SECTION 270000 - COMMUNICATIONS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of General Requirements/Provisions shall be considered a part of this section and shall have the same force as if printed herein full. In addition, all information related to communications infrastructure that is documented in the architectural, structural, mechanical, and electrical drawings/documents shall be included as part of the Communications documents.

1.02 QUALITY ASSURANCE

A. Specifications, Standards and Codes: All work shall be in accordance with the following:

1. 2020 National Electrical Code (NFPA 70) with Georgia Amendments.
2. 2018 Life Safety Code (NFPA 101) with Georgia Amendments.
3. 2018 International Building Code with Georgia Amendments.
4. TIA-568.0-X - Generic Telecommunications Cabling for Customer Premises.
5. TIA-568.1-X - Commercial Building Telecommunications Infrastructure Standard.
6. TIA-568-C.X – Twisted-Pair Copper Cabling and Components Standard.
7. TIA-568.3-X – Optical Fiber Cabling and Components.
8. TIA-568-C.X – Broadband Coaxial Cabling and Components.
9. TIA-569 - Telecommunications Pathway and Spaces.
10. TIA-570 - Residential Telecommunications Infrastructure Standard.
11. TIA-598 - Fiber Optic Color Codes.
12. TIA-607-X - Generic Telecommunications; Bonding and Grounding (Earthing) for Customer Premises.
13. TIA-758 - Customer-Owned Outside Plant Telecommunications Infrastructure Standard.
14. TIA-526-7 - Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant.
15. TIA-526-14 - Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant.
16. BICSI Telecommunications Distribution Methods Manual (Latest Edition including all addendums).
17. IEEE 1100 – Recommended Practice for Powering and Grounding Electronic Equipment (The Emerald Book).
18.
19. American National Standards Institute (ANSI)
20. NEMA WC 26 - Wire and Cable Packaging (Current Version adopted by the State, per NFPA website).
21. Electronic Industries Association (EIA)
22. Underwriters Laboratories (UL)
23. American Standards Association (ASA)
24. Federal Communications Commission (FCC)
25. Occupational Safety and Health Administration (OSHA)
26. American Society of Testing Material (ASTM)

27. Americans with Disabilities Act (ADA)
28. Local city and county ordinances governing electrical work
29. In the event of conflicts, the more stringent provisions shall apply.

1.03 SCOPE

A. The work to be done under this section of the Specifications shall include furnishing labor, material, equipment and tools required for the complete installation of the work indicated on the Drawings or as specified herein.

B. All materials, obviously a part of the Communications Infrastructure and necessary to its proper operation, but not specifically mentioned or shown on the Drawings, shall be furnished and installed without additional charge.

C. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawing and Specifications, the higher cost shall be included, and the Design Professional shall be notified of the discrepancy.

1.04 WORK INCLUDED

The Communications Infrastructure installed and work performed under this Division of the Specifications shall include but not necessarily be limited to the following:

A. Voice/Data Cabling Infrastructure

B. CATV Cabling Infrastructure System (where indicated in drawings and specifications)

C. Communications conduits, raceways, cable tray, racks, cabinets and equipment mounting boards (where indicated in drawings and specifications)

D. Grounding and Bonding

E. Concrete work for wall and floor penetrations (where indicated in drawings and specifications)

1.05 DEFINITIONS

A. Terms: The following definitions of terms supplement those of the General Requirements and are applicable to Division 27 - Communications:

B. Provide: As used herein shall mean "furnish, install and test (if applicable) complete."

C. Infrastructure: As used herein shall mean cable, conduit, raceway, cable tray or j-hooks with all required boxes, fittings, connectors, and accessories; completely installed.

D. Work: As used herein shall be understood to mean the materials completely installed, including the labor involved.

1.06 DRAWINGS

A. Drawings are generally diagrammatic and show the arrangement and location of pathways, outlets, support structures and equipment. The Construction Professional shall carefully investigate the structural and finish conditions affecting his work and arrange his work accordingly. Should conditions on the job make it necessary to adjust pathways or materials, the Construction Professional shall so advise the Design Professional and secure approval before proceeding with such work.

B. Where exact locations are required by equipment for stubbing-up and terminating conduit concealed in floor slabs, the Construction Professional shall request shop drawings, equipment location drawings, foundation drawings, and any other data required by him to locate the concealed conduit before the floor slab is poured.

C. Materials, equipment, or labor not indicated but which can be reasonably inferred to be necessary for a complete installation shall be provided. Drawings and Specifications do not undertake to indicate every item of material, equipment, or labor required to produce a complete and properly operating installation.

D. The right is reserved to make reasonable changes in locations of equipment indicated on Drawings prior to rough-in without increase in contract cost.

E. The Construction Professional shall not reduce the size or number of conduit runs indicated on the Drawings without the written approval of the Design Professional.

F. Any work installed contrary to Contract Drawings shall be subject to change as directed by the Design Professional, and no extra compensation will be allowed for making these changes.

G. The location of equipment, support structures, outlets, and similar devices shown on the Drawings are approximate only. Do not scale Drawings. Obtain layout dimensions for equipment from Architectural plans unless indicated on Communications plans.

H. Schematic diagrams shown on the Drawings indicate the required functions only. The technology of a particular manufacturer may be used to accomplish the functions indicated without exact adherence to the schematic Drawings shown. Additional labor and materials required for such deviations shall be furnished at the Construction Professional's expense.

I. Verify the ceiling type, ceiling suspension systems, and clearance above hung ceilings prior to ordering cabling and associated hardware. Notify the Design Professional of any discrepancies.

J. Review all architectural drawings for modular furniture.

K. Portions of these Drawings and Specifications are abbreviated and may include incomplete sentences. Omissions of words or phrases such as “the Construction

Professional shall," "shall be," "as indicated on the Drawings," "In accordance with," "a," "the" and "all are intended" shall be supplied by inference.

1.07 SUBMITTALS

A. Submit for approval, details of all materials, equipment, and systems to be furnished. Work shall not proceed without the Owner and/or the Project Manager's approval of the submitted items. Three (3) copies of the following shall be submitted:

1. Submittals for individual systems and equipment assemblies that consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered, reviewed, or stored, and such submittals will not be returned except at the request and expense of the Construction Professional.

2. Construction Professional shall generate shop drawings. Shop drawings shall include equipment racks, patch panels, termination blocks, connection details, rack mounting details, workstation/ patch panel labeling scheme, and any other details not included in the construction drawings.

3. Shop drawings shall be generated using AutoCAD or Revit software and shall include Construction Professional's title block. Shop drawings shall provide all necessary information for the installation of the system by Construction Professional's personnel and for future maintenance and modification of the system as required.

B. Any materials and equipment listed that are not in accordance with Specification requirements may be rejected.

C. The Construction Professional shall obtain complete shop drawings, product data and samples from the manufacturers, suppliers and vendors, for all materials and equipment as specified herein in various Sections of the Specifications, and shall submit data and details of such materials and equipment for review by the Design Professional. Prior to submission of the shop drawings, product data and samples to the Design Professional, the Construction Professional shall thoroughly review the shop drawings, product data and samples and certify they are in compliance with the Contract Drawings. Further, the Construction Professional shall check all materials and equipment upon their arrival on the Project site and verify their condition and compliance with the Contract Documents. Any Work which proceeds prior to receiving reviewed shop drawings shall be modified as required to comply with the Contract Documents and the shop drawings. A minimum period of ten (10) working days, exclusive of transmittal time, will be required in the Design Professional's office each time a shop drawing, product data and/or sample is submitted or resubmitted for review. This time period shall be considered by the Construction Professional when scheduling his Work. The initial shop drawing review for equipment and materials may be expedited through the mutual consent of the Construction Professional, Design Professional and Owner providing the Construction Professional agrees to submit complete, certified, documented, and coordinated shop drawings for review in accordance with the requirements of the Contract Documents.

D. The review of shop drawings, product data, and samples by the Design Professional shall not relieve the Construction Professional of the responsibility for dimensions or errors that may be contained therein, or for deviations from requirements in the Contract Documents. Is shall be clearly understood that the noting of some errors by the Design Professional but overlooking others does not grant the Construction Professional permission to proceed in error.

E. All shop drawings and product data/submittals shall be submitted in compliance with the requirements of the general and supplementary conditions. No more than four (4) copies of submittal data will be reviewed. Any additional copies will be returned unmarked. The responsibility of copying review comments on any additional copies will rest solely with the Construction Professional.

