

Project No. 1642.00

August 8, 2017

ADDENDUM NO. 1
TO THE
DRAWINGS AND PROJECT MANUAL
FOR
MIDDLE SCHOOL 6
EAGLE MOUNTAIN-SAGINAW I.S.D.
FORT WORTH, TEXAS



08/08/2017

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1.1 GENERAL

- A. This addendum modifies the drawings and project manual, dated August 3, 2017, as noted within and shall become part of the Contract Documents.
- B. Proposers shall acknowledge receipt of this addendum in the space provided on the proposal form. Failure to do so may subject proposer to disqualification.
- C. Each holder of proposal documents registered with the Owner will receive a copy of the addendum. Each prime proposer is responsible for distribution of information conveyed by this addendum to its sub-proposers and suppliers.

1.2 DOCUMENT 00 01 10 - TABLE OF CONTENTS

- A. Page 00 01 10 – 6, Add the following:

“27 05 00 - Common Work Results for Communications
27 05 26 - Grounding and Bonding for Communications
27 05 28 - Pathways for Communications Systems
27 05 53 - Identification for Communications Systems
27 11 00 - Communications Equipment Room Fittings
27 13 00 - Communications Backbone Cabling
27 15 00 - Communications Horizontal Cabling
27 41 00 - Audio-Video Systems
27 41 16 - Public Address System
28 05 00 - Common Work Results For Electronic Safety and Security
28 10 00 - Electronic Security Systems”

1.3 SECTION 27 05 00 - COMMON WORK RESULTS FOR COMMUNICATIONS

- A. This section, attached hereto, is entirely new and is hereby made a part of this addendum.

1.4 SECTION 27 05 26 - GROUNDING AND BONDING FOR COMMUNICATIONS

- A. This section, attached hereto, is entirely new and is hereby made a part of this addendum.

1.5 SECTION 27 05 28 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

- A. This section, attached hereto, is entirely new and is hereby made a part of this addendum.

1.6 SECTION 27 05 53 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

A. This section, attached hereto, is entirely new and is hereby made a part of this addendum.

1.7 SECTION 27 11 00 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

A. This section, attached hereto, is entirely new and is hereby made a part of this addendum.

1.8 SECTION 27 13 00 - COMMUNICATIONS BACKBONE CABLING

A. This section, attached hereto, is entirely new and is hereby made a part of this addendum.

1.9 SECTION 27 15 00 - COMMUNICATIONS HORIZONTAL CABLING

A. This section, attached hereto, is entirely new and is hereby made a part of this addendum.

1.10 SECTION 27 41 00 - AUDIO-VIDEO SYSTEMS

A. This section, attached hereto, is entirely new and is hereby made a part of this addendum.

1.11 SECTION 27 41 16 - PUBLIC ADDRESS SYSTEM

A. This section, attached hereto, is entirely new and is hereby made a part of this addendum.

1.12 SECTION 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

A. This section, attached hereto, is entirely new and is hereby made a part of this addendum.

1.13 SECTION 28 10 00 - ELECTRONIC SECURITY SYSTEMS

A. This section, attached hereto, is entirely new and is hereby made a part of this addendum.

END OF ADDENDUM NO. 1

SECTION 27 05 00

COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Structured cabling for voice and data
- B. Grounding and Bonding
- C. Cable Pathways
- D. Cable management
- E. Outfitting of communication equipment rooms

1.2 RELATED WORK SPECIFIED UNDER OTHER DIVISIONS

- A. Foundations and pads required for equipment furnished under this Division
- B. Field painting, except such painting as is required to maintain shop coat painting and factory finish painting.
- C. Flashing of conduits into roofing and outside walls.
- D. Heating, ventilating, and air conditioning equipment.
- E. Electrical service to equipment rooms.
- F. Cutting and patching for low voltage systems work, except for errors and omissions under this Division.

1.3 RELATED WORK - OWNER FURNISHED EQUIPMENT AND SYSTEMS

- A. Telephone system electronics
- B. Data network electronics
- C. Computer workstations, servers, printers and other peripherals

1.4 QUALITY ASSURANCE

- A. Contractor shall identify all types of quality control mechanisms they employ. Please list.
- B. Perform work in accordance with contract documents.
- C. All personnel performing the work of this Section shall be thoroughly familiar with the cabling methods set forth in the latest release of the BICSI TDMM (Building Industry Consulting Services International Telecommunications Distribution Methods Manuals).
- D. Contractor's RCDD shall review all required work prior to commencing. The Contractor's RCDD shall oversee the installation and will have the end responsibility for the quality of the installation work performed. All submitted designs and or changes to the design shall be approved and signed off by the Contractor's RCDD.
- E. The installed cabling systems shall not generate nor be susceptible to any harmful electromagnetic emission, radiation, or induction that degrades cabling systems.

- F. Expansion Capability: Unless otherwise indicated, provide spare positions in wall fields, cross connects, and terminal strips, and space in cable pathways to accommodate twenty (20) percent future growth in campus distribution and riser.
- G. Backward Compatibility: The provided solution shall be backward compatible with lower category ratings such that if higher category components are used with lower category components, the permanent link and channel measures shall meet or exceed the lower channel's specified parameters.
- H. Component Compliance: The provided solution's components shall each meet the minimum transmission specifications listed herein such that no individual component will be less than specifications for permanent and channel, regardless of the fact that tests for permanent and channel ultimately meet required specifications.
- I. Pre-installation inspection: Visually inspect all cables, cable reels, and shipping cartons to detect possible cable damage incurred during shipping and transport.
- J. Test optical fiber cable while on reels. Use an optical time domain reflectometer (OTDR) to verify the cable length and locate cable defects, splices, and connector, including the loss value of each.
- K. Test each pair of UTP cable for open and short circuits. Test results to be submitted to Owner.
- L. Visibly damaged goods are to be returned to the supplier and replaced at no additional cost to the Owner.

1.5 STANDARDS

- A. The Contractor's performance of the Work shall comply with applicable federal, state and local laws, rules and regulations. The Contractor shall give required notices, shall procure necessary governmental licenses, permits, and inspections and shall pay without burden to The Owner, all fees and charges in connection therewith unless specifically provided otherwise. In the event of violation, the Contractor shall pay all fines and penalties, including attorney's fees and other defense costs and expenses in connection therewith.
- B. Federal Communications Commission
 - 1. Equipment requiring FCC registration or approval shall have received such approval and shall be appropriately identified.
- C. Codes, Standards and Ordinances
 - 1. Design, manufacture, test, and install telecommunications cabling networks per manufacturer's requirements and in accordance with NFPA-70(National Electrical Code®), state codes, local codes, requirements of authorities having jurisdiction, and particularly the following standards:
 - a. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2010
 - b. ANSI/NECA/BICSI-568 – Standard for Installing Commercial Building Telecommunications Cabling, 2006
 - c. ANSI/TIA/EIA Standards
 - 1) ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises, 2009
 - 2) ANSI/TIA-568-C.0-1 –Generic Telecommunications Cabling for Customer Premises – Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling, 2010
 - 3) ANSI/TIA/EIA-568-C.1 – Commercial Building Telecommunications Cabling Standard, 2009 - Part 1: General Requirements, 2009
 - 4) ANSI/TIA/EIA-568-C.2 – Commercial Building Telecommunications Cabling Standard, 2009 - Part 2: Balanced Twisted Pair Cabling Components
 - 5) ANSI/TIA/EIA-568-C.3 – Optical Fiber Cabling Components Standard, 2008
 - 6) ANSI/TIA/EIA-569-B – Commercial Building Standard for Telecommunications Pathways and Spaces, 2004
 - 7) ANSI/TIA/EIA-606-B – The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 1993-2012
 - 8) ANSI-J-STD-607-A – Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2002
 - 9) ANSI/TIA/EIA-526-7 – Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant, 1998
 - 10) ANSI/TIA/EIA-526-14A – Measurement of Optical Power Loss of Installed Multimode Fiber Cable Plant, 1998
 - 11) ANSI/TIA/EIA-758-A – Customer-Owned Outside Plant Telecommunications Cabling Standard, 1999

- 12) ANSI/TIA-942 – Telecommunications Infrastructure Standard for Data Centers, 2006
 - 13) TIA/EIA TSB-67 – Transmission Performance Specifications for Field Testing of Unshielded Twisted Pair Cabling Systems.
- d. NEMA-VE-1 – Metal Cable Tray Systems, 2009
 - e. NEMA-VE-2 – Metal Cable Tray Installation Guidelines, 2006
 - f. NFPA-70 – National Electrical Code, 2008
 - g. Install cabling in accordance with the most recent edition of BICSI® publications:
 - 1) BICSI – Telecommunications Distribution Methods Manual, 13th Edition
 - 2) BICSI – Cabling Installation Manual
 - h. Federal, state, and local codes, rules, regulations, and ordinances governing the Work, are as fully part of the specifications as if herein repeated or hereto attached. If the Contractor should note items in the drawings or the specifications, construction of which would be code violations, promptly call them to the attention of the Owner's Representative in writing. Where the requirements of other sections of the specifications are more stringent than applicable codes, rules, regulations, and ordinances, the specifications shall apply.
 - i. American Society for Testing and Materials (ASTM): ASTM E. 814 – Standard Test Method for Fire Tests of Penetration Firestop Systems
 - j. Underwriters Laboratories, Inc. (UL): UL 1479 – Tests of Through-Penetration Firestop Systems
 - k. Americans with Disabilities Accessibility Guidelines.
 - l. Code of Federal Regulations, Title 29, Chapter XVII, Part 1910 (OSHA).
 - m. Uniform Building Code (UBC).
 - n. International Building Code (IBC).
 - o. Texas Department of State Health Services (TDSHS).
 - p. Applicable codes and directives of authorities having jurisdiction

1.6 COMPLETENESS OF WORK

- A. The Contract Documents depict low voltage systems which are intended to be complete and functioning systems. All products, materials, labor, and programming necessary to render a fully functional system to fulfill the design intent shown on the documents shall be provided by the Contractor.
- B. Catalog numbers referenced throughout this Division's drawings and specifications are intended to convey a general understanding of the type of quality of the product required. Where written descriptions differ from information conveyed by a catalog number, the written description shall govern. No extra charge shall be allowed because a catalog number is found to be incomplete or obsolete.

1.7 PRE-INSTALLATION CONFERENCE

- A. Arrange and schedule pre-installation conference prior to beginning any work of this section Communications.
- B. Agenda: Clarify questions in writing related to work to be performed, scheduling, coordination, etc. with consultant and/or project manager/Owner representative.
- C. All individuals, who will be in an on-site supervisory capacity, shall be required to attend the pre-installation conference. This includes project managers, site supervisor and lead installers. Individuals who do not attend the conference will not be permitted to supervise the personnel that install, terminate, or test communications cables on the project. The Contractor's RCDD that will oversee the installation is required to attend the pre-installation conference.
- D. The manufacturer that will be providing the extended warranty is required to have a representative attend the pre-installation conference.

1.8 SEQUENCE AND SCHEDULING

- A. The Contractor shall comply with all scheduling requests established by OAR, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and if accepted will be used to track work status.
- B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.

- C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.
- D. Submit schedule for installation of equipment and cabling. Indicate delivery, installation, and testing for conformance to specific job completion dates. As a minimum, dates are to be provided for bid award, installation start date, completion of station cabling, completion of riser cabling, completion of testing and labeling, cutover, completion of the final punch list, start of demolition, Owner acceptance, and demolition completion.

1.9 SUBMITTALS

- A. Comply with provisions of Division 01.
- B. Produce Shop Drawings for section 271100, 271300, and 271500.

1.10 ALTERNATES, SUBSTITUTIONS AND CHANGE ORDERS

- A. If a proposed alternate material is equal to or exceeds specified requirements, Contractor shall provide manufacturer's specifications in writing for written approval prior to purchase and installation of proposed materials. The proposed material substitution shall not void or change manufacturer's warranty.
- B. Contractor shall provide a complete cabling infrastructure according to these written specifications and drawings. If the Owner changes the scope of work to be performed by the Contractor, it shall be in writing. Contractor shall respond to these changes with a complete material list, labor, and taxes in writing presented to the Owner for approval. Contractor shall not proceed with additional scope of work without a signed approval by the Owner.
- C. Additional work performed by the Contractor will not be paid by Owner without signed approval of these changes prior to implementing changes. Submit a copy of signed change order upon billing.

1.11 USE OF THE SITE

- A. Use of the site shall be at the Owner's direction in matters in which the owner deems it necessary to place restriction.
- B. Access to building wherein the Work is performed shall be as directed by the Owner.
- C. The Owner will occupy the premises during the entire period of construction for conducting his or her normal business operations. Cooperate with the owner to minimize conflict and to facilitate the owner's operations.
- D. Schedule necessary shutdowns of plant services with the Owner, and obtain written permission from the owner. Refer to article - CONTINUITY OF SERVICES herein.
- E. Proceed with the Work without interfering with ordinary use of streets, aisles, passages, exits, and operations of the owner.
- F. All Contractor personnel must check in with the facilities engineering department and/or the General Contractor upon arrival and upon departure.

1.12 DELIVERY AND STORAGE

- A. Insofar as possible, deliver items in manufacturers' original unopened packaging. Where this is not practical, cover items with protective materials, to keep them from being damaged. Use care in loading, transporting, unloading, and storage to keep items from being damaged.
- B. Store items in a clean dry place and protect from damage.
- C. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the OAR.

- D. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.
- E. Provide protective covering during construction to prevent damage or entrance of foreign matter.
- F. Contractor is responsible for on-site security of tools, test equipment and materials.
- G. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.13 CONTRACTOR CLOSE OUT SUBMITTALS

- A. Submit Closeout documentation in accordance with Division 1 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 1 of the Project Manual, or a minimum of four (5) sets.
 - 1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.
 - 2. Test reports on all copper and optical fiber cables (electronic file format and hard copy).
 - 3. As-built cable schedules with recorded cable routing and lengths of each designated run.
 - 4. As built documentation of all cabling systems.
 - 5. As built documentation of IDF/TR modifications and associated cabinet elevations.
- B. Warranty, Operation, and Maintenance:
 - 1. Test Report Binder(s)
 - a. Commercial quality black, 3-ring binders with clear, durable, cleanable plastic covers.
 - b. Minimum size: 1"
 - c. Maximum size: 3"
 - d. When multiple binders are used, correlate the data into related groupings.
 - e. Label contents on spine and face of binder with full size insert label under plastic cover.
 - 2. Form of Operation/Maintenance Manuals
 - a. Prepare data in form of an instructional manual for use by Owner's personnel.
 - b. Format:
 - 1) Size: 8 1/2" x 11".
 - 2) Text: Manufacturer's printed data or neatly typewritten
 - c. Drawings:
 - 1) Provide reinforced punched binder tab and bind in text.
 - 2) Fold larger drawings to size of text pages
 - d. Provide flyleaf indeed tabs for each separate product or each piece of operating equipment.
 - e. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions."
 - List:
 - 1) Title of Project
 - 2) Identity of separate structures as applicable.
 - 3) Identity of general subject matter covered in the manual.
 - 3. Content of Operations/Maintenance Manuals
 - a. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
 - 1) Contractor, name of responsible principal, address and telephone number.
 - 2) A list of each product required to be included, indexed to content of the volume.
 - 3) List with each product, name, address and telephone number of:
 - a) Subcontractor or installer.
 - b) Maintenance contractor as appropriate.
 - c) Identify area of responsibility of each.
 - d) Local source of supply for parts and replacement.
 - 4) Identify each product by product name and other identifying symbols as set forth in Contract Documents.
 - b. Product Data:
 - 1) Include those sheets pertinent to the specific product.
 - 2) Annotate each sheet to:
 - a) Identify specific product or part installed.
 - b) Identify data applicable to installation.
 - c) Delete references to inapplicable information.
 - c. Drawings:
 - 1) Supplement product data with drawings as necessary to illustrate:
 - a) Relations of component parts of equipment and systems.
 - b) Cable Plant Layout

- 2) Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
 - 3) Do not use Project Record Documents as maintenance drawings.
 - d. Written text as required to supplement product data for the installation:
 - 1) Organize in consistent format under separate headings for different procedures.
 - 2) Provide logical sequence of instructions for each procedure.
 - e. Copy of each warranty, bond and service contract issued.
 - 1) Provide information sheet for Owner's personnel, giving:
 - a) Proper procedures in event of failure.
 - b) Instances which might affect validity of warranties or bonds.
 - f. Shop drawings, coordination drawings and product data as specified.
- C. Sections for Equipment and Systems.
1. Content for each unit of equipment and system as appropriate:
 - a. Description of unit and component parts.
 - 1) Function, normal operating characteristics, and limiting conditions.
 - 2) Performance data, engineering data and tests.
 - 3) Complete nomenclature and commercial number of replaceable parts.
 - b. Operating procedures:
 - 1) Start up, routine and normal operating instructions.
 - 2) Regulation, control, stopping, shut down and emergency instructions.
 - 3) Special operating instructions.
 - c. Maintenance procedures:
 - 1) Routine operations
 - 2) Guide to trouble-shooting.
 - 3) Disassembly, repair and reassembly.
 - 4) Adjusting and checking.
 - 5) Routine service
 - d. Manufacturer's printed operating and maintenance instructions.
 - e. Copies of typed directories of station outlets to reflect aerial room graphics numbers and room names (not architectural room numbers from the drawings).
 - 1) Data and Voice Distribution
 - 2) Security Devices
 - f. Original manufacturer's paths list, illustrations, assembly drawings and diagrams required for maintenance.
 - 1) Items recommended to be stocked as spare parts.
 - g. Schedule of low voltage wire and cable
 - h. Schedule of Communications station outlets and wiring devices
 - i. Schedule of security field devices
 - j. Each Contractor's coordination drawings.
 - 1) As installed color coded wiring and cabling diagrams.
 - k. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
 - l. Other data as required under pertinent sections of the specifications.
 2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
 3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications.
 4. Provide complete information for products specified in Division 27.
 5. Provide certificates of compliance as specified in each related section.
 6. Provide staid up and testing reports as specified in each related section.
 7. Provide signed receipts for spare parts and material.
 8. Provide training report and certificates.

1.14 RECORD DRAWINGS

- A. Keep a hard copy set of project drawings at the job site exclusively for recording deviations from the Construction Drawings.
- B. Record locations and depths of buried and concealed conduits from fixed, easily identifiable objects, such as building walls. Where conduits are concealed in walls, indicate distances off of building corners or other building features not likely to be disturbed by future alterations.
- C. Mark deviations in a different color so that work of various systems can be easily identified.

- D. When Work is completed, record all deviations in an electronic format using AutoCAD 2010 in a format usable to the Owner. Coordinate this format with the Owner.
- E. Submit two copies of completed "record drawings" on electronic media such as CD or DVD to Owner's Representative for distribution.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. All materials and equipment used in carrying out these specifications are to be new and have UL listing, or listing by other recognized testing laboratory when such listings are available.
- B. Model numbers and manufacturers included in this specification are listed to establish as standard of product quality.
- C. Other qualified manufacturers may be substituted only with The Owner's written consent. To request a substitution, the Contractor shall submit complete technical data, samples, and if requested, results of independent testing laboratory tests of proposed equipment.
 - 1. If proposed System includes equipment other than specified model numbers, submit a list of major items and their quantities, with a one-line schematic diagram for review.
 - 2. Material not specifically identified within this document but which is required for the successful implementation of the intended system(s), shall be of the same class and quality as the specified material and equipment.
 - 3. Include a list of previously installed projects using proposed equipment that are similar in nature to specified system.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Insofar as it is possible to determine in advance, advise the General Contractor to leave proper chases and openings. Place all outlets, anchors, sleeves, and supports prior to pouring concrete or installation of masonry work. Should the Contractor neglect doing this, any cutting and/or patching required is to be done at this Contractor's expense. Visit site and be informed of conditions under which work must be performed. No subsequent allowance will be made because of error or failure to obtain necessary information to completely estimate and perform work involved.
- B. Carefully coordinate with other divisions to ensure proper power requirements, grounding, fireproofing and interlocking controls between the fire alarm system, security system, and other owner furnished systems.
- C. Notify other tradesmen of any deviations or special conditions necessary for the installation of work. Interferences between work of various Contractors to be resolved prior to installation. Work installed not in compliance with specifications and drawings and without properly checking and coordinating as specified above shall, if necessary, be removed and properly reinstalled without additional cost to Owner.
- D. The Owner or the Owner's Representative shall be the mediating authority in all deviation and disputes arising on project.
- E. Coordinate with local telephone and cable service providers to assure that proper points of service, demarcation location and grounding requirements are in accordance with contract drawings. Duct bank is to be provided by Division 26. This Contractor shall be involved regarding discussions about services to the building.
 - 1. Coordinate with other trades to provide wall and ceiling access panels wherever required for access to communication equipment.
- F. Intent:
 - 1. These sections of specifications and drawings form a complete set of documents for communications systems for this project. Neither is complete without the other. Any item mentioned in one shall be as binding as though mentioned in both.
 - 2. The intent of these specifications and drawings is to form a guide for a complete systems installation. Where an item is reasonably necessary for a complete system but not specifically mentioned, such

as pull boxes, fittings, expansion fittings, support hangers, etc. provide same without additional cost to Owner.

3. Communication equipment room layouts indicated on drawings are diagrammatical only. Exact location of outlets and equipment to be coordinated and governed by project conditions. The designer reserves the right to make any reasonable changes (approximately 6 feet) in location of junction boxes, or equipment prior to roughing in of such without additional cost to Owner.

G. Deviations:

1. No deviations from specifications and drawings to be made without full knowledge and consent of the designer.
2. Should the Contractor find during progress of work that existing conditions make desirable a modification of the requirements of any particular item, report such item promptly to the designer for his decision and instructions.

H. Main Horizontal Pathway/Raceway

1. Unless otherwise noted on the drawings, all communications/low voltage systems cabling shall be routed above accessible corridor ceilings parallel to room walls and corridors via cable tray or J-hook supports. Cabling shall be segregated by function as follows:
 2. Voice/data cabling.
 3. All other systems.

3.2 CONTINUITY OF SERVICES

- A. The Contractor shall not take any action that will interfere with, or interrupt, existing building services unless previous arrangements have been made with the owner's representative. Arrange the Work to minimize shutdown time.
- B. Owner's personnel will perform shutdown of operating systems. The Contractor shall give three (3) days' advance notice for systems shutdown.
- C. Should services be inadvertently interrupted, immediately furnish labor, including overtime, material, and equipment necessary for prompt restoration of interrupted service.

3.3 TRENCHING, EXCAVATION, BACKFILLING, AND REPAIRS

- A. Trenching, Excavation, and Backfilling is the responsibility of the General Contractor. This Contractor is to coordinate all requirements with the GC. Failure to properly coordinate this effort resulting in additional trenching, excavation, backfilling, or repairs shall be performed without additional cost to Owner.

3.4 PLYWOOD BACKBOARD AND WALL BACKING

- A. Contractor shall provide 4' W x 8' H x 3/4" D fire retardant plywood backboard on each wall in all Communication Rooms. Plywood is to be painted with two coats of flat white fire retardant paint on all six sides and installed 6" above finished floor. The fire rating on the plywood shall be masked prior to painting and the mask removed after installation such that the fire rating is always visible.
- B. General Contractor is to provide appropriate backing in walls as required for mounting brackets and other wall mounted equipment per manufacturer requirements.
- C. Where work is to be done in an existing Telecommunication Room (TR), the Contractor shall ensure plywood in the TR is flame retardant. If the existing plywood does not comply the Contractor shall replace it with plywood compliant with 3.4.A.

3.5 FIRESTOPPING

- A. Select appropriate type or types of through penetration firestop devices or systems appropriate for each type of communications penetration and base each selection on criteria specified herein.
- B. Selected systems shall not be less than the hourly time delay ratings indicated in the Contract Documents for each respective fire-rated floor, wall, or other partition of building construction. Firestop for each type of communications penetration shall conform to requirements of an independent testing laboratory design drawing or manufacturer's approved modification when used in conjunction with details shown on the Drawings.

- C. Perform all necessary coordination with trades constructing floors, walls, or other partitions of building construction with respect to size and shape of each opening to be constructed and device or system approved for use in each instance.
- D. Coordinate each firestop selection with adjacent Work for dimensional or other interference and for feasibility. In areas accessible to public and other "finished" areas, firestop systems Work shall be selected, installed, and finished to the quality of adjacent surfaces of building construction being penetrated.
- E. Use materials that have no irritating or objectionable odors when firestopping is required in existing buildings and areas that are occupied.
- F. Provide damming materials, plates, wires, restricting collars, and devices necessary for proper installation of Firestopping. Remove combustible installation aids after firestopping material has cured.
- G. All firestops shall be installed in accordance with the manufacturer's instructions in order to maintain the specific rating assigned by the independent testing laboratory.
- H. Existing raceways, cable trays, and cabling that penetrate existing building construction shall be firestopped to the extent necessary to fill cavities that may exist between existing building construction and existing communications penetrations or existing conduit sleeve, and between existing conduits and existing conduit sleeve.
- I. If required by inspecting authorities:
 - 1. Expose and remove Firestopping to the extent directed by inspecting authority to permit his or her inspection.
 - 2. Reinstall new firestopping and restore Work where removed for inspection.

3.6 TESTS

- A. On completion of Work, installation shall be entirely free of damaged conductors, software errors, incomplete jack termination including labeling and faceplates and dust. Perform a thorough operation test in the presence of the Owner or their representative. Provide documentation of all test results as outlined in each system's specifications. Include labor, materials and instruments for above tests.
- B. Furnish owner, as a part of closing documents, a copy of such tests including identification of each cable, also the dedicated communication service ground test as required by each systems individual manufacturer indicating compliance with their requirements.
- C. Prior to final observation and acceptance, test and leave in satisfactory operating condition, all systems and equipment including but not limited to the following:
 - 1. Grounding.
 - 2. Firestopping of all sleeves and conduits.
 - 3. Telephone and LAN systems.
 - 4. Turn in test results on cabling.

3.7 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, dust, and construction debris and repair damaged finish, including chips, scratches, and abrasions. This includes touching up paint removed for grounding.
- B. Contractor shall provide a clean work environment, free from trash/rubbish accumulated during and after cabling installation.
- C. Maintain construction materials and refuse within the area of work. Clean the work area at the end of each day.
- D. Contractor shall keep all drinks (coffee, sodas, etc.) off finished floors, carpets, tiles, racks and equipment. If any liquid damage to above finishes or equipment, Contractor shall provide professional services to clean or repair scratched/soiled finishes or damaged equipment at own expense.

3.8 INSPECTION FEES AND PERMITS

- A. Obtain and pay for all necessary permits and inspection fees required for communication systems installation. Work shall not start until all permit applications are approved.

3.9 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to substantial completion, conduct an on-site training program to instruct Owner's operating personnel in the operation and maintenance of the communications systems.
 - 1. Provide the training during regular working day.
 - 2. The Ins0vctors shall be experienced in their phase of operation and maintenance of the electrical systems and with the project.
- B. Time to be allocated for instructions.
 - 1. Minimum of 12 hours dedicated instructor time
 - 2. 4 hours on each of 3 days
 - 3. Additional instruction time for specific systems as specified in other Sections.
- C. Before on-site training, submit the program syllabus; proposed time and dates; for review and approval, minimum 48 hours prior to proposed training time and date.
 - 1. One copy to the Owner
 - 2. One copy to the Architect/Engineer
- D. The Owner shall provide a list of personnel to receive instructions, and shall coordinate their attendance at file agreed upon times.
- E. Use operation and maintenance manuals as the basis of instruction. Review manual with personnel in detail. Explain all aspects of operation and maintenance.
- F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.
- G. Demonstrate equipment functions (both individually and as part of the total integrated system).
- H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.
- I. Submit a report within one week after completion of training. List time and date of each demonstration, hours devoted to the demonstration, and a list of people present, with their respective signatures.
- J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.
- K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.10 OBSERVATIONS

- A. When field observation services are a part of the project scope, the designer's office will provide periodic observation of the progress of Work specified herein. The purpose of the observation service is to ensure compliance of Contractor's Work with specifications and drawings. The designer's office may also observe tests required of this Contractor as called for in other sections of the specifications.
- B. Specifications and drawings represent Work to be done in view of total project requirements. To eliminate possible conflict with other trades, final location of conduits, jacks, outlets, components, etc., is responsibility of this Contractor. Contractor to provide all supervision required for his personnel to ensure that installation is made in accordance with specifications and drawings and all safety rules and regulations are observed. In event of conflicts of Work on project with other trades, Contractor is to make every reasonable effort to resolve conflict through meetings and discussions with other parties involved, by preparation of drawings, or other appropriate action. Only after this has been done shall the designer's assistance be requested through the RFI process.

- C. When the designer is requested to visit the project to aid in resolution of conflicts, or for witnessing tests, they shall be given a minimum of 48 hours' notice prior to time their presence is requested at job site.

3.11 WARRANTY-GUARANTEE

- A. The designer reserves right to accept or reject any part of the installation which does not successfully meet requirements as set out in these specifications.
- B. This Contractor shall, and hereby does, guarantee all Work installed under this division shall be free from defects in workmanship and materials for a period of two years from date of final acceptance. This Contractor further agrees to repair or replace any defective material or workmanship which is or becomes defective within the terms of this warranty-guarantee.
- C. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

END OF SECTION

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SECTION 27 05 26

GROUNDING AND BONDING FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide all labor, materials, and equipment for the complete installation of Work called for in the Contract Documents.
- B. This section includes the minimum requirements for the installation of telecommunications grounding systems in Telecommunications Rooms.
- C. Included in this section are the minimum composition requirements and installation methods for the following:
 - 1. Telecommunications Grounding Busbars
 - 2. Ground Blocks
 - 3. Compression Lugs
 - 4. Shield Bond Connectors

1.2 DEFINITIONS AND TERMS

- A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:
 - 1. ANSI American National Standards Institute
 - 2. AWG American Wire Gauge
 - 3. BICSI Building Industry Consulting Service International
 - 4. EIA Electronics Industries Association
 - 5. NECA National Electrical Contractors Association
 - 6. NEMA National Electric Manufacturers Association
 - 7. NFPA National Fire Protection Association
 - 8. RCDD Registered Communications Distribution Designer
 - 9. RFP Request for Proposal
 - 10. STD Standard
 - 11. TGB Telecommunications Grounding Busbar
 - 12. TIA Telecommunications Industry Association
 - 13. TMGB Telecommunications Main Ground Bus Bar
 - 14. UL Underwriters Laboratories

1.3 QUALITY ASSURANCE

- A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner.
- B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the Owner.
- C. Strictly adhere to all BICSI, EIA and TIA recommended installation practices when installing telecommunications grounding systems.
- D. Contractor's Qualifications:
 - 1. Firms regularly engaged in the installation of Electrical Systems or Data Communications cabling and that have five (5) years of installation experience with systems similar to that required for this project.
 - 2. Provide references to include client names, phone numbers and a summary of project details. These references will be checked and the clients will be asked questions relative to the performance of your company.
 - 3. Provide verification that installation personnel responsible have been properly trained to install the products described in this Section.

GROUNDING AND BONDING FOR COMMUNICATIONS

4. Provide a BICSI RCDD certified professional, or a master electrician, for oversight on this project. This person does not have to be working on-site, but must be accessible to answer questions and provide weekly status reports. The RCDD or master electrician shall be a full time employee of the contractor.
 5. Provide full time project manager with a minimum of ten (10) years field experience in installation of communications systems and infrastructures. Project manager shall be assigned for the duration of the project and shall not be replaced without written consent from the Owner.
- E. Manufacturer's Qualifications:
1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.
- F. Material and Work specified herein shall comply with the applicable requirements of:
1. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2010
 2. ANSI/NECA/BICSI-568 – Standard for Installing Commercial Building Telecommunications Cabling, 2006
 3. ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises, 2009
 4. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard, 2009
 5. ANSI/TIA/EIA-569-B – Commercial Building Standard for Telecommunications Pathways and Spaces, 2004
 6. ANSI/TIA/EIA-606-B – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 1993-2012
 7. ANSI-J-STD-607-A – Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2002
 8. ANSI/TIA-942 – Telecommunications Infrastructure Standard for Data Centers, 2005
 9. NFPA 70 – National Electric Code, 2008
 10. BICSI – Telecommunications Distribution Methods Manual, 12th Edition, 2009
 11. NEMA – VE 1 – Metal Cable Tray Systems, 2009
 12. NEMA – VE 2 – Metal Cable Tray Installation Guidelines, 2006
 13. Applicable codes and directives of authorities having jurisdiction
- G. Work:
1. The Work shall be performed in compliance with the applicable manufacturer's installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
 2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.
 3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
 4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.
- 1.4 CONFLICTS
- A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts between the aforementioned, notify the Owner in writing prior to commencement of affected work.
- 1.5 PERMITS
- A. The Contractor shall secure and pay for all necessary permits and fees required for the execution of this Work. Work will not start until all permit applications are approved.
- 1.6 SCHEDULING
- A. The Contractor shall comply with all scheduling requests established by Owner, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and, if accepted, will be used to track work status.
- B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.

- C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

1.7 REQUIREMENTS

- A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The Owner must approve material submittal and substitutions in writing.
- B. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.
- C. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.
- D. The requirements as given in this document are to be adhered to unless revised by the Owner in writing.
- E. The Owner reserves the right to waive these requirements at any time.

1.8 SUBMITTALS

- A. Comply with provisions of Division 01.
- B. Comply with provisions of Section 270500.
- C. Provide all submittal requirements under this section as a single package.
- D. Provide product data for the following:
 - 1. Product data consisting of manufacturers specifications for each type of product to be installed, all applicable certifications and elevation/plan documents supporting compliance with stated Specifications.
 - 2. Proposed format of as-built documentation.

