire Protective Signaling Systems.
UL 268A . . . . . .Smoke Detectors for Duct Applications
UL 346 . . . . . .Waterflow Indicators for Fire Protective Signaling Systems.
UL 464 . . . . . .Audible Signaling Appliances.
UL 521. . . . . Heat Detectors for Fire Protective Signaling Systems.
UL 864 . . . . . .Control Units for Fire Protective Signaling Systems.
UL 1481. . . . . .Power supplies for Fire Protective Signaling Systems.
UL 1971. . . . . .Visual Signaling Appliances.

1.5 Only Fire Alarm Control Panel Equipment and Peripheral Field Devices have been shown on the Contract Bid Single Line Block Diagram. Specific and complete wiring between Control Equipment and Peripheral Equipment has been deleted for clarity.

1.6 Submittal shall be made **in accordance with Division 26 01 00 – Shop Drawings and Submittals.** This submittal shall include the following:

1.6.1 Complete bills of quantities, including all materials, components, devices, and equipment required for this work. The bills of quantities shall be tabulated respective of each and every system as specified, and shall contain the following information for each item listed:

1.6.1.1 Quantity of each type of equipment item.
1.6.1.2 Description of each item.
1.6.1.3 Manufacturer's Name and Model Number.
1.6.1.4 Manufacturer's Specification Sheet.
1.6.1.5 California State Fire Marshall Listing Sheets for all components.
1.6.1.6 Equipment items which have individual components, will require that all component parts be listed individually.
1.6.1.7 Letter indicating the contractor's intent to comply with Phase II submittal drawings.

1.7 Phase II Submittal shall be provided **within (20) working days** after the approval of the Phase I submittals and prior to any fabrication or field conduit installations. All shop drawings shall be engineered and drawn on a CAD System. Each submission shall include 'D' or 'E' size print copies to match the contract drawings, and one (1) data disk copy with files in a AutoCAD 2000i or 2004 format . Building floor plan CAD files on disk, will be made available via express mail after the receipt of payment of $50.00 per building floor plan, or $300.00 minimum which ever is less. Contractor shall make the request for drawings in writing directly to Johnson Consulting Engineers, confirmation of the request and a release form will be forwarded to the contractor to include a signed copy with payment prior to release of files. Detail or riser diagram sheets or any other drawings other than floor or site plans, will not be made available to the contractor.

1.7.1 **Provide complete shop drawings to include the following:**

1.7.1.1 Complete floor plans, at scale of contract documents, showing the locations throughout the project of all receptacles, conduits, wireways, tray, pullboxes, junction boxes, equipment racks, and other devices.

1.7.1.2 Point to point wiring diagrams showing wiring from panel terminals to each device.

1.7.1.3 Scaled floor plans indicating the location of devices, conduit runs, types, and number of conductors.

1.7.1.4 Riser diagram indicating all wiring and circuits.

1.7.1.5 Current State Fire Marshal listing sheets for all components and devices.

1.7.1.6 Provide battery power supply calculations, indicate point of power supply connection, means of disconnect, over-current protection, etc. for each panel.

1.7.1.7 Provide detailed information on conductors to be used-manufacturer, type, size, insulation, etc.

1.7.1.8 Provide voltage drop calculations for all conductor run is from each panel (i.e., main FACP, remotes, power extenders, etc.) for each panel.

1.7.1.9 Provide written sequence of system operation matrix.

1.7.1.10 Provide list of zones. (Every device that is addressable.)

1.7.1.11 Provide detailed drawing for annunciator panel indicating all zones and initiating devices.

1.8 **Common submittal mistakes which will result in submittals being rejected:**

1.8.1 Not including the qualifications of the installing contractor.

1.8.2 Not including all items listed in the above itemized description.

1.8.3 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.