F. All product data/submittals shall bear the name of the manufacturer to be used.

G. All shop drawings and submittals shall include a stamped indication signifying that the submittal has been reviewed for compliance with the Contract Documents by the Construction Professional. This stamped indication also represents the fact that the Construction Professional has checked this submittal for its interaction with all other Divisions and certifies by his signature or initials that all coordination has taken place. The stamp shall include the date, name of the Contracting Firm, the signature of the Construction Professional, certification of compliance and approval. This stamp shall be on the submittal before the Design Professional will review it.

H. The Design Professional will review an individual submittal not more than twice. If the submittal is rejected again on the second review, the Construction Professional will bare all responsibility for paying for the Design Professional's time for additional reviews.

1.08 RECORD (AS-BUILT) DRAWINGS AND MAINTENCE MANUALS

A. The Construction Professional shall maintain on a daily basis at the Project site a complete set of "Record Drawings". The "Record Drawings" shall consist of a set of prints or AutoCAD files of the Construction Professional Coordination Drawings for this Division. The prints shall be marked or the AutoCAD file electronically updated to show the precise location of all buried or concealed work and equipment, including embedded conduit and junction boxes, and all changes and deviations in the Electrical work from that shown on the Contract Documents. This requirement shall not be construed as authorization for the Construction Professional to make changes in the layout or work without definite instructions from the Design Professional. Prior to commencing work, the Construction Professional shall obtain from the Design Professional a set of AutoCAD Release 2013 or compatible format Design Professional's Drawings on CD, to be used only to produce the Construction Professional's Coordination Drawings. The continuously update coordination drawings shall be used to produce the final "Record Drawings" which shall be delivered to the Owner in AutoCAD electronic format upon Project completion. The Construction Professional shall give to the Design Professional a written release acceptable to the Design Professional signed by a corporate officer of the Construction Professional prior to receipt of the Design Professional's Drawings.

B. Also provide the following documents for record to the tenant / owner at the conclusion of the project.

C. Test results with a clear indication of project. Also provide all test results in CSV format. Test results shall include testing of all system horizontal and all system backbone cabling.

D. Drawings with data equipment rack elevations

E. Floor plan with layouts indicating outlet locations and outlet labels.

F. A complete voice and data cabling system layout. This should include but not limited to cable routing, telecom closet(s), telecom outlet / connector label, locations of equipment and termination points.

G. Copy of the manufacturer's technical documentation on all devices used within the cabling system.

H. The design and engineering performed for the cabling system shall be approved by an accredited "Registered Communications Distribution Designer" (RCDD) as defined by Building Industry Consulting Service International (BICSI).

1.09 QUALITY ASSURANCE

A. Equipment and materials required for installation under these Specifications shall be the current model and new (less than one [1] year from the date of manufacture), unused and without blemish or defect.

B. Equipment shall bear labels attesting to Underwriters Laboratories, where subject to label service. Manufacturers of equipment and materials pertinent to these items shall have been engaged in the manufacture of said equipment a minimum of three (3) years and, if so directed by the Owner, be able to furnish proof of their ability by submitting affidavits and descriptive data about their product including size and magnitude comparable to requirements specified herein.

1.10 CONSTRUCTION PROFESSIONAL QUALIFICATIONS

A. The Construction Professional shall have total responsibility for the coordination and installation of the work shown and described in the Drawings and Specifications. The Construction Professional shall be a company specializing in the design, fabrication and installation of integrated communications systems.

B. Communications Systems specified shall be installed under the direction of a qualified Construction Professional. Qualification requirements shall include submittal by the Construction Professional to the Design Professional of the following:

1. List of previous projects of this scope, size, and nature; including names and sizes of projects, description of work, time of completion and names of contact persons for reference.

2. Shall certify that they are manufacturer-authorized for work to be performed.

C. Installer: Minimum of one BICSI certified Technician on the job site at all times with documented formal training in the installation of Category 6, Category 6A and fiber optic cabling systems. 50% of onsite installers shall possess a certification for a total systems solution being installed from the manufacturer of the cabling and terminating hardware. The contractor must present these certifications to the EOR before beginning work.

D. Installer Company: Full time BICSI RCDD with current credentialing on staff. Company specializing in the installation of Category 6, Category 6A, and single-mode fiber optic Structured Cabling Systems with a minimum of 5 years documented experience. Installation certification – 50% of Low voltage installers must be trained by the manufacturer and currently certified to install manufactures product line of copper/fiber wiring. Provide current installer certifications before doing any copper or fiber installations. This certification is part of the warranty.

1.11 COORDINATION WITH OTHER TRADES

A. The Construction Professional shall coordinate communications work with that of other sections as required in order to ensure that the entire communications work will be carried out in an orderly, complete and coordinated fashion.

1.12 SITE INVESTIGATION

A. Prior to submitting bids of the project, visit the site of the work to become aware of existing conditions that may affect the cost of the project. Where work under this project requires extension, relocation, reconnections or modifications to existing equipment or systems, the existing equipment, or systems, shall be restored to their original condition before the completion of this project.

1.13 PERMITS

A. Obtain all permits and inspections for the installation of this work and pay all charges incident thereto. Deliver to the Owner all certificates of said inspection issued by authorities having jurisdiction.

1.14 RENOVATIONS AND ADDITIONS

A. All work that would adversely affect the normal operation of the other portions of the Owner's property shall be done at a time other than normal working hours. Normal working hours shall be considered 8 a.m. to 5 p.m. Monday through Friday.

B. Interruption of existing telephone/internet service: Do not interrupt service to facilities occupied by Owner or other unless permitted under the following conditions:
   1. Notify Owner no fewer than 14 days in advance of proposed interruption of telephone service.

C. Prior to submitting bids on the project, visit the site of the work to become aware of existing conditions that may affect the cost of the project.

D. Where work under this project requires extension, relocation, reconnections or modifications to existing equipment or systems, the existing equipment or systems shall be restored to their original and operating condition. Remove all equipment indicated to be demolished, including outlets, devices, raceways and support structures.

E. Care shall be exercised in the removal and storage of equipment indicated to be relocated or removed and reused. Prior to placing back into service, equipment shall be cleaned, and all marred or chipped paint surfaces shall be touched-up.

F. Provide all coring, cutting, and patching to existing walls, floors, etc., required for the removal of existing work or the installation of new work.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Where equipment is identified by manufacturer and catalog number, it shall be as the base of requirements for quality and performance. Where manufacturers for equipment are identified by name, the Construction Professional may submit for approval, similar equipment of other manufacturers as substitution. The Design Professional's decision as to whether the submitted equipment is acceptable shall be final and binding.

B. All changes necessary to accommodate the substituted equipment shall be made at the Construction Professional's expense and shall be as approved by the Design Professional. Detailed drawings indicating the required changes shall be submitted for approval at the time the substitution is requested.

C. If substitutions are made in lieu of device specified; form, dimension, design and profile shall be submitted to the Design Professional for approval.

D. Submit request for approval of substitute materials in writing to the Design Professional at least ten days prior to bid opening.

2.02 MATERIALS

A. All materials used in this work shall be new and shall bear the inspection label of Underwriters' Laboratories Inc. or certification by other recognized laboratory.

B. The published standards and requirements of the Telecommunications Industries Association (TIA), National Electrical Manufacturers Association (NEMA), the American National Standard Institute (ANSI), the Institute of Electrical and Electronic Engineers (IEEE), and the American Society of Testing Materials (ASTM), are made a part of these Specifications and shall apply wherever applicable.

C. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts are available.

D. When more than one unit of the same class of equipment or material is required, such units shall be the products of a single manufacturer or partner manufacturers that offer a certified solution.

E. Components of an assembled unit need not be products of the same manufacturer but must offer a certified end-to-end solution.

F. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.

G. Components shall be compatible with each other and with the total assembly for the intended service.

PART 3 - EXECUTION

3.01 EXAMINATION OF CONDITIONS

A. Prior to the start of work, the Construction Professional shall carefully inspect the installed work of other trades and verify that such work is complete to the point where installation may properly commence. Start of work indicates acceptance of conditions.

B. Install equipment in accordance with applicable codes and regulations, the original design, and the referenced standards.