1.9 CONTRACTOR CLOSE OUT SUBMITTALS

- A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (5) sets.
 - 1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.
 - 2. Provide above closeout documentation as an electronic file in PDF format.
- B. Warranty and Maintenance:
 - 1. Record Drawings

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer's recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.
- B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the Owner.
- C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.
- D. Provide protective covering during construction to prevent damage or entrance of foreign matter.
- E. Contractor is responsible for on-site security of tools, test equipment and materials.

- F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

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

1.12 WARRANTY

- A. Warrant labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics, following Contractor Warranty requirements defined in Division 01. Repair or replace defects occurring in labor or product within the Warranty period without charge.
- B. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The products specified in this document do not necessarily constitute the exhaustive list of products required to complete the statement of work. Except where described in the SUMMARY subpart of this document, the contractor is responsible for providing any other parts and materials needed to deliver a complete and working system.

2.2 WALL-MOUNT BUSBARS

- A. Telecommunications Grounding Busbar (TGB)
 - 1. Telecommunications Grounding Busbar (TGB) shall be constructed of .25" (6.4 mm) thick solid copper bar.
 - 2. The busbar shall be 4" (100 mm) high and minimum 12" (300 mm) long and shall have multiple attachment points for two-hole grounding lugs.
 - 3. The hole pattern for attaching grounding lugs shall meet the requirements of ANSI-J-STD-607-A and shall accept at least 12 lugs with 5/8" (15.8 mm) hole centers and 3 lugs with 1" (25.4 mm) hole centers.
 - 4. The busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating a 2" (50 mm) standoff from the wall.
 - 5. The busbar shall be UL Listed as grounding and bonding equipment.
 - 6. Acceptable Manufacturers:
 - a. Chatsworth Products 40153-012
 - b. Harger GB114412TMGB
 - c. Panduit GB4B0612TPI-1
 - d. Owner Approved Equivalent.

2.3 BONDING CONDUCTORS

- A. Telecommunications Bonding Conductors
 - 1. Telecommunications bonding conductors shall be a minimum 6 AWG in size.
 - 2. Conductors shall be composed of solid copper wire strands, surrounded with a green insulating jacket, carrying a THHN rating.
 - 3. Acceptable products:
 - a. Harger 619G
 - b. Southwire 204974
 - c. Approved equivalent

2.4 BONDING ACCESSORIES

GROUNDING AND BONDING FOR COMMUNICATIONS

- A. Lay-In Ground Terminal Block
 - 1. Ground terminal block shall be made of electroplated tin aluminum extrusion.
 - 2. Ground terminal block shall accept conductors ranging from #14 AWG through 1/0.
 - 3. The conductors shall be held in place by two stainless steel set screws.
 - 4. Ground terminal block shall have two 1/4" (6.4 mm) holes spaced on 5/8" (15.8 mm) centers to allow secure two-bolt attachment to the rack or cabinet.
 - 5. Ground terminal block shall be UL Listed as a wire connector.
 - 6. Acceptable Manufacturers:
 - a. Chatsworth Products 40167-001
 - b. Harger LI2/0142
 - c. Owner Approved Equivalent

- B. Compression Lugs
 - 1. Compression lugs shall be manufactured from electroplated tinned copper.
 - 2. Compression lugs shall have two holes spaced on 5/8" (15.8 mm) or 1" (25.4 mm) centers, as stated below, to allow secure two bolt connections to busbars.
 - 3. Compression lugs shall be sized to fit a specific size conductor, sizes #6 to 4/0, as stated below.
 - 4. Compression lugs shall be UL Listed as wire connectors.
 - 5. Acceptable Manufacturers:
 - a. Panduit LCC Series
 - b. Harger
 - c. Chatsworth Products
 - d. Owner Approved Equivalent

- C. Shield Bond Connectors
 - 1. Cable shields of multi-pair communications cables shall be bonded to ground when entering the building using shield bonding connectors with screw stud connection.
 - 2. Shield bond connectors shall be compatible for all cables up to 0.8" (20.3 mm) O.D.
 - 3. Acceptable Manufacturers:
 - a. 3M Scotchlok 4460-D
 - b. Owner Approved Equivalent

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Wall-Mount Busbars
 - 1. Attach busbars to the wall with appropriate hardware according to the manufacturer's installation instructions.
 - 2. Conductor connections to the TMGB or TGB shall be made with 2-Hole Bolt-On Compression Lugs sized to fit the busbar and the conductors.
 - 3. Each lug shall be attached with stainless steel hardware after preparing the bond according to manufacturer recommendations and treating the bonding surface on the busbar with antioxidant to help prevent corrosion at the bond.
 - 4. The wall-mount busbar shall be bonded to the main building ground, in the nearest electrical room, as part of the overall Telecommunications Bonding and Grounding System.

- B. Ground Terminal Block
 - 1. Every rack and cabinet shall be bonded to the TMGB or TGB.
 - 2. Minimum bonding connection to racks and cabinets shall be made with a rack-mount 2-hole ground terminal block sized to fit the conductor and rack and installed according to manufacturer recommendations.
 - 3. Remove paint between rack/cabinet and terminal block, clean surface and use antioxidant between the rack and the terminal block to help prevent corrosion at the bond.

- C. Grounding Voice and Data Systems
 - 1. Provide an approved ground at all newly installed distribution frames and protector locations using proper bonding to any existing facility. Ensure ground continuity by properly bonding to any existing facility. Ensure ground continuity by properly bonding all appropriate cabling, closures, cabinets, service boxes, and framework. All grounds shall consist of minimum #6 AWG copper wire and shall be supplied from the Telecommunications Main grounding Busbar or a Telecommunications Grounding Busbar.
 - 2. Bond metallic conduits at one end to proper ground.
 - 3. Provide maximum 0.5 Ohm resistance at 0.05 volts at each ground bar.

GROUNDING AND BONDING FOR COMMUNICATIONS

4. Ground electronic components, equipment cabinets and racks, cable trays and cable racks.
5. Provide ground lead for copper cable in multiples of 25 or more.
6. For overall-shielded cable, bond shield to proper grounding sources at one end. Do not loop ground leads or share with conduit ground leads.

END OF SECTION

SECTION 27 05 28

PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide all labor, materials, and equipment for the complete installation of Work called for in the Contract Documents.
- B. This section includes the minimum requirements for the installation of communications cable pathways outside of Telecommunications Rooms.
- C. Included in this section are the minimum composition requirements and installation methods for the following:
 - 1. Non-Continuous Cable Support Systems
 - 2. Fire-Rated Pathway Devices
 - 3. Multi-Service Poke-Through Devices
 - 4. Conduit Systems
 - 5. Junction Boxes/ Pull Boxes

1.2 DEFINITIONS AND TERMS

- A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:
 - 1. AFF Above Finished Floor
 - 2. ANSI American National Standards Institute
 - 3. ASTM American Society for Testing and Materials International
 - 4. BICSI Building Industry Consulting Service International
 - 5. BOCA Building Officials and Code Administrators International,
 - 6. CAN Canada/Canadian
 - 7. EIA Electronics Industries Alliance
 - 8. EMT Electrical Metallic Tubing
 - 9. HVAC Heating, Ventilating and Air Conditioning
 - 10. NEC National Electric Code
 - 11. NECA National Electrical Contractors Association
 - 12. NEMA National Electric Manufacturers Association
 - 13. NFPA National Fire Protection Association
 - 14. OAR Owner's Authorized Representative
 - 15. OD Outer Diameter
 - 16. RCDD Registered Communications Distribution Designer
 - 17. RFP Request for Proposal
 - 18. RMC Rigid Metallic Conduit
 - 19. STD Standard
 - 20. TIA Telecommunications Industry Association
 - 21. UL Underwriters Laboratories
 - 22. ULC Underwriters Laboratories of Canada

1.3 QUALITY ASSURANCE

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

- D. Contractor's Qualifications:
1. Firms regularly engaged in the installation of Electrical Systems or Data Communications cabling and that have five (5) years of installation experience with systems similar to that required for this project.
 2. Provide references to include client names, phone numbers and a summary of project details. These references will be checked and the clients will be asked questions relative to the performance of your company.
 3. Provide verification that installation personnel responsible have been properly trained to install the products described in this Section.
 4. Provide a BICSI RCDD certified professional, or a master electrician, for oversight on this project. This person does not have to be working on-site, but must be accessible to answer questions and provide weekly status reports. The RCDD or master electrician shall be a full-time employee of the contractor.
 5. Provide full time project manager with a minimum of ten (10) years field experience in installation of communications systems and infrastructures. Project manager shall be assigned for the duration of the project and shall not be replaced without written consent from the OAR.
- E. Manufacturer's Qualifications:
1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.
- F. Material and Work specified herein shall comply with the applicable requirements of:
1. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2010
 2. ANSI/NECA/BICSI-568 – Standard for Installing Commercial Building Telecommunications Cabling, 2006
 3. ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises, 2009
 4. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard, 2009
 5. ANSI/TIA/EIA-569-B – Commercial Building Standard for Telecommunications Pathways and Spaces, 2009
 6. ANSI/TIA/EIA-606-B – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 2012
 7. ANSI-J-STD-607-A – Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2002
 8. ANSI/TIA-942 – Telecommunications Infrastructure Standard for Data Centers, 2006
 9. NFPA 70 – National Electric Code, 2014
 10. BICSI – Telecommunications Distribution Methods Manual, 13th Edition
 11. NEMA – VE 1 – Metal Cable Tray Systems, 2009
 12. NEMA – VE 2 – Metal Cable Tray Installation Guidelines, 2006
 13. Applicable codes and directives of authorities having jurisdiction
- G. Work:
1. The Work shall be performed in compliance with the applicable manufacturer's installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
 2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.
 3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
 4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

1.4 CONFLICTS

- A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts between the aforementioned, notify the OAR in writing prior to commencement of affected work.

1.5 PERMITS

- A. The Contractor shall secure and pay for all necessary permits and fees required for the execution of this Work. Work will not start until all permit applications are approved.

1.6 SCHEDULING

- A. The Contractor shall comply with all scheduling requests established by OAR, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and, if accepted, will be used to track work status.
- B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.
- C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

1.7 REQUIREMENTS

- A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The OAR must approve material submittal and substitutions in writing.
- B. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.
- C. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.
- D. The requirements as given in this document are to be adhered to unless revised by the OAR in writing.
- E. The Owner reserves the right to waive these requirements at any time.

1.8 SUBMITTALS

- A. Comply with provisions of Division 01.
- B. Comply with provisions of Section 27 05 00.
- C. Produce Shop Drawings for ALL horizontal and vertical pathways, to include but not limited to, dimensions/size of pathway, routing placement and its location relative to building structure (columns, floor or ceiling) and its relationship to electrical, mechanical elements as well as vertical and horizontal offsets and transitions.
- D. Provide all submittal requirements under this section as a single package.
- E. Provide product data for the following:
 - 1. Product data consisting of manufacturers specifications for each type of product to be installed, all applicable certifications and elevation/plan documents supporting compliance with stated Specifications.
 - 2. Proposed format of as-built documentation.

1.9 CONTRACTOR CLOSE OUT SUBMITTALS

- A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (5) sets.
 - 1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.
 - 2. Provide above closeout documentation as an electronic file in PDF format.
 - 3. As built documentation of all pathway systems to include cable tray, conduits (horizontal and vertical), and non-contiguous support.
- B. Warranty and Maintenance:
 - 1. Record Drawings

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer's recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.
- B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the OAR.
- C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.
- D. Provide protective covering during construction to prevent damage or entrance of foreign matter.
- E. Contractor is responsible for on-site security of tools, test equipment and materials.
- F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

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

1.12 WARRANTY

- A. Warrant labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics, following Contractor Warranty requirements defined in Division 01. Repair or replace defects occurring in labor or product within the Warranty period without charge.
- B. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The products specified in this document do not necessarily constitute the exhaustive list of products required to complete the statement of work. Except where described in the SUMMARY subpart of this document, the contractor is responsible for providing any other parts and materials needed to deliver a complete and working system.

2.2 NON-CONTINUOUS CABLE SUPPORT SYSTEMS

- A. Non-Continuous Cable Supports (J-Hooks) Will Be Used
 1. Non-continuous cable supports (j-hooks) are only permitted for use in low voltage cabling installation.
 2. Unless otherwise noted on the drawings, all communications/low voltage systems cabling shall be routed above accessible corridor ceilings parallel to room walls and corridors via cable tray, J-Hooks or conduit. Cabling shall be segregated by function as follows:
 - a. Voice/data cabling.
- B. Provide through-wall fire-rated pathway devices, as required.
 1. Cables penetrating through fire-rated floors or walls shall utilize fire-rated pathway devices capable of providing an F rating equal to the rating of the barrier in which the device is installed.
 2. The device shall be tested for smoke leakage (L rating) and shall not require the use of any optional sealing materials to achieve the published rating.
 3. The device shall utilize a fire and smoke sealing system that automatically adjusts to the addition or removal of cables.

4. Wiring devices shall be capable of allowing a 0 to 100-percent visual fill of cables.
5. Wire devices shall be of a sufficient size to accommodate the quantity and size of data cables required and shall be suitable for use with new or existing cable installations.
6. The installed device (in normal use) shall require no maintenance and shall accommodate future cable changes without mechanical adjustment and/or removal or replacement of protective materials.
7. Approved Products:
 - a. STI EZ-PATH
 - b. Hilti CP 653 Speed Sleeve
 - c. Legrand FlameStopper
 - d. Owner Approved Equivalent

2.3 POKE-THROUGH DEVICES

- A. Multi-Service Poke-Through Devices
1. Provide floor poke-through devices for terminating power and communications.
 2. The device shall provide up to 4 ports of communications connectivity and power receptacles wired for 2 circuits.
 3. Unit shall be equipped with slide covers to protect device and power openings.
 4. Device shall be UL Listed and UL Fire Classified under UL514A, UL514C and meet ADA Accessibility guidelines.
 5. Coordinate the flange colors and options with the architect.
 6. Acceptable products:
 - a. Wiremold/Legrand
 - 1) RC4 Multi-Service Poke-Through Device
 - 2) COM75 Communications Adapter
 - 3) RC4APTCBK Abandonment Plate
 - b. Owner Approved Equivalent

2.4 CONDUIT SYSTEMS

- A. General
1. Provide conduit for technology systems as required for installation of communications infrastructure. Conduit shall be provided for all spans of cabling not routed in cable tray.
 2. Provide conduit for installation of all horizontal security cabling infrastructure from end to end.
 3. All conduit system components shall be UL rated.
 4. All conduit system components shall comply with the NEC.
 5. All conduit fittings, junction and pull boxes shall provide minimum cable bend radius in accordance with ANSI/EIA/TIA-569B.
 6. All conduit fittings shall have plastic bushings on all exposed conduit ends.
- B. Rigid Metal Conduit (RMC) and Fittings Before Coating:
1. RMC shall be UL6 listed and conform to ANSI C80.4 and NEC Article 344.
 2. RMC coating shall comply with WW-C-581d.
- C. Electrical Metallic Tubing (EMT):
1. EMT shall be UL listed and conform to NEC Article 358.
 2. EMT fittings shall be formed steel compression ring type. Die cast fittings are not allowed.
 3. Only manufacturer's fittings, adapters, and terminators shall be used.
 4. All transition junction and pull boxes, fittings terminators and adapters shall be a metallic material.
 5. Shall be used inside buildings only.
- D. Flexible metal conduit is not permitted.
- E. Conduit Bodies are not permitted.
- F. Non-metallic conduits are not permitted in above ground installations.
- G. Conduit Fittings
1. All above ground fittings shall be of metallic material.
 2. Conversion fittings are required for non-metallic (below ground) to metallic (above ground) transitions.
 3. All fittings shall be compression or threaded.
 4. Fittings shall provide a secure connection for pulling communications cables.

5. Setscrew fittings are not permitted.

2.5 JUNCTION BOXES / PULL BOXES

- A. All pull boxes shall be constructed with a minimum of 14-gauge Galvanized Steel with an ANSI 61 grey polyester powder finish inside and out over Phosphatized surfaces or Galvanizes Steel unless otherwise specified.
- B. All pull boxes shall be minimum NEMA Type 1 rated on concourse level indoor spaces. Pull boxes shall be minimum NEMA Type 3R rated in ramp spaces and outdoor locations. Boxes are to be sized according to the table below unless otherwise specified.
- C. All pull boxes shall have flat, removable covers fastened with plated steel screws within unique keyhole screw slots in the cover to permit removal of the cover without extracting screws unless otherwise specified.
 1. All removable box covers shall be connected to box with a safety strap or chain.
 2. Remove all box covers before completing installation. Prepare properly and paint covers per the following color code by discipline; communication – blue, fire – red, security – green. Re-install painted covers to respective pull boxes.
- D. All pull boxes shall provide the appropriate provisioning for grounding.

Maximum Trade Size of Conduit (inches)	Minimum Box Size (inches)			For Each Additional Conduit Increase Width (inches)
	Width	Length	Depth	
1	4	16	3	2
1.25	6	20	3	3
1.5	8	27	4	4
2	8	36	4	5
2.5	10	42	5	6
3	12	48	5	6
3.5	12	54	6	6
4	15	60	8	8

2.6 OUTSIDE PLANT CABLE AND EQUIPMENT

- A. All fiber optic OSP cable shall be in conduit and innerduct for entire length.
- B. Handhole
 1. Install a minimum size handhole of 48" w x 48" l x 48" d.
 2. Install a bolt down cover, rated H-20.
 3. Install a minimum of 6" of gravel in the bottom of the handhole.
 4. Install a minimum of two 24" cable racks on each wall and four 7.5" rack hooks for each cable rack.
 5. Install handholes of additional depth as required to ensure minimum conduit depth is maintained throughout.
 6. Install a cover labeled "Telephone" or "Communications" with 2" high case lettering. Label verbiage to be decided by Owner.
 7. Install pre-cast polymer concrete type handhole.
- C. Conduit caulking compound
 1. Compounds for sealing conduit ducts shall have a putty-like consistency workable with the hands at temperatures as low as 35 degrees Fahrenheit, shall not slump at a temperature of 300 degrees Fahrenheit, and shall not harden materially when exposed to the air. Compounds shall readily caulk or adhere to clean surfaces of plastic conduit, metallic conduit, or conduit coatings; concrete,

masonry; any cable sheaths, jackets, covers, or insulation material, and the common metals. Compounds shall form a seal without dissolving, noticeable changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect on the hands of workers or upon materials. Compound shall be STOPAQ 2100 from Corrosion Control Products Company or approved equal.

- D. Innerduct
 - 1. Corrugated Innerduct, 1" Orange.

PART 3 - EXECUTION

3.1 GENERAL

- A. Raceways shall be mechanically and electrically connected to all boxes and fittings and shall be properly grounded per NEC.
- B. The routing and location of all conduits, cable tray, cable hooks and other raceways shall be coordinated with other trades prior to and during building construction to avoid delays and conflicts.
- C. Conduit shall be provided for all security system infrastructure pathway, unless specifically noted otherwise on the drawings.
- D. Where raceways pass through walls, partitions and floors, seal penetrations to provide a neat installation that will maintain the integrity of the waterproofing or fireproofing, as applicable, of the structure. Coordinate installation requirements with roofing installer where conduits pass through the roof.
- E. All Raceways shall be run at least 6-inches from hot flues, steam pipes, hot water pipes and other hot surfaces.
- F. All raceways entering a building from underground shall be sealed to prevent water, moisture, gas, or other foreign matter from entering the building. Service conduits shall be sealed in accordance with NEC 230-8.
- G. Contractor's on-site RCDD supervisor shall review, approve and stamp all shop drawings, coordination drawings and records drawings.
- H. DO NOT route communication pathways under HVAC condensing units.
- I. Expansion Fittings:
 - 1. Raceways shall be provided with expansion fitting where necessary to compensate for thermal expansion and contraction.
 - 2. Use expansion-deflection fittings on conduit crossing structural expansion joints and on exposed conduit runs where necessary. Provide bonding jumpers across fittings in metal raceway systems.

3.2 INSTALLATION

- A. Non-Continuous Cable Supports (J-Hooks) will Be Used
 - 1. Non-continuous cable supports (j-hooks) are only permitted for use in low voltage cabling installation.
- B. Firestopping
 - 1. Comply with manufacturer's product data, including product technical bulletins, product catalog installation instruction, and product carton instruction for installation.
 - 2. Verify substrate conditions are acceptable for product installation in accordance with manufacturer's instructions.
 - 3. Install firestopping to comply with performance requirements specified herein.
 - a. Install firestopping to comply with listed fire rated assemblies in accordance with ASTM and UL requirements.
 - b. Installer shall be trained and approved by the manufacturer.
 - 4. Protect installed products from damage during construction operations until final completions.
 - 5. Inspection: Code official or building inspectors to review proper installation using manufacturer's guidelines.

3.3 PATHWAY INSTALLATION

- A. Raceways shall be mechanically and electrically connected to all boxes and fittings and shall be properly grounded per NEC.
- B. The routing and location of all conduits, cable tray, cable hooks and other raceways shall be coordinated with other trades prior to and during building construction to avoid delays and conflicts.
- C. Where raceways pass through walls, partitions and floors, seal penetrations to provide a neat installation that will maintain the integrity of the waterproofing or fireproofing, as applicable, of the structure. Coordinate installation requirements with roofing installer where conduits pass through the roof.
- D. All Raceways shall be run at least 6-inches from hot flues, steam pipes, hot water pipes and other hot surfaces.
- E. All raceways entering a building from underground shall be sealed to prevent water, moisture, gas, or other foreign matter from entering the building. Service conduits shall be sealed in accordance with NEC 230-8.
- F. Contractor's on-site RCDD supervisor shall review, approve and stamp all shop drawings, coordination drawings and records drawings.
- G. DO NOT route communication pathways under HVAC condensing units.
- H. Expansion Fittings:
 - 1. Raceways shall be provided with expansion fitting where necessary to compensate for thermal expansion and contraction.
 - 2. Use expansion-deflection fittings on conduit crossing structural expansion joints and on exposed conduit runs where necessary. Provide bonding jumpers across fittings in metal raceway systems.

3.4 CONDUIT INSTALLATION

- A. Conduit shall be installed with threaded fittings and couplings.
- B. All metallic couplings, connectors and fittings shall be malleable Iron or Steel and finished with Zinc plating or by Galvanizing.
- C. All conduits shall be plugged immediately upon installation to prevent the entrance of construction dirt and debris. All conduits shall be swabbed and cleaned before wires are pulled:
- D. Expansion fittings shall be utilized in all cases where conduits pass through building expansion joints. Fittings shall be of an approved weatherproof telescopic type bonding jumpers around or through the fitting.
- E. Connection of Conduit to Pull / Junction Boxes and Enclosures:
 - 1. Connection to NEMA 1 type boxes and enclosures:
 - a. Rigid conduit: Install insulated bushings and double locknuts.
 - b. EMT: Install compression box connectors with insulated throats.
 - 2. Connection to NEMA 3R, 4, 4X, and 12 type boxes: Install insulated bushings and sealing locknuts or hubs.
 - 3. When conduits enter floor mounted enclosures from below and there is no sheet metal to which to attach; install grounding bushings on the conduit. Bond bushings to ground bus using a conductor the same size as required for an equipment grounding conductor sized for the given circuit.
 - 4. Install sealing bushing within all conduits which have entered a building from outside, whether from above or below grade.
- F. Each Conduit route shall be installed with the least amount of bends as possible. No section of conduit shall be longer than 30 meters (100 feet) or contain more than two 90-degree bends (offset is considered to be a 90-degree bend) between pull points, pull boxes or reverse bends.
- G. The inside radius of bends in conduit shall be.
 - 1. 6 times the internal diameter for 2-inches or less.

2. 10 times the internal diameter for greater than 2-inches.
- H. A measured pull tape shall be placed in all installed conduit.
- I. Any single conduit run extending from an IDF/MDF shall not serve more than one outlet.
- J. All communication conduits shall be identified with color coded blue tape marked "Communications" every 50 feet. Tag conduit termination points (to include J-Box locations) with the origination and destination location.
- K. Conduit shall be reamed to eliminate sharp edges and terminated with an insulated bushing.
- L. Conduit protruding through the floor shall be terminated at a minimum of 3 inches above the floor surface.
- M. All stubbed conduit ends shall be provided with a ground bushing.
- N. All conduit penetrations shall be provided with the proper conduit sleeves.
1. Sleeves shall extend three inches AFF or four inches below finished ceiling, with a bushing.
 2. Sleeves shall be installed in the communications room floor or ceiling a minimum of two to four inches on center from the wall.
 3. Conduit floor sleeves shall be spaced to allow space for ground bushing and insulated bushing for cable protection.
 4. Shall be installed in a single tier or row from left to right horizontally. If two tiers or rows are required, the conduits shall be staggered minimum of 2 inches between tiers.
 5. Cable support anchors shall be installed 18 to 24 inches above the sleeves.
- O. All cable (horizontal, riser or backbone) wall or ceiling penetrations shall be provided with the proper conduit sleeves.
1. Sleeves shall extend three inches AFF or four inches below finished ceiling, with a bushing.
 2. Sleeves shall be installed in the floor or ceiling a minimum of two to four inches on center from the wall.
 3. Sleeves shall be installed in the walls at a minimum of two inches extended on each side of the wall.
 4. Cable floor, ceiling and wall sleeves shall be spaced to allow space for ground bushing and insulated bushing for cable protection.
 5. Shall be installed in a single tier or row from left to right horizontally.
 6. If two tiers or rows are required, the conduits shall be staggered minimum of 2 inches between tiers.
 7. Cable support anchors shall be installed 18 to 24 inches above the sleeves.
- P. All conduit and cabinet entrances shall be sealed with an approved, re-enter able sealant material to prevent ingress of water, dust or other foreign materials.
- Q. Conduit shall not be embedded in the required fire protective covering of a structural member that is to be individually encased in accordance with BOCA.
- R. Install all exposed conduit parallel or perpendicular to lines of existing construction and grouped together where possible, without interfering with use of premises or working areas. Prevent safety hazards and interference with operating and maintenance procedures.
- S. Conduit Sizing and supports:
1. Horizontal (station) conduit is defined as the conduit run between the communications outlet and the cable tray or communications room as indicated on Drawings.
 2. Each horizontal conduit run shall be a one-inch metallic conduit and shall be home run from each communications outlet box to the equipment room, termination equipment or cable tray, as indicated in Drawings.
 3. Each route shall be installed with the least amount of conduit bends. Each single horizontal conduit run shall be provided with a junction or pull box every 30 meters (100 feet) or contain more than two 90-degree bends (offset is considered to be a 90-degree bend).
 4. Each dual horizontal conduit run shall be provided with a Junction or Pull Box every 30 meters (100 feet) or contain more than two 90-degree bends (offset is considered to be a 90-degree bend). The quantity of conduits entering the Junction or Pull Box shall equal the number of conduits exiting the Junction or Pull Box.
 5. Each terminating (outlet end) conduit connection shall be provided with the proper connecting insulated bushing or fitting.

6. Each originating end (communications room end) shall be provided with the proper connecting insulated ground bushing and properly bonded to ground.
- T. Horizontal Conduit Routes:
1. Horizontal (station) conduit is defined as the conduit run between the communications outlet and the cable tray or communications room as indicated on Drawings.
 2. Each horizontal conduit run shall be a one-inch metallic conduit and shall be home run from each communications outlet box to the equipment room, termination equipment or cable tray, as indicated in Drawings.
 3. Each route shall be installed with the least amount of conduit bends. Each single horizontal conduit run shall be provided with a junction or pull box every 30 meters (100 feet) or contain more than two 90-degree bends (offset is considered to be a 90-degree bend).
 4. Each dual horizontal conduit run shall be provided with a Junction or Pull Box every 30 meters (100 feet) or contain more than two 90-degree bends (offset is considered to be a 90-degree bend). The quantity of conduits entering the Junction or Pull Box shall equal the number of conduits exiting the Junction or Pull Box.
 5. Each terminating (outlet end) conduit connection shall be provided with the proper connecting insulated bushing or fitting.
 6. Each originating end (communications room end) shall be provided with the proper connecting insulated ground bushing and properly bonded to ground.
- U. Horizontal conduit entrance in communications rooms – wall entry
1. Horizontal conduits shall enter the communications room wall 12 to 18 inches above the top of the cable tray. Maintain cable bend radius with supporting device as required.
 2. Conduit wall stubs shall be spaced in increments equal to the conduit outside diameter (OD) from each other.
 3. All conduit wall stubs shall be extended to the terminating equipment, electronics, or cable tray, as noted in Drawings.
 4. Conduit crossovers are not permitted.
- V. Horizontal conduit entrance in communications rooms – ceiling entry
1. Horizontal conduits shall enter or be extended from the equipment room ceiling 12 to 18 inches above the top of the cable tray.
 2. Ceiling conduit stubs shall be spaced in increments equal to the conduit outside diameter (OD) from each other.
 3. All ceiling conduit stubs shall be extended to the terminating equipment, electronics, or cable tray, as noted in Drawings.
 4. Conduit crossovers are not permitted.
- W. Horizontal conduit entrance in communications rooms – floor entry
1. Horizontal conduits shall enter the communications room floor 2 to 4 inches on center from the wall and shall be stubbed 3 inches AFF.
 2. Conduit floor stubs shall be spaced in increments equal to the conduit OD from each other.
 3. Conduit crossovers are not permitted.
 4. Provide vertical ladder rack or d-hooks properly secured to wall to transverse cable to cable tray over-head.
- X. Horizontal conduit to cable tray
1. Non-communications conduit shall NOT be attached to the cable tray in any fashion.
 2. Conduit terminating end shall be attached to cable tray side rail with “conduit-to-cable tray” clamps. No other form of attachment shall be permitted.
 3. Top or bottom cable tray conduit feeds and attachments are not permitted.
- Y. Horizontal Junction/Outlet Boxes
1. Each horizontal conduit shall be terminated into an outlet box.
 2. Each outlet box shall be a deep 4-inch square junction box with a minimum of two 1-inch knockouts on each of the sides.
 3. Each conduit home run shall be provided with a deep 4-inch square junction box (w/cover) at 100-foot intervals and 6 inches above each ceiling and wall intersection.
- Z. Riser conduit entrance in communications rooms – wall entry
1. Riser conduits shall enter the communications room wall a minimum of 24 inches above the top of the cable tray.
 2. Conduit wall stubs shall be spaced in increments to equal the conduit OD from each other.

3. Riser conduits shall be installed in a single tier or row from left to right horizontally.
 - a. If two tiers or rows are required, the conduits shall be staggered between tiers.
 - b. No more than two tiers or rows are permitted.
4. All conduit wall stubs shall be extended to and over the cable tray to access cable tray pathway.
5. All rise conduit stubs shall be provided with the proper universal drop-out/waterfall cable exit runway, which shall be supported by and mounted to channel strut.
6. Conduit crossovers are not permitted.

AA. Riser conduit entrance in communications rooms – floor entry

1. Riser conduits shall enter the communications room floor 2 to 4 inches on center from the wall and shall stub up 6 inches AFF.
2. Conduit floor stubs shall be spaced in increments to equal the conduit OD from each other.
3. Riser conduits shall be installed in a single tier or row from left to right horizontally.
 - a. If two tiers or rows are required, the conduits shall be staggered between tiers.
 - b. No more than two tiers or rows are permitted.
4. Exiting cable shall be extended to the bottom of the cable tray and be provided with cable support anchors and secured with supporting hardware every six inches above the conduit bushings.
5. Conduit floor stubs shall be extended 2 to 4 inches from wall on center and 3 inches above AFF.
6. The riser cable shall be extended in the cable tray to the terminating equipment, as noted in the Drawings.
7. Conduit crossovers are not permitted.

3.5 OUTSIDE PLANT EQUIPMENT

A. Four Inch Non-Metallic Conduit and Galvanized, Rigid steel conduit

1. Install spacers between all conduits being installed.
2. Encase all conduits installed under a roadway in concrete.
3. The minimum depth to the top of the highest conduit is 36 inches.
4. Cement conduits and fittings in a manner that will allow a water tight seal.
5. Slope conduits (minimum 1% every hundred feet) away from all access points and the building.
6. Provide a ½" high strength foot-marked conduit measuring tape inside each conduit, and secure at each access point.
7. Seal all conduits using manufactured duct and conduit plugs/seals to prevent moisture, gas and rodents from entering at both ends.

B. Corrugated Innerduct

1. Install four one-inch innerducts in all 4-inch conduits
2. Provide a ½" high strength foot-marked conduit measuring tape inside each innerduct, and secure at each access point.

C. Handholes

1. Install 6 inches of gravel in the bottom of every handhole.
2. Install top of the handhole flush with the finished grade.
3. Racking system shall be installed per the manufacturer's instructions.
4. All conduits entering a handhole shall be sealed from the outside of the handhole prior to backfilling.
5. Handholes shall be placed with the long dimension in line with the conduit run. The conduit shall enter opposite ends of the handhole on the short sides so that the handhole shall not be used (where possible) as a 90 degree bend in cable installation.

3.6 TESTING

- A. Test cable trays to ensure electrical continuity of bonding and grounding connections, and to demonstrate compliance with specified maximum grounding resistance. See NFPA 70B, Chapter 18, for testing and test methods.
- B. Manufacturer shall provide test reports witnessed by an independent testing laboratory of the "worst case" loading conditions outlined in this specification and performed in accordance with the latest revision of NEMA VE-1; including test reports verifying rung load capacity in accordance with NEMA VE-1 Section 5.4.