1.8.4 Not including actual manufacturer's catalog information of proposed products.

1.8.5 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

1.9 All equipment and material shall be new and unused, and listed by Underwriter's Laboratories for the specific intended purpose. All control panel components and field peripherals shall be designed for continuous duty without degradation of function or performance. All equipment covered by this specification or noted on Installation. Drawings shall be equipment suited for the application and shall be provided by a single manufacturer or be recognized and UL listed as compatible by both manufacturers.

1.10 It will be the responsibility of the Contractor to ensure proper specification adherence for system operation, final connection, test, turnover, warranty compliance, and after-market service. The distributor of the equipment specified must be factory-trained and certified.

1.11 Basic System Functional Operation, upon operation of any automatic, manual or other initiation device the following shall occur:

1.11.1 The system alarm LED shall flash.

1.11.2 A local piezo electric signal in the control panel shall sound.

1.11.3 A backlit 80 character LCD display shall indicate all information associated with the fire alarm condition, including the alarm point and its location within the protected premises.

1.11.4 History storage equipment shall log the information associated with each new fire alarm control panel condition, along with time and date of occurrence.

1.11.5 All system output programs assigned via control by event equations to be activated by the particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.

1.11.6 LED display and audible signaling at the remote annunciator indicating building, fire zone, and type of device. Annunciator shall also provide a separate audible signal for CO detection with a green flashing light, with classroom number indication.

1.11.7 Automatic retransmission to a UL central station for fire department notification.

1.11.8 Automatic shut down of air conditioning units and/or smoke dampers furnished with duct detectors. Each building shall shut down all A/C units and dampers within that building as one zone.

1.12 All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approval agency for use as part of a protective signaling system, meeting the NFPA 72, 2016 Edition with California State Amendments.

1.13 All equipment and components shall be installed in strict compliance with manufacturer's recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

1.14 All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place. Fasteners and supports shall be adequate to support the required load.

1.15 All wiring shall be installed in a conduit system.

1.16 The contractor shall provide as a part of this contract additional control modules, heat detectors, smoke detectors, CO detector, duct detectors, manual pull stations, strobes, mini-horns and exterior horn devices etc., to equal 10% of the total quantity of devices shown on the drawings, or a minimum of three (3) for each type, whichever is greater. Installation of conduit, boxes and wiring of these devices shall be included, and required locations coordinated with CSFM final approved shop drawings. Any devices not required to be included during construction shall be delivered to the District at the completion of the project. The quantities of these devices shall be listed as a part of the Phase I submittals.

1.17 The installing contractor shall provide a copy of current documentation, indicating that the contractor installing the fire alarm systems or devices and wiring, is certified by Underwriters Laboratories (UL) in its product directories under the listing category "PROTECTIVE SIGNALING SERVICES - LOCAL, AUXILIARY, REMOTE STATION, AND PROPRIETARY." The contractor shall be certified by the manufacturer to install and program the system. The contractor must also provide complete installation of all wiring and equipment, and software programming. Supervised installation of the wiring, devices and/or any software programming shall not be permitted.

1.17.1 The installing contractor must also be an "authorized dealer" by the equipment manufacturer, and must have completed all required training prior to the bid of this project.

1.17.2 The fire alarm system installation shall be warranted by the manufacturer's representative.

1.17.3 The Contractor shall have a current California C-10 or C-7 Contractor's License, and all individuals working on this project shall have passed the Department of Industrial Relations Division of Apprenticeship Standards – "Fire / Life Safety Certification Program."

1.17.4 The installing contractor shall provide, at the time of submittal, a letter of intent to provide an extended service warranty. This warranty shall extend for a total of three (3) years, starting at the completion, testing, and training of this project. The service warranty shall cover all material and labor to keep operational all system devices installed under this project, and shall include two (2) complete U.L. system's tests and cleaning of all devices at year two (2) and year three (3) of the warranty. Routine cleaning of devices, other than at the two (2) specified U.L. system's testing periods, will not be included as a part of this warranty.

1.17.5 The installing contractor shall provide, at the time of submittal, a letter indicating that the installation crew for this project meets the following NICET certifications:

1.17.5.1 25% of the installing field personnel must have completed NICET Level 2 Certification.