C. In the event of a discrepancy, immediately notify the Project Manager.

D. Do not proceed with installation until unsatisfactory conditions and discrepancies have been fully resolved.

3.02 PROTECTION OF SYSTEMS AND EQUIPMENT

A. Protect materials and equipment from damage during storage at the site and throughout the construction period. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, theft, moisture, extreme temperature, and rain.

B. Damage from rain, dirt, sun and ground water shall be prevented by storing the equipment on elevated supports and covering the sides with securely fastened protective rigid or flexible waterproof coverings.

C. During installation, equipment shall be protected against entry of foreign matter on the inside and be vacuum cleaned both inside and outside before testing, operating, or painting.

D. As determined by the Project Manager, damaged equipment shall be fully repaired or shall be removed and replaced with new equipment to fully comply with requirements of the Contract Documents. Decision of the Project Manager shall be final.

E. Damaged paint on equipment and materials shall be repainted with painting equipment and finished with the same quality of paint and workmanship as used by the manufacturer.

3.03 ACCESS TO EQUIPMENT

A. Equipment shall be installed in location and manner that will allow convenient access for maintenance and inspection.

B. Working spaces shall be not less than specified in the National Electrical Code (NEC) for voltages specified.

C. In the preparation of Drawings, a reasonable effort to accommodate acceptable equipment manufacturer's space requirements has been made. However, since space requirements and equipment arrangement vary according to each manufacturer, the responsibility for initial access, maintenance access, code required access, and proper fit rests with the Construction Professional.

D. Physical dimensions and arrangements of equipment to be installed shall be subject to the Design Professional's review.

E. Where the Project Manager determines that the Construction Professional has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled, one time only, as directed by the Project Manager, at no additional cost to the Owner. "Conveniently accessible" is defined as being capable of being reached without the use of ladders or without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping, and duct work.

F. The Construction Professional shall coordinate the installation of ductwork, conduit, busway, piping, cable trays, etc., installation with lighting fixtures, special ceiling construction, air distribution equipment, and the structure. Provide additional rises, drops and offsets as required. If after installed, new ductwork, conduit, busway, piping or cable is found to be in conflict with the architecture, structure, or other trade Work which is either existing or shown on the Contract Documents, the ductwork, conduit, busway, piping or cable shall be relocated without additional cost to the Owner.

G. No conduit, equipment, cabling, etc., shall be installed in the eight (8) inch high zone directly above the ceiling in tenant areas to allow for tenant build-out and flexibility unless otherwise specifically shown on the Drawings or prior written authorization is received from the Design Professional.

H. Cabling, cable tray, etc., shall be installed in accessible locations, avoiding obstructions, preserving headroom, and keeping openings and passageways clear.

I. Minor adjustments in the locations of equipment shall be made where necessary, providing such adjustments do not adversely affect functionality of the equipment.

J. The Owner's representative will periodically review the progress of the cabling installation.

3.04 CLEANING

A. During construction, and prior to Owner acceptance of the building, remove from the premises and dispose of packing material and debris caused by communications work.

B. Remove dust and debris from interiors and exteriors of electrical equipment. Clean accessible current carrying elements prior to being energized.

3.05 COMPLETION

A. General: Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools, and similar items. Leave the premises clean, neat, and orderly.

B. Results Expected: Systems shall be complete and operational, and controls shall be set and calibrated. Testing, start-up, and cleaning work shall be complete.

C. Maintenance Materials: Special tools for proper operation and maintenance of the equipment provided under this Specification shall be delivered to the Owner.

3.06 TESTING AND VERIFICATION

A. See specific Division 27 sections for testing parameters of sub-systems.

B. The Construction Professional shall verify that requirements of this Specification are met. Verification shall be through a combination of analyses, inspections, demonstrations and tests, as described below.

C. Verification by inspection includes examination of items and comparison of pertinent characteristics against the qualitative or quantitative standard set forth in the Specifications. Inspection may require moving or partially disassembling the item to accomplish the verification, included as part of the work at no additional cost to the Owner.

D. The Construction Professional shall verify by formal demonstrations or tests that the requirements of this Specification have been met. The Construction Professional shall demonstrate that the communications systems, components, and subsystems meet Specification requirements in the "as-installed" operating environment during the "System Operation Test." Even though no formal environmental testing is required, the Construction Professional shall measure and record temperature, humidity and other environmental parameters and the environmental conditions, which were encountered during the "System Operation Test."

E. The Construction Professional shall carefully plan and coordinate the final acceptance tests so that tests can be satisfactorily completed. The Construction Professional shall provide necessary instruments, labor and materials required for

tests, including the equipment manufacturer's technical representative and qualified technicians in sufficient numbers to perform the tests within a reasonable time.

F. The Construction Professional shall satisfy all items detailed in the final acceptance check-off list (punch list). The list shall be a complete representation of specified installation requirements. At the time of final acceptance punch list items shall be corrected until the system is found to be acceptable to the Owner and the Project Manager.

G. The installer will be required to repair or replace any section of cable that does not meet the specified test results. After repair, this section of cable shall be retested. For any area requiring this replace/repair and retesting, the installer shall update the original test results documentation.

H. After the Construction Professional systems have been installed and tested, the completed test plan shall be signed by the Communications Construction Professional Project Manager and submitted for approval.

I. All delivered documentation will be reviewed for completeness and compliance to the specifications. Any item that is not acceptable by the owner will be returned to the Installer, the error or omission shall be corrected by the installer and returned to the Owner in a period of 7 days.

END OF SECTION 270000

SECTION 270510 - FIRESTOPPING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Firestopping for Communications Systems.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver Products in manufacturer's original unopened containers or packages with labels intact, identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions, where applicable.

B. Store and handle materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.05 PROJECT CONDITIONS OR SITE CONDITIONS

A. Environmental Requirements:
   1. Do not install materials when temperature of substrate material and ambient air is below 60 degrees F.
   2. Maintain minimum temperature before, during, and for 3 days after installation of materials.
   3. Keep away from heat, open flame, sparks, or other sources of ignition until curing is complete. Use only with adequate ventilation.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Firestopping Manufacturer(s)

   1. Flamestopper Thru-Wall Fitting - Legrand Company (Firestop Devices)

2. Unique Firestop Products (Firestop Devices)
3. Specified Technologies Incorporated (STI) (Firestop Devices, Putties, Caulks, Sealants, etc.)
4. Hilti Firestop Systems (Firestop Devices, Putties, Caulks, Sealants, etc.)
5. Nelson Firestop Products (Firestop Devices)
6. Tremco Firestop Systems (Firestop Devices, Putties, Caulks, Sealants, etc.)
7. Rectorseal (Putties, Caulks, Sealants, etc.)

2.02 TYPES OF PRODUCTS

A. Sealants

1. Intumescent Firestop Sealants and Caulks
2. Latex Firestop Sealant
3. Acrylic Water-Based Sealant
4. Silicone Firestop Sealants and Caulks
5. Firestop Putty
6. Firestop Collars
7. Wrap Strips
8. 2-Part Silicone Firestop Foam
9. Firestop Mortar
10. Firestop Pillows
11. Elastomeric Spray
12. Accessories:
13. Forming/Damming Materials: Mineral fiberboard or other type as per manufacturer recommendation

B. Firestop Devices

1. Thru-Wall Fitting (Flamestopper by Legrand)
    a. The firestop device box shall be constructed of 16 gage G90 steel.
    b. The firestop device intumescent block shall be constructed of a graphite base material with expansion starting at 375°F and an unrestrained expansion between 6 to 12 times. The intumescent block shall be held securely by the box in order to prevent tampering and damage during installation.
    c. The firestop device shall have doors which can be adjusted to prevent materials from penetrating the device if the device is empty or completely full. The doors shall be constructed of 16 gage G90 steel with No. 10-32 screws use to adjust opening size.
    d. The firestop device shall be available for 2" and 4" trade size EMT conduit.
    e. The firestop device shall be available in safety yellow powder coat, custom colors and an unpainted galvanized finish.
2. Threaded Firestop Device (Unique Firestop Products)
    a. Threaded steel sleeve device incorporating flat washers secured by threaded device shall be installed around cables. The device shall be available in 1, 2 and 4-inch sizes. Maximum diameter of the wall penetration for 1, 2 and 4-inch sizes shall be 1-1/4, 2-7/16 and 4-1/2 inches respectively.
3. Smooth Firestop Device (Unique Firestop Products)

a. Smooth steel sleeve device incorporating flat washers secured by sliding compression couplers. The device shall be available in 1, 2 and 4-inch sizes. Maximum diameter of the wall penetration for 1, 2 and 4-inch sizes shall be 1-1/4, 2-7/16 and 4-1/2 inches respectively.