END OF SECTION

SECTION 27 05 53

IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 – GENERAL

1.1 SUMMARY

- A. Provide all labor, materials, and equipment for the complete installation of Work called for in the Contract Documents.
- B. This section includes the minimum requirements for the labeling of communications infrastructure.
- C. Included in this section are the minimum composition requirements and installation methods for the following:
 - 1. Equipment Rack Labels
 - 2. Copper Tie Block Labels
 - 3. Patch Panel Labels
 - 4. Cable Labels
 - 5. Faceplate Labels
 - 6. Conduit System Labels
 - 7. Ground Tags
 - 8. Innerduct Tags

1.2 DEFINITIONS AND TERMS

- A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:
 - 1. ANSI American National Standards Institute
 - 2. AWG American Wire Gauge
 - 3. BICSI Building Industry Consulting Service International
 - 4. EIA Electronics Industries Association
 - 5. NECA National Electrical Contractors Association
 - 6. NEMA National Electric Manufacturers Association
 - 7. NFPA National Fire Protection Association
 - 8. OAR Owner's Authorized Representative
 - 9. RCDD Registered Communications Distribution Designer
 - 10. RFP Request for Proposal
 - 11. STD Standard
 - 12. TGB Telecommunications Grounding Busbar
 - 13. TIA Telecommunications Industry Association
 - 14. TMGB Telecommunications Main Ground Bus Bar
 - 15. UL Underwriters Laboratories

1.3 QUALITY ASSURANCE

- A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the OAR.
- B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the OAR.
- C. Strictly adhere to all BICSI, EIA and TIA recommended installation practices when installing communications labeling systems.
- D. Contractor's Qualifications:

IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

1. Firms regularly engaged in the installation of Communications Cabling or Electrical Systems and that have five (5) years of installation experience with systems similar to that required for this project.
 2. Provide references to include client names, phone numbers and a summary of project details. These references will be checked and the clients will be asked questions relative to the performance of your company.
 3. Provide verification that installation personnel responsible have been properly trained to install the products described in this Section.
 4. Provide a BICSI RCDD certified professional, or a master electrician, for oversight on this project. This person does not have to be working on-site, but must be accessible to answer questions and provide weekly status reports. The RCDD or master electrician shall be a full-time employee of the contractor.
 5. Provide full time project manager with a minimum of ten (10) years field experience in installation of communications systems and infrastructures. Project manager shall be assigned for the duration of the project and shall not be replaced without written consent from the OAR.
- E. Manufacturer's Qualifications:
1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.
- F. Material and Work specified herein shall comply with the applicable requirements of:
1. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2010
 2. ANSI/TIA/EIA-606-B – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 2012
 3. NFPA 70 – National Electric Code, 2014
 4. BICSI – Telecommunications Distribution Methods Manual, 13th Edition
 5. Applicable codes and directives of authorities having jurisdiction
- G. Work:
1. The Work shall be performed in compliance with the applicable manufacturer's installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
 2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.
 3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
 4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

1.4 CONFLICTS

- A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts between the aforementioned, notify the OAR in writing prior to commencement of affected work.

1.5 PERMITS

- A. The Contractor shall secure and pay for all necessary permits and fees required for the execution of this Work. Work will not start until all permit applications are approved.

1.6 SCHEDULING

- A. The Contractor shall comply with all scheduling requests established by OAR, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and, if accepted, will be used to track work status.
- B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.
- C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

1.7 REQUIREMENTS

- A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The OAR must approve material submittal and substitutions in writing.
- B. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.
- C. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.
- D. The requirements as given in this document are to be adhered to unless revised by the OAR in writing.
- E. The Owner reserves the right to waive these requirements at any time.

1.8 SUBMITTALS

- A. Comply with provisions of Division 01.
- B. Comply with provisions of Section 27 05 00.
- C. Provide product data for the following:
 - 1. Product data consisting of manufacturers specifications for each type of product to be installed, all applicable certifications and elevation/plan documents supporting compliance with stated Specifications.
 - 2. Proposed format of as-built documentation.

1.9 CONTRACTOR CLOSE OUT SUBMITTALS

- A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (5) sets.
 - 1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.
 - 2. Provide above closeout documentation as an electronic file in PDF format.
- B. Warranty and Maintenance:
 - 1. Record Drawings

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer's recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.
- B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the OAR.
- C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.
- D. Provide protective covering during construction to prevent damage or entrance of foreign matter.
- E. Contractor is responsible for on-site security of tools, test equipment and materials.
- F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

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

1.12 WARRANTY

- A. Warrant labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics, following Contractor Warranty requirements defined in Division 01. Repair or replace defects occurring in labor or product within the Warranty period without charge.
- B. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

PART 2 – PRODUCTS

2.1 GENERAL

- A. The products specified in this document do not necessarily constitute the exhaustive list of products required to complete the statement of work. Except where described in the SUMMARY subpart of this document, the contractor is responsible for providing any other parts and materials needed to deliver a complete and working system.
- B. Labels and markings shall be physically and chemically resistant to damage that would render the label unreadable.
- C. All labels shall be TIA/EIA-606-B compliant labeling products. All cables, faceplates, patch panels, copper riser termination blocks, conduit, innerduct and patch cords shall be labeled to TIA/EIA-606-B standards.

2.2 ADHESIVE COMPONENT LABELS

- A. Outlet Label - 2-Port Identifier
 1. Ink/laser printed labels shall be constructed of die-cut, adhesive polyolefin.
 2. Thermal transfer labels shall be constructed of die-cut, adhesive polyester.
 3. Label shall be 1.25" (31.8 mm) W x 0.30" (7.6 mm) H.
 4. The label shall be white in color, with black machine-printed characters.
 5. Acceptable products:
 - a. Panduit
 - 1) C125X030FJC Network Label, P1 Cassette
 - 2) C125X030FJJ Network Label, Laser/Ink Jet
 - 3) C125X030YPT Network Label, Thermal Transfer
 - b. Brady
 - c. HellermannTyton
 - d. Owner approved equal
- B. Copper Patch Panel and Work Area Outlet Label, 4-Port
 1. Ink/laser printed labels shall be constructed of die-cut, adhesive polyolefin.
 2. Thermal transfer labels shall be constructed of die-cut, adhesive polyester.
 3. Label shall be 2.52" (64.0 mm) W x 0.30" (7.6 mm) H.
 4. The label shall be white in color, with black machine-printed characters.
 5. Acceptable products:
 - a. Panduit

- 1) C252X030FJC Component Label, P1 Cassette
 - 2) C252X030FJJ Component Label, Laser/Ink Jet
 - 3) C252X030YPT Component Label, Thermal Transfer
- b. Brady
 - c. HellermannTyton
 - d. Owner approved equal
- C. Copper Patch Panel Label, 6-Port
1. Ink/laser printed labels shall be constructed of die-cut, adhesive polyolefin.
 2. Thermal transfer labels shall be constructed of die-cut, adhesive polyester.
 3. Label shall be 3.79" (96.3 mm) W x 0.30" (7.6 mm) H.
 4. The label shall be white in color, with black machine-printed characters.
 5. Acceptable products:
 - a. Panduit
 - 1) C379X030FJC Component Label, P1 Cassette
 - 2) C379X030FJJ Component Label, Laser/Ink Jet
 - 3) C379X030YPT Component Label, Thermal Transfer
 - b. Brady
 - c. HellermannTyton
 - d. Owner approved equal
- D. Fiber Patch Panel Port Labels
1. Ink/laser printed labels shall be constructed of die-cut, adhesive polyester, or black-on-white vinyl tape.
 2. Label shall be 3.50" (88.9 mm) W x 1.00" (25.4 mm) H.
 3. The label shall be white in color, with black machine-printed characters.
 4. Acceptable products:
 - a. Panduit
 - 1) T100X100VPC-BK Component Label, P1 Cassette
 - 2) C350X100YJJ Component Label, Laser/Ink Jet
 - 3) C350X100YJT Component Label, Thermal Transfer
 - b. Brady
 - c. HellermannTyton
 - d. Owner approved equal
- E. Rack and Cabinet Labels, and Cabinet Row End Labels
1. Ink/laser printed labels shall be constructed of die-cut, adhesive polyolefin.
 2. Thermal transfer labels shall be constructed of die-cut, adhesive polyester.
 3. Label shall be 2.00" (50.8 mm) W x 1.00" (25.4 mm) H.
 4. The label shall be white in color, with black machine-printed characters.
 5. Acceptable products:
 - a. Panduit
 - 1) C200X100YPC Component Label, P1 Cassette
 - 2) C200X100YJJ Component Label, Laser/Ink Jet
 - 3) C200X100YJT Component Label, Thermal Transfer
 - b. Brady
 - c. HellermannTyton
 - d. Owner approved equal
- F. Cabinet Row End Labels
1. Labels shall be constructed of die-cut, adhesive polyester.

2. Label shall be 4.00" (101.6 mm) W x 4.00" (101.6 mm) H.
3. The label shall be white in color, with black machine-printed characters.
4. Acceptable products:

- a. Panduit

- 1) C400X400YJJ Component Label, Laser/Ink Jet
- 2) C400X400YJT Component Label, Thermal Transfer

- b. Brady
- c. HellermannTyton
- d. Owner approved equal

G. Raised Panel Rack and Cabinet Labels

1. Label to have a raised thermal transfer printable surface, with high-tack adhesive.
2. Label shall be 2.00" (50.8 mm) W x 1.00" (25.4 mm) H.
3. The label shall be white in color, with black machine-printed characters.
4. Acceptable products:

- a. Panduit

- 1) C200X100APT Component Label, Thermal Transfer

- b. Brady
- c. HellermannTyton
- d. Owner approved equal

H. Raised Cabinet Row End Labels

1. Label to have a raised thermal transfer printable surface, with high-tack adhesive.
2. Label shall be 3.00" (76.2 mm) W x 2.50" (63.5 mm) H.
3. The label shall be white in color, with black machine-printed characters.
4. Acceptable products:

- a. Panduit

- 1) C300X250APT Component Label, Thermal Transfer

- b. Brady
- c. HellermannTyton
- d. Owner approved equal

2.3 ADHESIVE WIRE MARKER LABELS

A. Category 6 UTP Cable and Patch Cord Labels

1. Label shall be constructed of self-laminating vinyl.
2. Label shall be 1.50" (38.1 mm) L x 1.00" (25.4 mm) W.
3. Label shall accommodate an outside diameter of 0.16" (4.0 mm) to 0.32" (8.1 mm).
4. The print-on area height shall be 0.50" (12.7 mm) and shall be white in color, with black machine-printed characters.
5. Acceptable products:

- a. Panduit

- 1) S100X150VAC Self-Laminating Label, P1 Cassette
- 2) S100X150YAJ Self-Laminating Label, Laser/Ink Jet
- 3) S100X150VAT Self-Laminating Label, Thermal Transfer

- b. Brady
- c. HellermannTyton
- d. Owner approved equal

IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

- B. Fiber (2 mm & 3 mm) Cable Labels
1. Label shall be constructed of self-laminating vinyl.
 2. Label shall be 1.60" (40.6 mm) L x 1.00" (25.4 mm) W.
 3. Label shall accommodate an outside diameter of 0.25" (6.4 mm).
 4. The print-on area height shall be 0.80" (20.3 mm) and shall be white in color, with black machine-printed characters.
 5. Acceptable products:
 - a. Panduit
 - 1) S100X160VAC Self-Laminating Label, P1 Cassette
 - 2) S100X160YAJ Self-Laminating Label, Laser/Ink Jet
 - 3) S100X160VAT Self-Laminating Label, Thermal Transfer
 - b. Brady
 - c. HellermannTyton
 - d. Owner approved equal
- C. Fiber Duplex and Ribbon Cable Labels
1. Label shall be constructed of self-laminating vinyl.
 2. Label shall be 2.20" (55.9 mm) L x 1.00" (25.4 mm) W.
 3. Label shall accommodate an outside diameter of 0.48" (12.2 mm).
 4. The print-on area height shall be 1.10" (27.9 mm) and shall be white in color, with black machine-printed characters.
 5. Acceptable products:
 - a. Panduit
 - 1) S100X220VAC Self-Laminating Label, P1 Cassette
 - 2) S100X220YAJ Self-Laminating Label, Laser/Ink Jet
 - 3) S100X220VAT Self-Laminating Label, Thermal Transfer
 - b. Brady
 - c. HellermannTyton
 - d. Owner approved equal
- D. Copper Riser Cable
1. Label shall be constructed of self-laminating vinyl.
 2. Label shall be 2.25" (57.2 mm) L x 1.00" (25.4 mm) W.
 3. Label shall accommodate an outside diameter of 0.24" (6.1 mm) to 0.48" (12.2 mm).
 4. The print-on area height shall be 0.75" (19.1 mm) and shall be white in color, with black machine-printed characters.
 5. Acceptable products:
 - a. Panduit
 - 1) S100X225VAC Self-Laminating Label, P1 Cassette
 - 2) S100X225YAJ Self-Laminating Label, Laser/Ink Jet
 - 3) S100X225VAT Self-Laminating Label, Thermal Transfer
 - b. Brady
 - c. HellermannTyton
 - d. Owner approved equal

2.4 WIRE MARKER LABEL CORES

- A. Fiber Label Core
1. Label identification sleeve for fiber jumpers.
 2. Sleeve locates on a straight section of cable of at least 2.00" from fiber boot.
 3. Sleeve made of flexible PVC material.
 4. Acceptable products:

- a. Panduit
 - 1) NWSLC-2Y for 2 mm Simplex Fiber, Yellow
 - 2) NWSLC-3Y for 3 mm Simplex Fiber, Orange
 - 3) NWSLC-7Y for 3 mm Duplex Fiber, White
- b. Owner approved equal

2.5 NON-ADHESIVE LABELS

A. Outlet Label, 2-Port

- 1. Label shall be constructed of die-cut, non-adhesive polyester.
- 2. Label shall be 1.25" (31.8 mm) W x 0.40" (10.2 mm) H.
- 3. The label shall be white in color, with black machine-printed characters.
- 4. Acceptable products:

- a. Panduit
 - 1) C195X040Y1C Component Label, P1 Cassette
 - 2) C195X040Y1J Component Label, Laser/Ink Jet
 - 3) C195X040Y1T Component Label, Thermal Transfer
- b. Brady
- c. HellermannTyton
- d. Owner approved equal

B. Copper Patch Panel and Work Area Outlet Label, 4-Port

- 1. Label shall be constructed of die-cut, non-adhesive polyester.
- 2. Label shall be 2.61" (66.3 mm) W x 0.35" (8.9 mm) H.
- 3. The label shall be white in color, with black machine-printed characters.
- 4. Acceptable products:

- a. Panduit
 - 1) C261X035Y1C Component Label, P1 Cassette
 - 2) C261X035Y1J Component Label, Laser/Ink Jet
 - 3) C261X035Y1T Component Label, Thermal Transfer
- b. Brady
- c. HellermannTyton
- d. Owner approved equal

C. Copper Patch Panel Label, 6-Port

- 1. Label shall be constructed of die-cut, non-adhesive polyester.
- 2. Label shall be 3.90" (99.1 mm) W x 0.30" (7.6 mm) H.
- 3. The label shall be white in color, with black machine-printed characters.
- 4. Acceptable products:

- a. Panduit
 - 1) C390X030Y1C Component Label, P1 Cassette
 - 2) C390X030Y1J Component Label, Laser/Ink Jet
 - 3) C390X030Y1T Component Label, Thermal Transfer
- b. Brady
- c. HellermannTyton
- d. Owner approved equal

D. Copper Riser Termination Block Label Insert

- 1. Label shall be constructed of die-cut, non-adhesive polyester.
- 2. Label shall be 7.50" (190.5 mm) W x 0.50" (12.7 mm) H.

IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

3. The label shall be white in color, with black machine-printed characters.
4. Acceptable products:
 - a. Panduit
 - 1) C750X050Y1C Component Label, P1 Cassette
 - 2) C750X050Y1J Component Label, Laser/Ink Jet
 - 3) C750X050Y1T Component Label, Thermal Transfer
 - b. Brady
 - c. HellermannTyton
 - d. Owner approved equal

PART 3 – EXECUTION

3.1 GENERAL

- A. Labeling shall be by mechanical means. Hand-lettered labels are not permitted unless otherwise noted.
 1. Utilize Panduit, or equivalent, labeler and software
- B. Tags shall be non-removable.
 1. Exceptions:
 - a. Faceplate labels that are placed in recessed label holders
 - b. Patch panel labels that are placed in recessed label holders
 - c. Telecommunications Ground tags secured with cable ties
 - d. Innerduct tags secured with cable ties
- C. Labels shall match hardware layout and design.
- D. Labels shall be as large as practicable while fitting properly.
- E. No lettering shall be smaller than 10-point.

3.2 LABELING STANDARDS

- A. Room Identification
 1. Label Communications Backboard or Equipment Rack closest to entry door with unique identifying code.
 2. Characters shall be 1-inch minimum.
- B. Equipment Rack Identification
 1. Label each Equipment rack with a unique alpha numeric character indicating a TR/MER and a rack number
 - a. Example: TR1-01
 2. Position labels at top of rack.
 3. Characters shall be 1-inch minimum
- C. Wall Field Identification
 1. Each wall field chassis must be labeled with the TR/MER ID then an alphabetical code 'AA' to 'ZZ'.
 2. Each wall field row must be labeled numerically starting with '01' at the top.
 3. Each chassis port shall be labeled by Destination Faceplate ID – Chassis# - Row#
 - a. Example: TR1-017-AF-04-02
- D. Patch Panel and Port Labeling
 1. Patch panel ports are numbered from left to right, top to bottom starting with '01' to '24', then for a 48 port patch panel '25' - '48'.
 2. The top line of the data port label shall indicate the Destination Faceplate

- a. Example: TR1-017
3. The second line (port label) shall be labeled by Cabinet/Rack# - Rack Unit – Port#
 - a. Example: 03-24-15
- E. Patch Panel to Patch Panel Labeling
 1. The top line of the label shall indicate Destination Cabinet-Rack ID
 - a. Example: TR1-09
 2. The second line of the label shall indicate Destination Rack Unit – Port #
 - a. Example: 24-15
- F. Telecommunications Outlet Identification
 1. Label each Telecommunications Outlet connector with a unique identifying code
 - a. Position labels in recessed label holders on faceplate and cover with plastic covers.
 2. Telecommunications Outlet Faceplate labeling code shall be as follows:
 - a. TR/MER – Faceplate number where:
 - 1) “TR/MER” is identifier for room where cable terminates in horizontal cross-connect.
 - 2) Faceplate number starts with ‘001’ to ‘999’
 - 3) Example: TR1-117
 - b. WAO Jack ID
 - 1) Destination Data room/Cabinet/Rack #-Rack Unit-Port # (e.g. YYY-YY-YY-YY).
 - a) Port number starts with ‘01’ to ‘24’ for 24-port patch panel or ‘48’ if connected to a 48-port patch panel.
- G. Horizontal Cabling
 1. All horizontal cables shall be labeled at Telecommunications outlet and horizontal cross-connect with self-laminating labels via Panduit labeler and software.
 2. Cables shall be labeled at each end with information indicating termination point of both ends of cable as follows:
 - a. TR/MER – Faceplate #, Rack #/Wall Field ID – Rack Unit/Row – Port #
 - 1) Example:
 - a) Data Cable: TR1-017-03-21-03
 - b) Voice Cable: TR1-0122-AA-21-03
 3. Cables shall be labeled on a visible part of the cable within three to six (3-6) inches of termination point for ease of identification after termination.
 4. Labels at the telecommunications outlet shall be visible by removing the faceplate.
 5. Rooms with multiple outlet locations shall be numbered sequentially beginning clockwise from the first outlet to the left of the main entrance to the room.
- H. Backbone Cabling
 1. All backbone cabling shall be labeled at each end with self-laminating labels via Panduit labeling system.
 2. Cables shall be labeled at each end with information indicating termination point of both ends of the cable as follows:
 - a. TR/MER -Cabinet Rack/Wall Field ID – Rack Unit-Row/Destination Cabinet Rack/Wall Field ID-Rack Unit-Row
 - 1) Example:

IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

- a) Data: TR1-03-06 / MER-02-03
 - b) Voice: TR1-AD-02 / MER –AB-03
 3. Cables shall be labeled on a visible part of the cable within twelve (12) inches of termination point for ease of identification after termination.
 4. Fiber backbone cabling shall be labeled at each end with information indicating the building identifier, owner, room, cable number and “FO” indicating fiber.
 - a. “S” shall be used after the FO to indicate the use of single-mode fiber.
 - b. “M” shall be used after the FO to indicate the use of multi-mode fiber.
 - c. Fiber shall be labeled on the front of the fiber enclosure.
 - 1) SMF for single-mode fiber.
 - 2) MMF for multi-mode fiber.
- I. Outside Plant Cabling (Fiber and Copper)
1. All outside plant cabling shall be labeled at each end with self-laminating labels via Panduit labeling system.
 2. Cables shall be labeled at each end with information indicating termination point of both ends of the cable as follows:
 - a. Field Number –TR/MER –Cabinet/Rack #-Rack Unit / Destination Field number –TR/MER – Cabinet Rack # - Rack Unit
 - b. Example: 2349-MER-02-14 / 2476 –RES1-01-16
- J. Conduit Labeling
1. All conduits shall be labeled at each end with self-laminating labels via Panduit labeling system.
 2. Conduits shall be identified in accordance with the identification legend in Appendix A.
 3. Conduits shall be labeled at each end and at each junction box or pull box as follows:
 - a. Origin / Destination –Conduit identification
 - 1) Example: MER / TR1-BR2435
 4. Metallic conduit shall be labeled as follows:
 - a. Metallic conduit that is 2” or larger shall be labeled every fifty (50) feet with UV rated, chemical resistant 3” vinyl labels that are ORANGE in color and are affixed with permanent adhesive. Conduit should be marked in 2” black lettering (MAIN lettering) or 1/4” black lettering (SECONDARY lettering).
 - 1) MAIN lettering shall identify the system.
 - a) All conduit shall be marked “COMMUNICATIONS”
 - 2) SECONDARY lettering shall identify;
 - a) Origination
 - b) Destination
 - c) Construction Contract Number
 - b. Metallic conduit that is smaller than 2” shall be labeled with UV rated, chemical resistant 1” vinyl labels that are ORANGE in color and are affixed with permanent adhesive. Conduit should be marked in 3/4” black lettering (MAIN lettering) or 3/16” black lettering (SECONDARY lettering).
 - 1) MAIN lettering shall identify the system.
 - a) All conduit shall be marked “COMMUNICATIONS”
 - 2) SECONDARY lettering shall identify;
 - a) Origination
 - b) Destination

c) Construction Contract Number

K. Fiber Optic Patch Cable Labeling

1. All backbone cabling shall be labeled at each end with self-laminating labels via Panduit labeling system.
2. Cables shall be labeled at each end with the origin / destination by TR/ER # - Cabinet/Rack # - Rack Unit # - strand # or switch port

a. Example: MER-03-40-17/18 /TR1-01-44-17/18

L. Telecommunications Grounds

1. Label Grounds on a visible part of the ground cable within twelve (12) inches of termination point for ease of identification after termination.
2. Tags shall be secured to ground cable using self-locking ties

M. Innerduct

1. Innerduct containing fiber optic cable shall be labeled where exposed.

a. Includes areas where Innerduct is installed in trays and equipment rooms.

2. Label tags to include unique identifiers and pair counts of cable(s) contained therein.

a. Use Backbone Cable labeling formats as described above.

b. Hand lettering is acceptable.

1) Use indelible type ink

3. Tag shall be secured to Innerduct using self-locking ties.

N. Communications Pull Boxes

1. Communications pull boxes shall be have a blue access cover and labeled to indicate that they are reserved for Communications cabling. Label the pull box "COMMUNICATIONS."

END OF SECTION

SECTION 27 11 00

COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 – GENERAL

1.1 SUMMARY

- A. Provide all labor, materials, and equipment for the complete installation of Work called for in the Contract Documents.
- B. This section includes the minimum requirements for the installation of cabinets, racks, frames and enclosures in data centers, computer rooms and communications equipment rooms.
- C. Included in this section are the minimum composition requirements and installation methods for the following:
 - 1. Free standing Equipment Racks
 - 2. Vertical Wire Management
 - 3. Horizontal Wire Management
 - 4. Ladder Rack & Accessories

1.2 DEFINITIONS AND TERMS

- A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:
 - 1. AHJ Authority Having Jurisdiction
 - 2. ANSI American National Standards Institute
 - 3. ASTM American Society for Testing and Materials International
 - 4. AWG American Wire Gauge
 - 5. BICSI Building Industry Consulting Service International
 - 6. EIA Electronics Industries Alliance
 - 7. NEC National Electric Code
 - 8. NEMA National Electric Manufacturers Association
 - 9. NFPA National Fire Protection Association
 - 10. OAR Owner's Authorized Representative
 - 11. RCDD Registered Communications Distribution Designer
 - 12. RFP Request for Proposal
 - 13. RU Rack Unit
 - 14. STD Standard
 - 15. TGB Telecommunications Grounding Busbar
 - 16. TIA Telecommunications Industry Association
 - 17. TMGB Telecommunications Main Ground Bus Bar
 - 18. UL Underwriters Laboratories
 - 19. UPS Uninterruptable Power System

1.3 QUALITY ASSURANCE

- A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the OAR.
- B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the OAR.
- C. Strictly adhere to all BICSI, EIA and TIA recommended installation practices when installing the products specified in this section.
- D. Contractor's Qualifications:

1. Firms regularly engaged in the installation of Electrical Systems or Data Communications cabling and that have five (5) years of installation experience with systems similar to that required for this project.
2. Provide references to include client names, phone numbers and a summary of project details. These references will be checked and the clients will be asked questions relative to the performance of your company.
3. Provide verification that installation personnel responsible have been properly trained to install the products described in this Section.
4. Provide a BICSI RCDD certified professional, or a master electrician, for oversight on this project. This person does not have to be working on-site, but must be accessible to answer questions and provide weekly status reports. The RCDD or master electrician shall be a full-time employee of the contractor.
5. Provide full time project manager with a minimum of ten (10) years field experience in installation of communications systems and infrastructures. Project manager shall be assigned for the duration of the project and shall not be replaced without written consent from the OAR.

E. Manufacturer's Qualifications:

1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.

F. Material and Work specified herein shall comply with the applicable requirements of:

1. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2010
2. ANSI/NECA/BICSI-568 – Standard for Installing Commercial Building Telecommunications Cabling, 2006
3. ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises, 2009
4. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard, 2009
5. ANSI/TIA/EIA-569-B – Commercial Building Standard for Telecommunications Pathways and Spaces, 2004
6. ANSI/TIA/EIA-606-B – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 2012
7. ANSI-J-STD-607-A – Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2002
8. ANSI/TIA-942 – Telecommunications Infrastructure Standard for Data Centers
9. NFPA 70 – National Electric Code, 2014
10. UL 1449 – Standard for Surge Protective Devices.
11. BICSI – Telecommunications Distribution Methods Manual, 13th Edition
12. NEMA – VE 1 – Metal Cable Tray Systems, 2009
13. NEMA – VE 2 – Metal Cable Tray Installation Guidelines, 2006
14. Applicable codes and directives of authorities having jurisdiction

G. Work:

1. The Work shall be performed in compliance with the applicable manufacturer's installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.
3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

1.4 CONFLICTS

- A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts between the aforementioned, notify the OAR in writing prior to commencement of affected work.

1.5 PERMITS

- A. The Contractor shall secure and pay for all necessary permits and fees required for the execution of this Work. Work will not start until all permit applications are approved.

1.6 SCHEDULING

COMMUNICATIONS EQUIPMENT ROOM FITTINGS

- A. The Contractor shall comply with all scheduling requests established by OAR, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and, if accepted, will be used to track work status.
- B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.
- C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

1.7 REQUIREMENTS

- A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The OAR must approve material submittal and substitutions in writing.
- B. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.
- C. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.
- D. The requirements as given in this document are to be adhered to unless revised by the OAR in writing.
- E. The Owner reserves the right to waive these requirements at any time.

1.8 SUBMITTALS

- A. Comply with provisions of Division 01.
- B. Comply with provisions of Section 27 05 00.
- C. Produce Shop Drawings for ALL (tele)communications rooms which shall include dimensions, rack/cabinet placement, cable tray/ladder racking placement, rack/cabinet elevations, and each wall within the space.
- D. Provide all submittal requirements under this section as a single package.
- E. Provide product data for the following:
 - 1. Product data consisting of manufacturers specifications for each type of product to be installed, all applicable certifications and elevation/plan documents supporting compliance with stated Specifications.
 - 2. Proposed format of as-built documentation.

1.9 CONTRACTOR CLOSE OUT SUBMITTALS

- A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (5) sets.
 - 1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.
 - 2. Provide above closeout documentation as an electronic file in PDF format.
 - 3. Laminated as-built drawing sheet of TR service area representing each level, with a scale of not less than 1/8in, mounted on the wall of each TR.
- B. Warranty and Maintenance:
 - 1. Record drawings of final room configurations

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer's recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.
- B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the OAR.
- C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.
- D. Provide protective covering during construction to prevent damage or entrance of foreign matter.
- E. Contractor is responsible for on-site security of tools, test equipment and materials.
- F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

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

1.12 WARRANTY

- A. Warrant labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics, following Contractor Warranty requirements defined in Division 01. Repair or replace defects occurring in labor or product within the Warranty period without charge.
- B. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

PART 2 – PRODUCTS

2.1 GENERAL

- A. The products specified in this document do not necessarily constitute the exhaustive list of products required to complete the statement of work. Except where described in the SUMMARY subpart of this document, the contractor is responsible for providing any other parts and materials needed to deliver a complete and working system.

2.2 EQUIPMENT RACKS

- A. Free-standing Equipment Racks
 1. Racks shall be manufactured from aluminum extrusion.
 2. 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 nut and bolt hardware. The base angles will be pre-punched for attachment to the floor.
 3. 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.
 4. When assembled with top and bottom angles, equipment-mounting channels will be spaced to allow attachment of 19" EIA rack-mount equipment. Attachment points will be threaded with 12-24 roll-formed threads. The rack will include assembly and equipment-mounting hardware. Racks will include 50 each combination pan head, pilot point mounting screws.
 5. Two-Post Rack - The assembled rack outside dimensions will be 7' (84") high, 20" wide and 15" deep. The sides (webs) 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. The rack will be rated for 1,000 lb. of equipment.

6. Four-Post Frame:
 - a. Capacity: 2,000 lb (907.2 kg).
 - b. Mounting Channels: Front and rear tapped #12-24 3 inch (76 mm) deep flange with the EIA-310-D Universal hole pattern.
 - c. Size: 19 inches (482 mm) wide by 7 feet (2.1 m) high (45U), by 23.2 inches (600mm) deep.
 7. The rack will be UL Listed.
 8. Finish shall be epoxy-polyester hybrid powder coat in the color black.
 9. Acceptable products:
 - a. Chatsworth Products, Inc. (CPI)
 - 1) 2-Post - 55053-703, Standard Rack, 19" x 7", Black, UL Listed.
 - 2) 4-Post - 50120-703, quadra rack ; 19" w x 7'h x 29" d
 - 3) 40605-005, Equipment Mounting Screws, #12-24, 50 pack, Black
 - 4) 40604-003, Rack Installation Kit, Concrete Slab, Zinc
 - 5) 12816-704, Flush Mount Plug Strip with NEMA L5-15P, and Surge Protection
 - b. Owner Approved Equivalent.
- B. Vertical Wire Managers
1. Every rack/frame shall have a minimum of one vertical cable manager. The vertical cable manager shall create a space for storing and organizing cables along the side of the rack/frame. The cable manager shall maintain separation between patch/equipment/jumper cords and premise cables.
 2. The vertical cable manager shall match the height of the rack(s)/frame(s).
 3. The vertical cable manager shall bolt to the side of racks/frames with included hardware.
 4. The cable manager shall be sized to match cabling requirements. Maximum cable fill shall be calculated by dividing 50% of the usable area within the cable manager by the area of a single cable.
 5. A single vertical cable manager may be used in between bayed racks/frames if it is sized to match cable requirements for both racks/frames.
 6. The single-sided vertical cable manager shall be a C-shaped trough with a front door. The single-sided trough shall provide a single cable pathway. The front sides of the cable manager shall have T-shaped cable guides separated by openings that align with each U space on the rack. The back of the manager shall be mostly open to allow easy cable pass-through. Three fixed position accessory mounting panels shall allow attachment of cable management accessories at the back of the manager.
 7. The double-sided vertical cable manager shall be a double-sided H-shaped trough with a front door and a rear door. The double-sided trough shall provide independent front and rear cable pathways. The front and rear sides of the cable manager shall have T-shaped cable guides separated by openings that align with each U space on the rack. The middle of the managers shall be mostly open to allow easy cable pass-through. Three movable mid-sections shall allow attachment of cable management accessories inside the cable manager. The movable mid-sections shall adjust front-to-rear to allow a 40/60, 50/50 or 60/40 front/rear split of the interior cable management space.
 8. The combination vertical cable manager shall be a single-sided C-shaped trough with a front door and individual cable rings on the rear side. The single-sided trough and cable rings shall provide independent front and rear cable pathways. The front sides of the cable manager shall have T-shaped cable guides separated by openings that align with each U space on the rack. The back of the manager shall have individual rings with plastic spin-open latches. The rings will provide attachment points for cable management accessories inside the cable management trough. Openings between the rings will allow easy cable pass-through.
 9. The door shall be removable, hinged to open from the right or left side, with a two-point latch and a single knob on the right and left side to secure the door in the closed position. The front door shall have a two-tone finish: black with a vertical aluminum panel at the center. The rear door on double-sided cable managers shall be flat with a black finish.
 10. The T-shaped cable guides shall be made from a composite plastic material (not metal) and shall have rounded edges to protect cables. Openings between the T-shaped guides will be evenly spaced. When the cable manager is attached to a rack/frame, each cable opening shall align with a rack-mount space (U) on the rack/frame. Each opening shall pass a minimum of 24 each .25" OD patch cords.
 11. The cable manager shall be delivered individually boxed, and available in several widths as specified below and in the contract documents.
 12. The vertical cable manager shall be manufactured from steel, aluminum and plastic.
 13. Finish shall be epoxy-polyester hybrid powder coat paint in the color as specified below and in the contract documents. T-shaped cable guides and latch hardware is black.
 14. Optional internal cable management accessories will include cable management spools that attach to the panels/mid-sections to provide slack management for patch cords; a cable lashing bar kit to

provide tie points for cable bundles at the rear/mid of the manager; and a fiber segregation kit that creates a separate pathway inside the manager to separate fiber from other cables.