1.17.5.2 One of the installing field personnel and /or supervisor must have completed NICET Level 3 Certification.

1.17.5.3 Contractor shop drawings shall be signed by an individual who has completed NICET Level 4 Certification.

1.18 All conduit and standard backboxes will be furnished and installed by the Division 26 Contractor. Specialty boxes will be furnished by the equipment supplier to be installed by the Division 26 Contractor.

1.19 Equipment and materials shall be the standard product of Simplex, Notifier, or FCI.

Alternate equipment as manufactured by any other manufacturer not specifically listed above will not be approved for use on this project. D.S.A approved drawings are included as a part of the drawing set

PART 2 - PRODUCTS

2.1 Main Fire Alarm Control Panel

2.1.1 Fire alarm control panel Simplex, Notifier, or FCI .

2.1.2 The system shall be controlled and supervised by a microprocessor based monitoring fire alarm control panel. The systems shall be addressable, field configurable, programmable and editable. The system shall continuously scan devices for change of status. Each device shall have its own unique address, but shall also be grouped by building as a separate zone for remote annunciation and alarm report purposes.

2.1.3 The system shall be provided with a networking card and software and modem to communicate with the District-wide diagnostic and annunciation network.

2.1.4 The fire alarm control panel shall be housed in a lockable, code gauge steel cabinet with 80 character LCD display, master controller operators panel, Indicating lamps, silence switch and reset switch mounted on cabinet front. The fire alarm control panel shall be physically and visually located in the general office for monitoring by staff, and shall sound the “Temporal Pattern” in all zones. Signal duration shall be field programmable and initially set at three minutes. Provide all control modules, synchronous modules, etc., to provide a complete working system per all codes that apply.

2.1.5 The fire alarm control panel shall come with standardized software for on-site customization of the system. The unit shall be capable of providing a 600-event historical log with zone or point selectable alarm verification.

2.1.6 The unit shall support 127 addressable points per module and one output point, SPST contact per zone. Provide the number of modules

necessary to control and supervise fire alarm devices as shown on the Drawings, as well as to provide 25% spare capacity.

2.1.7 The fire alarm control panel shall be capable of providing a walk test.

2.2 The power feed for the FACP shall be 3-wire, 120volt, AC, single phase (20A circuit) permanently labeled “FIRE ALARM CONTROL POWER”, terminating at the master fire alarm control and supervisory panel. The label shall be red with 1/4” high white lettering. The source circuit breaker must be provided with a lock-on device.

2.3 In addition to the AC circuit, the panel shall be equipped with a DC battery to activate an audible alarm and pilot light in case of a power failure on the AC circuit.

2.4 Batteries must drive signaling devices per current requirements of California State Fire Marshal. Battery calculations are required as part of the submittal.

2.5 The master fire alarm panel shall be equipped with a manual pull lever type, supervised report station.

2.6 With the exception of the manually operated report station required at the master fire alarm panel and large assembly areas, the remainder of the school facility shall be equipped with approved, electronically supervised, automatic fire detection devices, such that every room, space, including concealed spaces, such as the attic spaces above ceilings, etc., is provided with approved coverage.

2.7 Automatic fire detection devices shall be addressable analog smoke and heat detectors. Where used, heat detectors shall be fixed temperature x-rate of rise, fixed at 135□F and a 15□F/min rate of rise. In janitor rooms equipped with kilns, devices shall be fixed at 170□F.

2.8 MANUAL FIRE ALARM STATIONS shall be addressable test-reset lock in order that they may be tested, and so designed that after actual emergency operation, they cannot be restored to normal, except by use of a key. An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of 100 feet, front or side. Manual stations shall be constructed of die-formed, satin-finished aluminum, with operating directions provided on the cover in depressed red letters. The word FIRE shall appear on each side of the stations in depressed letters, 1/2-inch in size or larger. Stations shall be suitable for semi-flush mounting on a standard single-gang box or switch plate, and shall be provided with a terminal block for connection of fire alarm system wiring. Manual pull stations must comply with CBC sections 11B-309 and 11B-403.