4. Split-Sleeve Firestop Device (Unique Firestop Products)
   a. Threaded steel sleeve halves incorporating split couplings and slotted washers to fit the specific diameter of the opening. The device shall be available in 1, 2 and 4-inch sizes. Maximum diameter of the wall penetration for 1, 2 and 4-inch sizes shall be 1-1/4, 2-7/16 and 4-1/2 inches respectively.
5. Fire Rated Cable Pathway (STI EZ-PATH)
   a. Fire rated cable pathway device modules shall be comprised of steel raceway with intumescent foam pads allowing 0-100 percent cable fill.
   b. Capable of being retrofitted around existing cables. Capable of ganging multiple units together.
6. Ready Sleeve (STI)
   a. Sleeve kit device designed for new cabling penetrations, available in 1-inch, 2-inch, and 4-inch diameters.
   b. Kit consists of steel sleeve, steel escutcheon plates with intumescent gaskets, and firestop putty.

2.03 UL CLASSIFICATION

A. Thru-Wall Fitting - The firestop device for use in through-penetration firestop systems shall have been examined and tested by Underwriters Laboratories Inc. to UL1479 (ASTM E 814) and bear the U.S. and Canadian UL Classification Mark.

B. Threaded, Smooth and Split-Sleeve Firestop Devices - Firestopping sealants and devices shall be used together as a firestop system. All firestop systems shall bear a UL Classification system number. UL Classification system numbers are as follows:

1. Threaded Firestop System
   a. Block Wall - W-J-3049
   b. Dry Wall - W-L-3138
2. Threaded Firestop System (Vertical)
   a. Slab - F-A-3010
3. Smooth Firestop System
   a. Block Wall - W-J-3048
   b. Dry Wall - W-L-3137
4. Split-Sleeve Firestop System
   a. Block Wall - W-J-3047
   b. Dry Wall - W-L-3136

2.04 FIRESTOPPING SYSTEMS

A. Thru-Wall Fitting Firestop System:

1. The device shall be classified for use in one-, two-, three, and four-hour rated gypsum, concrete and block walls and provide a maximum L rating

of six cfm. The devices shall also been tested by Underwriters Laboratories Inc. to UL2043 and determined to be suitable for use in air handling spaces.

B. Threaded, Smooth and Split-Sleeve Firestop Systems:

1. Shall conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire tests in a configuration that is representative of field conditions.
2. The F rating must be a minimum of one (1) hour but not less than the fire resistance rating of the assembly being penetrated. T rating shall be based on measurement of the temperature rise on penetrating item(s). The fire test shall be conducted with a minimum positive pressure differential of 0.01 inches of water column.
3. For joints, must be tested to UL 2079 with movement capabilities equal to those of the anticipated conditions.

C. Firestopping materials and systems must be capable of closing or filling through-openings created by 1) the burning or melting of combustible pipes, cable jacketing, or pipe insulation materials, or 2) deflection of sheet metal due to thermal expansion (electrical & mechanical duct work).

D. Firestopping material shall be asbestos and lead free and shall not incorporate nor require the use of hazardous solvents.

E. Firestopping sealants must be flexible, allowing for normal pipe movement.

F. Firestopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surfaces.

G. Firestopping materials shall be moisture resistant and may not dissolve in water after curing.

PART 3 - EXECUTION

3.01 CONDITIONS REQUIRING FIRESTOPPING

A. General

1. Provide firestopping for conditions specified whether or not firestopping is indicated, and if indicated, whether such material is designed as insulation, safing, or otherwise.

B. Through-Penetrations

1. Firestopping shall be installed in all open penetrations and in the annular space in all penetrations in any bearing or non-bearing fire-rated barrier.

C. Membrane-Penetrations

1. Where required by code, all membrane-penetrations in rated walls shall be protected with firestopping products that meet the requirements of third-party time/temperature testing.

D. Construction Joints/Gaps

1. Firestopping shall be provided between the edges of floor slabs and exterior walls, between the tops of walls and the underside of floors, in the control joint in masonry walls and floors and in expansion joints.

E. Smoke-Stopping

1. As required by the other sections, smoke-stops shall be provided for through-penetrations, membrane-penetrations, and construction gaps with a material approved and tested for such application.

3.02 EXAMINATION

A. Examine the areas and conditions where firestops are to be installed and notify the Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Verify that environmental conditions are safe and suitable for installation of firestop products.

C. Verify that all pipes, conduit, cable, and other items that penetrate fire-rated construction have been permanently installed prior to installation of firestops.

3.03 INSTALLATION

A. Preparation
1. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping material.
2. Remove incompatible materials which may affect bond.
3. When required to properly contain firestopping materials within openings, damming or packing materials may be utilized. Combustible damming material must be removed after appropriate curing. Noncombustible damming materials may be left as a permanent component of the firestop system.

B. General

1. Installation of firestops shall be performed by an applicator/installer qualified and trained by the manufacturer. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.
2. Apply firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, and manufacturer's recommendations.
3. Unless specified and approved, all insulation used in conjunction with through-penetrants shall remain intact and undamaged and may not be removed.
4. Seal holes and penetrations to ensure an effective smoke seal.

5. In areas of high traffic, protect firestopping materials from damage. If the opening is large, install firestopping materials capable of supporting the weight of a human.
6. Insulation types specified in other sections shall not be installed in lieu of firestopping material specified herein.
7. All combustible penetrants (e.g. non-metallic pipes or insulated metallic pipes) shall be fire-stopped using products and systems tested in a configuration representative of the field condition.
8. All sleeves in gypsum board walls shall be installed and mechanically supported to manufacturer's recommendations.
9. Maintain percent fill of device to manufacturer's maximum rating or less.

3.04 FIELD QUALITY CONTROL

A. Prepare and install firestopping systems in accordance with manufacturer's printed instructions and recommendations.

B. Follow safety procedures recommended in the Material Safety Data Sheets.

C. Finish surfaces of firestopping that are to remain exposed in the completed work to a uniform and level condition.

D. All areas of work must be accessible until inspection by the applicable Code Authorities.

E. Correct unacceptable firestops and provide additional inspection to verify compliance with this Specification.

3.05 CLEANING

A. Clean excessive fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturer's of firestopping Products and of products in which opening and joints occur.

B. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations.

C. If damage occurs, cut out and remove damaged or deteriorated firestopping and install new materials.

3.06 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 270510

SECTION 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Grounding and Bonding for Communications Systems.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.
B. Provide resistance testing results as outlined in Part 3

1.03 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Equipment Grounding Conductor Manufacturer(s)

1. Southwire
2. Belden
3. West Penn
4. Anixter
5. Okonite
6. General Cable

B. Approved Grounding Lug Manufacturer(s)

1. 3M
2. Burndy
3. Buchanan
4. Thomas & Betts
5. Chatsworth Products, Inc.

C. Approved Grounding Busbar Manufacturer(s)

1. Chatsworth Products, Inc.
2. B-Line/Cooper
3. Harger
4. Burndy
5. Legrand

2.02 GROUNDING CONDUCTORS

A. Grounding Conductor

1. Construction shall be Type THHN copper conductors, insulated with heat and moisture resistant PVC over which a UL listed jacket is applied.
2. Jacket color shall be green or black. Black jacketed cable shall be identified at each termination point with a wrap of green tape.

2.03 GROUNDING LUGS

A. Grounding Lugs and Hardware

1. Grounding lugs shall be 2-hole and installed with a crimper that when properly executed the die of the crimper impresses the die # on the lug base. All lugs shall be sleeved with clear heat-shrink to allow for inspection of the crimp. Silicon bronze or stainless-steel bolts and washers shall be used to install lugs to equipment. Exothermic welding is also allowed.