15. Acceptable products:
 - a. Chatsworth Products, Inc. (CPI), Velocity™ Cable Management:
 - 1) Part Number 13912-703, Vertical Cable Manager, 7' High x 6" Wide x 16.6" Deep
 - 2) Part Number 15008-001, Cable Distribution Spools, Pack of 4, Black.
 - 3) Part Number 13935-701, Cable Distribution Spools, Pack of 4, Black.
 - 4) Part Number 13928, Cable Lashing Bar Kit
 - b. Owner Approved Equivalent.

C. Horizontal Wire Managers

1. Place horizontal cable managers above and below each patch panel on/in each rack/frame. The horizontal cable manager will guide patch/equipment cords between the vertical cable manager and individual network port connections.
2. The horizontal cable manager shall match the rack-mount width of the rack(s)/frame(s).
3. The horizontal cable manager shall attach to the front or rear of the rack/frame with screws and shall be sized to fit in standard EIA-310-D or EIA-310-E Universal rack-mount spacing (1-3/4in high U).
4. The horizontal cable manager shall be sized to match cabling requirements. Provide a minimum of 2U of horizontal cable management for every 2U of connectivity. Cables must be able to access the cable manager so that no ports are blocked by the cables.
5. A single horizontal cable manager may be used to support multiple patch panels as long as it is sized to match cable fill requirements. Cables must be able to access the cable manager so that no ports are blocked by the cables.
6. The horizontal cable manager shall be a single-sided C-shaped trough with a cover. 2U high cable managers shall have three edge-protected oval openings at the rear to facilitate front-to-rear cabling through the horizontal manager. The front of the cable manager shall have T-shaped cable guides along the top and bottom surfaces of the cable manager. Evenly spaced cable openings in between the T-shaped cable guides shall allow cables to enter/exit the cable manager from/into the rack-mount space. The cover shall be removable, hinged to open up or down and shall snap on to secure the cover in the closed position.
7. The horizontal cable manager shall be delivered individually boxed, and available in the width(s) and height(s) as specified below and in the contract documents.
8. The horizontal cable manager shall be manufactured from steel, aluminum and plastic.
9. Finish shall be epoxy-polyester hybrid powder coat paint in the color as specified below and in the contract documents. Edge-protectors, T-shaped cable guides and latch hardware is black.
10. Acceptable products:
 - a. Chatsworth Products, Inc. (CPI), Velocity™ Horizontal Cable Management:
 - 1) Part Number 35441-702, Evolution Single-Sided Horizontal Cable Manager, 2U x 19inEIA x 8.2in Deep (208 mm), Black
 - b. Panduit
 - c. TE Connectivity (ADC Krone)
 - d. Owner Approved Equivalent

2.3 LADDER RACK, SUPPORTS, AND ACCESSORIES

A. Ladder Rack (Cable Runway)

1. Ladder rack shall be manufactured from 3/8" wide by 1-1/2" high tubular steel.
2. Ladder rack (side stringers) will be 9'-11 1/2" long. Cross members will be welded in between stringers on maximum 12" centers beginning 5-3/4" from one end so that there are a minimum 10 cross members per ladder rack. There will be a maximum 10-1/2" of open space in between each cross member.
3. Finish shall be epoxy-polyester hybrid powder coat (paint) in the color(s) specified below.
4. Refer to the drawing set to determine the width.
5. Acceptable products: ("xx" denotes nominal width)
 - a. Chatsworth 10250-7xx
 - b. Cooper B-Line SB17TxxBFB
 - c. Owner Approved Equivalent

B. Horizontal 90° Turns

1. Horizontal 90° turns shall be manufactured from 3/8" wide by 1-1/2" high tubular steel with .065" wall thickness.

2. Stringers (sides) will be formed in a 90° arc. Cross members will be welded in between stringers on approximate 23° increments so that there are 5 cross members per turn. The welded assembly will have a 15" inside radius and will create a smooth horizontal 90° turn.
 3. Horizontal 90° turns will be available in the width(s) specified below.
 4. Finish shall be epoxy-polyester hybrid powder coat (paint) in the color(s) specified below.
 5. Acceptable products: ("xx" denotes nominal width)
 - a. Chatsworth 10822-7xx
 - b. Cooper B-Line SB17HRBxxFB
 - c. Owner Approved Equivalent
- C. Vertical-To-Horizontal 90° Turns
1. Vertical-to-horizontal 90° turns shall be manufactured from 3/8" wide by 1-1/2" high tubular steel with .065" wall thickness.
 2. Stringers (sides) will be formed in a 90° arc with a 12-1/2" outside radius. Cross members will be welded in between stringers on approximate 23° increments so that there are 3 cross members per turn. The welded assembly will create a smooth 90° vertical-to-horizontal turn.
 3. Finish shall be epoxy-polyester hybrid powder coat (paint) in the color(s) specified below.
 4. Acceptable products: ("xx" denotes nominal width)
 - a. Chatsworth 10724-7xx
 - b. Cooper B-Line SB16VRBxxFB
 - c. Owner Approved Equivalent
- D. Corner Brackets
1. Corner brackets shall be manufactured from 3/8" wide by 1-1/2" high tubular steel with .065" wall thickness.
 2. The inside stringers of the corner bracket will be formed at 90° with a small chamfer at the vertex. The outside stringer of the corner bracket will be formed in a 90° arc that is either 15" or 24" in radius. A single cross member will connect the chamfered portion of the inside stringer to the outside stringer. The welded assembly will create a smooth 90° turn within the L-shaped corner created by two intersecting ladder racks.
 3. Corner brackets will be available in the size(s) specified below. Installation hardware will be included with the corner bracket. Corner bracket installation hardware does not include the junction splice kit required to form the L-shaped intersection between two ladder racks.
 4. Finish shall be epoxy-polyester hybrid powder coat (paint) in the color specified below.
 5. Acceptable products: ("xx" denotes nominal radius)
 - a. Chatsworth 11959-7xx
 - b. Cooper B-Line SB2104FB
 - c. Owner Approved Equivalent
- E. Ladder Rack Splices
1. Splice kits will provide a method of mechanically connecting ladder rack sections and turns together end-to-end or side-to-end to form a continuous pathway for cables.
 2. Grounding kits will provide a method of bonding ladder rack sections and turns together that is independent of the pathway splices. The grounding kit should be constructed of UL Listed components. The preferred solution is a #6 AWG green insulated stranded copper conductor connected on both ends to ladder rack using two-hole compression lugs and stainless steel hardware.
 3. An insulator bar kit will provide a means of electrically isolating individual ladder rack sections through an end-to-end splice separated with a non-conductive material. The preferred solution is a 3/8" wide by 1-1/2" high by 5-1/2" long insulator bar made of Delrin® (by DuPont, Delrin is a registered trademark of E.I. du Pont de Nemours and Company).
 4. Splices (splice plates) will be manufactured from steel. Splice, grounding and insulator bar kits will include installation hardware.
 5. Finish (of splice plates and hardware) shall be zinc plate in the color(s) specified below. Colors are applied as a chem. film over the zinc plate.
 6. Acceptable products:
 - a. Chatsworth Products, Inc. (CPI)
 - 1) 11301-701 Butt Splice Kit
 - 2) 11302-701 Junction Splice Kit
 - b. Cooper B-Line
 - 1) SB2107BZ Butt Splice Kit
 - 2) SB2101ABZ Junction Splice Kit
 - c. Owner Approved Equivalent

- F. Ladder Rack Supports
1. Supports will be sized to match the width of the ladder rack that is supported. Some supports will Work with all widths of ladder rack.
 2. Each support will include a means of securing ladder rack to the support.
 3. Supports will be manufactured from steel or aluminum.
 4. Finish shall be epoxy-polyester hybrid powder coat (paint) in the color(s) specified below or zinc plate with a gold chem. finish specified gold. Included hardware shall be zinc plated with a gold chem. finish.
 5. Acceptable products:
 - a. Chatsworth Products, Inc. (CPI) ("xx" denotes nominal width)
 - 1) 11312-7xx Triangular Support Bracket
 - 2) 11421-7xx Wall Angle Support Kit
 - 3) 11310-001 Threaded Ceiling Kit, 3/8" Rod
 - 4) 10595-7xx Rack-To-Runway Mounting Plate
 - b. Cooper B-Line
 - 1) SB213xxKFB Triangular Support Bracket
 - 2) SB2113xxFB Wall Angle Support Kit
 - 3) SB2221BZ Threaded Ceiling Kit, 3/8" Rod
 - 4) SB2133xxFB Rack-To-Runway Mounting Plate
 - c. Owner Approved Equivalent
- G. Ladder Rack Accessories
1. Provide end caps to cover exposed ladder rack ends.
 - a. End caps used to cover the ends of ladder rack will be manufactured from a black fire-retardant rubberized material. End caps will be sized for 3/8" wide by 1-1/2" high side stringers and will be sold in pairs.
 2. Provide one radius drop for each rack and cabinet and stringer mounted radius drops, as required.
 - a. Radius drops used to create a radius to form cables over as the cables exit or enter the ladder rack will be manufactured from aluminum extrusion. The extrusion will be formed in a 90° arc with a minimum bend radius of 3". Radius drops will attach to either the side stringer or the cross member of the ladder rack using a clevis pin. Radius drops will include 1-1/2" high cable spools that attach to the top of the radius drop to guide cables.
 3. Provide moveable cross members, as required.
 - a. Movable cross members used to support cross member radius drops in between welded cross members on ladder rack will be manufactured from 3/8" by 1-1/2" aluminum bar. Movable cross members will attach to ladder rack at the side stringers with included hardware so that the location of the movable cross member can be adjusted. Moveable cross member will support a cross member radius drop.
 4. Touch-up paint used on ladder rack and ladder rack system components will be color-matched to the finish on the ladder rack or component. A spray on and brush on option will be available.
 5. Unless otherwise noted, finish on all metal components shall be epoxy-polyester hybrid powder coat (paint) in the color(s) specified below. Hardware will be zinc plated with a gold chem. finish.
 6. Acceptable products: ("xx" denotes nominal width)
 - a. Chatsworth Products, Inc. (CPI)
 - 1) 10642-001 Cable Runway Protective End Caps
 - 2) 12100-7xx Radius Drop, Cross Member
 - 3) 12101-7xx Radius Drop, Stringer
 - 4) 12115-7xx Moveable Cross Member
 - b. Cooper B-Line
 - 1) SB110A1B Cable Runway Protective End Caps
 - 2) SB2129xxFB Radius Drop, Cross Member
 - 3) SB2120DSxxFB Radius Drop, Stringer
 - 4) SB17RKxxFB Moveable Cross Member
 - c. Owner Approved Equivalent

PART 3 – EXECUTION

3.1 INSTALLATION

- A. The installation recommendations contained within ANSI/TIA-568-B, ANSI/TIA-569 and the BICSI Telecommunications Distribution Methods Manual (TDMM), including the Manufacturer's recommended installation methods or practices for a Standards-based Structured Cabling System, are mandatory minimum standards and requirements.

- B. Mount equipment and enclosures plumb and level. Permanently installed equipment to be firmly and safely held in place. Equipment supports must support loads imposed with a safety factor of at least five.
- C. Relay Racks
1. Assemble relay racks according to manufacturer's instructions. Verify that equipment mounting rails are sized properly for rack-mount equipment before attaching the rack to the floor.
 2. All racks must be attached to the floor in four places using appropriate floor mounting anchors. When placed over a raised floor, threaded rods should pass through the raised floor tile and be secured in the structural floor below.
 3. Racks shall be grounded to the TGB using appropriate hardware provided by the contractor. The ground will meet local code requirements and will be approved by the AHJ.
 4. In seismic areas, the rack should have additional bracing as required by building codes and the recommendations of a licensed structural engineer.
 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.
 6. The equipment load should be evenly distributed and uniform on the rack. Place large and heavy equipment towards the bottom of the rack. Secure all equipment to the rack with equipment mounting screws.
- D. Vertical Cable Managers
1. When more than one cable manager is used on a rack/frame or group of racks/frames, use the same make, style and size of vertical cable manager on the rack/frame or in between racks/frames.
 2. The color of the rack(s)/frame(s) and cable manager(s) must match.
 3. Attach vertical cable managers to the side of the rack/frame using the manufacturer's installation instructions and included hardware.
 4. When a single vertical cable manager is used in between two racks/frames, attach the vertical cable manager to both racks/frames.
 5. Dress cables through the openings in between the T-shaped guides on the manager so that cables make gradual bends as they exit or enter the cable manager into the rack-mount space (U). Do not twist, coil or make sharp bends in cables.
 6. Doors shall be attached to the cable manager and in the closed position after cabling is complete.
- E. Horizontal Cable Managers
1. When more than one horizontal cable manager is used on a rack/frame or group of racks/frames, use the same make and style of cable manager on the rack/frame or racks/frames.
 2. The color of the rack(s)/frame(s) and cable manager(s) must match.
 3. Attach horizontal cable managers to the rack/frame with four screws according to the manufacturer's installation instructions. Each cable manager shall be centered within the allocated rack-mount space (U).
 4. Horizontal managers shall be located so that the number of ports (cables) that each manager supports shall not exceed each cable manager's cable fill capacity.
 5. Dress cables through the openings in between the T-shaped guides on the cable manager so that cables make gradual bends as they exit or enter the cable manager into the rack-mount space (U). Do not twist, coil or make sharp bends in cables.
 6. Covers shall be attached to the cable manager and in the closed position after cabling is complete.
- F. Cable Tray and Ladder Rack
1. Provide all components of the ladder rack system (ladder rack, turns, splices, supports, and accessories) from a single manufacturer.
 2. Ladder rack shall be installed with side stringers facing down so that the ladder forms an inverted U-shape and so that welds between the stringers (sides) and cross members (middle) face away from cables.
 3. Ladder rack shall be secured to the structural ceiling, building truss system, wall, and the tops of equipment racks and/or cabinets using the manufacturer's recommended supports and appropriate installation hardware and methods as defined by local code or the authority having jurisdiction (AHJ).
 4. Ladder rack splices will be made in mid-span, not over a support, with the manufacturer's recommended splice hardware.
 5. Ladder rack shall be supported every 5' or less in accordance with TIA-569-B. Ladder rack shall be supported within 2' of every splice and within 2' on both/all sides of every intersection. Support ladder rack within 2' on both sides of every change in elevation. Support ladder rack every 2' when attached vertically to a wall.
 6. Heavy-duty splices are recommended for ladder rack in excess of 18" width (18" wide ladder rack). Heavy-duty splices are required for any splice formed in the vertical orientation including changes

- in elevation formed using vertical-to-horizontal 90° turns or horizontal-to-vertical 90° turns. Use heavy-duty splices to secure all overhead turns to the overhead horizontal pathway(s).
7. When the pathway is overhead, ladder rack shall be installed with a minimum clearance of 12" above the ladder rack. Leave a minimum of 12" in between ladder rack and ceiling/building truss structure. Leave a minimum of 3" in between ladder rack and the tops of equipment racks and/or cabinets. Multiple tiers of ladder rack shall be installed with a minimum clearance of 12" in between each tier of ladder rack. When located above an acoustical drop ceiling, leave a minimum of 3" clearance between the top of the drop ceiling tiles and the bottom of the ladder rack.
 8. When installed under a raised floor, ladder rack shall be installed with a minimum 3" clearance between the top of the ladder rack and the bottom of the floor tiles or floor system stringers, whichever is lower in elevation. Maintain a 3" clearance between ladder racks wherever ladder racks cross.
 9. Within each telecommunications room, ladder rack should be bonded together, electrically continuous, and bonded to the TGB, unless otherwise noted in the specifications and contract documents. Ladder rack and turns shall be bonded across each splice with a bonding kit. Ladder rack shall be bonded to the Telecommunications Grounding Busbar (TGB) using an approved ground lug on the ladder rack and a minimum #6 grounding wire or as recommended by the AHJ. Remove paint from the ladder rack where bonding/ground lugs contact the ladder rack so that the lug will contact bare metal. Use antioxidant joint compound in between the bare metal on the ladder rack and ground lug. Use antioxidant joint compound in between the bus bar and the ground lug. Verify continuity through the bonds at splices and intersections between individual ladder rack sections and turns and through the bond to the TGB.
 10. The quantity of cables within the ladder rack will not exceed a whole number value equal to 50% of the interior area of the ladder rack divided by the cross-sectional area of the cable. The interior area of ladder rack will be considered to be the width of the ladder rack multiplied by a height of 2", unless cable retaining posts are added to the ladder rack. The interior area of ladder rack equipped with cable retaining posts will be considered to be the width of the ladder rack multiplied by a height of 6". Actual cable fill for ladder rack that is not equipped with cable retaining posts will not exceed 2" in height. Actual cable fill for ladder rack equipped with cable retaining posts will not exceed 6" in height.
 11. The combined weight of cables within the ladder rack will not exceed the stated load capacity of the ladder rack as stated in the manufacturer's product specifications or load/design tables.
 12. Cables (cable bundles) will be secured to the cross members of ladder rack with ¾" wide reusable straps. Straps are not required when ladder rack is equipped with cable retaining posts.
 13. Add 8" high cable retaining posts to the open sides of ladder rack when cable fill exceeds 2" in height or when cable bundles cannot be secured directly to the ladder rack cross members with a strap. Cable fill within any ladder rack should not exceed 6" in height.
 14. When a single ladder rack supports different types of cable media, the cable media will be separated within the pathway by cable spools that attach to the cross members on the ladder rack. Treat each type of cable media and divided area of the ladder rack separately when determining cable fill limits.
 15. Use a radius drop to guide cables wherever cable exits overhead ladder rack to access a rack, frame, cabinet or wall-mounted rack, cabinet or termination field. If necessary, provide a moveable cross member also to attach and align the radius drop in between the welded cross members of a ladder rack.
 16. Cover the exposed ends of cable runway that do not terminate against a wall, the floor or the ceiling with end caps or an end closing kit.
 17. Use auxiliary support brackets that attach to the side stringer of the ladder rack to support interconnect cabling (patch cords, equipment cords, jumper cords) that is routed between racks using the ladder rack. Auxiliary support brackets can be used to support other conductors that should be physically separated from cables within the ladder rack as defined by local code or the authority having jurisdiction (AHJ).
 18. Whenever possible, maintain a 2' separation between ladder rack used for communications cables and pathways for other utilities or building services.
 19. The installer will provide touch-up paint color-matched to the finish on the ladder rack and will correct any minor cosmetic damage (chips, small scratches, etc.) resulting from normal handling during the installation process prior to delivery to the owner. If a component is cosmetically damaged to the extent that correction in the field is obvious against the factory finish, the component will be replaced with a new component finished from the factory. If a component is physically damaged due to mishandling or modification during the installation process, it shall not be used as part of the ladder rack system.

3.2 AC POWER AND GROUNDING

- A. Coordinate and verify final connection of related electrical power, TMGB and TMB Grounding Busbar and ground conductors.
- B. Provide ground system compliant with the reference ANSI-J-607-A Standard, ANSI/NFPA-70 and authorities having jurisdiction.
- C. Ground equipment chassis not having a three-wire power cord, other metal enclosures, and equipment rack frames in the ER and IDF room(s) to the ground bus bar in that room using # 6 AWG insulated conductor and bonding with 10/32 nuts, bolts and lock-washers.
- D. Remove any finish and make-bare any metallic surface at the point where grounding wire is connected to and or terminated on equipment frames, racks or devices.

END OF SECTION

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SECTION 27 13 00

COMMUNICATIONS BACKBONE CABLING

PART 1 – GENERAL

1.1 SUMMARY

- A. Provide all labor, materials, and equipment for the complete installation of Work called for in the Contract Documents.
- B. This section includes the minimum requirements for the installation of backbone cabling between Telecommunications Rooms.
- C. Included in this section are the minimum composition requirements and installation methods for the following:
 - 1. Multi-pair Category 3 UTP Cable
 - 2. UTP Termination Hardware
 - 3. Conventional Fiber Optic Cabling
 - 4. Fiber Optic Splicing and Termination Hardware
 - 5. Fiber Enclosures, Adapter Panels and Splice Trays
 - 6. Fiber Optic Patch Cords.

1.2 DEFINITIONS AND TERMS

- A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:
 - 1. ANSI American National Standards Institute
 - 2. BICSI Building Industry Consulting Service International
 - 3. CMR Communications Riser Cable
 - 4. CMP Communications Plenum Cable
 - 5. DCM Design Criteria Manual
 - 6. EIA Electronics Industries Alliance
 - 7. FOCIS Fiber Optic Connector Intermateability Standards
 - 8. ICEA Insulated Cable Engineers Association
 - 9. IDC Insulation Displacement Connector
 - 10. IEEE Institute of Electrical and Electronics Engineers
 - 11. MER Main Equipment Room
 - 12. NECA National Electrical Contractors Association
 - 13. NEMA National Electric Manufacturers Association
 - 14. NFPA National Fire Protection Association
 - 15. OAR Owner's Authorized Representative
 - 16. OLTS Optical Loss Test Set
 - 17. OFNR Optical Fiber Nonconductive Riser
 - 18. RCDD Registered Communications Distribution Designer
 - 19. RFP Request for Proposal
 - 20. STD Standard
 - 21. TIA Telecommunications Industry Association
 - 22. TR Telecommunications Room
 - 23. TSA Transportation Security Administration
 - 24. UL Underwriters Laboratories
 - 25. UTP Unshielded Twisted Pair

1.3 QUALITY ASSURANCE

- A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the OAR.
- B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, or a substitution is

requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the OAR.

- C. Strictly adhere to all BICSI, EIA and TIA recommended installation practices when installing communications backbone cabling.
- D. Contractor's Qualifications:
1. Firms regularly engaged in the installation of Data Communications cabling and that have five (5) years of installation experience with systems similar to that required for this project.
 2. Provide references to include client names, phone numbers and a summary of project details. These references will be checked and the clients will be asked questions relative to the performance of your company.
 3. Provide verification that installation personnel responsible have been properly trained to install the products described in this Section.
 4. Provide a BICSI RCDD certified professional for oversight on this project. This person does not have to be working on-site, but must be accessible to answer questions and provide weekly status reports. The RCDD shall be a full-time employee of the contractor.
 5. Provide full time project manager with a minimum of ten (10) years field experience in installation of communications systems and infrastructures. Project manager shall be assigned for the duration of the project and shall not be replaced without written consent from the OAR.
- E. Manufacturer's Qualifications:
1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.
- F. Material and Work specified herein shall comply with the applicable requirements of:
1. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2010
 2. ANSI/NECA/BICSI-568 – Standard for Installing Commercial Building Telecommunications Cabling, 2006
 3. ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises, 2009
 4. ANSI/TIA-568-C.0-1 – Telecommunications Cabling for Customer Premises – Addendum 1, Updated reference for balanced twisted Pair Cabling, 2010
 5. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard, 2009
 6. ANSI/TIA-568-C.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards, 2009
 7. ANSI/TIA-568-C.3 – Optical Fiber Cabling Components Standard, 2008
 8. EIA/TIA TSB-36 – Additional Cable Specifications for Unshielded Twisted Pair
 9. EIA/TIA TSB-40 – Additional Transmission Specifications for Unshielded Twisted Pair
 10. EIA/TIA TSB-67 – Transmission Performance Specifications for Field-testing of Unshielded Twisted Pair Cabling Systems
 11. ANSI/TIA/EIA-526-7, Optical Power Loss Measurements of Installed Singlemode Fiber Cable Plant
 12. ANSI/TIA/EIA-526-14-A, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
 13. ANSI/TIA/EIA-569-B – Commercial Building Standard for Telecommunications Pathways and Spaces, 2009
 14. ANSI/TIA/EIA-606-B – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 2012
 15. ANSI-J-STD-607-A – Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2002
 16. ANSI/TIA-942 – Telecommunications Infrastructure Standard for Data Centers
 17. NFPA 70 – National Electric Code, 2014
 18. UL 13 – Standard for Safety for Power-Limited Circuit Cables
 19. UL 444 – Standard for Safety for Communications Cables
 20. BICSI – Telecommunications Distribution Methods Manual, 13th Edition
 21. IEEE 802 – Local Area Network Standard
 22. Applicable codes and directives of authorities having jurisdiction
- G. Work:
1. The Work shall be performed in compliance with the applicable manufacturer's installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
 2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.

3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

1.4 CONFLICTS

- A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts between the aforementioned, notify the OAR in writing prior to commencement of affected work.

1.5 PERMITS

- A. The Contractor shall secure and pay for all necessary permits and fees required for the execution of this Work. Work will not start until all permit applications are approved.

1.6 SCHEDULING

- A. The Contractor shall comply with all scheduling requests established by OAR, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and, if accepted, will be used to track work status.
- B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.
- C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

1.7 REQUIREMENTS

- A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The OAR must approve material submittal and substitutions in writing.
- B. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.
- C. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.
- D. The requirements as given in this document are to be adhered to unless revised by the OAR in writing.
- E. The Owner reserves the right to waive these requirements at any time.

1.8 SUBMITTALS

- A. Comply with provisions of Division 01.
- B. Comply with provisions of Section 27 05 00.
- C. Produce Shop Drawings for ALL backbone cabling, to include but not limited to, proposed routing and its location relative to building structure (columns, floor or ceiling) and its relationship to electrical, mechanical elements.
- D. Provide all submittal requirements under this section as a single package.
- E. Provide product data for the following:
 1. Product data consisting of manufacturers specifications for each type of product to be installed, all applicable certifications and elevation/plan documents supporting compliance with stated Specifications.

2. Manufacturer's certificate of acceptance of the qualifications of the installing Contractor to install, test and maintain the manufacturer's equipment.
3. Manufacturer's installation specifications for copper cabling and optical fiber, indicating minimum bend radius and maximum pull tension.
4. Outline of administration labeling scheme for voice and data communications cabling and termination locations per ANSI/EIA/TIA-606.
5. Proposed format of as-built documentation

1.9 CONTRACTOR CLOSE OUT SUBMITTALS

- A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (4) sets.
 1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.
 2. Test reports on all copper and optical fiber cables (electronic file format and hard copy).
 3. As-built cable schedules with recorded cable routing and lengths of each designated run.
 4. As built documentation of all cabling systems.
 5. As built documentation of all pathway systems to include cable tray, conduits (horizontal and vertical), and non-contiguous support.
 6. As built documentation of TR modifications and associated cabinet elevations.
 7. Laminated as-built drawing sheet of TR service area, with a scale of not less than 1/8 inch, mounted in the wall of each TR.
- B. Warranty and Maintenance:
 1. Test Report Binder(s)
 2. Record Drawings

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer's recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.
- B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the OAR.
- C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.
- D. Provide protective covering during construction to prevent damage or entrance of foreign matter.
- E. Contractor is responsible for on-site security of tools, test equipment and materials.
- F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

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

1.12 WARRANTY

- A. Warrant labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics, following Contractor Warranty requirements defined in Division 01, or for a period of 1 year from date of final completion, whichever is longer. Repair or replace defects occurring in labor or product within the Warranty period without charge.

- B. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

PART 2 – PRODUCTS

2.1 GENERAL

- A. The products specified in this document do not necessarily constitute the exhaustive list of products required to complete the statement of work. Except where described in the SUMMARY subpart of this document, the contractor is responsible for providing any other parts and materials needed to deliver a complete and working system.

2.2 ACCEPTABLE DISTRIBUTORS

- A. Contractor shall procure all horizontal cabling components through authorized Manufacturer product distributors.

2.3 ACCEPTABLE VENDORS AND MATERIALS

- A. Subject to compliance with requirements, install products from the following manufacturers, except where noted:
 - 1. Cable, Copper
 - a. General Cable Technologies Corp.
 - b. Superior Essex Inc.
 - c. Owner approved equivalent
 - 2. Cable, Fiber Optic
 - a. Corning
 - b. Owner approved equivalent
 - 3. Termination Components
 - a. Panduit Corp.
- B. Part numbers are provided for convenience purposes only; the contractor is responsible for complete material list and quantities. All materials listed are manufactured by General, Superior Essex or Corning unless otherwise noted. Colors are to be approved by Owner.

2.4 UTP PRODUCTS

- A. UTP Cable
 - 1. Provide multi-pair Category 3 cabling for all copper backbone connectivity.
 - 2. Conductors shall be 24 AWG solid annealed copper.
 - 3. Pairs shall be formed into 25-pair binder groups.
 - 4. The jacket shall be constructed of flame retardant PVC.
 - 5. Comply with ICEA S-90-661 for mechanical properties.
 - 6. Comply with ANSI/TIA-568-C.1 & ANSI/TIA-568-C.2 for performance specifications.
 - 7. Provide plenum-rated cable for all plenum environments and riser-rated cable for all non-plenum environments.
 - 8. Approved products:
 - a. General Cable Category 3 Plenum
 - b. General Cable Category 3 Non-Plenum
 - c. Superior Essex Category 3 CMR/CMP
 - d. Owner approved equivalent.
- B. UTP Cable Terminating Hardware
 - 1. Terminate each end of copper backbone cables with rack mount 110 style field termination kits.
 - 2. Hardware to exceed the TIA/EIA-568-B.2 Category 3 standard.
 - 3. Hardware to be field terminable.
 - 4. Include required quantity of bases and connecting blocks, label holders and labels.
 - 5. Kit shall include jumper troughs.
 - 6. Connecting blocks shall be of the 5-pair variety.
 - 7. Acceptable products:
 - a. Panduit P110B1005R4WJY 110 Punchdown Kit with Bases, 5 Pair Connector Blocks, Jumper Troughs

- b. Owner approved equivalent.

2.5 FIBER OPTIC PRODUCTS

A. Single mode Fiber

1. Provide singlemode fiber optic backbone cabling, as indicated in the drawing set.
2. Optical fibers shall be minimum OS1 compliant.
3. Maximum attenuation coefficient shall be:
 - a. 0.65 dB/km at 1310 nm
 - b. 0.65 dB/km at 1383 nm
 - c. 0.65 dB/km at 1550 nm
4. Provide plenum-rated cable for all plenum environments and riser-rated cable for all non-plenum environments.
5. Jacket to be yellow in color.
6. Jacket to be imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.
7. Refer to the drawing set for exact fiber counts.
8. Approved products:
 - a. Corning MIC® Interlocking Armored Plenum Cable
 - 1) xxxE88-31131-A3 (2-24 fibers)
 - 2) xxxE88-61131-A3 (36-48 fibers)
 - 3) xxxE88-T3131-A3 (60-144 fibers)
 - 4) Where xxx equals fiber strand count
 - b. Owner approved equivalent.

B. Fiber Optic Connectors

1. Provide LC pigtail connectors to fusion splice to each fiber.
2. Quick-connect, simplex or duplex, type LC connectors.
3. Connector to comply with FOCIS specifications of TIA-604-10A
4. Insertion loss of not more than 0.75 dB
5. Acceptable Products:
 - a. Panduit F9B10-NM1Y LC To Pigtail PC, Singlemode, 9µm Simple Buffered, 1m
 - b. Owner approved equivalent

C. Fiber Optic Splice Module

1. Provide fusion splice modules for fiber enclosures
2. Modules shall accept up to 24 fusion splices.
3. Modules shall be designed to install in rack mount fiber enclosures.
4. Provide a quantity of modules to accommodate every splice within each enclosure.
5. Acceptable products:
 - a. Panduit FOSMH4U Fiber Optic Splice Module
 - b. Panduit FOSMF Fiber Optic Splice Module for 24 Fusion Splices
 - c. Owner approved equivalent

D. Fiber Enclosures

1. Provide rack mount modular fiber enclosures.
2. Enclosures shall accept splice modules and fiber adapter modules.
3. Populate unused fiber adapter panel openings with blank filler plates.
4. Refer to the drawing set to determine exact size and configuration.
5. Acceptable Products:
 - a. Panduit FRME1U Rack Mount Fiber Enclosure 1RU
 - b. Panduit FRME2U Rack Mount Fiber Enclosure 2RU
 - c. Panduit FCE4U Rack Mount Fiber Enclosure 4RU
 - d. Owner approved equivalent

E. Fiber Adapter Panel

1. Provide LC duplex fiber adapter panels for fiber enclosures
2. Modules shall 12 duplex LC fibers.
3. Modules shall be designed to install in rack mount fiber enclosures.
4. Provide a quantity to accommodate every fiber within each enclosure
5. Acceptable products:
 - a. Panduit FAP12WBUDLCZ Fiber Adapter Panel, 12 duplex SM LC
 - b. Panduit FAPB Blank Fiber Adapter Panel
 - c. Owner approved equivalent

- F. Fiber Optic Patch Cords
 - 1. Provide factory-made, duplex fiber jumpers.
 - 2. Singlemode jumpers shall be constructed of 8.3/125µm (OS1 minimum) fiber.
 - 3. Provide a variety of lengths (1M, 2M and 3M), as needed, based on the rack elevations in the drawing set.
 - 4. Provide a mixed variety of patch cord quantities for each closet. Provide a 50% ratio of terminated ports to patch cords of each type and an additional 20% for spares.
 - 5. Acceptable Products:
 - a. Panduit F9E10-10MxY LC to LC Fiber Jumper, Duplex, 10 GbE Singlemode
 - b. Panduit F9E3-10MxY SC to LC Fiber Jumper, Duplex, 10 GbE Singlemode
 - c. Owner Approved Equivalent

PART 3 – EXECUTION

3.1 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

- A. Install cables in conduits, raceways and cable trays.
- B. Install plenum cable in environmental air spaces where cabling will be exposed, including plenum ceilings.
- C. Bundle, lace, and train cables within racks and enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and wiring troughs, as required.