2.9 HORN / STROBE DEVICE shall be of the semi-flush type designed for mounting to a standard four-inch square electrical outlet box. Each device shall be provided with a semi-flush accessory plate. Exterior horns shall be weatherproof. The strobe unit shall have a meantime between failure (MTBF) of 1,000 hours or greater. The strobe section shall have a minimum flash rate of approximately

one flash per second, with candela rating as per UL standard 1971. Housing shall be white.

2.9.1 In areas containing two or more audible devices, or three or more visual devices, these devices shall be synchronized, Per NFPA 72, Chapter 6 California Amendments (2016).

2.10 STROBES. The strobe unit shall have a meantime between failure (MTBF) of 1,000 hours or greater. The strobe section shall have a minimum flash rate of approximately one flash per second, with candela rating as per UL standard 1971. Housing shall be white.

2.10.1 In areas containing two or more audible devices, or three or more visual devices, these devices shall be synchronized, per NFPA 72, Chapter 6 California Amendments (2016).

2.10.2 Maximum pulse duration to be 0.20 of a second with an ADAAG 4.28.3(3). Visual alarms maximum duty cycle of 40%.

2.10.3 Capable of providing minimum candela. Intensity as shown on plans (effective strength measured at the source).

2.10.4 The flash rate to be a minimum of 1.Hz and a maximum of 3 Hz.

2.11 HEAT DETECTOR DEVICES shall be addressable, fixed temperature x rate of rise, fixed at 135□F and a 15□F/min rate of rise. In janitor rooms equipped with kilns, devices shall be fixed at 170□F.

2.12 SMOKE DETECTOR DEVICES shall be analog addressable, photo-electric.

2.13 CO – CARBON MONOXIDE detectors shall be provided in all Group E Classrooms and provided with a sounder base to alarm individual classrooms with a 4-pulse temporal pattern as well as transmitting to the staffed remote annunciator.

2.14 DUCT TYPE DETECTORS shall be analog addressable, photo-electric type, provide with remote test switch and auxiliary contacts as required for control of A/C units or smoke dampers.

2.15 DIGITAL ALARM COMMUNICATOR TRANSMITTER. The control panel shall have the ability to meet the requirements of UL 864 for central station connections, and shall be UL listed for use with the fire alarm control panel. The communicator shall be connected to supervise two telephone lines, all wiring required for this connection shall be provided by the fire alarm contractor Coordinate interface with District monitoring company as required.

2.16 REMOTE ANNUNCIATOR shall be an 80 character backlit, alphanumeric, LCD readout display. The display shall include alarm, supervisory, CO detection and trouble condition LEDs and tone alert. Each condition shall have a dedicated

acknowledge push button switch to silence the local tone alert but leaves the LED lights on until all conditions have been restored.

PART 3 - EXECUTION

3.1 All wiring shall be (min) #18 AWG copper or as noted on drawings. All underground conductors shall be UL wet location rated for use in wet locations, West Penn “Aquaseal” or equal. There shall be no splices in underground handholes or vaults. A multi-conductor cable rated for use in wet locations will also be acceptable. It must be labeled “FIRE ALARM” in all pull boxes, using a water-tight labeling system.

3.2 Interior, dry location wiring for low voltage initiating circuits shall be #18 AWG copper, twisted shielded pair minimum, signaling circuits shall be No. 14 AWG minimum, and wiring for 120 volt circuits shall be No. 12 AWG minimum. All wiring shall be color coded, solid copper conductor. Use of power limited cable shall be restricted to controls listed for this purpose. Single conductors shall be type THHN/THWN-2 insulated copper.

3.3 Wire markers shall be provided for each wire connected to equipment. The marker shall be of the taped bank type, of permanent material, and shall be suitable and permanently stamped with the proper identification. The markers shall be attached in a manner that will not permit accidental detachment. Changing of wire colors within circuits shall be unacceptable.