2.04 GROUNDING BUSBARS

A. Grounding Busbar

1. The grounding busbar shall be made of 1/4" thick solid copper.
2. The grounding busbar shall be installed with minimum clearance from mounting surface, 1" offsets and 1-1/2" insulators.
3. The grounding busbar shall accommodate 2-hole compression lugs.
4. The grounding busbar shall meet or exceed ANSI/TIA-607-D requirements.
5. Telecommunications main grounding busbar (TMGB) / Primary Bonding Busbar (PBB)
   a. Minimum size will be **4 inch H x 0.25 inch W x 24 inch L**. The TMGB/PBB shall be mounted as close as possible to the building grounding electrode system busbar to keep the Telecom Bonding Conductor (TBC) as straight and as short as possible.
6. Telecommunications grounding busbar (TGB) / Secondary Bonding Busbar (SBB)
   a. Minimum size will be 2 inch H x 0.25 inch W x 12 inch L.

PART 3 - EXECUTION

3.01 GROUNDING

A. The facility shall be equipped with a Communications Bonding Backbone (TBB). This backbone shall be used to ground all communications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor. The TBB shall be installed

independent of the building's electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA-607-D Telecommunications Bonding and Ground Standard.

B. The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding busbar (TMGB) / Primary Bonding Busbar (PBB). Each telecommunications room (TR) shall be provided with a telecommunications ground busbar (TGB) / Secondary Bonding Busbar (SBB). The TMGB/PBB shall be connected to the building electrical entrance grounding facility. Project drawings shall indicate whether telecommunication ground busbars are provided by electrical contractor or by telecom contractor.

C. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the MC/IC/TC shall be grounded to the respective TGB/SBB or TMGB/PBB using a minimum #6 AWG stranded copper bonding conductor and compression lugs.

D. All wires used for communications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap or green tape. All cables and busbars shall be identified and labeled in accordance with the ANSI/TIA-606-C.

E. Each 2-lug compression connector shall have antioxidant coating applied to lug and busbar prior to attachment.

F. The maximum value of resistance between any point in the Telecommunications bonding system and the building electrical grounding electrode system shall be 100 Milliohms or .1 ohm to comply with TIA-607-D standard. This result shall be provided as testing submittal to the EOR.

3.02 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 270526

SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Pathways for Communications Systems.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

D. Refer to Division 26 specifications for conduit and wireway requirements

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.
B. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
   1. Structural members in paths of pathway groups with common supports.
   2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
   3. Underground ducts, piping, and structures in location of underground enclosures and handholes.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all the required material whether specifically addressed in the Specification or not.
B. The scope of work shall be included as follows:
   1. Low Voltage Conduit System- reference project electrical drawings and specifications.
   2. Telecom contractor shall furnish and install the complete Cable Tray System as indicated on Low Voltage drawings.
   3. Telecom contractor shall furnish and install all Velcro straps and plastic tie-wraps (plenum rated).

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Innerduct/Inner-Conduit Channel Manufacturer(s)

   1. Carlon

2. Endot Industries
3. MaxCell
4. Petroflex
5. Eastern

B. Approved Cable Tray System and Basket Tray System Manufacturer(s)

1. Commscope
2. Flex Tray
3. Wiremold
4. Legrand
5. Hubbell
6. EZ Tray
7. Mono Systems, Inc.
8. Snake Tray
9. B-Line
10. Gulf Coast Systems

C. Approved Cable Hanger Manufacturer(s)

1. Erico Products – Caddy
2. B-Line (Eaton)
3. Panduit
4. Legrand
5. Or Approved Equal

D. Approved Tie Wrap/Velcro Strap Manufacturer(s)

1. Leviton
2. Panduit
3. Hellerman-Tyton
4. Or Approved Equal

2.02 CABLE TRAY

A. Cable Tray System

1. Cable tray shall be steel or aluminum construction.
2. Cable tray cross members shall be factory welded at 12" intervals maximum.
3. Cable tray shall be equipped with one (1) or two (2) support rails that run the length of each segment.
4. End caps shall be installed on the exposed ends of the cable tray, channel supports and bolts. Protective covers shall be installed on threaded rods that may come in contact with cabling plant.
5. Wall mount cable tray used in limited clearance areas shall be hook style and constructed of aluminum.
6. See Drawings for cable tray dimensions.
   a. Cable Tray color shall be black.

2.03 CABLE HANGERS

A. J-Hooks

1. J-hooks shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables. J-hook shall be UL Listed and shall comply with TIA-569-D.
2. J-hooks shall have flared edges to prevent damage while installing cables.
3. J-hooks sized 1 5/16" and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.

B. Adjustable Non-Continuous Cable Support Sling

1. Constructed from steel and woven laminate; sling length can be adjusted to hold up to 425 4-pair balanced twisted pair cables; rated for indoor use in non-corrosive environments. Rated to support Category 5e and higher cable, or optical fiber cable. Cable support sling shall be UL Listed.
2. Adjustable non-continuous cable support sling shall have a static load limit of 100 lbs.
3. Adjustable non-continuous cable support sling shall be suitable for use in air handling spaces.

2.04 TIE WRAPS AND VELCRO STRAPS

A. Tie Wraps and Velcro Straps

1. Cables shall be fastened to support structures with tie wraps/Velcro straps.
2. Tie wraps must be carefully installed so that cable is not deformed.
3. Only Velcro straps shall be used in telecommunications rooms.
4. Tie wraps/Velcro straps installed in air handling spaces must be plenum rated.
   a. Non-plenum Tie Wrap color shall be black.
   b. Plenum Tie Wrap color shall be red.
   c. Non-plenum Velcro strap color shall be black.
   d. Plenum Velcro strap color shall be red.

2.05 INNERDUCT

A. Innerduct

1. Innerduct shall be corrugated plastic equipped with pull-string or mule tape.
2. Inner-conduit channel (MaxCell) shall be 3-channel with each channel equipped with mule tape.
3. See Drawings for innerduct / inner-conduit channel (MaxCell) details.

PART 3 - EXECUTION

3.01 PENETRATIONS

A. Holes through concrete and masonry in new and existing structures shall be cut with a diamond core drill or concrete saw upon approval of the structural engineer of record for the base of building. Pneumatic hammer, impact electric, hand or manual hammer type drills shall not be allowed, except where permitted by the Project Manager as required by limited working space. X-ray all floor penetrations accordingly.

B. Holes shall be located so as not to affect structural sections such as ribs or beams.

C. Holes shall be laid out in advance. The Project Manager shall be advised prior to drilling through structural sections, for determination of proper layout.

D. Structural Penetrations: Where conduits, wireways and other raceways pass through fire partitions, fire walls or walls and floors provide a code compliant effective barrier against the spread of fire, smoke and gases.

E. All penetrations where conduit is not used shall be sleeved.

F. No gaps or rough edges shall be allowed between wall and conduit/sleeve.

3.02 CONDUIT SYSTEM

A. Conceal all conduits, except in unfinished spaces such as equipment rooms or as indicated by symbol on the Drawings.

B. Leave all empty conduits with a 200-pound test nylon cord pull line.

C. Flattened, dented, or deformed conduits are not permitted and shall be removed and replaced.

D. Fasten conduit support device to structure with wood screws on wood, toggle bolts on hollow masonry, anchors as specified on solid masonry or concrete, and machine bolts, clamps, or spring steel clips, on steel.

E. Install conduit with wiring, including homeruns as indicated on the Drawings. Any change resulting in a savings in labor or materials is to be made only in accordance with a contract change. Deviations shall be made only where necessary to avoid interferences and when approved by Engineer by written authorization.

F. Conduit shall be run parallel or at right angles to existing walls, ceilings, and structural members.

G. Attach backbone conduits larger than one-inch trade diameter to or from structure on intervals not exceeding twelve feet with conduit beam clamps, one-hole conduit straps or trapeze type support.

H. Where conduits must pass through structural members obtain approval of Architect.

I. Install all conduits or sleeves penetrating or routed within rated firewalls or fire floors to maintain fire rating of wall or floor. Conduit shall not be installed in rated

floors or walls if it compromises or violates the fire rating of floor or wall. Refer to architectural documents.

J. Provide expansion and deflection coupling where conduit passes over a building expansion joint.

K. All other conduit, unless specified herein, shall be electrical metallic tubing (EMT) or electrical non-metallic tubing (ENT). PVC conduit is not allowed in exposed or concealed areas, but only within concrete.