3.3 INSTALLATION OF CABLES

- A. General Requirements for Cabling:
 - 1. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - 2. Install 110-style IDC termination hardware unless otherwise indicated.
 - 3. Terminate all conductors; no cable shall contain unterminated elements.
 - 4. UTP Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and no more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 5. Verify that installed cable's minimum bend radius does not exceed the installed conduit's bend radius at any point. Coordinate any conduit bend radius conflicts with Installing/General Contractor prior to installation of cable.
- B. Installation of Cable Routed Exposed under Raised Floors:
 - 1. Install plenum-rated cable only.
 - 2. Install cabling after the flooring system has been installed in raised floor areas.
 - 3. Coil cable 6 feet long no less than 12 inches in diameter below each feed point.

3.4 POST-INSTALLATION TESTING

- A. Contractor shall test each pair or strand of every cable prior to acceptance. (100% PASS)
- B. Contractor shall supply all required test equipment used to conduct acceptance tests.
- C. Contractor shall submit acceptance documentation as defined below. No cabling installation is considered complete until test results have been completed, submitted and approved.
- D. Standards Compliance and Test Requirements:
 - 1. Copper backbone shall exceed ANSI/TIA-568-C.2 Backbone Cabling requirements and meet the manufacturer's specifications for the installed product.
 - 2. Optical fiber shall exceed ANSI/TIA-568-C.3 Optical Fiber Cabling Components Standard requirements and meet the manufacturer's specifications for the installed product.

3. Contractor shall certify to TIA/TSB-140 Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems.

E. Cable Test Documentation:

1. Optical Fiber: Testing shall be performed on all fibers in the completed end-to-end system.
 - a. Power Meter and Source Loss Reports: Testing shall consist of a bi-directional, dual wave length end to end test. The system loss measurements shall be provided at 850 and 1300 nanometers for multi-mode fibers and 1310 and 1550 for single mode fibers.
 - b. Optical Time Domain Reflectometer (OTDR) Reports: Testing shall consist of a bi-directional end to end OTDR trace performed per TIA/EIA 455-61. Reflective events (connections) shall not exceed 0.75 dB.
 - c. Non-reflective events (splices) shall not exceed 0.3 dB.
 - d. Fibers shall be inspected at 250X or 400X magnification. 250X magnification is suitable for inspecting multimode and single mode fibers. 400X magnification may be used for detailed examination of single mode fibers.
 - e. Testing shall be performed on each cabling segment (connector to connector).
 - f. Testing of the cabling shall be performed using high-quality test cords of the same fiber type as the cabling under test. The test cords for optical loss test set (OLTS) testing shall be between one meter and five meters in length. The test cords for OTDR testing shall be approximately 100 meters for the launch cable and at least 25 meters for the receive cable.
 - g. Testing shall be performed on each cabling channel (equipment to equipment) that is planned for use per the owner's instructions.
2. Test results saved within the field-test instrument shall be transferred into a Windows™ based database utility that allows for the maintenance, inspection and archiving of the test records. These test records shall be uploaded to the PC unaltered, i.e., "as saved in the field-test instrument". The file format, CSV (comma separated value), does not provide adequate protection of these records and shall not be used.
3. The detailed test results documentation data is to be provided in an electronic database for each tested optical fiber and shall contain the following information:
 - a. The identification of the customer site as specified by the end-user.
 - b. The name of the test limit selected to execute the stored test results.
 - c. The name of the personnel performing the test.
 - d. The date and time the test results were saved.
 - e. The manufacturer, model and serial number of the test instrument.
 - f. The version of the test software and the version of the test limit database held within the test instrument.
 - g. The fiber identification number.
 - h. The length for each optical fiber.
 - i. The index of refraction used for length calculation when using a length capable OLTS.
 - j. Test results to include OLTS attenuation link and channel measurements at the appropriate wavelength(s) and the margin (difference between the measured attenuation and the test limit value).
 - k. Test results to include OTDR link and channel traces and event tables at the appropriate wavelength(s).
 - l. The length for each optical fiber as calculated by the OTDR
 - m. Overall Pass/Fail evaluation of the link-under-test for OLTS and OTDR measurements.
 - n. Circuit IDs reported by the test instrument should match the specified label ID.

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections in accordance with project specifications. Provide minimum 24 hours notice to OAR prior to testing. All testing shall be witnessed by OAR, at OAR's discretion.
- B. Tests and Inspections:
 1. Furnish proposed test procedures, recording forms, list of testing personnel and test equipment to OAR for review prior to commencement of testing.
 2. Follow recommended procedures for testing as published by test equipment manufacturer.
- C. Copper Cable Testing:
 1. Testing of all copper wiring shall be performed prior to system cutover. 100% of riser wiring pairs shall be tested for opens, shorts, polarity reversals, transposition and presence of AC voltage.
 2. Category 3 riser cables shall be tested for conformance to TIA 568C.
 3. OAR shall randomly perform unannounced, onsite reviews during installation. OAR shall perform final inspection and a complete review of test results before installation is accepted.

- D. Optical Fiber Testing with OTDR
1. The Contractor shall test all optical fiber cable prior to installation. The Contractor shall assume all liability for the replacement of the cable should it be found defective at a later date.
 2. All fiber testing shall be performed on all fibers in the completed system. Bidirectional end-to-end OTDR testing shall be performed in accordance with TIA 455-78-B. The system loss measurement shall be provided at 850 and 1310 nanometers for multimode fibers and 1310 and 1550 for single mode fibers.
 3. Fiber links shall have a maximum loss of (allowable cable loss per km) (km of fiber in the link) + (.4dB)(number of mated connectors) = maximum allowable loss.
 4. Documentation shall be provided in both hard copy and CD format to the OAR.
- E. Optical Fiber Testing with Power Meter
1. Multimode Horizontal Link Segments should be tested in both directions at 850-nm and 1300-nm wavelengths.
 2. Multimode backbone and composite link segments should be tested in both directions at both 850-nm and 1300-nm wavelengths.
 3. Singlemode horizontal link segments shall be tested in both directions at 1300-nm and 1550-nm wavelengths.
 4. Singlemode backbone and composite link segments should be tested in both direction at both 1310-nm and 1550-nm wavelengths.
- F. Testing documentation shall be submitted in accordance with TIA/EIA 526-14-A "Optical Power Loss Measurement in Installed Multimode Fiber Cable Plant" and TIA/EIA 526-7 "Measurement of Optical Power Loss of Installed Singlemode Fiber Cable Plant". At minimum, the following information shall be documented during testing:
1. Names of personnel conducting the test.
 2. Type of test equipment used (manufacturer, model, serial number).
 3. Date test is being performed.
 4. Fiber identification.
 5. End point locations.
 6. Test direction.
 7. Reference power measurement (when not using a power meter with a relative power measurement mode).
 8. Measured attenuation of the link segment.
 9. Acceptable link attenuation.
 10. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

END OF SECTION

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SECTION 27 15 00

COMMUNICATIONS HORIZONTAL CABLING

PART 1 – GENERAL

1.1 SUMMARY

- A. Provide all labor, materials, and equipment for the complete installation of Work called for in the Contract Documents.
- B. This section includes the minimum requirements for the installation of horizontal cabling between Telecommunications Rooms and Work Area Outlets.
- C. Included in this section are the minimum composition requirements and installation methods for the following:
 - 1. Category 6 and Category 6A Cable
 - 2. Faceplates, Jacks, and Modules
 - 3. Patch Panels
 - 4. Patch Cords
 - 5. Cable Ties

1.2 DEFINITIONS AND TERMS

- A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:
 - 1. ANSI American National Standards Institute
 - 2. AWG American Wire Gauge
 - 3. BICSI Building Industry Consulting Service International
 - 4. CMR Communications Riser Cable
 - 5. CMP Communications Plenum Cable
 - 6. DCM Design Criteria Manual
 - 7. EIA Electronics Industries Alliance
 - 8. FEP Fluorinated Ethylene Propylene
 - 9. IDC Insulation Displacement Connector
 - 10. IEC International Electrotechnical Commission
 - 11. IEEE Institute of Electrical and Electronics Engineers
 - 12. ISO International Standards Organization
 - 13. MER Main Equipment Room
 - 14. NEMA National Electric Manufacturers Association
 - 15. NEXT Near End Crosstalk
 - 16. NFPA National Fire Protection Association
 - 17. OAR Owner's Authorized Representative
 - 18. PCI Panduit Certified Installer
 - 19. RCDD Registered Communications Distribution Designer
 - 20. RFP Request for Proposal
 - 21. RL Return Loss
 - 22. STD Standard
 - 23. STP Shielded Twisted Pair
 - 24. TIA Telecommunications Industry Association
 - 25. TR Telecommunications Room
 - 26. TSA Transportation Security Administration
 - 27. TSB Technical Services Bulletin
 - 28. UL Underwriters Laboratories
 - 29. UTP Unshielded Twisted Pair

1.3 QUALITY ASSURANCE

- A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the OAR.

- B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the OAR.
- C. Strictly adhere to all BICSI, EIA and TIA recommended installation practices when installing communications cabling.
- D. Contractor's Qualifications:
1. Firms regularly engaged in the installation of Data Communications cabling and that have five (5) years of installation experience with systems similar to that required for this project.
 2. Provide references to include client names, phone numbers and a summary of project details. These references will be checked and the clients will be asked questions relative to the performance of your company.
 3. Provide verification that installation personnel responsible have been properly trained to install the products described in this Section.
 4. Provide a BICSI RCDD certified professional for oversight on this project. This person does not have to be working on-site, but must be accessible to answer questions and provide weekly status reports. The RCDD shall be a full-time employee of the contractor.
 5. Provide full time project manager with a minimum of ten (10) years field experience in installation of communications systems and infrastructures. Project manager shall be assigned for the duration of the project and shall not be replaced without written consent from the OAR.
- E. Manufacturer's Qualifications:
1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.
- F. Material and Work specified herein shall comply with the applicable requirements of:
1. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2010
 2. ANSI/NECA/BICSI-568 – Standard for Installing Commercial Building Telecommunications Cabling, 2006
 3. ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises, 2009
 4. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard, 2009
 5. ANSI/TIA-568-C.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards, 2009
 6. EIA/TIA TSB-36 – Additional Cable Specifications for Unshielded Twisted Pair
 7. EIA/TIA TSB-40 – Additional Transmission Specifications for Unshielded Twisted Pair
 8. EIA/TIA TSB-67 – Transmission Performance Specifications for Field-testing of Unshielded Twisted Pair Cabling Systems
 9. ANSI/TIA-568-C.3 – Optical Fiber Cabling Components Standard, 2008
 10. ANSI/TIA/EIA-569-B Commercial Building Standard for Telecommunications Pathways and Spaces, 2009
 11. ANSI/TIA/EIA-606-B – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 2012
 12. ANSI-J-STD-607-A – Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2002
 13. ANSI/TIA-942 – Telecommunications Infrastructure Standard for Data Centers
 14. NFPA 70 – National Electric Code, 2014
 15. UL 13 – Standard for Safety for Power-Limited Circuit Cables
 16. UL 444 – Standard for Safety for Communications Cables
 17. BICSI – Telecommunications Distribution Methods Manual, 13th Edition
 18. IEEE 802 – Local Area Network Standard
 19. Applicable codes and directives of authorities having jurisdiction
- G. Work:
1. The Work shall be performed in compliance with the applicable manufacturer's installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
 2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.
 3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.

4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

1.4 CONFLICTS

- A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts between the aforementioned, notify the OAR in writing prior to commencement of affected work.

1.5 PERMITS

- A. The Contractor shall secure and pay for all necessary permits and fees required for the execution of this Work. Work will not start until all permit applications are approved.

1.6 SCHEDULING

- A. The Contractor shall comply with all scheduling requests established by OAR, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and, if accepted, will be used to track work status.
- B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.
- C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

1.7 REQUIREMENTS

- A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The OAR must approve material submittal and substitutions in writing.
- B. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.
- C. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.
- D. The requirements as given in this document are to be adhered to unless revised by the OAR in writing.
- E. The Owner reserves the right to waive these requirements at any time.

1.8 SUBMITTALS

- A. Comply with provisions of Division 01.
- B. Comply with provisions of Section 27 05 00.
- C. Produce Shop Drawings for ALL horizontal cabling, to include but not limited to, proposed routing and its location relative to building structure (columns, floor or ceiling) and its relationship to electrical, mechanical elements as well as any horizontal cables that may exceed 295' in length (including service loops).
- D. Provide all submittal requirements under this section as a single package.
- E. Provide product data for the following:
 1. Product data consisting of manufacturers specifications for each type of product to be installed, all applicable certifications and elevation/plan documents supporting compliance with stated Specifications.
 2. Manufacturer's certificate of acceptance of the qualifications of the installing Contractor to install, test and maintain the manufacturer's equipment.

COMMUNICATIONS HORIZONTAL CABLING

3. Manufacturer's installation specifications for UTP cabling and optical fiber, indicating minimum bend radius and maximum pull tension.
4. Outline of administration labeling scheme for voice and data communications cabling and termination locations per ANSI/EIA/TIA-606.
5. Proposed format of as-built documentation.

1.9 CONTRACTOR CLOSE OUT SUBMITTALS

- A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (4) sets.
 1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.
 2. Test reports on all copper and optical fiber cables (electronic file format and hard copy).
 3. As-built cable schedules with recorded cable routing and lengths of each designated run.
 4. As built documentation of all cabling systems.
 5. As built documentation of IDF/TR modifications and associated cabinet elevations.
 6. Laminated as-built drawing sheet of TR service area representing each level, with a scale of not less than 1/8in, mounted on the wall of each TR.
- B. Warranty and Maintenance:
 1. Test Report Binder(s)
 2. Record Drawings

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer's recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.
- B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the OAR.
- C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.
- D. Provide protective covering during construction to prevent damage or entrance of foreign matter.
- E. Contractor is responsible for on-site security of tools, test equipment and materials.
- F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

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

1.12 WARRANTY

- A. Warrant labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics, following Contractor Warranty requirements defined in Division 01, or for a period of 1 year from date of final completion, whichever is longer. Repair or replace defects occurring in labor or product within the Warranty period without charge.
- B. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

- C. In addition to the warranty outlined above, the Contractor shall facilitate a warranty between the Owner and the Manufacturer that provides coverage of the installed cabling system for a period of (25) twenty-five years (Panduit Certification Plus System Warranty). This warranty will cover the installed horizontal cabling system (Patch Panel to Workstation). Category 6 copper links originating from patch panels shall be warranted against the link performance minimum expected results defined in the ANSI/TIA/EIA Telecommunications Systems Bulletin (TSB-67), now incorporated into TIA/EIA 568-B, for Category 6 performance requirements. Category 6 copper links originating from wall mounted 110-style termination blocks shall be warranted against link performance minimum expected results for Category 6 performance requirements. Installation shall be performed by a Panduit Certified Installer.

PART 2 – PRODUCTS

2.1 GENERAL

- A. The products specified in this document do not necessarily constitute the exhaustive list of products required to complete the statement of work. Except where described in the SUMMARY subpart of this document, the contractor is responsible for providing any other parts and materials needed to deliver a complete and working system.

2.2 ACCEPTABLE DISTRIBUTORS

- A. Contractor shall procure all horizontal cabling components thru an approved cabling system Manufacturer product distributor.

2.3 ACCEPTABLE VENDORS AND MATERIALS

- A. Subject to compliance with requirements, install products from the following manufacturers, except where noted:
1. Cable, Copper
 - a. Panduit Corp.
 2. Termination Components
 - a. Panduit Corp.
- B. Part numbers are provided for convenience purposes only; the contractor is responsible for complete material list and quantities. All materials listed are manufactured by Panduit, unless otherwise noted. Colors shall be approved by Owner.
- C. Cable Jacket, patch cable, and Jack colors shall match Eagle Mountain Saginaw ISD standard
1. Red – Voice
 2. Blue – Data
 3. Green – Wi-Fi
 4. White - Security

2.4 CATEGORY 6A PRODUCTS

- A. UTP Cable
1. Provide Category 6A cabling for all wireless access point outlets.
 2. Cable shall exceed requirements of ANSI/TIA-568-C.2, ISO 11801 Class EA Edition 2.1, and IEEE 802.3an-2006 standard channel requirements for supporting 10GBASE-T, and be third party tested to 650 MHz.
 3. The conductors shall be 23 AWG construction with FEP (CMP) insulation.
 4. The copper conductors shall be twisted in pairs, separated by internal dividers to improve NEXT performance, and shall be covered by a low smoke, flame retardant (CMP) jacket.
 5. The jacket colors for cables shall be Eagle Mountain Saginaw ISD standard.
 6. Approved products:
 - a. Panduit PUP6A04xx-UG TX6™ 10Gig™ Category 6A UTP Copper Cable, Plenum
 - b. Owner approved equivalent
- B. UTP Jack Modules
1. Provide Category 6A jack modules to terminate both ends of each Category 6A horizontal cable.
 2. Module shall exceed requirements of ANSI/TIA-568-C.2, ISO 11801 Class EA Edition 2.1, and IEEE 802.3an-2006 standard channel requirements for supporting 10GBASE-T component standards.

3. Module shall meet requirements of IEEE 802.af and IEEE 802.3at for Power over Ethernet (PoE) applications.
 4. Module shall be 100% tested to ensure NEXT and RL performance and be individually serialized for traceability.
 5. Modules at work area outlet locations shall match Eagle Mountain Saginaw ISD standards in color.
 6. Modules in patch panels shall match Eagle Mountain Saginaw ISD standards in color.
 7. Approved products:
 - a. Panduit CJ6X88TG Mini-Com® TX6™ 10Gig™ UTP Jack Module
 - b. Owner approved equivalent
- C. Copper Patch Cords
1. Provide Category 6A patch cords for patching within the MCR or data center.
 2. Patch cord shall exceed requirements of ANSI/TIA-568-C.2 Category 6A, IEEE 802.3an-2006, and ISO 11801 Class EA channel standards.
 3. Shall meet requirements of IEEE 802.af and IEEE 802.3at for PoE applications.
 4. Each patch cord shall be 100% performance tested and wired T568B.
 5. Patch cord shall be constructed of TX6A™ 10Gig™ 24 AWG stranded copper cable and TX6™ PLUS Modular Plugs for superior performance.
 6. Patch cord plugs shall meet all applicable ANSI/TIA-968-A requirements and exceeds IEC 60603-7 specifications.
 7. Plugs shall use an integral pair manager to optimize performance and consistency by reducing untwisting of conductors within the plug.
 8. Patch cord shall perform in center of TIA/EIA component range, ensuring interoperability and 10GBASE-T Ethernet channel performance.
 9. Patch cord shall be labeled with an identification of performance level, length, and a quality control number.
 10. Provide a variety of 5', 7' and 10' length patch cords. Include a quantity necessary to patch every available patch panel port:
 11. 25% of the patch cords are to be 5' in length.
 12. 50% of the patch cords are to be 7' in length.
 13. 25% of the patch cords are to be 10' in length.
 14. Patch cords shall match color of system (Eagle Mountain Saginaw ISD color standard).
 15. Approved products:
 - a. Panduit UTP6A5 Category 6A Copper Patch Cord, 5'
 - b. Panduit UTP6A7 Category 6A Copper Patch Cord, 7'
 - c. Panduit UTP6A10 Category 6A Copper Patch Cord, 10'
 - d. Owner approved equivalent.

2.5 CATEGORY 6 PRODUCTS

- A. UTP Cable (Voice/Data)
1. Provide Category 6 cabling for all voice and data work area outlet locations.
 2. Cable shall far exceed ANSI/TIA/EIA-568-B.2-1 and ISO/IEC 11801 Class E standards.
 3. The conductors shall be 23 AWG construction with FEP (CMP) or polyolefin (CMR) insulation.
 4. The copper conductors shall be twisted in pairs, separated by an integrated pair divider and shall be covered by a low smoke, flame retardant (CMP) jacket or a flame retardant (CMR) jacket.
 5. Provide plenum-rated cable for all plenum environments and riser-rated cable for all non-plenum environments.
 6. The jacket colors for cables shall be Eagle Mountain Saginaw ISD standard.
 7. Approved products:
 - a. Panduit PUP6504xx-UY TX6500™ Category 6 UTP Copper Cable, Plenum
 - b. Panduit PUR6504xx-UY TX6500™ Category 6 UTP Copper Cable, Non-Plenum
 - c. Owner approved equivalent
- B. UTP Jack Modules
1. Provide Category 6 jack modules to terminate both ends of each horizontal cable.
 2. Module shall exceed requirements of ANSI/TIA-568-C.2 Category 6, IEEE 802.3an-2006, and ISO 11801 Class E channel standards and exceed requirements of ANSI/TIA-568-C.2 Category 6 and IEC 61156-5 Category 6 component standards.
 3. Module shall meet requirements of IEEE 802.af and IEEE 802.3at for Power over Ethernet (PoE) applications.
 4. Module shall be 100% tested to ensure NEXT and RL performance and be individually serialized for traceability.
 5. Modules at work area outlet locations shall match Eagle Mountain Saginaw ISD standards in color.

6. Modules in patch panels shall match Eagle Mountain Saginaw ISD standards in color.
 7. Approved products:
 - a. Panduit CJ688TG Mini-Com® TX6™ PLUS UTP Jack Module
 - b. Owner approved equivalent
- C. Category 6 Patch Cords
1. Provide Category 6 patch cords for voice and data in the data rooms.
 2. Patch cords shall match color of system (Eagle Mountain Saginaw ISD color standard).
 3. Patch cord shall exceed ANSI/TIA-568-C.2 Category 6 and ISO 11801 Class E standards.
 4. Shall meet requirements of IEEE 802.af and IEEE 802.3at for PoE applications.
 5. Each patch cord shall be 100% performance tested and wired T568B.
 6. Patch cord shall be constructed of Category 6/6A, 24 AWG UTP stranded cable Modular RJ-45 Plugs.
 7. Patch cord plugs shall meet all applicable ANSI/TIA/EIA-968-A requirements and exceeds IEC 60603-7 specifications.
 8. Plugs shall use an integral pair manager to optimize performance and consistency by reducing untwisting of conductors within the plug.
 9. Patch cord shall perform in center of TIA/EIA component range, ensuring interoperability and excellent performance.
 10. Patch cord shall be labeled with an identification of performance level, length, and a quality control number.
 11. Provide a 25% ratio quantity of each of the following lengths, 3', 5', 7', 10' patch cords for every port in the data rooms.
 12. Approved products:
 - a. Panduit UTPSP Category 6 Copper Patch Cord
 - b. Panduit UPP Category 6 Plenum Rated Copper Patch Cord
 - c. Owner approved equivalent

2.6 WORK AREA OUTLET PRODUCTS

- A. Wall Mount Faceplates
1. Provide faceplates for voice and data work area outlets in all spaces. Match type (stainless steel/plastic) and color of electrical outlets.
 2. Faceplate shall accept four (4) or six (6) modules for STP and UTP, fiber optic, and audio/video, which snap in and out for easy moves, adds, and changes.
 3. Include label/label covers for easy port identification.
 4. Approved products:
 - a. Plastic/Stainless Steel Faceplate, 4-Port.
 - b. Plastic/Stainless Steel Faceplate, 6-Port.
 - c. Owner approved equivalent.
- B. Surface Mount Outlet Box
1. Provide surface mount outlet boxes for work area outlet locations where outlets cannot be recessed.
 2. Shall accept Jack Modules for STP and UTP, fiber optic, and audio/video, which snap in and out for easy moves, adds, and changes.
 3. Mount easily with supplied mounting screws, adhesive tape or optional magnet.
 4. Cable entry from side and rear knockouts and from opening in center of base.
 5. Outlet box shall be white in color.
 6. Approved products:
 - a. Surface Mount Box, 2 Port
 - b. Surface Mount Box, 4 Port
- C. Blank Modules
1. Populate any unused faceplate module openings with blank modules.
 2. Blank module color shall match the faceplate color.
 3. Populate any unused patch panel module openings with blank modules.
 4. Blank module color shall match the patch panel color.
 5. Approved products:
 - a. Blank Module
- D. Patch Panels
1. Provide patch panels in TR locations for all horizontal cabling.
 2. Patch panel shall contain integrated Category 6 or Category 6A Modules for UTP, fiber optic, and audio/video, on the front and integrated termination on the rear of the panel.

3. Use of two label pocket face plate allowing both port and panel identification.
4. Can be clearly identified with Hand-Held Thermal Transfer Printers.
5. Use 48-port patch panels in all locations.
6. Approved products:
 - a. Patch Panel, 48 Port, Black

2.7 MISCELLANEOUS PRODUCTS

- A. Cable Ties
1. Provide "hook & loop" cable ties for bundling cables.
 2. The material shall consist of nylon loops with polypropylene hooks.
 3. Use plenum-rated ties in plenum spaces.
 4. Approved products:
 - a. TE Connectivity (ADC KRONE)
 - b. Panduit
 - c. Or approved equal

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verify conduit, raceways, boxes, fittings and bodies are properly installed as described in Division 26.
- B. Verify grounding and bonding following Section 270526.
- C. Verify supporting devices are properly installed following Section 270528.
- D. Verify conduit has a minimum 1-inch diameter for UTP home runs.
- E. All protected telecommunication terminations require bonding, grounding and a busbar.

3.2 INSTALLATION

- A. General
1. Cables shall be pulled in accordance with the manufacturers recommended practices and in compliance with the NEC and the BICSI Telecommunications Distribution Methods Manual. Planning and care shall be taken to prevent abuse and damage during the handling or installation phase. Specified minimum cable bend radius shall be met without deviation.
 2. Pull cables simultaneously where more than one is being installed in same raceway. Use pulling compound or lubricant where necessary. Compound used must not deteriorate conductor or insulation. Use pulling means including fish tape, cable, rope, and basket weave wire/cable grips that will not damage media or raceway.
 3. Protect cable from tension, compression, torsion, bending, squeezing and vibration. Do not pull cables improperly or exceed the Manufacturer's tensile rating. This value shall be not more than thirty-two (32) lbf. force (provide breakable link for all cable pulling). There shall be no coils of excess cable left in the ceilings, cable trays, or raised floor areas unless specified otherwise. A trailer pull string shall be left in all conduits before and after cables have been installed. The cabling within the wiring closets/cabinets shall be routed and dressed neatly to their termination points such that no excess cable is present. As cables are pulled into the cabinet, bundle them in groups with Velcro type straps according to their terminating row position. Strap exposed cables for strain relief at the termination in the communications rooms.
 4. All strapping and lashing of cable within the TR(s) and ITR(s) shall be made with "Velcro" type straps for easy access to cable bundles to facilitate future "adds and changes". No plastic tie-wraps will be allowed for support of cable.
 5. All cabling will be rated for a minimum operation range of -20°C to 75°C
 6. All floor and wall penetrations shall be fire-stopped in accordance with local codes and restrictions.
 7. New cabling will be installed in cable tray, conduit, and/or J-hooks throughout entirety of cable path.
- B. Horizontal Cable
1. Install voice and data cable locations and configurations as depicted on drawings.
 2. Test all cable prior to installation. Upon failure to perform testing, the installer shall accept the cable as good and assume all liability for the replacement of the cable should it be found defective at a later date.

3. All conformance standards must be certified for multipair and individual cable runs.
4. Jacketing and insulation must satisfy the Underwriter's Laboratories (UL) listed fire rated cable insulation requirements in plenum areas.
5. Any pulling compound or lubricant used in cable installation must not deteriorate the conductor or the insulation. Provide 3M type WLC or an approved equal.
6. Copper cable runs shall not exceed 295 feet. All runs shall be continuous. No splicing is allowed.
7. The Contractor shall install copper cable with a minimum bend radius of six times the diameter of the cable.
8. Provide a 10-foot, patch cable with RJ-45 connectors for 50% of each work area outlet insert installed. Provide a combination of 5, 7 and 10-foot patch cords for each termination in the TR rooms, as required on the contract drawings. The patch cable rating and connector shall match the horizontal cable/connector rating.
9. Install 10-feet of spare copper cable (service loop) in each closet prior to termination. Provide Velcro type tie wrap for cable support and organization.
10. Install minimum 12-inches of spare copper cable in ceiling plenum prior to dropping down wall to outlet. Support slack to structure with J-Hook and Velcro ties. If there is no plenum, loop shall be located in box prior to termination. Provide box of sufficient size to accommodate spare cable, termination equipment if applicable and maintain bending radius.
11. Install 10-feet of spare copper cable (service loop) at each above ceiling outlet prior to termination. Provide Velcro type tie wrap for cable support and organization.
12. All horizontal cable shall be rated for plenum use.
13. The maximum pulling tension for 4-pair 23 AWG horizontal UTP cables shall not exceed 32 lbf. The Contractor shall provide a tension meter during the pulling of all cables. If the meter shows that the tension has exceeded 32 lbf, the Contractor shall discard the cable and pull new cable.

3.3 WORKSTATION TERMINATION

- A. At the workstation termination point, cables shall be routed and dressed to provide a service loop in case re-termination is necessary. Leave 12 inches of slack at the junction box. Provide strapping of voice and data cable to provide strain relief of cable in relation to outlet termination.
- B. Each horizontal workstation cable shall terminate on a modular jack connector and attached to the outlet faceplate. All unused faceplate ports will have a blank insert.
- C. The Contractor shall adhere to the latest termination procedures as specified by manufacturer's instructions.
- D. Follow TIA/EIA 568-B termination procedures.

3.4 PATCH SYSTEM

- A. Each horizontal data cable will terminate on an IDC based patch panel. Horizontal termination of individual data cables within the communications room shall be the same as aforementioned termination procedures for the workstation cables.
- B. Mount the distribution panels starting at the upper most position of the racks/rails beginning with contractor provided fiber patch panels. Allow for sufficient space between the distribution panels to allow for horizontal wire managers and cross connect component installation. Provide a detail of your elevation plan to the OWNER or Owner's Representative before proceeding.
- C. Provide and install Category 6/6A patch cables (as described in parts list) for channel testing. Three/five/seven/ten foot cables for IT space patching.
- D. Small diameter patch cords, which are installed in the IT spaces (Telecommunications Rooms) shall installed in a manner as to limit the bundling of patch cords to no more than 40 patch cords.

3.5 TESTING

- A. Copper Media Testing:
 1. Contractor shall utilize personnel trained in the operation of the following Level II rated test equipment:
 - a. Fluke DSX Series
 - b. Ideal LanTEK III

- c. Or approved equal
- 2. All cables and termination hardware shall be 100% tested for defects in installation and to verify cable channel performance under installed conditions. The Contractor prior to system acceptance shall verify all conductors of each cable useable. Any defect in the cable system installation including but not limited to cable, connectors, patch panels and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.
- 3. Perform end to end link testing of all cabling and connections with specified equipment and certify as meeting the criteria as defined in Category 6 UTP cabling systems within the most current publication of TIA/EIA 568-C.
- 4. Provide equipment calibration reports with test results.
- 5. Provide 72 hours notice to the OAR prior to testing.

3.6 CLEANING

- A. Upon completion of the installation, make all components free of any oil, grease, dust and debris.
- B. Work areas will be cleaned at the end of each work day and a final cleanup will occur at project completion.

3.7 DOCUMENTATION

- A. Electronic submittal, via CD ROM, of required cable test results, As-Built drawings, and warranty information will be submitted to the Owner or Owner's representative at least ten (10) working days before Certificate of Occupancy is awarded. CAD files shall be submitted in AutoCAD (.dwg) format. When proprietary software is needed to view cable test results, the contractor will provide a licensed copy for Eagle Mountain Saginaw ISD IT Department.

3.8 ACCEPTANCE

- A. Review test results and conduct a final inspection and punch list walk-thru with Owner and/or OAR, to inspect installation and obtain concurrence. Concurrence does not waive the responsibility of the Contractor to correct deficiencies.

END OF SECTION

SECTION 27 41 00

AUDIO-VIDEO SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide all labor, materials, and equipment for the complete installation of Work called for in the Contract Documents.
- B. This section includes the minimum requirements for sound reinforcement systems.
 - 1. The sound reinforcement systems shall distribute audio signals throughout the two gymnasiums and the Café/Dining Area.
 - 2. The PA System shall accept microphone inputs and line level audio signals.
- C. Included in this section are the minimum composition requirements and installation methods for the following:
 - 1. Program Sources.
 - 2. Digital Audio Processors.
 - 3. Audio Power Amplifiers.
 - 4. Loudspeakers, enclosures and mounting hardware.
 - 5. Equipment racks.
 - 6. Cables, connectors, plates and wiring.
 - 7. Other items necessary for delivering a complete and working system.