3.4 A terminal cabinet shall be installed in the electric room for the fire alarm systems at each building. All fire alarm wiring shall terminate on UL approved strips in this terminal cabinet. All wiring shall be labeled at each termination strip. Wiring shall be configured such that all end-of-line resistors will be installed at the terminal cabinet.

3.5 Fire Sprinkler Activation detecting System(s) shall each be indicated on a separate zone in the fire alarm control panel.

3.6 Fire Alarm Control Panel and all other equipment shall be mounted with the center of all operable reset buttons, located a maximum of 48" front approach / 54" side approach above floor level.

3.7 Contractor shall provide complete wiring between all equipment.

3.8 The Fire Alarm/Life Safety Installation shall comply fully with all Local, State and National Codes, and the Local Authority Having Jurisdiction (AHJ) DSA.

3.9 The Fire Alarm Control Panel and power supply shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main Power Distribution Panel as FIRE ALARM CIRCUIT.

3.10 The Control Panel Cabinet shall be grounded securely to a power system ground conductor. Provide a 1/2-inch conduit and 1#12 grounding conductor to the building electrical service ground bus.

3.11 Conduit shall enter into the Fire alarm Control Panel back box only at those areas of the back box which have factory conduit knockouts.

3.12 All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring; an audible and visual trouble signal will be activated until the system and its associated field wiring are restored to normal condition.

3.13 All cables and wiring shall be listed for Fire Alarm/Life Safety use, and shall be of the type as required by and installed per CEC Article 760.

3.14 Final System Acceptance

3.14.1 Provide an NFPA Certificate of Compliance to DSA, the School District and Local Fire Marshall. Complete fire alarm system shall comply with and be sound-tested for a “Temporal Pattern” in all zones.

3.14.2 Beam detectors shall be tested by two methods:

3.14.2.1 Manual slow cover test to confirm reflector alignment is correct.

3.14.2.2 Software fire test per UL268.5 to demonstrate when signal level is reduced simulating obstruction the detector will go into alarm.

3.14.3 The system will be accepted only after a satisfactory test of the entire system has been accomplished by a Factory-Trained Distributor in the presence of a representative of the authority having jurisdiction and the Owner's representative. This contractor shall provide all personnel, ladders and testing equipment to assist the local authority in completing this test. Actuate each device and verify that the system performs as specified.

3.14.4 The Contractor will present a complete set of "as-built" Fire Alarm/Life Safety system drawings, and the factory supplied Operator's Manuals as required by the General Provisions section of this specification.

3.14.5 Once the system has been tested and the certificate of compliance completed, the contract shall not be considered complete until after owner training has been completed. The contractor shall notify in writing their intent to provide the training for the system. This notification shall be given to the Division 21 Contractor, Architect and the Project Engineer a minimum of 2 weeks prior to the scheduled training session. The Division 21 Contractor and/or the architect shall be responsible for notifying the owner to confirm that the appropriate District personnel will be made available for this training session. If the Division 21 Contractor does not receive confirmation that the training session can be performed on the proposed date, than another time shall be provided. The training shall consist of the following:

3.14.5.1 Provide a minimum of one (1) four-to-six -hour training period located at the project site, to instruct District personnel in proper operation of all systems.

3.14.5.2 Provide a minimum of three (3) complete owner operation manuals for the District records.

3.14.5.3 Provide a minimum of two (2) complete as built sets of drawings for the District records.

3.14.5.4 Provide all spare parts as described in part 1 of these specifications

3.14.5.5 Provide written confirmation and proposed scheduled dates for follow up training and 1 year complete system test.

3.15 Follow up Training

3.15.1 Provide as a part of this contract, the follow up instructional training period within six (6) months after the final acceptance of the systems. This training shall include a minimum of one four-to-six-hour training period to instruct District personnel in proper operation of all systems and shall instruct the District technicians how to repair any non-operational parts of the system as required. All defective parts shall be replaced at no cost to the owner.

END OF SECTION