L. Conduit Installations Within Slab/Floor

1. Conduit shall be run following the most direct route between points.
2. Conduit shall not be installed in concrete where the outside diameter is larger than 1/3 of the slab thickness.
3. Protect each metallic conduit installed in concrete slab or conduits 1-1/2 inch and smaller passing through a concrete slab against corrosion where conduit enters and leaves concrete by wrapping conduit with vinyl all-weather electrical tape.
4. Protect all conduits entering and leaving concrete floor slabs from physical damage during construction.
5. Provide expansion fittings in all conduits where length or run exceeds 200 feet or where conduits pass through building expansion joints.
6. Install all conduits penetrating or routed within rated fire floors to maintain the fire rating of the floor. Conduit shall not be installed in rated floors or walls if it compromises or violates the fire rating of floor or wall. Refer to architectural documents.
7. Conduits installed within concrete floor slabs which are in direct contact with grade or which penetrate the building roof shall be galvanized rigid steel (G.R.S.), intermediate metal conduit (I.M.C.) or Schedule 40, heavy wall PVC.

M. Communications cables shall not occupy conduits with power cables.

N. Metallic conduits shall be grounded in accordance with ANSI/TIA-607-D.

O. Conduit runs shall not have more than two (2) 90-degree bends between pull points.

P. Communications conduit system shall contain no condulets (also know as an LB) unless where specifically noted on drawings.

A. Rigid metal conduit (RMC) or intermediate metal conduit (IMC) shall be used for entrance conduits that exceed 50 feet into the building.

B. Horizontal Conduits

1. Support horizontal conduits at intervals not exceeding ten feet and within three feet of each outlet, junction box, backboard, enclosure, or cabinet. Support conduits from structural steel members with spring steel type or beam conduit clamps and to non-metallic structural members with one-hole conduit straps. For exposed conduits and where conduits must be

suspended below structure, single conduit runs shall be supported from structure by hanger rod and conduit clamp assembly, and multiple conduits shall be supported by trapeze type support suspended from structure. Do not attach conduits to ceiling suspension system channels or suspension wires.

2. For runs that total more than 100 feet in length, insert pull boxes so that no segment between boxes exceeds the 100 feet limit.
3. Each horizontal home-run conduit can serve from one (1) to three (3) outlet boxes. For one (1) outlet box, a 3/4" conduit shall be used, minimum. For two (2) outlet boxes, a 1" conduit shall be used, minimum. For three (3) outlet boxes, a 1-1/4" conduit shall be used, minimum.

3.03 COMMUNICATIONS OUTLET BOXES

A. Exact locations of the outlet boxes shall be coordinated with the electrical contractor and other trades.

B. Non-metallic communications outlet boxes may only be used for wood frame construction and/or where code allows.

C. The approximate locations of the outlets are indicated on the Drawings. The exact locations of outlets shall be determined at the building. The right is reserved to change, without additional cost, the exact location of any outlet, a maximum of 10' before it is permanently installed.

D. Orientation of outlet boxes (horizontal or vertical) shall be as indicated on the architectural elevations.

E. Install all outlet boxes in finished areas flush with the wall. Maintain 1/4" or less space between outlet box front and finished wall surface.

F. Outlet boxes shall be firmly anchored in place and shall not depend on the coverplate to hold it secure to the wall.

G. Outlet boxes installed back-to-back in fire-rated walls shall be separated horizontally by a minimum of 24".

3.04 PULL BOXES

A. Pull boxes shall be secured, independent of the conduit entries into the box. Pull boxes shall be secured to the building structure. In ceiling applications, pull boxes shall not be supported with ceiling wires.

B. Pull boxes shall be sized per NFPA 70

C. Conduits entering pull boxes shall connect to pull boxes using die-cast zinc connectors.

D. Pull boxes shall be free from burrs, dirt, and debris.

E. Pull boxes shall be installed in accordance with ANSI/TIA-569-D.

F. Pull boxes shall be grounded in accordance with ANSI/TIA-607-D.

3.05 CABLE TRAY SYSTEM

A. Install trays in accordance with recognized industry practices, to ensure that the cable tray equipment complies with requirements of the NEC.

B. All open trays shall be installed a minimum of six (6) inches away from any light fixture.

C. Provide external grounding strap at expansion joints, sleeves, crossover, and other locations where tray continuity is interrupted.

D. Support all pathways from building construction. Do not support pathways from ductwork, piping, or equipment hangers.

E. Install cable tray level and straight.

F. Provide all hardware, accessories, fasteners, anchors, threaded rods, and support channels required to provide a complete cable tray system.

G. Cable trays shall not be used to house both low voltage and power cables unless cables are separated by a grounded physical barrier.

H. Cable tray system shall be grounded in accordance with ANSI/TIA-607-D.

3.06 CABLE HANGERS

A. Installation and configuration shall conform to the requirements of ANSI/TIA-568-C.0, ANSI/TIA-568-C.1 & ANSI/TIA-569-D, NFPA 70 (National Electrical Code), applicable local codes, and to the manufacturer's installation instructions.

B. Install cables using techniques, practices, and methods that are consistent with Category 5e or higher requirements and that supports Category 5e or higher performance of completed and linked signal paths, end to end.

C. Install cables without damaging conductors, shield, or jacket.

D. Allow 25% future capacity with exceeding design capacity limits.

E. Provide a hanger at each change of direction.

F. Shall be supported by dedicated support wires. Do not use ceiling grid support wire or support rods.

G. Hook spacing shall be no more than 5' . Install randomized between 4' and 5' to prevent inductive resonance.

H. Do not bend cables, in handling or in installing, to smaller radii than minimums recommended by manufacturer.

I. Pull cables without exceeding cable manufacturer's recommended pulling tensions. Use pulling means that will not damage media.

J. Do not exceed load ratings specified by manufacturer.

K. Adjustable non-continuous support sling shall have a static load limit of 100 lbs.

L. To avoid electromagnetic interference (EMI), pathways shall provide minimum clearances of four feet from motors or transformers, one foot from conduit and cables used for electrical power distribution, and five inches from fluorescent lighting. Pathways shall cross perpendicular to fluorescent lighting and electrical power cables or conduits.

3.07 TIE WRAPS AND VELCRO STRAPS

A. Tie wraps/Velcro straps shall be installed around cables at intervals of 12" minimum.

B. Do not over-cinch cables.

3.08 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 270528

SECTION 270553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the equipment and execution requirements relating to Identification for Communications Systems.

C. Equipment specifications, general considerations, and guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - LABELING

2.01 LABELING REQUIREMENTS

A. Labeling shall be done in accordance with the recommendations made in the ANSI/TIA-606-C document, manufacturer's recommendations, and best industry practices unless indicated otherwise by owner's IT representative.

B. Coordinate labeling with owner's IT representative.

C. All spaces, pathways, outlets, cables, termination hardware, grounding system and equipment shall be labeled with machine-generated labels. Provide labels at the following specific locations and any additional locations indicated on the project drawings:

1. Rack frames
2. Cabinet frames
3. Device face plates.
4. Port on front and at rear of each patch panel
5. Horizontal cable in ceiling above (or below) outlet.
6. Horizontal cables at poke through locations (both sides).
7. Horizontal cables at rear of patch panel.
8. Ends of spare cable that is not terminated.
9. All 110 blocks.

D. Generally, riser and horizontal cables shall contain labels indicating room numbers (to and from) numbers and a unique name.

E. All labels shall be clear with black text.

F. All cables shall be labeled with machine generated, adhesive-backed, wrap around vinyl labels in black uppercase lettering on machine generated permanent adhesive self-laminating label of contrasting color from cable sheath..

G. For large cable bundles, label shall be installed on a plastic label holder and tie-wrapped to bundle.

H. A total of three (3) labels per horizontal cable are required at the following intervals: 6" from outlet; 18" from outlet' 12" from termination block/patch panel.

I. Labeling scheme shall be alphanumeric.

J. Provide label reference chart in the IDF room indicating the following information:

1. Data patch panel outlet port information
2. Voice riser cross connect information.
3. Voice outlet cable pair termination.

K. Label file used to generate labels shall be turned over to the owner as part of the final documentation package.

PART 3 - NOT USED

END OF SECTION 270553

SECTION 270800 - COMMISSIONING OF COMMUNICATIONS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the equipment and execution requirements relating to Commissioning of Communications.

C. Equipment specifications, general considerations, and guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - TESTING

2.01 TESTING REQUIREMENTS

A. General

1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA-568-C.0, ANSI/TIA-568-C.1, and/or ANSI/TIA-1152. All conductors and/or strands of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors and/or strands in all cables installed.
2. Test results shall be submitted to EOR for approval and shall be included in the close-out documentation.
3. Cable test parameters shall be set to the manufacturers values for NVP and test limit.