1.2 DEFINITIONS AND TERMS

- A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:
 - 1. BICSI Building Industry Consulting Service International
 - 2. BGM Background Music
 - 3. CATV Cable Television
 - 4. DSP Digital Signal Processor
 - 5. Hz Hertz (cycles/second)
 - 6. IBC International Building Code
 - 7. ISO International Organization of Standardization
 - 8. MER Main Equipment Room
 - 9. NECA National Electrical Contractors Association
 - 10. PA Public Address System
 - 11. RCDD Registered Communications Distribution Designer
 - 12. RFP Request for Proposal
 - 13. STD Standard
 - 14. TR Telecommunications Room
 - 15. UL Underwriters Laboratories
 - 16. UTP Unshielded Twisted Pair
 - 17. VAC Volts with Alternating Current

1.3 QUALITY ASSURANCE

- A. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the Owner.
- B. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner.
- C. Contractor's Qualifications:
 - 1. Firms regularly engaged in the installation of public address systems and that have three (3) years of installation experience with systems similar to that required for this project. The Contractor shall

have been actively engaged in installing, maintaining and operating similar systems and services as outlined in this document.

2. The Contractor shall have a minimum of three (3) sites that are actively similar systems, and at least one of those sites must be utilizing a system similar to that being proposed. The system must be currently in operation, and have been in operation for at least the proceeding twelve (12) months.
3. Provide references to include client names, phone numbers and a summary of project details. These references will be checked and the clients will be asked questions relative to the performance of your company.
4. Provide verification that installation personnel responsible have been factory trained to install the products described in this Section.
5. Provide full time project manager with a minimum of ten (10) years field experience in installation of communications systems and infrastructures. Project manager shall be assigned for the duration of the project and shall not be replaced without written consent from the Owner.

D. Manufacturer's Qualifications:

1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.

E. Material and Work specified herein shall comply with the applicable requirements of:

1. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2010
2. ISO/IEC 60849, Sound Systems for Emergency Purposes, 1998
3. ISO/IEC 24504, Ergonomics - Accessible Design, 2014
4. BICSI – Telecommunications Distribution Methods Manual, 13th Edition
5. Applicable codes and directives of authorities having jurisdiction

F. Work:

1. The Work shall be performed in compliance with the applicable manufacturer's installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.
3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

1.4 CONFLICTS

- A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts notify the Owner in writing prior to commencement of affected work.

1.5 PERMITS

- A. The Contractor shall secure and pay for all necessary permits and fees required for the execution of this Work. Work will not start until all permit applications are approved.

1.6 SCHEDULING

- A. The Contractor shall comply with all scheduling requests established by Owner, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and, if accepted, will be used to track work status.
- B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.
- C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

1.7 REQUIREMENTS

- A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The Owner must approve material submittal and substitutions in writing.
- B. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.
- C. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.
- D. The requirements as given in this document are to be adhered to unless revised by the Owner in writing.
- E. The Owner reserves the right to waive these requirements at any time.

1.8 SUBMITTALS

- A. Comply with provisions of Division 01.
- B. Comply with provisions of Section 27 05 00.
- C. Provide all submittal requirements under this section as a single package.
- D. Produce Shop Drawings for ALL system elements, to include but not limited to, proposed placement of speakers and microphones relative to building structure (columns, floor or ceiling) and its relationship to low-voltage pathway, electrical, mechanical elements as well as the anticipated rack elevations of equipment.
- E. Provide product data for the following:
 - 1. Product data consisting of manufacturers specifications for each type of product to be installed, all applicable certifications and elevation/plan documents supporting compliance with stated Specifications.
 - 2. Proposed format of as-built documentation.

1.9 CONTRACTOR CLOSE OUT SUBMITTALS

- A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (4) sets.
 - 1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.
 - 2. Provide above closeout documentation as an electronic file in PDF format.
- B. Warranty and Maintenance:
 - a. Record Drawings.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer's recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.
- B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the Owner.
- C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.
- D. Provide protective covering during construction to prevent damage or entrance of foreign matter.
- E. Contractor is responsible for on-site security of tools, test equipment and materials.
- F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

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

1.12 WARRANTY

- A. Warrant labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics, following Contractor Warranty requirements defined in Division 01. Repair or replace defects occurring in labor or product within the Warranty period without charge.
- B. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The products specified in this document do not necessarily constitute the exhaustive list of products required to complete the statement of work. Except where described in the SUMMARY subpart of this document, the contractor is responsible for providing any other parts and materials needed to deliver a complete and working system.

2.2 VIDEO DISPLAY SYSTEMS

A. Video Wall

- 1. Provide a video wall in the media area.
- 2. The wall shall consist of (9) minimum 46" diagonal LCD monitors arranged in a 3x3 layout.
- 3. The entire wall shall have a 16:9 aspect ratio.
- 4. The entire system shall function as one monitor, with
- 5. The system shall include a custom mounting solution capable of providing seamless alignment of the monitors.
- 6. Acceptable products:
 - a. Planar Clarity Matrix MX46HDX
 - b. Approved equivalent

B. Video Switcher

- 1. Provide a 2x1 HDMI switcher for the video wall and remote displays.
- 2. Shall function as an automatic switcher, with one input being the primary source. If no signal is present, the switcher shall output the secondary source.
- 3. Shall be HDMI & HDCP compliant.
- 4. Shall have EDID, 3D and HDMI audio pass-through.
- 5. Provide a rack mount kit.
- 6. Acceptable products:
 - a. FSR DV-HSW-21A
 - b. Kramer VS-211HA
 - c. Approved equivalent.

C. Distribution Amplifier

- 1. Provide a 1x4 HDMI distribution amplifier.
- 2. Shall be HDMI & HDCP compliant.
- 3. Shall have EDID, 3D and HDMI audio pass-through.
- 4. Provide a rack mount kit.
- 5. Acceptable products:
 - a. Kramer VM-4HN
 - b. Approved equivalent.

D. HDBaseT Extenders

1. Provide HDBaseT extenders for each video source and each display output.
 2. Extenders for sources shall have wallplate style transmitters.
 3. Extenders for video displays shall have wallplate style receivers.
 4. Other transmitters and receivers shall be rack mounted in the same TR.
 5. Extenders shall be HDMI & HDCP compliant.
- E. Motorized Rear Projection Screen
1. Provide a motorized rear projection screen in the cafeteria, above the stage.
 2. Screen surface shall be tab-tensioned and designed for high-resolution rear projection systems.
 3. The aspect ratio shall be 16:10.
 4. The image area shall be 90" H x 160" W
 5. The case shall be ceiling recessed.
 6. Include a low voltage control interface.
 7. Acceptable products:
 - a. Da-Lite Tensioned Advantage Electrol w/100" x 160" Da-Tex Surface
 - b. Draper Access V w/100" x 160" CineFlex CH1200V Surface
 - c. Approved equivalent
- F. Projector
1. Provide a projector for the cafeteria.
 2. Projector shall be configurable to allow for rear-projection use.
 3. The minimum ANSI lumens shall be 5000.
 4. The native resolution shall be 1920 x 1200 pixels.
 5. Include an appropriate mount.
 6. Acceptable products:
 - a. Epson PowerLite 5535U
 - b. Hitachi CP-WU8451
 - c. Approved equivalent.

2.3 LOUDSPEAKERS

- A. Type 1 Loudspeaker
1. The loudspeaker system shall be a UL 94V-0 fire rated ABS baffle/bezel assembly, zinc plated steel rear enclosure, powdered coated grille with safety tether, transformer with 8-ohm bypass.
 2. The loudspeaker shall include an 8-inch polypropylene low frequency transducer with coaxially-mounted waveguide coupled to 1-inch titanium coated dome tweeter.
 3. The loudspeaker shall meet the following criteria: power rating shall be 75 watts of EIA RS-426A pink noise (6 dB crest factor). Frequency response, uniform from 50 Hz to 20 kHz.
 4. Pressure sensitivity shall be 91 dB SPL at 1 meter (3.3 feet) on axis with one watt of pink noise (ref. 20 μ Pa).
 5. The loudspeaker shall include factory wired 70.7 Volt transformer with taps of 30, 15, 7.5, 3.7 and 1.9 Watts.
 6. Coverage angle shall be 110 degrees.
 7. Acceptable products:
 - a. Electro-Voice® model EVID C8.2.
 - b. Approved equivalent
- B. Type 2 Loudspeaker
1. The Type 2 loudspeaker shall be used as a stage floor monitor loudspeaker.
 2. The loudspeaker system shall be a 200-watt, 12-inch two-way speaker system.
 3. Effective frequency range shall be a minimum 65 Hz to 20 kHz.
 4. Sensitivity shall be a minimum 98 dB broad-band.
 5. Coverage angle shall be 90 degrees horizontal and 50 degrees vertical.
 6. Acceptable products:
 - a. Electro-Voice® model TX1122FM
 - b. JBL Pro JRX212
 - c. Approved equivalent
- C. Type 3 Loudspeaker
1. The Type 3 loudspeaker shall be a self-contained engineered loudspeaker solution with 360-degree of horizontal coverage.
 2. The power handling shall be a minimum 200W.
 3. The effective frequency range shall be 50Hz to 20kHz.
 4. The coverage shall be 360 degrees horizontal and 180 degrees vertical
 5. The enclosure shall be impact resistant.

6. Acceptable products:
 - a. Octasound SP820A
 - b. Approved equivalent

- D. Type 4 Loudspeaker
 1. The Type 4 loudspeaker shall be a self-contained bi-pole subwoofer.
 2. The power handling shall be a minimum 500W.
 3. The effective frequency range shall be 25Hz to 200Hz.
 4. The coverage shall be 360 degrees, horizontal and vertical.
 5. The enclosure shall be impact resistant.
 6. Acceptable products:
 - a. Octasound OS2X12
 - b. Approved equivalent

- E. Type 5 Loudspeaker
 1. The Type 5 loudspeaker shall be a line array column unit.
 2. The coverage shall be selectable from a minimum 45 to 90 degrees horizontally.
 3. The frequency response shall be a minimum 60 Hz to 20 kHz.
 4. The speaker shall contain multiple high frequency and low frequency drivers, housed in a single enclosure.
 5. Include a wall mount bracket.
 6. Acceptable products:
 - a. JBL Pro
 - 1) CBT 70J-1 Line Array
 - 2) MTC-CBT-FM2 Bracket
 - b. Approved equivalent

2.4 AUDIO ELECTRONICS

- A. Microphone Mixer:
 1. Mixer shall be rack mountable.
 2. Minimum (6) microphone/line-level inputs.
 3. Each input channel shall have switchable microphone or line-level operation, and switchable 48V phantom power.
 4. Acceptable products:
 - a. Ashly MX-206
 - b. Rolls RM82
 - c. Shure SCM800
 - d. Approved Equivalent.

- B. Digital Signal Processor
 1. Provide a speaker processor for the cafeteria system.
 2. Processor shall provide the following functions:
 - a. Equalization
 - b. Feedback elimination
 - c. Automatic control
 - d. Compression and limiting
 - e. Alignment and zone delay
 3. Include a security cover to prevent access to the controls.
 4. Acceptable products:
 - a. Ashly Protea 3.6SP
 - b. dbx DriveRack 260
 - c. Mackie SP260
 - d. Approved equivalent

- C. Type 1 Power Amplifier
 1. Two-channel power amplifier
 2. The per-channel power shall be a minimum of 275W at 8 ohms.
 3. The amplifier shall include onboard digital signal processing, including crossovers, EQ filters, delay and output limiting.
 4. Frequency response ± 1 dB, 20 Hz to 20 kHz.
 5. Include a security cover to prevent access to the controls.
 6. Acceptable products:
 - a. Ashly nX4002
 - b. Crown CDi 1000

- c. QSC GXD4
 - d. Approved Equivalent
- D. Type 2 Power Amplifier
- 1. Two-channel power amplifier
 - 2. The per-channel power shall be a minimum of 475W at 8 ohms.
 - 3. The amplifier shall include onboard digital signal processing, including crossovers, EQ filters, delay and output limiting.
 - 4. Frequency response ± 1 dB, 20 Hz to 20 kHz.
 - 5. Include a security cover to prevent access to the controls.
 - 6. Acceptable products:
 - a. Ashly nX8002
 - b. Crown CDi 2000
 - c. QSC GXD8
 - d. Approved Equivalent
- E. Wireless Microphone System:
- 1. Wireless diversity receiver with 1400 selectable frequencies.
 - 2. Removable $\frac{1}{2}$ wavelength antennas.
 - 3. XLR and $\frac{1}{4}$ inch output connectors.
 - 4. System includes a handheld transmitter.
 - 5. System includes a cardioid lavalier microphone, with a bodypack transmitter.
 - 6. Include a security cover to prevent access to the receiver controls.
 - 7. Acceptable products:
 - a. Audio Technica AEW-4314a, with AT898 Lavalier
 - b. Shure ULXS124/85 Combo System
 - c. Approved Equivalent
- F. Assistive Listening Transmitter
- 1. System shall include a 3-channel RF transmitter.
 - 2. The transmitter is to operate in the North America 72 MHz frequency band.
 - 3. The frequency response shall be a minimum of 50Hz to 15kHz.
 - 4. The transmitter shall include input and output level controls.
 - 5. Include signage kit, rack mount kit, and antenna mounting kit
 - 6. Include a security cover that prevents access to the controls.
 - 7. Acceptable products:
 - a. Listen Technologies
 - 1) LT-803-072-01 Transmitter
 - 2) LA-304 Signage Kit
 - 3) LA-326 Rack Mount Kit
 - 4) LA-122 Antenna Kit
 - b. Williams Sound
 - 1) PPA T45 Transmitter
 - 2) IDP 008 Signage Kit
 - 3) RPK 005 Rack Mount Kit
 - 4) ANT 025 Antenna Kit
 - c. Approved equivalent.
- G. Media Player:
- 1. The media player shall play CD media, provide Bluetooth connectivity, USB playback and a 3.5 mm AUX input.
 - 2. USB storage shall be FAT16/32, Flash/HDD.
 - 3. Acceptable products:
 - a. Denon Professional DN-500CB.
 - b. Owner Approved Equivalent
- H. Unbalanced to Balanced Line Combiner:
- 1. The unbalanced to balanced line combiner shall combine the two RCA (unbalanced) outputs of the media player to feed a balanced or unbalanced line input.
 - 2. The unit shall include two high-impedance, line-level inputs.
 - 3. The output of the unit shall be a mono mix of the two inputs.
 - 4. Acceptable products:
 - a. RDL TX-LC2 with PS-24AS power supply.
 - b. Approved Equivalent.

2.5 CABINETS AND POWER DISTRIBUTION

- A. Equipment Racks and Cabinets:
1. EIA compliant 19" wall mount rack.
 2. The cabinet shall have a minimum 18RU high opening for equipment mounting.
 3. The cabinet shall include a solid, locking front door.
 4. The cabinet shall include a minimum 15-inch center section, with 19-inch-wide E.I.A. rack rails for equipment mounting.
 5. Full unused rack spaces with solid blank filler panels.
 6. Include horizontal and vertical lacer bars, as required for proper wire management.
 7. Include a fan kit
 8. Acceptable products:
 - a. Middle Atlantic
 - 1) DWR Series Wall Mount Cabinet
 - 2) FD Series Solid Front Door
 - 3) DWR-FK Series Fan Kit
 - b. AtlasIED
 - 1) WMA Series Wall Mount Cabinet
 - 2) SFD Series Solid Front Door
 - 3) EFP3-2 Fan Kit
 - c. Approved Equivalent.
- B. Storage Drawer
1. Provide a lockable storage drawer for each cabinet.
 2. Drawer to be 3RU in height
 3. Acceptable products:
 - a. Middle Atlantic D3LK
 - b. AtlasIED SD3 w/SD-LOCK
 - c. Approved equivalent
- C. Fixed Security Covers
1. Provide security covers for equipment that does not require end-user adjustment, and to prevent tampering.
 2. Covers shall have plexiglass inserts to allow easy viewing of displays.
 3. Acceptable products:
 - a. Middle Atlantic
 - 1) SL-1 1RU Cover
 - 2) SL-2 2RU Cover
 - b. Approved equivalent
- D. Power Conditioner/Rack Mount AC Power Outlets:
1. Provide 1 RU power conditioner with a minimum five 120V, 20 Amp Outlets.
 2. Acceptable products:
 - a. Furman P-8 PRO C
 - b. SurgeX SX-1120-RT
 - c. Approved Equivalent.
- E. Stage Boxes
1. Provide (3) stage boxes for the cafeteria.
 2. The boxes shall be able to accommodate voltage dividers for separating power and speaker circuits from the data and microphone cabling.
 3. The box covers shall be equipped with a cable opening that allows the cover to be fully closed, while cables are plugged in.
 4. The covers shall be flat black.
 5. Acceptable manufacturers:
 - a. Ace Backstage
 - b. FSR Inc.
 - c. Approved equivalent

2.6 ACCESSORIES

- A. Assistive Listening Receivers
1. Provide one set of receivers, neck loops, earbuds and charging cases for the entire facility, based on the combined seating capacity of the two gymnasiums and the cafeteria, per section 219 of the 2012 edition of the Texas Accessibility Standards.

2. Receiver frequency band and channels shall match the transmitter.
 3. Shall be equipped with an 1/8-inch monaural audio jack.
 4. Shall interface with a telecoil neck loop.
 5. The signal-to-noise ratio for internally-generated noise shall be a minimum of 18dB.
 6. The peak clipping level shall not exceed 18dB, relative to the peaks of speech.
 7. The sound pressure level shall be between 110-118dB, with a dynamic volume of 50dB.
 8. Include earphones and neck loops for each receiver.
 9. Acceptable products:
 - a. Listen Technologies
 - 1) LR-5200 Receiver
 - 2) LA-166 Neck Loop
 - 3) LA-405 Earbuds
 - 4) LA-380 12-Unit Charging Case
 - b. Williams Sound
 - 1) PPA R38
 - 2) NKL 001 Neck Loop
 - 3) EAR 002 Earphones
 - 4) CHG 3512 PRO 12-Unit Charging Case
 - c. Approved equivalent
- B. Wired Microphones
1. Provide (5) handheld microphones.
 2. The cartridge shall have a cardioid pattern.
 3. Microphone shall be equipped with an on/off switch.
 4. Acceptable products:
 - a. Sennheiser e 835-S
 - b. Shure SM58S
 - c. Approved Equivalent
- C. Microphone Floor Stand
1. Provide (3) microphone stands for handheld microphones.
 2. Stands shall be of a two-section design, painted black.
 3. Acceptable products:
 - a. Atlas MS-20E
 - b. Approved equivalent
- D. Microphone Boom
1. Provide (3) microphone booms.
 2. Shall be 34" long and of fixed length.
 3. Boom shall be capable of being attached to a conventional microphone stand.
 4. Boom shall be painted black.
 5. Acceptable products:
 - a. Atlas PB15EB
 - b. Approved equivalent
- E. Desktop Microphone Stand
1. Provide (2) desktop microphone stands.
 2. Acceptable products:
 - a. Atlas Sound DS2
 - b. Approved equivalent
- F. Microphone Cables
1. Provide (8) microphone cables.
 2. The length of each cable is to be 25'.
 3. The cables shall be factory terminated with one male 3-pin XLR and one female 3-pin XLR.
 4. Acceptable products:
 - a. ProCo AQ-25
 - b. Shure C25J
 - c. Approved equivalent
- G. Speaker Cables
1. Provide (2) speaker cables for stage monitors.
 2. Cables shall be constructed with minimum 12 AWG, 4-conductor wire and factory terminated with 4-pole speakON connectors.
 3. Cables are to be 25' in length.

4. Acceptable products:
 - a. ProCo S114NN-25
 - b. Whirlwind NL4-025
 - c. Approved equivalent

2.7 CABLE AND CONNECTORS

- A. Microphone Inputs Plates
 1. Provide microphone input plates for the floor boxes.
 2. Plate shall be manufactured of stamped stainless steel.
 3. The connector shall be a 3-pin female XLR panel mount, with a D series metal shell.
 4. Acceptable products:
 - a. ProCo WP1004
 - b. Approved Equivalent.
- B. Loudspeaker Output Plates
 1. Provide speaker output plates for the stage monitor loudspeakers.
 2. Plate shall be manufactured of stamped stainless steel.
 3. The connector shall be a 4-pole female speakON panel mount, with a D series metal shell.
 4. Acceptable products:
 - a. ProCo WP1009
 - b. Approved equivalent
- C. Installed Microphone Cable/Wire
 1. Permanently installed microphone cable shall be 22 AWG, 4-conductor, plenum-rated
 2. Acceptable products:
 - a. Belden 8761
 - b. West Penn D25454
 - c. Approved Equivalent.
- D. Loudspeaker Cable/Wire
 1. The permanently installed loudspeaker cable shall be 12 AWG, two-conductor, plenum-rated, unshielded NEC Type CL2P.
 2. Acceptable products:
 - a. Belden 6000UE
 - b. West Penn 25227B
 - c. Approved equivalent.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions for compliance with requirements and other conditions affecting the performance of the PA System. Advise Consultant of any discrepancies between field conditions and drawings that affect subject Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Installation shall include the delivery; unloading; setting in place; fastening to walls, floors, ceilings, counters, and other structures where required. Interconnecting wiring of the system components, equipment alignment and adjustments, and all other Work whether expressly required herein which is necessary to result in a complete operational system. Install system in accordance with National and/or Local applicable codes. Install equipment in accordance with manufacturer's written instructions.
- B. During installation, and up to the date of final acceptance, the Contractor shall be under obligation to protect his finished and unfinished Work against damage and loss. In the event of any such loss or damage, the Contractor shall replace or repair such Work or equipment at no cost to Owner.
- C. Install plumb and level and secured in accordance with manufacturer's instructions.

3.3 EQUIPMENT ENCLOSURES

- A. Size equipment enclosures and load all equipment per equipment requirement. Contractor shall provide detailed rack elevations in the Contractor's submittal drawings.

- B. Power Provisions: Install a single switch in the cabinet to supply the cabinet power distribution system. Provide electrical outlets to accommodate the AC power cords of each item of equipment. Outlets should be spaced to optimize neatness of cable runs within the rack. Number of circuits and amperage requirements for each receptacle should be sized appropriately for the equipment that will be plugged into it. In systems where new-dedicated AC power is being provided, the Contractor shall bring all unterminated circuits to a junction box within each equipment enclosure where the electrical Contractor will tie them in. The junction boxes should provide knockouts for various standard conduit sizes. For systems utilizing existing power outlets, the Contractor shall provide appropriate power distribution within the equipment enclosure terminating to an approved electrical connector and providing the necessary jacketed cabling to reach the existing power outlet.
- C. Ventilation: Provide in the cabinet a low-noise fan for forced air ventilation. Equip fan with a filtered input vent and connect to operate from 105-130-V, 50 Hz electrical power, partly fused and switchable and arranged to be powered whenever the main cabinet power switch is on.
- D. Equipment Rack: Mount equipment in 19 inch racks in accordance with Electronic Industries Association Standards: Group items of the same function together, either vertically or side-by-side. Arrange controls symmetrically. Make all power supply connections, AC and DC, with approved plugs and receptacles. Arrange all inputs, outputs, interconnections, and test points so they are accessible at the rear of the rack for maintenance and testing, with each item removable from the rack without disturbing other items or connections. Cover empty space in equipment racks with blank panels so that the entire front of the rack is occupied. Provide ventilated rear and side panels. Provide louvers in panels to insure adequate ventilation. Provide racks and panels with a uniform baked-enamel factory finish over rust-inhibiting primer.

3.4 CABLING

- A. Wiring within Enclosures: Provide adequate length of conductors. Bundle, and lace the conductors to terminal points with service loop. Provide and use lacing bars where appropriate. Cabling shall be neatly strapped, dressed, and adequately supported.
- B. Identification of Conductors and Cables: All cables shall be marked with wrap-around number or letter cable markers at both ends with clear shrink tube covering the label. There shall be no unmarked cables at any place in the system. All cable markings shall correspond with system wiring diagrams and as-built documentation.
- C. Connection Practices: All wiring connections shall be made with rosin-core solder or with approved mechanical connectors.
- D. Connection plate receptacles shall be used on all panels and plates where audio and video equipment is connected to audio and video cable plant
- E. Splices, Taps and Terminations: Make splices, taps, and terminations on numbered terminal strips in junction boxes, outlet boxes, and equipment enclosures.
- F. Wire Nuts: The use of wire nuts at any point within the system is unacceptable. The sole exceptions are as follows:
 - 1. AC circuit connections within equipment rack junction boxes.
 - 2. Splicing outdoor speaker cables. These wire nuts shall be underground rated and filled with a silicone-based sealant.
- G. Spade Lugs: Utilize plated or tinned copper, of appropriate size to the application. Except for the use of mil spec lugs, all crimp connectors in audio paths shall be soldered as well as crimped. Only uninsulated lugs shall be used.
- H. As standard practice, all control cables, power cables, and high level cables shall be run on the left side of an equipment rack as viewed from the rear. All other cables shall be run on the right side of an equipment rack, as viewed from the rear.
- I. Control Circuit Wiring: Install control circuits in accordance with NFPA 70 and as indicated. Provide the number of conductors as recommended by system manufacturer to provide control functions indicated or specified.
- J. Install all cabling with a bend radius of no less than is recommended by the cable manufacturer.

- K. Insulation for Wire in Conduit: Thermoplastic not less than .794 mm (1/32") thick.
- L. Amplifier Outputs: Speaker wiring terminating on amplifiers equipped with a screw-down terminal strips shall be connectorized with forked lugs.

3.5 GROUNDING

- A. Provide equipment-grounding connections for system as indicated. Tighten connections to comply with tightening torque specified in UL Standard 486A to secure permanent and effective grounds.
- B. System Grounding:
 - 1. Racks: Audio racks must not connect electrically to the conduits. All conduits terminating at the equipment rack must terminate through insulated fittings to isolate conduit grounds from the equipment rack grounds. Electrically isolate audio equipment racks from all grounds except for a single low impedance connection to technical ground. Provide a copper grounding buss in each equipment rack for isolated technical grounding of all equipment. Connect the common point of each rack frame and that rack's grounding buss to the isolated technical ground common point via an insulated copper conductor no smaller than 6 AWG. Connect the frames of all audio equipment racks to the isolated technical ground buss.
 - 2. Equipment: A separate 12 AWG copper insulated ground conductor shall connect the chassis of each piece of equipment to the ground buss. Connections to the buss shall be secured by machine screws at holes, which are drilled and tapped. All connections shall be properly crimped and soldered as provided elsewhere.
 - 3. Under no conditions shall the AC neutral conductor, either in the power panel or in a receptacle outlet, be used for a system ground.
 - 4. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments.
 - 5. Technical Grounding: All equipment within the technical power system will be grounded back to the technical reference ground using an isolated star grounding system. Technical ground is insulated and isolated from all other systems, except at the electrical connection where the master technical ground connects to the neutral bus, and ground electrode system at the service entrance equipment. Measure and record the DC resistance between the technical ground in any equipment rack and the main building ground. Resistance should be 0.15 ohms or less.

3.6 FIELD QUALITY CONTROL

- A. Pre-testing: Upon completing installation of the system, align, adjust, and balance the system and perform complete pre-testing. Determine, through pre-testing, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pre-testing. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.
- B. Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the systems.
- C. Testing: Upon completion of pre-testing, notify the Consultant a minimum of 10 days in advance of acceptance test performance. Schedule and conduct tests in his presence. Provide a written record of test results.
- D. Retesting: Rectify deficiencies indicated by tests and completely retest Work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards. Provide a written record of all retest results.

3.7 COMMISSIONING

- A. Test all PA System components, in the presence of the Owner, and/or Owner Authorized Representative, for compliance with the performance standards.
- B. Check all control functions, from all controlling devices to all controlled devices, for proper operation.
- C. Adjust, balance, and align all equipment for optimum quality and to meet the manufacturer's published specifications. Establish and mark normal settings for all level controls, and record these settings in the "System Operation and Maintenance Manual".

- D. Upon approval of the Contractor's test report, and at the time set by the Consultant, demonstrate that the final system adjustments and tests meet the performance requirements. Provide all labor, materials, tools and measurement equipment for these tests and adjustments.
- E. The Contractor is responsible for all costs incurred to satisfy criteria requirements.
- F. Deliver "Operation and Maintenance" manuals and "Instruction Guides" to Owner.
- G. Clearly label all critical settings of knobs, levers, and switches with a visible tag to signify optimal settings of all audio and video equipment.
- H. Post Occupancy Adjustments: When requested by the Consultant within one (1) year of final acceptance provide up to three (3) separate, two (2) day, on-site assistance visits in adjusting sound levels and equalizers, adjusting visual displays, control system programming additional system presets, and adjusting controls to suit actual occupied conditions.

3.8 CLEANING

- A. Upon completion of the installation, make all components free of any oil, grease, dust and debris.
- B. Work areas will be cleaned at the end of each work day and a final cleanup will occur at project completion.

END OF SECTION

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SECTION 27 41 16

PUBLIC ADDRESS SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide all labor, materials, and equipment for the complete installation of Work called for in the Contract Documents.
- B. This section includes the minimum requirements for a Public Address (PA)/Sound Reinforcement Systems.
 - 1. The PA Systems shall distribute audio signals throughout the two gymnasiums and the Café/Dining Area.
 - 2. The PA System shall accept microphone inputs and line level audio signals.
- C. Included in this section are the minimum composition requirements and installation methods for the following:
 - 1. Program Sources.
 - 2. Digital Audio Processors.
 - 3. Audio Power Amplifiers.
 - 4. Loudspeakers, enclosures and mounting hardware.
 - 5. Equipment racks.
 - 6. Cables, connectors, plates and wiring.
 - 7. Other items necessary for delivering a complete and working system.

1.2 DEFINITIONS AND TERMS

- A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:
 - 1. BICSI Building Industry Consulting Service International
 - 2. BGM Background Music
 - 3. CATV Cable Television
 - 4. Hz Hertz (cycles/second)
 - 5. IBC International Building Code
 - 6. ISO International Organization of Standardization
 - 7. MER Main Equipment Room
 - 8. NECA National Electrical Contractors Association
 - 9. PA Public Address System
 - 10. RCDD Registered Communications Distribution Designer
 - 11. RFP Request for Proposal
 - 12. STD Standard
 - 13. TR Telecommunications Room
 - 14. UL Underwriters Laboratories
 - 15. UTP Unshielded Twisted Pair
 - 16. VAC Volts with Alternating Current

1.3 QUALITY ASSURANCE

- A. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the Owner.
- B. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner.
- C. Contractor's Qualifications:
 - 1. Firms regularly engaged in the installation of public address systems and that have three (3) years of installation experience with systems similar to that required for this project. The Contractor shall have

been actively engaged in installing, maintaining and operating similar systems and services as outlined in this document.

2. The Contractor shall have a minimum of three (3) sites that are actively similar systems, and at least one of those sites must be utilizing a system similar to that being proposed. The system must be currently in operation, and have been in operation for at least the proceeding twelve (12) months.
 3. Provide references to include client names, phone numbers and a summary of project details. These references will be checked and the clients will be asked questions relative to the performance of your company.
 4. Provide verification that installation personnel responsible have been factory trained to install the products described in this Section.
 5. Provide full time project manager with a minimum of ten (10) years field experience in installation of communications systems and infrastructures. Project manager shall be assigned for the duration of the project and shall not be replaced without written consent from the Owner.
- D. Manufacturer's Qualifications:
1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.
- E. Material and Work specified herein shall comply with the applicable requirements of:
1. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2010
 2. ISO/IEC 60849, Sound Systems for Emergency Purposes, 1998
 3. ISO/IEC 24504, Ergonomics - Accessible Design, 2014
 4. BICSI – Telecommunications Distribution Methods Manual, 13th Edition
 5. Applicable codes and directives of authorities having jurisdiction
- F. Work:
1. The Work shall be performed in compliance with the applicable manufacturer's installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
 2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.
 3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
 4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

1.4 CONFLICTS

- A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts notify the Owner in writing prior to commencement of affected work.

1.5 PERMITS

- A. The Contractor shall secure and pay for all necessary permits and fees required for the execution of this Work. Work will not start until all permit applications are approved.

1.6 SCHEDULING

- A. The Contractor shall comply with all scheduling requests established by Owner, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and, if accepted, will be used to track work status.
- B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.
- C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

1.7 REQUIREMENTS

- A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The Owner must approve material submittal and substitutions in writing.
- B. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.
- C. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.
- D. The requirements as given in this document are to be adhered to unless revised by the Owner in writing.
- E. The Owner reserves the right to waive these requirements at any time.

1.8 SUBMITTALS

- A. Comply with provisions of Division 01.
- B. Comply with provisions of Section 27 05 00.
- C. Provide all submittal requirements under this section as a single package.
- D. Produce Shop Drawings for ALL system elements, to include but not limited to, proposed placement of speakers and microphones relative to building structure (columns, floor or ceiling) and its relationship to low-voltage pathway, electrical, mechanical elements as well as the anticipated rack elevations of equipment.
- E. Provide product data for the following:
 - 1. Product data consisting of manufacturers specifications for each type of product to be installed, all applicable certifications and elevation/plan documents supporting compliance with stated Specifications.
 - 2. Proposed format of as-built documentation.

1.9 CONTRACTOR CLOSE OUT SUBMITTALS

- A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (4) sets.
 - 1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.
 - 2. Provide above closeout documentation as an electronic file in PDF format.
- B. Warranty and Maintenance:
 - a. Record Drawings.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer's recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.
- B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the Owner.
- C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.
- D. Provide protective covering during construction to prevent damage or entrance of foreign matter.
- E. Contractor is responsible for on-site security of tools, test equipment and materials.
- F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

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

1.12 WARRANTY

- A. Warrant labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics, following Contractor Warranty requirements defined in Division 01. Repair or replace defects occurring in labor or product within the Warranty period without charge.
- B. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The products specified in this document do not necessarily constitute the exhaustive list of products required to complete the statement of work. Except where described in the SUMMARY subpart of this document, the contractor is responsible for providing any other parts and materials needed to deliver a complete and working system.

2.2 SYSTEM CONTROLLER

- A. VoIP Single Campus Controller
 1. Provides call routing for paging and intercom for a single facility.
 2. Connects to the district-provided telephone network via a SIP connection.
 3. Supports a flexible numbering plan allowing two, three, four, five, or six digit extensions.
 4. SIP interface to a district-provided telephone network shall enable connected phones to display classroom call-ins, answer internal intercom call-ins, make pages, and change priorities of call-ins in progress.
 5. Direct Dialing, two-way amplified voice intercom between any provided telephone or administrative console, and IP speaker, without the use of a press-to-talk or talk-listen switch.
 6. Ability to place two levels of call-in from any call-in switch.
 7. The ability to answer intercom calls registered at administrative consoles and pre-selected telephones.
 8. The ability to automatically escalate incoming calls to an alternate telephone, or group of telephones, if they remain unanswered for a predetermined amount of time.
 9. The ability to manually upgrade an intercom call to an alternate telephone, or group of telephones.
 10. The ability for classrooms to "check-in" via push button, when they have successfully secured their location during emergency.
 11. Administrative console shall display locations that have not "checked-in", to confirm their secured location, and provide hands-free audio monitoring and communication to unsecured locations.
 12. The controller shall not need direct connection to any classroom, via home run or distributed wiring. It shall communicate solely through the IP Network.
 13. Single button access from any telephone on the system to distribute emergency announcements within the facility, to all or select locations equipped with speakers. Emergency announcements originating from any assigned administrative telephone shall have priority over all regular system functions.
 14. Ability for administrative consoles and connected phones to selectively monitor audio at any two-way speaker during an emergency.
 15. Stores a minimum 48 hours of Bell Event Schedules, all emergency notification sequences, as well as facility-wide configuration.
 16. System has the ability to synchronize system time to the master clock, or to the school's, or district's network time server.
 17. System's SIP Interface shall provide:

- a. Audio paging access from any telephone to any single intercom speaker, zone (group) of intercom/paging speakers, or all speakers/paging horns throughout the entire facility.
 - b. Ability to answer a call directed to that SIP extension.
 - c. Ability to upgrade a call directed to that SIP extension
 - d. Single button access from any telephone on the system to initiate alarm signals within the facility to all or select locations equipped with speakers. A minimum of 25 separate distinct alarm signals shall be provided. Alarm signals originating from any assigned administrative telephone shall have priority over all regular system functions.
 - e. Ability to initiate school-wide emergencies including lockdown and evacuate sequences.
18. The system will have the ability to utilize a web browser and a USB microphone, connected to the PC, to deliver district wide live emergency paging, pre-recorded messages and tones from any authorized computer in the facility or district. The system must be capable of automatically notifying district personnel, via the WAN, of an alarm condition.
19. The system can automatically broadcast emergency instructions throughout an entire campus when an alarm (e.g. lockdown, lockout, security, fire) is tripped, or manually activated. The emergency instructions are pre-programmed and require no user intervention. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.
20. Approved product:
- a. Rauland Model TCC2000
 - b. Owner approved equivalent

2.3 IP ADDRESSABLE MODULES

A. General

1. The system shall provide multiple IP addressable modules for intercom, paging and relay activation.
 - a. All modules are POE 802.3af compliant.
 - b. All Modules support DHCP.
 - c. All Modules connect to the network with a single RJ-45 connector

B. IP Addressable Speaker Module

1. Speaker modules shall interface classroom devices, such as speakers and call-in switches, to provide a reliable communications link to the administrative consoles and connected phones utilizing the school's data network. Capable of delivering a full 2 Watts of audio power to an 8 Ohm speaker, the speaker module provides excellent audio coverage for all K-12 classrooms. The speaker module can be easily programmed through the web browser's volume slider interface to adjust the audio power (0.25W, 0.5W, 1W, 1.5W and 2W) to each 8 Ohm speaker.
2. Speaker modules shall be equipped with a SPST relay that can trigger a visual indicator, such as a strobe, whenever a high-priority audio signal is present.
3. Speaker modules may belong to one or more of a minimum of 100 independent zones for zone paging, program/music distribution and class change tone reception; this assignment is a programmable function, changeable by time of day. Each IP Speaker Modules location shall be programmed in software to belong to any combination of software zones. IP Speaker Modules shall be designed to mount to ceiling and wall speakers specified herein and in the plenum space.
4. Approved product:
 - a. Rauland Model TCC2011
 - b. Owner approved equivalent

C. IP Addressable Zone Paging Module

1. Zone paging modules convert the IP-based audio to an analog line-level audio signal to drive the Audio/Program Amplifiers specified herein.
2. Zone paging modules shall connect multiple speakers for district all page, all page, zone paging, bells, audio events and, emergency notifications.
3. Zone paging modules shall be rack mounted in the MDF/IDF's using the Rauland Model TCC2099 Universal Rack Mounting Kit.
4. Zone paging modules shall be able to belong to one or more of 100 independent zones for live paging, bells, pre-recorded audio and emergency notifications.
5. Approved product:
 - a. Rauland Model TCC2022
 - b. Owner approved equivalent

D. IP Addressable Auxiliary Input/output Module

1. Auxiliary I/O Modules provide two (2) network enabled, individually addressable contact closures providing an interface to external systems such as fire alarm panels, security panels, strobes and door latches.

2. Auxiliary I/O modules provide the ability to connect a "Panic Button" to the system.
 3. Auxiliary I/O Modules shall be rack mounted using the Rauland Model TCC2099 Universal Rack Mounting Kit.
 4. User can program relays to be activated manually, through an event/bell schedule and during emergency notification.
 5. Approved product:
 - a. Rauland Model TCC2033
 - b. Owner approved product
- E. IP Addressable Program Line Input Module
1. Line Input Module converts stereo or mono line-level analog audio to IP-Based Data for use in the Telecenter U system.
 2. Equipped with 3.5mm (headphone style) input socket.
 3. Desktop or rack mountable with Rauland Model TCC2099 Universal Rack Mounting Kit.
 4. Includes a male 3.5mm to dual male RCA connector cable.
 5. Approved product:
 - a. Rauland Model TCC2055
 - b. Owner approved equivalent
- F. Twenty-Four (24) Port Gateway
1. Supports 24 classrooms that utilize 25 Volt speakers and all current Telecenter call switches for front office notification
 2. Intercom, zone paging, emergency notification, program/music and event tone distribution.
 3. Compatible with CAT5e, CAT6 and 2-pair shielded, twisted field cabling.
 4. Built-in paging audio amplification of 25 Watts total per Gateway (5 Watts maximum per port).
 5. Requires 10/100/1000 Mb, multicast-enabled switch on fully switched network.
 6. 10/100/1000 RJ45 network socket connector on front panel.
 7. Two (2) female Amphenol-style connectors for field wiring on back of unit.
 8. Up to twenty (20) TCC2024 Gateways per Telecenter U school.
 9. Dimensions: 1.7" H x 19.0" W x 15.25" D.
 10. Power requirements: 90-260VAC, 1 Amp.
 11. Manufacturer's 5-year warranty.
 12. Approved product:
 - a. Rauland Model TCC2024
 - b. Owner approved equivalent
- G. IP Addressable Administrative Console
1. A full color screen with 64 soft keys, 3 line select, volume control, push to talk, speakerphone mode, left/right and up/down scrolling.
 2. Audio paging access from any Console to any single intercom speaker, zone (group) of intercom/paging speakers or all speakers/paging horns throughout the entire school.
 3. Programmable soft key access from any console on the system to initiate alarm signals within the school to all or select locations equipped with speakers. A minimum of 25 separate distinct alarm signals shall be provided. Alarm signals originating from any assigned administrative telephone shall have priority over all regular system functions.
 4. Programmable soft key access from any console to automatically broadcast page emergency instructions throughout an entire school when an alarm (e.g. lockdown, lockout, security, fire) is tripped or manually activated. The emergency instructions are preprogrammed and require no user intervention. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.
 5. Ability to perform intercom communication to any single IP Addressable Speaker Module.
 6. Ability to display 3 call-ins at a time on the screen, with unlimited number of call-ins annunciating and the ability to scroll to view all call-ins.
 7. Ability to upgrade a call-in via a soft key.
 8. Programmable soft key access from any console for activating relays, campus wide.
 9. Ability to maintain, along with controller and other IP Modules system functions, including intercom, bells and paging for the local campus in the event of district wide connection loss.
 10. Approved product:
 - a. Rauland Model TCC2044
 - b. Owner approved product

2.4 ANALOG AUDIO PRODUCTS

A. Audio Paging/Program Amplifier(s)

1. Power amplifier(s) shall be provided to provide a minimum of 2 watts of power to all paging speakers and 15 watts of power to all paging horns.
 2. The maximum load on the paging/program amplifiers shall be 80% of the rated maximum output of the amplifiers.
 3. Acceptable products:
 - a. Rauland DAX-Series
 - b. JBL CSA-Series
 - c. Stewart Audio CVA25-1 Series
 - d. Biamp Series MPA
 - e. Approved equivalent
- B. Universal Control Panel - Check-in/Emergency Dual Pushbutton Call-in Switch
1. Serial Ports (RS-232)
 - a. Speed: 2400-115,200 bps (Ports 1,2,3) 2400-57,600 bps (Port 4)
 - b. Pins: TX, RX and GND
 - c. Connector type: Screw terminal.
 2. IR Ports
 - a. Connector type: Screw terminal
 - b. I/O Ports (FLEX-LT200, -LT300 and T6)
 - c. Output: open collector, current limited to 100mA, (24VDC max)
 3. Compliance and supported features
 - a. Compliant with IEEE 802.3/802.3u (10BASE-TX) Compliant with ISO 802-3 / IEEE 802.3 (10BASE-T)
 - b. Supports auto-negotiation.
 - c. Supports automatic polarity detection and correction Supports HP Auto MDI/MDI-X.
 4. One (1) "Check-in" call-in switch that shall activate a distinctive "NORMAL" call annunciation from single button activation under non-emergency conditions and shall activate a "Check-in" annunciation to confirm the location is secured during lockdown conditions. The button shall be blue in color and shall be clearly marked "CHECK IN" and will route the call-in to any one or more Administrative Telephones and/or Displays for quick and easy response from an Administrative Telephone.
 5. One (1) "Emergency" call-in switch that shall activate a distinctive "EMERGENCY" level call from single button activation. The button shall be red in color and shall be clearly marked "EMER" and will route the call-in to any one or more Administrative Telephones for quick and easy response. Provide as indicated on the drawings.
 6. Approved product:
 - a. Model SWC LT200SP
 - b. Owner approved equivalent
- C. Tile Ceiling Mounted Paging Speaker
1. Shall be a pre-assembled 2 foot by 2 foot lay-in assembly complete with 8" full range speaker, 70VOLT line matching, rotary-select tap transformer, perforated steel baffle with white baked epoxy finish and an integrated back box that covers the full area of the baffle.
 2. The speaker assembly shall have a pair of speaker wires through a hole suitable for a 3/4-inch conduit fitting as the connection point for twisted/shielded cabling to the Audio Paging/Program Amplifiers specified herein. Provide as indicated on the drawings.
 3. Approved product:
 - a. Rauland Model BAFKIT2X2L70V
 - b. Owner approved equivalent
- D. Gypsum Ceiling Mounted Paging Speaker Assembly
1. Shall consist of a high efficiency loudspeaker, complete with a 25/70 Volt multi-tap line matching transformer mounted on a round white epoxy steel baffle. The recessed ceiling back box shall be an 8" round enclosure with a plaster flange mounting ring and a depth of 4-1/8".
 2. Approved product:
 - a. Rauland Model US0188 Speaker
 - b. Rauland Model ACC1000 Baffle
 - c. Rauland Model ACC1110 Plaster Ring
 - d. Owner approved equivalent
- E. Surface Ceiling Mounted Paging Speaker
1. Shall be an 8" permanent magnet seamless cone type with an additional cone provided to extend high frequency response. It shall have a frequency range of 65-17,000Hz, an 8-watt program power-handling capacity and an axial sensitivity of 93db at 1 watt with a 1 watt input. Voice coil shall be 3/4-inch diameter with an impedance of 8 Ohms. The speaker shall be equipped with a multi-tap transformer (0.312, 0.625, 1.25, 2.5 and 5 watts) at 25V and 70V.

2. The surface back box shall be 18-gauge cold-rolled steel with an attractive white epoxy finish. The interior surfaces are jute-lined to prevent metallic resonance, vibration and provide proper acoustical results. The back box shall be 12-1/2" square by 4" deep.
 3. The baffle shall be constructed of 22-gauge cold-rolled steel that is zinc- treated to resist corrosion. The finish is baked, powdered white epoxy which is virtually scratch- and mar-proof. Provide as indicated on the drawings.
 4. Approved assembly:
 - a. Rauland Model US0188 Speaker
 - b. Rauland Model ACC1112 Backbox
 - c. Rauland Model ACC1003 Baffle
 - d. Owner approved equivalent
- F. Recessed Wall Mounted Exterior Paging Speaker Assembly
1. The speaker shall be an 8" single cone driver with a moisture-resistant cone and a 10 oz. magnet. The cone is cotton cloth with a phenolic resin treatment and a double dipped acrylic lacquer coating to provide superior protection in areas of high humidity.
 2. Include a recessed back box, of heavy gauge cold-rolled steel, spot welded for stability with a rust-retardant gray primer finish. Acoustically treat the interior to eliminate mechanical resonance.
 - a. The back box shall be 9.6" square X 3.75" deep.
 3. The baffle shall be vandal proof, the faceplate constructed of a special aluminum alloy with a tensile strength of 44,000PSI. The baffle front is backed with a heavy gauge, perforated steel screen which protects the speaker. Provide tamper-resistant hardware.
 4. Approved assembly:
 - a. Lowell Model 8C10MRB-T72 Speaker
 - b. Rauland Model ACC1108 Backbox
 - c. Rauland model ACC1008 Baffle
 - d. Owner approved equivalent
- G. Surface Exterior & Canopy Mounted Paging Speaker Assembly
1. The speaker shall be an 8" single cone driver with a moisture- resistant cone and a 10 oz. magnet. The cone is cotton cloth with a phenolic resin treatment and a double dipped acrylic lacquer coating to provide superior protection in areas of high humidity.
 2. The recessed back box shall be of heavy gauge cold-rolled steel, spot welded for stability with a rust-retardant gray primer finish. Acoustically treat the interior to eliminate mechanical resonance. The surface back box shall be 11.5" square X 4" deep.
 3. The grille shall be 14-gauge steel, with secondary steel barrier constructed of 22-gauge steel screen which protects the speaker. Provide tamper resistant hardware.
 4. Approved assembly:
 - a. Lowell Model 8C10MRB-T72 Speaker
 - b. Lowell model CB84-SGVP Backbox
 - c. Lowell model SG-8VP Grille
 - d. Equivalent by Quam
 - e. Owner approved equivalent
- H. Wireless Clock System
1. Provide complete and satisfactorily operating NTP Synchronized Wireless Clock System with analog and/or digital secondary clocks as described herein, using materials and equipment of types, sizes, ratings, and performances as indicated.
 2. (NTP) Network Time Protocol is a network standard protocol that assures accurate synchronization to the millisecond of computer clock times in a network of computers. Based on UTC, NTP synchronizes client workstation clocks to the U.S. Naval Observatory Master Clocks in Washington, DC and Colorado Springs, CO. running as a continuous background client program on a computer, NTP sends periodic time requests to servers, obtaining server time stamps and using them to adjust computer clocks.
 3. The system shall be easy to learn and operate. All standard system programming shall be user friendly to allow the system administrator the ability to easily program system features.
 4. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction, in accordance with published product information.
 5. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions.
 6. The NTP Synchronized Wireless System consists of a master transmitter located on the inside of the building, and a NTP receiver connected to a time server. An unlimited number of wireless analog and digital clocks are synchronized to the NTP time. System shall synchronize all clocks to each other. System shall utilize NTP technology to provide atomic time to components.

7. System shall not require hard wiring for its components except for AC Power. Analog Clocks may be battery operated for full portability, if required.
8. Analog Clocks shall synchronize to +/- 1 second of the transmitter displayed time.
9. Clocks shall automatically adjust for Daylight Saving per settings on the transmitter
10. The system shall have an internal clock that is continually updated by the NTP receiver. If a NTP failure were to occur, the clocks would continue to be synchronized to the internal clock and would not deviate from each other. Once NTP time is restored, all clocks would once again be synchronized to the NTP time.
11. The system must have a fail-safe design so that if a power interruption were to occur, the clocks will continue to operate. If a synchronization signal is not received by the analog clocks for 48 hours, the second hand will double pulse to indicate this condition. Upon restoration of power, the transmitter will once again communicate with the clocks and normal operation will resume.
12. Battery powered analog clocks shall require 2 D-cell batteries.
13. System shall be 100% programmable from the front operational panel with lights that indicate power status and NTP reception. Panel programming will also include Time Zone, Frequency, 12- or 24-hour operation and DST on/off.
14. The wireless backbone must support expansion of the system to include wireless alphanumeric displays for emergency crisis communications for district-wide communications.
15. The system may be modified to use GPS instead of NTP as the time source without the need to replace the transmitter. A GPS receiver would need to be added with access to the outside of the building.
16. The system shall lend itself to expansion by simple addition of wireless secondary clocks and their required power source.
17. Equipment and Material
 - a. Wireless Transmitter - Rauland Model WCXATRAN
 - 1) FCC Part 90 Approved, 467.2125-467.4375 MHz frequency range
 - 2) Radio Technology (Narrowband FM, 12.5 KHz bandwidth)
 - 3) 10 selectively available channels
 - 4) 5-watt transmitter
 - 5) Daylight Savings Time pre-programmed
 - 6) Time Zone Pre-set
 - 7) Non-Volatile Memory
 - 8) LCD Display for time, date, year, power, time zone and signal reception
 - 9) Operating Range (32 degrees F to 158 degrees F)
 - 10) Rack (Rauland Model WCTRRBKT) or Shelf Mount (Rauland Model WCTRWS).
 - 11) Power Supply Input: 120-volt AC, Output: 12-volt DC, 3 Amps
 - 12) 7" Rear Mounted Antenna
 - 13) Dimensions: 12" L x 6" W x 1.75" H
 - 14) NTP Receiver – Rauland Model WCXRVRNTP
 - 15) Optional External Antenna for use in large campus applications. Up to 2 miles radius
 - b. Secondary 13" Analog Wireless Clock – Rauland Model WCA1312B
 - 1) Battery Powered using 2" D-Cell batteries.
 - 2) Maintenance Free.
 - 3) Five-year manufacturer's warranty.
 - 4) Microprocessor based with built-in wireless receiver
 - 5) Heavy Duty Construction
 - 6) Durable ABS Casing
 - 7) Clock numbering graphics shall be Standard Arabic Format (12Hour- 60 Minute)
 - 8) Face of clock is white
 - 9) Hour and Minute hands shall be black, second hand is red
 - 10) The clock lens shall use a shatterproof polycarbonate material with no visible molding marks. Glass and/or visible molding marks are unacceptable.
 - 11) The clock shall have a low-profile, semi-flush design
 - 12) Wire Guard – Rauland Model WCANA13WG in areas where protection is required as indicated on drawings or by owner.
 - c. Secondary 16" Analog Battery Clock – Rauland Model WCA1612B
 - 1) Battery Powered using 2" D-Cell batteries.
 - 2) Maintenance Free.
 - 3) Five-year manufacturer's warranty.
 - 4) Microprocessor based with built-in wireless receiver
 - 5) Heavy Duty Construction
 - 6) Durable ABS Casing
 - 7) Clock numbering graphics shall be Standard Arabic Format (12Hour- 60 Minute)
 - 8) Face of clock is white
 - 9) Hour and Minute hands shall be black, second hand is red

- 10) The clock lens shall use a shatterproof polycarbonate material with no visible molding marks. Glass and/or visible molding marks are unacceptable.
- 11) Wire Guard – Rauland Model WCANA16WG in areas where protection is required as indicated on drawings or by owner.
- 12) The clock shall have a low-profile, semi-flush design
- d. Secondary 4" Digital Clock – Rauland Model WCD404W
 - 1) 4" 7-Segment LED
 - 2) 24VAC Powered – Rauland Model 2515 Power Supply. West Penn #25226B Power Cable.
 - 3) 120VAC Powered – Rauland Model WCP24AC1 Transformer with local 120VAC Power by Div. 16 Contractor
 - 4) 4 - Digit (Hours/Minutes)
 - 5) Maintenance Free
 - 6) Five-year manufacturer's warranty
 - 7) Microprocessor based with built-in wireless receiver
 - 8) Heavy Duty Construction
 - 9) 12/24 Hour Display Format
 - 10) Clear Anti-Glare LED Display
 - 11) Adjustable Brightness
 - 12) AM/PM Indicator
 - 13) Wire Guard – Rauland Model WCDIG40WG in areas where protection is required as indicated on drawings or by owner.
 - 14) Bright White LED Digits
- e. Dual-face Digital Clock Wall Kit – Rauland Model WCD40MW
 - 1) 16 Gauge, Cold Rolled Steel
 - 2) Baked Black Epoxy Finish
 - 3) Mounts Over Standard Double-Gang Electrical Box 4)
 - 4) 8" H (base) x 19.9" W x 5.5" D (base)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions for compliance with requirements and other conditions affecting the performance of the PA System. Advise Consultant of any discrepancies between field conditions and drawings that affect subject Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Installation shall include the delivery; unloading; setting in place; fastening to walls, floors, ceilings, counters, and other structures where required. Interconnecting wiring of the system components, equipment alignment and adjustments, and all other Work whether expressly required herein which is necessary to result in a complete operational system. Install system in accordance with National and/or Local applicable codes. Install equipment in accordance with manufacturer's written instructions.
- B. During installation, and up to the date of final acceptance, the Contractor shall be under obligation to protect his finished and unfinished Work against damage and loss. In the event of any such loss or damage, the Contractor shall replace or repair such Work or equipment at no cost to Owner.
- C. Install plumb and level and secured in accordance with manufacturer's instructions.

3.3 EQUIPMENT ENCLOSURES

- A. Size equipment enclosures and load all equipment per equipment requirement. Contractor shall provide detailed rack elevations in the Contractor's submittal drawings.
- B. Power Provisions: Install a single switch in the cabinet to supply the cabinet power distribution system. Provide electrical outlets to accommodate the AC power cords of each item of equipment. Outlets should be spaced to optimize neatness of cable runs within the rack. Number of circuits and amperage requirements for each receptacle should be sized appropriately for the equipment that will be plugged into it. In systems where new-dedicated AC power is being provided, the Contractor shall bring all unterminated circuits to a junction box within each equipment enclosure where the electrical Contractor will tie them in. The junction boxes should provide knockouts for various standard conduit sizes. For systems utilizing existing power outlets, the Contractor shall provide appropriate power distribution within

the equipment enclosure terminating to an approved electrical connector and providing the necessary jacketed cabling to reach the existing power outlet.

- C. Ventilation: Provide in the cabinet a low-noise fan for forced air ventilation. Equip fan with a filtered input vent and connect to operate from 105-130-V, 50 Hz electrical power, partly fused and switchable and arranged to be powered whenever the main cabinet power switch is on.
- D. Equipment Rack: Mount equipment in 19 inch racks in accordance with Electronic Industries Association Standards: Group items of the same function together, either vertically or side-by-side. Arrange controls symmetrically. Make all power supply connections, AC and DC, with approved plugs and receptacles. Arrange all inputs, outputs, interconnections, and test points so they are accessible at the rear of the rack for maintenance and testing, with each item removable from the rack without disturbing other items or connections. Cover empty space in equipment racks with blank panels so that the entire front of the rack is occupied. Provide ventilated rear and side panels. Provide louvers in panels to insure adequate ventilation. Provide racks and panels with a uniform baked-enamel factory finish over rust-inhibiting primer.

3.4 CABLING

- A. Wiring within Enclosures: Provide adequate length of conductors. Bundle, and lace the conductors to terminal points with service loop. Provide and use lacing bars where appropriate. Cabling shall be neatly strapped, dressed, and adequately supported.
- B. Identification of Conductors and Cables: All cables shall be marked with wrap-around number or letter cable markers at both ends with clear shrink tube covering the label. There shall be no unmarked cables at any place in the system. All cable markings shall correspond with system wiring diagrams and as-built documentation.
- C. Connection Practices: All wiring connections shall be made with rosin-core solder or with approved mechanical connectors.
- D. Connection plate receptacles shall be used on all panels and plates where audio and video equipment is connected to audio and video cable plant
- E. Splices, Taps and Terminations: Make splices, taps, and terminations on numbered terminal strips in junction boxes, outlet boxes, and equipment enclosures.
- F. Wire Nuts: The use of wire nuts at any point within the system is unacceptable. The sole exceptions are as follows:
 - 1. AC circuit connections within equipment rack junction boxes.
 - 2. Splicing outdoor speaker cables. These wire nuts shall be underground rated and filled with a silicone-based sealant.
- G. Spade Lugs: Utilize plated or tinned copper, of appropriate size to the application. Except for the use of mil spec lugs, all crimp connectors in audio paths shall be soldered as well as crimped. Only uninsulated lugs shall be used.
- H. As standard practice, all control cables, power cables, and high level cables shall be run on the left side of an equipment rack as viewed from the rear. All other cables shall be run on the right side of an equipment rack, as viewed from the rear.
- I. Control Circuit Wiring: Install control circuits in accordance with NFPA 70 and as indicated. Provide the number of conductors as recommended by system manufacturer to provide control functions indicated or specified.
- J. Install all cabling with a bend radius of no less than is recommended by the cable manufacturer.
- K. Insulation for Wire in Conduit: Thermoplastic not less than .794 mm (1/32") thick.
- L. Amplifier Outputs: Speaker wiring terminating on amplifiers equipped with a screw-down terminal strips shall be connectorized with forked lugs.

3.5 GROUNDING

- A. Provide equipment-grounding connections for system as indicated. Tighten connections to comply with tightening torque specified in UL Standard 486A to secure permanent and effective grounds.
- B. System Grounding:
 - 1. Racks: Audio racks must not connect electrically to the conduits. All conduits terminating at the equipment rack must terminate through insulated fittings to isolate conduit grounds from the equipment rack grounds. Electrically isolate audio equipment racks from all grounds except for a single low impedance connection to technical ground. Provide a copper grounding buss in each equipment rack for isolated technical grounding of all equipment. Connect the common point of each rack frame and that rack's grounding buss to the isolated technical ground common point via an insulated copper conductor no smaller than 6 AWG. Connect the frames of all audio equipment racks to the isolated technical ground buss.
 - 2. Equipment: A separate 12 AWG copper insulated ground conductor shall connect the chassis of each piece of equipment to the ground buss. Connections to the buss shall be secured by machine screws at holes, which are drilled and tapped. All connections shall be properly crimped and soldered as provided elsewhere.
 - 3. Under no conditions shall the AC neutral conductor, either in the power panel or in a receptacle outlet, be used for a system ground.
 - 4. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments.
 - 5. Technical Grounding: All equipment within the technical power system will be grounded back to the technical reference ground using an isolated star grounding system. Technical ground is insulated and isolated from all other systems, except at the electrical connection where the master technical ground connects to the neutral bus, and ground electrode system at the service entrance equipment. Measure and record the DC resistance between the technical ground in any equipment rack and the main building ground. Resistance should be 0.15 ohms or less.

3.6 FIELD QUALITY CONTROL

- A. Pre-testing: Upon completing installation of the system, align, adjust, and balance the system and perform complete pre-testing. Determine, through pre-testing, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pre-testing. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.
- B. Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the systems.
- C. Testing: Upon completion of pre-testing, notify the Consultant a minimum of 10 days in advance of acceptance test performance. Schedule and conduct tests in his presence. Provide a written record of test results.
- D. Retesting: Rectify deficiencies indicated by tests and completely retest Work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards. Provide a written record of all retest results.

3.7 COMMISSIONING

- A. Test all PA System components, in the presence of the Owner, and/or Owner Authorized Representative, for compliance with the performance standards.
- B. Check all control functions, from all controlling devices to all controlled devices, for proper operation.
- C. Adjust, balance, and align all equipment for optimum quality and to meet the manufacturer's published specifications. Establish and mark normal settings for all level controls, and record these settings in the "System Operation and Maintenance Manual".
- D. Upon approval or the Contractor's test report, and at the time set by the Consultant, demonstrate that the final system adjustments and tests meet the performance requirements. Provide all labor, materials, tools and measurement equipment for these tests and adjustments.
- E. The Contractor is responsible for all costs incurred to satisfy criteria requirements.

- F. Deliver "Operation and Maintenance" manuals and "Instruction Guides" to Owner.
- G. Clearly label all critical settings of knobs, levers, and switches with a visible tag to signify optimal settings of all audio and video equipment.
- H. Post Occupancy Adjustments: When requested by the Consultant within one (1) year of final acceptance provide up to three (3) separate, two (2) day, on-site assistance visits in adjusting sound levels and equalizers, adjusting visual displays, control system programming additional system presets, and adjusting controls to suit actual occupied conditions.

3.8 CLEANING

- A. Upon completion of the installation, make all components free of any oil, grease, dust and debris.
- B. Work areas will be cleaned at the end of each work day and a final cleanup will occur at project completion.

END OF SECTION

SECTION 28 05 00

COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 SUMMARY

- A. Electronic Access Control Systems
- B. Video Surveillance Systems
- C. Grounding and Bonding
- D. Cable Pathways
- E. Cable management

1.2 RELATED WORK SPECIFIED UNDER OTHER DIVISIONS

- A. Foundations and pads required for equipment furnished under this Division.
- B. Field painting, except such painting as is required to maintain shop coat painting and factory finish painting.
- C. Flashing of conduits into roofing and outside walls.
- D. Heating, ventilating and air conditioning equipment.
- E. Electrical service to equipment rooms.
- F. Cutting and patching for low voltage systems work, except for errors and omissions under this Division.

1.3 QUALITY ASSURANCE

- A. Comply with applicable local, state and federal codes.
- B. Comply with applicable requirements of recognized industry associations which produce standards for the various trades.
- C. Warrant Work under this specification against faulty material or Workmanship in accordance with Division 01. If the project is occupied or the systems placed in operation in several phases at the request of the Owner, then the warranty of each system or piece of equipment used shall begin on the date of substantial completion for each phase. The use of building equipment for temporary service and testing does not constitute the beginning of the warranty.
- D. Equipment and material provided under this Division shall be periodically inspected and serviced by competent installers. This function becomes the responsibility of the Owner once the system is accepted by the Owner. The one year material and workmanship warranty is not intended to supersede normal inspection or service and shall not be construed to mean the Contractor shall provide free service for normal maintenance items such as periodic cleaning and adjustment due to normal use, nor to correct without charge, breakage, maladjustment and other trouble caused by improper maintenance.
- E. Upon completion of contract and progressively as work proceeds, clean-up and remove dirt, debris and scrap materials. Maintain the premises in a neat and clean condition at all times during construction. Protect and preserve access to head-end equipment at all times. Clean items with factory finishes. Touch-up minor damage to surfaces; refinish entire piece of equipment when sustained major damage. All electronics must be protected from dust and other airborne debris. Contractor shall identify all types of quality control mechanisms they employ. List all types.

1.4 STANDARDS

COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

- A. The Contractor's performance of the Work shall comply with applicable federal, state and local laws, rules and regulations. The Contractor shall give required notices, shall procure necessary governmental licenses, permits, and inspections and shall pay without burden to The Owner, all fees and charges in connection therewith unless specifically provided otherwise. In the event of violation, the Contractor shall pay all fines and penalties, including attorney's fees and other defense costs and expenses in connection therewith.
- B. Federal Communications Commission
 - 1. Equipment requiring FCC registration or approval shall have received such approval and shall be appropriately identified.
- C. Codes, Standards and Ordinances
 - 1. Design, manufacture, test and install telecommunications cabling networks per manufacturer's requirements and in accordance with NFPA-70(National Electrical Code®), state codes, local codes, requirements of authorities having jurisdiction and particularly the following standards:
 - a. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2010
 - b. ANSI/NECA/BICSI-568 – Standard for Installing Commercial Building Telecommunications Cabling, 2006
 - c. ANSI/TIA/EIA Standards
 - 1) ANSI/TIA/EIA-606-B – The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 1993-2012
 - 2) ANSI-J-STD-607-A – Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2002
 - d. NFPA-70 – National Electrical Code
 - e. Federal, state, and local codes, rules, regulations, and ordinances governing the Work, are as fully part of the specifications as if herein repeated or hereto attached. If the Contractor should note items in the drawings or the specifications, construction of which would be code violations, promptly call them to the attention of the Owner's Representative in writing. Where the requirements of other sections of the specifications are more stringent than applicable codes, rules, regulations, and ordinances, the specifications shall apply.
 - f. American Society for Testing and Materials (ASTM): ASTM E. 814 – Standard Test Method for Fire Tests of Penetration Firestop Systems
 - g. Underwriters Laboratories, Inc. (UL): UL 1479 – Tests of Through-Penetration Firestop Systems
 - h. Americans with Disabilities Accessibility Guidelines
 - i. Code of Federal Regulations, Title 29, Chapter XVII, Part 1910 (OSHA)
 - j. Uniform Building Code (UBC)
 - k. International Building Code (IBC)
 - l. Applicable codes and directives of authorities having jurisdiction

1.5 COMPLETENESS OF WORK

- A. The Contract Documents depict low voltage systems which are intended to be complete and functioning systems. All products, materials, labor, and programming necessary to render a fully functional system to fulfill the design intent shown on the documents shall be provided by the Contractor.
- B. Catalog numbers referenced throughout this Division's drawings and specifications are intended to convey a general understanding of the type of quality of the product required. Where written descriptions differ from information conveyed by a catalog number, the written description shall govern. No extra charge shall be allowed because a catalog number is found to be incomplete or obsolete.