B. Copper Testing

1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category 5e, Category 6, or Category 6A performance depending on type of cable installed. Horizontal balanced twisted pair cabling shall be tested using a level III, or IV test unit for category 5e/6/6A performance compliance.

2. Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity, and pair-reversals, crossed pairs and split pairs. The test shall be recorded as pass/fail as indicated by the test unit and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.
3. Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA-568-C.2 Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.
4. High bandwidth links – CAT6A cables or cables indicated in the drawing package as high bandwidth shall be tested with additional test showing parameters;
    a. Delay Skew
    b. DC Loop Resistance
    c. Insertion Loss
    d. Return Loss
    e. NEXT
    f. Alien Cross-talk
5. Approved tester is as follows:
    Fluke DSX
    Others as Approved

C. Fiber Testing (where installed)

1. All fiber testing shall be performed on all fibers in the completed end-to-end system. There shall be no splices unless clearly defined in the Drawings. These tests also include continuity checking of each fiber.
2. The fiber testers and test heads shall have passed calibration within one year of actual test date. Any calibration in excess of one year is not acceptable. Each test set and fiber head must have the recent calibration paper printout from the calibration lab for inspection by EOR, prior to testing. The calibration printout must show actual serial numbers of test sets (main and remote and each fiber tested).
3. Test Reference Cords (TRC's) must be used. Test Reference Cord verification must be shown in the final test result submission.
4. Tier 1, Tier Method B (one jumper) and Tier 2 OTDR testing is required. The Tier 2 OTDR requires bi-directional testing.
5. The installer shall Set a Reference based on Method B (Single Jumper) which includes both mated connector losses and the loss of the link under test.
6. The installer shall perform Tier 1 Testing with Optical Loss Test Set (OLTS) that includes testing for length.
7. The installer shall perform Tier 2 testing with OTDR to show all splices.
8. The supplier shall perform Bi-directional testing on all installed fiber optic cabling. Supplier test equipment shall perform testing of fiber in accordance with the fiber type being tested, TIA-526-7 for Single mode fiber.

9. All fiber strands will be tested bi-directionally. Any fiber test results that only show testing in one direction will be rejected.
10. Single mode fiber optic cable shall be tested bi-directionally at 1310 nm and 1550 nm.
11. Cable tester test parameter shall be set to correct values for:
    a. Actual manufacturer of fiber being installed. Tester to be specific to the manufacturer's model of fiber cable being tested; tester cannot be a generic fiber type.
    b. Index of Refraction based on manufacturer specifications for cable type being tested.
    c. Quantity of adapters: Test Method B, one Jumper, 2 adapters.
    d. Fiber Type.
    e. Test to Tier 1 as mandated by TIA-568-C.4.
12. Fiber optic cables shall pass all attenuation tests referenced to formulas presented in the listed standards.
13. Perform end-to-end tests of each fiber optic backbone cable as follows (applies to CCR/TR/TE applications only):
    a. Tier 1 Test: Light Source Power meter tests per TIA-568-C specification.
    b. Optical Time Domain Reflectometer (OTDR) tests per TIA-568-C specification including all addendums.
    c. Performing one test and not the other does not satisfy a complete fiber test. Both tests must be submitted in one file, all at the same time.
    d. Measured effective cable run length.
14. Optical photographs of each fiber end shall be submitted for documentation and warranty purposes.
15. Approved optical fiber test equipment manufacturers are as follows:
    a. Power Meters & Light Sources
       Optical Wavelength Laboratories (OWL)
       Noyes
       Photonix
       Fluke
       Agilent
    b. Optical Time Domain Reflectometers (OTDR)
       GN Nettest
       Agilent
       Fluke
       Anritsu
       Tektronix

D. Coaxial Testing (where installed)

1. Sweep testing of each reel of coaxial cable shall be performed over the 5 MHz through 1 GHz range by the cable manufacturer for transmission and structural return loss and be so certified in writing by the cable manufacturer.
2. Verification testing with a verification field test instrument will determine shorts, continuity, termination location and length of cable.
3. Approved testers are as follows:
   Fluke DTX

4. Signal strength measurement shall be performed with a field strength meter.
5. Signal level at each outlet will be +5 dBmv, + 3 dB.

E. Test Results

1. Test documentation shall be provided on disk or flash drive as part of the as-built package. The disk or flash drive shall be clearly marked on the outside front cover with the words "Project Test Documentation," the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair (or strand) and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.
2. The field test equipment shall meet the requirements of ANSI/TIA-568-C.2, ANSI/TIA-568-C.3, and/or ANSI/TIA-1152.
3. Printouts generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. Alternately, the Contractor may furnish the test results in electronic form as defined by the Specification and be of a format readable from Microsoft Word.
4. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

PART 3 - DOCUMENTATION, AS-BUILTS, TRAINING AND RECORDS

3.01 DOCUMENTATION & AS-BUILTS

A. As-Built record documentation for communications work shall include:

1. Cable routing and identification
2. System function diagrams
3. Manufacturers' description literature for equipment
4. Connection and programming schedules as appropriate
5. Equipment material list including quantities
6. Spare parts list with quantities
7. Details not on original Contract Documents
8. Test results
9. Warranties
10. Release of liens

B. The Contractor shall provide and maintain at the site a set of prints on which shall be accurately shown the actual installation of all work under this section, indicating any variation from contract drawings, including changes in pathways, sizes, locations, and dimensions. All changes shall be clearly and completely indicated as the work progresses.

C. Progress prints shall be available for inspection by the Owner or any of his representatives and may be used to determine the progress of communications infrastructure work.

D. At the completion of the work, prepare a new set of as-built drawings, of the work as actually noted on the marked-up prints, including the dimensioned location of all pathways.

E. Furnish as-built drawings and documentation to the Project Manager. As-built drawings shall be generated in AutoCad 2015 or later. Submit as-built drawings electronically and hard copy.

3.02 OPERATIONS AND MAINTENANCE MANUAL

A. After completion of the work, the Contractor shall furnish and deliver to the Engineer three (3) copies of a complete Operations & Maintenance Manual. A system wiring diagram shall be furnished for each separate system. Documents may be delivered in electronic format only, if prior authorization is obtained from the Owner.

B. The manual shall be subdivided into separate sections with tab dividers to identify subsystems of the integrated system. Reference appropriate Specification sections.

C. Provide the following additional information for each electronic system. Information shall be edited for this project where applicable.

1. Operations manuals for components and for systems as a whole
2. Maintenance manuals for components and for system as a whole
3. Point-to-point diagrams, cabling diagrams, construction details and cabling labeling details
4. List of spare parts, materials and suppliers of components. Provide name, address, and telephone number for each supplier.
5. Emergency instructions for operational and maintenance requirements
6. Delivery time frame for replacement of component parts from suppliers
7. Recommended inspection schedule and procedures for components and for system as a whole
8. List of spare parts, materials, and suppliers of components. Provide name, address, and telephone number for each supplier.
9. Complete “reviewed” shop drawings and product data for components and system as a whole
10. Troubleshooting procedures for each system and for each major system component

3.03 TRAINING

A. The Contractor shall be responsible for training of facility personnel. Training shall take place after occupancy and before acceptance and shall include programs for on-site operations and maintenance of technology and communications systems. Training shall be for not more than ten (10) people, shall be held at the Owner's site and shall be of sufficient duration and depth to ensure that the

trained personnel can operate the installed systems and can perform usual and customary maintenance actions.

B. Training sessions shall be recorded and a copy of the recording provided to the Owner.

3.04 WARRANTY

A. General

1. All equipment is to be new and warranted free of faulty workmanship and damage.
2. Replacement of defective equipment and materials and repair of faulty workmanship within 24 hours of notification, except emergency conditions (system failures), which must be placed back in service within eight (8) hours of notification, all at no cost to the Owner.
3. The minimum warranty provisions specified shall not diminish the terms of individual equipment manufacturer's warranties.