1.6 PRE-INSTALLATION CONFERENCE

- A. Arrange and schedule pre-installation conference prior to beginning any work of this section Communications.
- B. Agenda: Clarify questions in writing related to work to be performed, scheduling, coordination, etc. with consultant and/or project manager/Owner representative.
- C. All individuals, who will be in an on-site supervisory capacity, shall be required to attend the pre-installation conference. This includes project managers, site supervisor and lead installers. Individuals who do not attend the conference will not be permitted to supervise the personnel that install, terminate or test communications cables on the project. The Contractor's RCDD that will oversee the installation is required to attend the pre-installation conference.

- D. The manufacturer that will be providing the extended warranty is required to have a representative attend the pre-installation conference.

1.7 SEQUENCE AND SCHEDULING

- A. The Contractor shall comply with all scheduling requests established by OAR, both prior to commencing Work and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and if accepted will be used to track work status.
- B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.
- C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.
- D. Submit schedule for installation of equipment and cabling. Indicate delivery, installation and testing for conformance to specific job completion dates. As a minimum, dates are to be provided for bid award, installation start date, completion of station cabling, completion of riser cabling, completion of testing and labeling, cutover, completion of the final punch list, start of demolition, Owner acceptance and demolition completion.

1.8 SUBMITTALS

- A. Comply with provisions of Division 01.
- B. Provide all submittal requirements under this section as a single package.

1.9 ALTERNATES, SUBSTITUTIONS AND CHANGE ORDERS

- A. If a proposed alternate material is equal to or exceeds specified requirements, Contractor shall provide manufacturer's specifications in writing for written approval prior to purchase and installation of proposed materials. The proposed material substitution shall not void or change manufacturer's warranty.
- B. Contractor shall provide a complete cabling infrastructure according to these written specifications and drawings. If the Owner changes the scope of work to be performed by the Contractor, it shall be in writing. Contractor shall respond to these changes with a complete material list, labor, and taxes in writing presented to the Owner for approval. Contractor shall not proceed with additional scope of work without a signed approval by the Owner.
- C. Additional work performed by the Contractor will not be paid by Owner without signed approval of these changes prior to implementing changes. Submit a copy of signed change order upon billing.

1.10 USE OF THE SITE

- A. Use of the site shall be at the Owner's direction in matters in which the Owner deems it necessary to place restriction.
- B. Access to the building wherein the Work is performed shall be as directed by the Owner.
- C. The Owner will occupy the premises during the entire period of construction for conducting his or her normal business operations. Cooperate with the Owner to minimize conflict and to facilitate the owner's operations.
- D. Schedule necessary shutdowns of plant services with the Owner and obtain written permission from the Owner. Refer to article - CONTINUITY OF SERVICES herein.
- E. Proceed with the Work without interfering with ordinary use of streets, aisles, passages, exits and operations of the Owner.
- F. All Contractor personnel must check in with the facilities engineering department and/or the General Contractor upon arrival and upon departure.

1.11 DELIVERY AND STORAGE

- A. Insofar as possible, deliver items in manufacturers' original unopened packaging. Where this is not practical, cover items with protective materials, to keep them from being damaged. Use care in loading, transporting, unloading and storage to keep items from being damaged.
- B. Store items in a clean dry place and protect from damage.
- C. Storage space on project site may be limited. The Contractor shall coordinate delivery and arrange storage of materials and equipment with the OAR.
- D. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.
- E. Provide protective covering during construction to prevent damage or entrance of foreign matter.
- F. Contractor is responsible for on-site security of tools, test equipment and materials.
- G. Replace at no expense to the Owner, product damaged during transporting, storage, handling or the course of construction.

1.12 CONTRACTOR CLOSE OUT SUBMITTALS

- A. Submit Closeout documentation in accordance with Division 1 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 1 of the Project Manual, or a minimum of four (4) sets.
 - 1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues
 - 2. Test reports on all systems (electronic file format and hard copy)
 - 3. As-built door and device schedules
 - 4. As built documentation of all systems installed under this project
 - 5. As built documentation of TR modifications and associated cabinet and wall elevations
- B. Warranty and Maintenance:
 - 1. Test Report Binder(s)
 - 2. Record Drawings

1.13 RECORD DRAWINGS

- A. Keep a hard copy set of project drawings at the job site exclusively for recording deviations from the Construction Drawings.
- B. Record locations and depths of buried and concealed conduits from fixed, easily identifiable objects, such as building walls. Where conduits are concealed in walls, indicate distances off of building corners or other building features not likely to be disturbed by future alterations.
- C. Mark deviations in a different color so that work of various systems can be easily identified.
- D. When Work is completed, record all deviations in an electronic format using AutoCAD 2007 in a format usable to the Owner. Coordinate this format with the Owner.
- E. Submit two copies of completed "record drawings" on electronic media such as CD or DVD to Owner's Representative for distribution.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. All materials and equipment used in carrying out these specifications are to be new and have UL listing, or listing by other recognized testing laboratory when such listings are available.
- B. Model numbers and manufacturers included in this specification are listed to establish as standard of product quality.

- C. Other qualified manufacturers may be substituted only with The Owner's written consent. To request a substitution, the Contractor shall submit complete technical data, samples, and if requested, results of independent testing laboratory tests of proposed equipment.
 - 1. If the proposed System includes equipment other than specified model numbers, submit a list of major items and their quantities, with a one-line schematic diagram for review.
 - 2. Material not specifically identified within this document but which is required for the successful implementation of the intended system(s), shall be of the same class and quality as the specified material and equipment.
 - 3. Include a list of previously installed projects using proposed equipment that are similar in nature to specified system.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Insofar as it is possible to determine in advance, advise the General Contractor to leave proper chases and openings. Place all outlets, anchors, sleeves, and supports prior to pouring concrete or installation of masonry work. Should the Contractor neglect doing this, any cutting and/or patching required is to be done at this Contractor's expense. Visit site and be informed of conditions under which work must be performed. No subsequent allowance will be made because of error or failure to obtain necessary information to completely estimate and perform work involved.
- B. Carefully coordinate with other divisions to ensure proper power requirements, grounding, fireproofing and interlocking controls between the fire alarm system, security system, and other owner furnished systems.
- C. Notify other tradesmen of any deviations or special conditions necessary for the installation of work. Interferences between work of various Contractors to be resolved prior to installation. Work installed not in compliance with specifications and drawings and without properly checking and coordinating as specified above shall, if necessary, be removed and properly reinstalled without additional cost to the Owner.
- D. The Owner or the Owner's Representative shall be the mediating authority in all deviation and disputes arising on project.
- E. Coordinate with local telephone and cable service providers to assure that proper points of service, demarcation location and grounding requirements are in accordance with contract drawings. Duct bank is to be provided by Division 26. This Contractor shall be involved regarding discussions about services to the building.
 - 1. Coordinate with other trades to provide wall and ceiling access panels wherever required for access to communication equipment.
- F. Intent:
 - 1. These sections of specifications and drawings form a complete set of documents for communications systems for this project. Neither is complete without the other. Any item mentioned in one shall be as binding as though mentioned in both.
 - 2. The intent of these specifications and drawings is to form a guide for a complete systems installation. Where an item is reasonably necessary for a complete system but not specifically mentioned, such as pull boxes, fittings, expansion fittings, support hangers, etc. provide same without additional cost to Owner.
 - 3. Communication equipment room layouts indicated on drawings are diagrammatical only. The exact location of outlets and equipment to be coordinated and governed by project conditions. The Designer reserves the right to make any reasonable changes (approximately 6 feet) in location of junction boxes or equipment prior to roughing in of such without additional cost to Owner.
- G. Deviations:
 - 1. No deviations from specifications and drawings to be made without full knowledge and consent of the Designer.
 - 2. Should the Contractor find during progress of work that existing conditions make desirable a modification of the requirements of any particular item, report such item promptly to the Designer for his decision and instructions.
- H. Main Horizontal Pathway/Raceway:

1. Unless otherwise noted on the drawings, all communications/low voltage systems cabling shall be routed above accessible corridor ceilings parallel to room walls and corridors via cable tray or J-hook supports. Cabling shall be segregated by function as follows:
 - a. Voice/data cabling
 - b. All other systems

3.2 CONTINUITY OF SERVICES

- A. The Contractor shall not take any action that will interfere with, or interrupt, existing building services unless previous arrangements have been made with the owner's representative. Arrange the Work to minimize shutdown time.
- B. Owner's personnel will perform shutdown of operating systems. The Contractor shall give three (3) days' advance notice for systems shutdown.
- C. Should services be inadvertently interrupted, immediately furnish labor, including overtime, material, and equipment necessary for prompt restoration of interrupted service.

3.3 TRENCHING, EXCAVATION, BACKFILLING AND REPAIRS

- A. Trenching, Excavation and Backfilling is the responsibility of the General Contractor. This Contractor is to coordinate all requirements with the GC. Failure to properly coordinate this effort resulting in additional trenching, excavation, backfilling or repairs shall be performed without additional cost to Owner.

3.4 PLYWOOD BACKBOARD AND WALL BACKING

- A. Contractor shall provide 4' W x 8' H x 3/4" D fire retardant plywood backboard as indicated in all Communication Rooms. Plywood is to be painted with two coats of flat white fire retardant paint on all six sides and installed 6" above finished floor. The fire rating on the plywood shall be masked prior to painting and the mask removed after installation such that the fire rating is always visible.
- B. General Contractor is to provide appropriate backing in walls as required for mounting brackets and other wall mounted equipment per manufacturer requirements.
- C. Where work is to be done in an existing Telecommunication Room (TR), the Contractor shall ensure plywood in the TR is flame retardant. If the existing plywood does not comply the Contractor shall replace it with plywood compliant with 3.4-A.

3.5 FIRESTOPPING

- A. Select appropriate type or types of through penetration firestop devices or systems appropriate for each type of communications penetration and base each selection on criteria specified herein.
- B. Selected systems shall not be less than the hourly time delay ratings indicated in the Contract Documents for each respective fire-rated floor, wall or other partition of building construction. Firestop for each type of communications penetration shall conform to requirements of an independent testing laboratory design drawing or manufacturer's approved modification when used in conjunction with details shown on the Drawings.
- C. Perform all necessary coordination with trades constructing floors, walls or other partitions of building construction with respect to size and shape of each opening to be constructed and device or system approved for use in each instance.
- D. Coordinate each firestop selection with adjacent Work for dimensional or other interference and for feasibility. In areas accessible to public and other "finished" areas, firestop systems Work shall be selected, installed and finished to the quality of adjacent surfaces of building construction being penetrated.
- E. Use materials that have no irritating or objectionable odors when firestopping is required in existing buildings and areas that are occupied.
- F. Provide damming materials, plates, wires, restricting collars and devices necessary for proper installation of Firestopping. Remove combustible installation aids after firestopping material has cured.

- G. All firestops shall be installed in accordance with the manufacturer's instructions in order to maintain the specific rating assigned by the independent testing laboratory.
- H. Existing raceways, cable trays and cabling that penetrate existing building construction shall be firestopped to the extent necessary to fill cavities that may exist between existing building construction and existing communications penetrations or existing conduit sleeve, and between existing conduits and existing conduit sleeve.
- I. If required by inspecting authorities:
- J. Expose and remove Firestopping to the extent directed by inspecting authority to permit his or her inspection
- K. Reinstall new firestopping and restore Work where removed for inspection

3.6 TESTS

- A. On completion of Work, installation shall be entirely free of damaged conductors, software errors, incomplete jack termination including labeling and faceplates and dust. Perform a thorough operation test in the presence of the Owner or their representative. Provide documentation of all test results as outlined in each system's specifications. Include labor, materials and instruments for above tests.
- B. Furnish to the Owner, as a part of closing documents, a copy of such tests including identification of each cable, also the dedicated communication service ground test as required by each systems individual manufacturer indicating compliance with their requirements.
- C. Prior to final observation and acceptance, test and leave in satisfactory operating condition, all systems and equipment including but not limited to the following:
 - 1. Grounding
 - 2. Firestopping of all sleeves and conduits
 - 3. Telephone and LAN systems
 - 4. Turn in test results on cabling

3.7 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, dust, and construction debris and repair damaged finish, including chips, scratches and abrasions. This includes touching up paint removed for grounding.
- B. Contractor shall provide a clean work environment, free from trash/rubbish accumulated during and after cabling installation.
- C. Maintain construction materials and refuse within the area of work. Clean the work area at the end of each day.
- D. Contractor shall keep all liquids (drinks, sodas, etc.) off finished floors, carpets, tiles, racks and equipment. If any liquid damage to above finishes or equipment, Contractor shall provide professional services to clean or repair scratched/soiled finishes or damaged equipment at own expense.

3.8 INSPECTION FEES AND PERMITS

- A. Obtain and pay for all necessary permits and inspection fees required for communication systems installation. Work shall not start until all permit applications are approved.

3.9 OBSERVATIONS

- A. When field observation services are a part of the project scope, the Designer's office will provide periodic observation of the progress of Work specified herein. The purpose of the observation service is to ensure compliance of Contractor's Work with specifications and drawings. The Designer's office may also observe tests required of this Contractor as called for in other sections of the specifications.
- B. Specifications and drawings represent Work to be done in view of total project requirements. To eliminate possible conflict with other trades, final location of conduits, jacks, outlets, components, etc., is the

responsibility of this Contractor. Contractor to provide all supervision required for his personnel to ensure that installation is made in accordance with specifications and drawings and all safety rules and regulations are observed. In the event of conflicts of Work on project with other trades, Contractor is to make every reasonable effort to resolve conflict through meetings and discussions with other parties involved, by preparation of drawings or other appropriate action. Only after this has been done shall the Designer's assistance be requested through the RFI process.

- C. When the Designer is requested to visit the project to aid in resolution of conflicts, or for witnessing tests, he shall be given a minimum of 48 hours' notice prior to time their presence is requested at job site.

3.10 WARRANTY GUARANTEE

- A. The Designer reserves the right to accept or reject any part of the installation which does not successfully meet requirements as set out in these specifications.
- B. This Contractor shall, and hereby does, guarantee all Work installed under this division shall be free from defects in workmanship and materials for a period of one year from date of final acceptance. This Contractor further agrees to repair or replace any defective material or workmanship which is or becomes defective within the terms of this warranty-guarantee.
- C. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

3.11 METHOD OF MEASUREMENT

- A. Cabling pathways shall be measured in lineal feet. Electronic access control systems, video surveillance systems, cable management shall be measured in each unit.

3.12 METHOD OF PAYMENT

- A. Payment shall be made at the contract unit price based on the measurements listed herein. Payment shall be full compensation for all labor, materials, tools, equipment and incidentals required to complete the work specified herein and on the drawings.

END OF SECTION

SECTION 28 10 00

ELECTRONIC SECURITY SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide all labor, materials, and equipment for the complete installation of Work called for in the Contract Documents.
- B. This section includes the minimum requirements for the installation of electronic access control, intrusion detection and video surveillance systems.
- C. Included in this section are the minimum composition requirements and installation methods for the following:
 - 1. Intrusion Detection System
 - 2. Door Position Sensors
 - 3. Electronic Locking Devices
 - 4. Credential Readers
 - 5. Field Panels, Power Supplies and Batteries
 - 6. Video Surveillance Cameras
 - 7. Wireless Duress System

1.2 DEFINITIONS AND TERMS

- A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:
 - 1. ACS Access Control System
 - 2. AHJ Authority Having Jurisdiction
 - 3. ANSI American National Standards Institute
 - 4. AVI Automatic Vehicle Identification
 - 5. AWG American Wire Gauge
 - 6. BICSI Building Industry Consulting Service International
 - 7. EIA Electronics Industries Association
 - 8. EPT Electrical Power Transfer
 - 9. NECA National Electrical Contractors Association
 - 10. NEMA National Electric Manufacturers Association
 - 11. NFPA National Fire Protection Association
 - 12. OAR Owner's Authorized Representative
 - 13. PIR Passive Infrared
 - 14. RFP Request for Proposal
 - 15. STD Standard
 - 16. TGB Telecommunications Grounding Busbar
 - 17. TIA Telecommunications Industry Association
 - 18. TMGB Telecommunications Main Ground Bus Bar
 - 19. UL Underwriters Laboratories
 - 20. UPS Uninterruptable Power Supply
 - 21. VMS Video Management System
 - 22. VSS Video Surveillance System

1.3 QUALITY ASSURANCE

- A. The Texas Department of Public Safety requires that portions of this work defined as regulated under the provisions of SB 1252, 78th Legislative Session of the State of Texas be performed by a contractor holding a valid and current Class B Security Contractor Company License.
- B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the OAR.

- C. Comply with NEC as applicable to construction and installation of security system components and accessories.
- D. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the OAR.
- E. Contractor's Qualifications:
1. Firms regularly engaged in the installation of Electronic Access Control systems and that have five (5) years of installation experience with systems similar to that required for this project. The Contractor shall have been actively engaged in installing, maintaining and operating similar systems and services as outlined in this document.
 2. Provide references to include client names, phone numbers and a summary of project details. These references will be checked and the clients will be asked questions relative to the performance of your company.
 3. Provide verification that installation personnel responsible have been properly trained to install the products described in this Section.
 4. Provide full time project manager with a minimum of ten (10) years field experience in installation of communications systems and infrastructures. Project manager shall be assigned for the duration of the project and shall not be replaced without written consent from the OAR.
- F. Manufacturer's Qualifications:
1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.
- G. Material and Work specified herein shall comply with the applicable requirements of:
1. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2010
 2. ANSI/NECA/BICSI-568 – Standard for Installing Commercial Building Telecommunications Cabling, 2006
 3. ANSI/TIA/EIA-606-A – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 1993-2002
 4. ANSI-J-STD-607-A – Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2002
 5. NFPA 70 – National Electric Code, 2014
 6. IBC - International Building Code, 2015
 7. UL 13 – Standard for Safety for Power-Limited Circuit Cables
 8. UL 294 – Standard for Access Control System Units, 2009
 9. UL 444 – Standard for Safety for Communications Cables
 10. UL 497B – Standard for Protectors for Data Communications and Fire-Alarm Circuits
 11. UL 681 – Standard for Safety Installation and Classification of Mercantile and Bank Burglar Alarm Systems
 12. UL 969 – Standard for Marking and Labeling Systems
 13. UL 1037 – Standard for Safety Antitheft Alarms and Devices, Third Ed.
 14. UL 1076 – Standard for Proprietary Burglar Alarm Units and Systems, Fourth Ed.
 15. IEEE 802 – Local Area Network Standard
 16. Title 47 CFR Part 15 – Radio Frequency Devices
 17. NFPA 70 – National Electric Code, 2008
 18. BICSI – Telecommunications Distribution Methods Manual, 12th Edition, 2009
 19. Applicable codes and directives of authorities having jurisdiction
- H. Work:
1. The Work shall be performed in compliance with the applicable manufacturer's installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
 2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.
 3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
 4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

1.4 CONFLICTS

- A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts between the aforementioned, notify the OAR in writing prior to commencement of affected work.

1.5 PERMITS

- A. The Contractor shall secure and pay for all necessary permits and fees required for the execution of this Work. Work will not start until all permit applications are approved.

1.6 SCHEDULING

- A. The Contractor shall comply with all scheduling requests established by OAR, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and, if accepted, will be used to track work status.
- B. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

1.7 REQUIREMENTS

- A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The OAR must approve material submittal and substitutions in writing.
- B. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.
- C. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.
- D. The requirements as given in this document are to be adhered to unless revised by the OAR in writing.
- E. The Owner reserves the right to waive these requirements at any time.

1.8 SUBMITTALS

- A. Provide all submittal requirements under this section as a single package.
- B. Submit manufacturer's data on Access Control System components including, but not limited to, electrical specifications, mechanical specifications, rough-in diagrams, and instructions for installation, operation and maintenance, suitable for inclusion in maintenance manuals.
- C. Provide Shop Drawings showing equipment/locations and arrangements. Provide an assembly drawing of every equipment rack and card cage enclosure with location and dimensions shown. Provide wiring diagrams showing all field connected wiring.
- D. Prepare and submit Phased System Testing documents and plans, Final Testing and Acceptance Plans, Test Procedures, Test Reports, and System Availability Test documents as described in this specification section.

1.9 CONTRACTOR CLOSE OUT SUBMITTALS

- A. Submit a minimum of four (4) sets of close-out documentation.
 - 1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues. Include a CD, or flash drive, containing a PDF version of the binder contents.
 - 2. A record drawing set, and supplemental documentation shall be compiled after system fabrication and testing, and shall incorporate any changes made after Shop Drawing submittal.
 - 3. The documents shall include wiring diagrams, schematics, and functional details such that any component, wire, or piece of equipment making up the system may be easily identified by going to the actual equipment and making reference to this information. Every terminal, wire, component, or piece of equipment, relay, and other such items shall have a number or letter designation.
 - 4. Provide above closeout documentation as an electronic file in PDF format. Include the following:

- a. Record drawings, with functional block diagrams, schematics, floor plans, wall fields and rack layouts.
 - b. Operation & maintenance manuals for each piece of equipment installed.
 - c. Manufacturer warranty cards and related information for each device.
 - d. All source code and configuration files for the various control system components, digital signal processors and other programmable devices. If a component fails in the future, these files will be required to configure its replacement.
- B. Turn over all keys and combinations to racks, enclosures, and any equipment equipped with locks.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer's recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.
- B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the OAR.
- C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.
- D. Provide protective covering during construction to prevent damage or entrance of foreign matter.
- E. Contractor is responsible for on-site security of tools, test equipment and materials.
- F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

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

1.12 WARRANTY

- A. Warrant labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics for one (1) year after the date of acceptance. Repair or replace defects occurring in labor or product within the Warranty period without charge.
- B. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Portions of this section are entirely performance-based. This contractor is expected to select an appropriate solution that meets the requirements below, design the system and install it.
- B. References to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction.
- C. The products specified in this document do not necessarily constitute the exhaustive list of products required to complete the statement of work. Except where described in the SUMMARY subpart of this document, the contractor is responsible for providing any other parts and materials needed to deliver a complete and working system.

2.2 INTRUSION DETECTION SYSTEM

- A. Intrusion Detection System Panel
 1. Provide a control panel for intrusion monitoring in the school at large and the kitchen.
 2. System to provide the ability to send alarm signals over the Internet.
 3. System shall utilize hard-wired zones for all devices.
 4. Include one keypad inside the main entry and one inside the kitchen access controlled door.
 5. Acceptable products:
 - a. Honeywell Vista 20P.
 - b. Honeywell 4219 Zone Expander.
 - c. Approved equivalent.

- B. Door Contacts
 1. Provide recessed door contacts on doors monitored by the intrusion detection system.
 2. Contact shall allow for up to 5/8" gap for steel doors.
 3. Contact to be 3/4" diameter.
 4. Acceptable products:
 - a. Bosch ISN-CSD70
 - b. Honeywell MPS70WG
 - c. Approved equivalent

- C. Roof Hatch Door Contacts
 1. Provide surface mount wide gap armored contacts on each roof hatch.
 2. Utilize L-brackets to adapt magnet and/or contact orientation.
 3. Acceptable products:
 - a. Interlogix Sentrol 2200 Series
 - b. Approved equivalent.

- D. Passive Infrared/ Microwave Motion Detector
 1. Install combination passive infrared and microwave technology motion detectors as shown on the design drawings, connected to the intrusion detection system.
 2. Detector to be ceiling mount.
 3. Detector shall be compensated for variances in room temperature.
 4. Detector shall be equipped with a variable sensitivity adjustment.
 5. Acceptable products:
 - a. Bosch DS9370
 - b. Approved equivalent

- E. Duress Button
 1. Install duress buttons at reception and principal's desks.
 2. Installer will coordinate with owner on exact placement.
 3. Terminate the duress button to the intrusion detection controller in IDF A226. The zone will be identified by the owner.
 4. Acceptable products:
 - a. Bosch ND 100 GLT Panic Button
 - b. Approved equivalent

2.3 VIDEO SURVEILLANCE SYSTEM

- A. Network Cameras
 1. Provide network cameras at the locations indicated in the drawing set.
 2. Camera shall have a megapixel sensor.
 3. Camera shall support H.264 or H.265 compression.
 4. Camera shall be equipped with a varifocal lens, with remote zoom and focus capability, and an automatic iris.
 5. Exterior cameras shall be weatherproof.
 6. Interior cameras shall be and vandal resistant.
 7. All cameras shall include active IR.
 8. Unit shall be powered using Power-over-Ethernet (PoE).
 9. Acceptable products:
 - a. Interior cameras.
 - 1) Panasonic WV-S2131L.
 - 2) Approved equivalent.
 - b. Exterior cameras.

- 1) Panasonic WV-V2530L1.
- 2) Approved equivalent.

B. Network Video Recorder

1. Provide Network Video Recorder (NVR) compatible with VideoInsight Video Management System.
2. Provide sufficient storage capacity within the NVR to maintain 21 days of recording for all cameras at 15 frames per second.
3. Acceptable Products:
 - a. VideoInsight NVR.
 - b. Approved equivalent.

2.4 ACCESS CONTROL SYSTEM

A. Access Control Processing

1. System: Access Control System shall be Hirsch Velocity 3.6 (existing district owned server and software.)
2. Connectivity between the server and the access control panels shall be provided over the district WAN.
3. The contractor shall be responsible for providing a complete and functional system as specified.
4. All devices required to complete the installation may not be described within this subsection, but shall be provided as if specifically called for within the specification. All system components shall be approved and certified for the function they will perform.
5. The Access Control System (ACS) shall be an enterprise-class system that supports system programming, system monitoring, administrative activities, report generation, card/credential enrollment and ID badge issuance.
6. A workstation that gives a user an interface allowing the control of the local/global sites shall be provided by Contractor or Customer as agreed upon in contract documents.
7. The Contractor shall optimize existing system settings as required by system owner to support the system operation, system monitoring, credential enrollment, badge ID issuance, and record keeping.
8. Contractor / VAR shall provide end-user training to end-user satisfaction.

B. Access Control Panels (ACPs) and Cabinet Enclosures:

1. The Access Control Panels (ACPs) shall be of a distributed database design; and shall use intelligent microprocessors to make smart decisions at the Access Control Panel.
2. Acceptable product.
 - a. Hirsch MX-8 Door Controller
 - b. Approved equivalent.
3. Power Supply(s) and Batteries: power supply and sealed back-up batteries shall be included with the ACP.
4. Tamper switch: The cabinet shall be protected by an anti-tamper device in such a way that a tamper alarm shall be generated if any portion of any door moves more than one quarter of one inch from its closed position. This alarm shall be sent to the Monitoring Station.
5. Other equipment required to provide a functional, working system.

C. Power Requirements:

1. The Access Control Panels and related hardware shall be fed from an emergency power system power at 120VAC as required.
2. Lock Power Supply:
 - a. The electric lock power supply shall be Von Duprin PS902-2RS at each door.

D. Proximity Readers

1. Provide proximity credential readers at each access controlled door.
2. Reader shall be a multi-class reader capable of reading 125 KHz proximity and 13.56 MHz contactless smart cards.
3. Reader to provide audio and visual feedback of a credential read.
4. Provide mullion readers in locations with curtain walls. Provide standard width readers in all other locations.
5. Acceptable products:
 - a. HID Global:
 - 1) ProxPoint Plus 6005

2.5 DOOR HARDWARE

A. Exit device with electric latch retraction

1. Von Duprin 98/99 with QEL option

ELECTRONIC SECURITY SYSTEMS

2. Von Duprin EPT

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions for compliance with requirements and other conditions affecting the performance of the AV System. Advise Consultant of any discrepancies between field conditions and drawings that affect subject Work. Do not proceed until unsatisfactory conditions have been corrected.
- B. Provide weekly status report. All concerns and issues related to maintaining the proposed schedule should be addressed in these reports. Issues that are not documented in this format will be considered the sole responsibility of the Contractor.
- C. It is the Contractor's responsibility to contact the General Contractor and AV Consultant to coordinate any required data cabling installation prior to commencing any installation Work.

3.2 INSTALLATION

- A. Installation shall include the delivery; unloading; setting in place; fastening to walls, floors, ceilings, counters, and other structures where required. Interconnecting wiring of the system components, equipment alignment and adjustments, and all other Work whether or not expressly required herein which is necessary to result in a complete operational system. Install system in accordance with NFPA 70 and any other National, State, and/or Local applicable codes. Install equipment in accordance with manufacturer's written instructions.
- B. During installation, and up to the date of final acceptance, the Contractor shall be under obligation to protect his finished and unfinished Work against damage and loss. In the event of any such loss or damage, the Contractor shall replace or repair such Work or equipment at no cost to Owner.
- C. Install plumb and level and secured in accordance with manufacturer's instructions.

3.3 EQUIPMENT ENCLOSURES

- A. Size equipment enclosures and load all equipment per equipment requirement. Contractor shall provide detailed rack elevations in the Contractor's submittal drawings.
- B. Power Provisions: Install a single switch in the cabinet to supply the cabinet power distribution system. Provide electrical outlets to accommodate the AC power cords of each item of equipment. Outlets should be spaced to optimize neatness of cable runs within the rack. Number of circuits and amperage requirements for each receptacle should be sized appropriately for the equipment that will be plugged into it. In systems where new-dedicated AC power is being provided, the Contractor shall bring all unterminated circuits to a junction box within each equipment enclosure where the electrical Contractor will tie them in. The junction boxes should provide knockouts for various standard conduit sizes. For systems utilizing existing power outlets, the Contractor shall provide appropriate power distribution within the equipment enclosure terminating to an approved electrical connector and providing the necessary jacketed cabling to reach the existing power outlet.
- C. Ventilation: Provide in the cabinet a low-noise fan for forced air ventilation. Equip fan with a filtered input vent and connect to operate from 105-130-V, 60 Hz electrical power, partly fused and switchable and arranged to be powered whenever the main cabinet power switch is on.
- D. Equipment Rack: Mount equipment in 19-inch racks in accordance with Electronic Industries Association Standards: Group items of the same function together, either vertically or side-by-side. Arrange controls symmetrically. Make all power supply connections, AC and DC, with approved plugs and receptacles. Arrange all inputs, outputs, interconnections, and test points so they are accessible at the rear of the rack for maintenance and testing, with each item removable from the rack without disturbing other items or connections. Cover empty space in equipment racks with blank panels so that the entire front of the rack is occupied. Provide ventilated rear and side panels. Provide louvers in panels to insure adequate ventilation. Provide racks and panels with a uniform baked-enamel factory finish over rust-inhibiting primer.

3.4 GROUNDING

- A. Provide equipment-grounding connections for system as indicated. Tighten connections to comply with tightening torque specified in UL Standard 486A to secure permanent and effective grounds.
- B. System Grounding:
 - 1. Equipment: A separate 12-gauge copper insulated ground conductor shall connect the chassis of each piece of equipment to the ground buss. Connections to the buss shall be secured by machine screws at holes, which are drilled and tapped. All connections shall be properly crimped and soldered as provided elsewhere.
 - 2. Under no conditions shall the AC neutral conductor, either in the power panel or in a receptacle outlet, be used for a system ground.
 - 3. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 0.1-ohm ground at main equipment location. Measure, record, and report ground resistance. Provide isolation transformers as necessary.
 - 4. Technical Grounding: All equipment within the technical power system will be grounded back to the technical reference ground using an isolated star grounding system. Technical ground is insulated and isolated from all other systems, except at the electrical connection where the master technical ground connects to the neutral bus, and ground electrode system at the service entrance equipment.

3.5 FIELD QUALITY CONTROL

- A. Pre-testing: Upon completing installation of the system, align, adjust, and balance the system and perform complete pre-testing. Determine, through pre-testing, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pre-testing. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.
- B. Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the systems.
- C. Testing: Upon completion of pre-testing, notify the Consultant a minimum of 10 days in advance of acceptance test performance. Schedule and conduct tests in his presence. Provide a written record of test results.
- D. Retesting: Rectify deficiencies indicated by tests and completely retest Work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards. Provide a written record of all retest results.

3.6 COMMISSIONING

- A. Test all Audio-Video System components, in the presence of the Owner, and/or Owner Authorized Representative, for compliance with the performance standards.
- B. Check all control functions, from all controlling devices to all controlled devices, for proper operation.
- C. Adjust, balance, and align all equipment for optimum quality and to meet the manufacturer's published specifications. Establish and mark normal settings for all level controls, and record these settings in the "System Operation and Maintenance Manual".
- D. Upon approval or the Contractor's test report, and at the time set by the Consultant, demonstrate that the final system adjustments and tests meet the performance requirements. Provide all labor, materials, tools and measurement equipment for these tests and adjustments.
- E. The Contractor is responsible for all costs incurred to satisfy criteria requirements.
- F. Deliver "Operation and Maintenance" manuals and "Instruction Guides" to Owner.
- G. Clearly label all critical settings of knobs, levers, and switches with a visible tag to signify optimal settings of all audio and video equipment.
- H. Post Occupancy Adjustments: When requested by the Consultant within one (1) year of final acceptance provide up to three (3) separate, two (2) day, on-site assistance visits in adjusting sound levels and

equalizers, adjusting visual displays, control system programming additional system presets, and adjusting controls to suit actual occupied conditions.

3.7 TRAINING

- A. Upon completion of any punch list items and submittal delivery, the Contractor shall coordinate with Consultant and the Owner to schedule the following training sessions:
- B. One two-hour session to train end users on basic system operations in a group style format.

END OF SECTION