B. Voice & Data Structured Cabling

1. Manufacturer(s) shall provide a **minimum** 25-year warranty for components used in the installed Voice & Data Structured Cabling System. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

C. Coaxial Cabling Infrastructure (where installed)

1. Manufacturer(s) shall provide a minimum 1-year warranty for components used in the installed Coaxial Cabling Infrastructure. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

D. Pathway & Support Infrastructure

1. Manufacturer(s) shall provide a minimum 1-year warranty for components used in the installed Pathway & Support Infrastructure. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

END OF SECTION 270800

SECTION 271116 - COMMUNICATIONS CABINETS, RACKS AND ENCLOSURES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Cabinets, Racks, Enclosures, and Telecom Room Backboards.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all the required material whether specifically addressed in the Specification or not.

B. The work shall include the furnishing and installation of the following as a minimum: Equipment Cabinets, Equipment Racks, Telecom Room Backboards.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Equipment Rack/Cabinet Manufacturer(s)

1. Chatsworth Products, Inc.
2. Commscope
3. Bud
4. Hoffman
5. Great Lakes
6. Lowell
7. Eaton
    a. Tripp-Lite
8. Panduit
9. Legrand
    a. Middle Atlantic
    b. Ortronics
10. No Exceptions

B. Un-approved Equipment

1. Nave Point is not a approved manufacturer or alternate

2.02 EQUIPMENT RACKS/CABINETS

A. Equipment Racks

1. The equipment rack shall be constructed of high strength, lightweight aluminum.
2. The vertical rails of the equipment rack shall be equipped with the EIA hole pattern.
3. Rack shall be: 2-post. Provide any 4-post racks where noted on the drawings.
4. Rack shall be: 7'H x 19"W floor mounted.
5. Rack color shall be black.

PART 3 - EXECUTION

3.01 EQUIPMENT RACKS/CABINETS

A. Each rack shall be provided with an installation kit and isolation pads for securing and isolating the rack to and from the floor.

B. Equipment racks/cabinets shall be installed as per the requirements specified by the manufacturer's installation guidelines.

C. Equipment racks/cabinets shall be placed with a minimum of 36-inch clearance from the walls from the front and rear of the rack or as indicated on Drawings.

D. All equipment racks/cabinets shall be grounded to the equipment grounding bar installed in the rack with a dedicated jumper.

E. All racks/cabinets shall be installed with dedicated ground bars installed on the rack. The ground bars shall be bonded to the telecom bonding bar in the room.

F. Mounting screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.

3.02 BACKBOARDS

A. Backboards shall be 3/4" void free plywood A/C rated with C side installed against wall. Size of backboard shall be 4' x 8' unless noted differently on Drawings. Backboards shall be painted with two (2) coats of white or gray fire-retardant paint, including full perimeter of backboard. Fire rated backboards are permitted in lue of painted backboards, rating label shall remain visible after equipment installation and shall not be painted over.

3.03 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 271116

SECTION 271119 - COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Termination Blocks and Patch Panels.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Patch Panel Manufacturer(s)

1. Leviton
2. Commscope
3. Siemon
4. Hubbell
5. Legrand
6. Panduit
7. No Exceptions

B. Approved Optical Fiber Enclosure Manufacturer(s)

1. AFL
2. Corning
3. Commscope
4. Siemon
5. Hubbell
6. Legrand
   a. Ortronics
7. Panduit

8. No Exceptions

C. Approved Termination Block Manufacturer(s)

1. Leviton
2. Commscope
3. Siemon
4. Hubbell
5. Legrand
6. Panduit
7. No Exceptions

D. Approved Cable Management Manufacturer(s)

1. Leviton
2. Commscope
3. Siemon
4. Hubbell
5. Legrand
6. Panduit
7. No Exceptions

E.

2.02 PATCH PANELS

A. Category 6 Patch Panel

1. The Category 6 patch panel shall be compatible with 19" equipment racks, cabinets or wall mount brackets.
2. The Category 6 patch panel shall be equipped with 8-position modular ports and shall allow for termination using both T568A and T568B wiring schemes.
3. The Category 6 patch panel shall be equipped with front labeling space to facilitate port identification.
4. The connector module shall meet or exceed the Category 6 performance criteria per ANSI/TIA-568-C.2.

PART 3 - EXECUTION

3.01 PATCH PANELS

A. Cables shall be dressed and terminated in accordance with the recommendations made in ANSI/TIA-568-C.0 and/or ANSI/TIA-568-C.1, manufacturer's recommendations and best industry practice.

B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).

C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

D. Cables shall be neatly bundled and dressed to their respective patch panel. Each patch panel shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

E. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

F. Install manufacturer supplied strain relief bar assemblies for every 12, 24 and 48 port rear copper terminations. Secure cable with hook and loop cable straps. Plastic tie wraps are not acceptable.

3.02 OPTICAL FIBER PANELS/ENCLOSURES

A. Cables shall be dressed and terminated in accordance with the recommendations made in ANSI/TIA-568-C.0 and/or ANSI/TIA-568-C.1, manufacturer's recommendations and best industry practices.

B. Each cable shall be individually attached to the respective splice enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.

C. Bend radius of the optic fiber cable in the panel/enclosure shall not exceed 10 times the outside diameter of the cable.

D. Each fiber bundle shall be stripped upon entering the splice tray and the individual fibers routed in the splice tray.

E. Each cable shall be clearly labeled at the entrance to the splice enclosure. Cables labeled within the bundle shall not be acceptable.

3.03 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 271119

SECTION 271123 - COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Cable Management and Ladder Rack.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Horizontal Cable Management Manufacturer(s)

1. Leviton
2. Ortronics (Legrand) Corporation.
3. CommScope
4. Siemon
5. Chatsworth
6. Panduit
7. No Exceptions

B. Approved Vertical Cable Management Manufacturer(s)

1. Leviton
2. Ortronics (Legrand) Corporation.
3. CommScope
4. Siemon
5. Chatsworth
6. Panduit
7. No Exceptions

C. Approved Ladder Rack System Manufacturer(s)

1. Chatsworth Products, Inc.
2. Hoffman
3. Eaton
4. Middle Atlantic
5. No Exceptions

D. Approved Tie Wrap/'Hook-Loop' Strap Manufacturer(s)

1. Velcro
2. Leviton
3. Hellerman Tyton
4. Or Approved Equal

2.02 CABLE MANAGEMENT - HORIZONTAL

A. Horizontal Cable Management

1. The horizontal wire manager shall be compatible with 19-inch equipment racks, cabinets, or wall mount brackets.
2. The horizontal cable manager shall provide support for patch cords at the front of the panel.
3. The horizontal cable manager shall be 2 rack-units in height when matched with a 2 rack-unit patch panel or switch.
4. The horizontal cable manager shall be 1 rack-unit in height when matched with a 1 rack-unit patch panel or switch.

2.03 CABLE MANAGEMENT - VERTICAL

A. Vertical Cable Management

1. The vertical cable manager shall be double-sided.
2. The vertical cable manager shall provide support for patch cords at the front of the rack and wire management at the rear of the rack.
3. The vertical cable manager shall be a minimum width of 4", refer to drawing for rack elevations
4. Vertical cable manager color shall be black.

2.04 LADDER RACKS

A. Ladder Rack System

1. See Drawings for ladder rack system details.
2. NEMA LOAD/Span Class 20C
3. Straight Section Rung Spacing: 9 inches on center
4. The ladder rack system shall be securely mounted with hardware designed for use in ladder rack systems.
5. Provide approved manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps. Obtain cable tray components from a single manufacturer.

6. End caps shall be installed on the exposed ends of the ladder racks, channel supports and bolts. Protective covers shall be installed on threaded rods that contact cabling plant.
7. Provide Drop-Out Shields where cables enter/exit tray.
8. Ladder Rack System color shall be black
9. Ladder Rack System shall be bonded to the Telecom Ground system and bonding jumpers shall be installed between the joints of the Ladder Rack System,
10. Inside radius of fittings 24" min. unless otherwise shown on drawings.

2.05 VELCRO STRAPS

A. Velcro Straps

1. Backbone cables shall be fastened to support structures with Velcro straps.
2. Horizontal cables shall be fastened to support structures with Velcro straps.
   a. Velcro Strap color shall be black, unless noted to match jacket color in the drawings

PART 3 - EXECUTION

3.01 CABLE MANAGEMENT - HORIZONTAL

A. Horizontal cable managers shall be installed below patch panels in a 1:1 ratio (one horizontal cable manager per patch panel) or as indicated on Drawings.

3.02 CABLE MANAGEMENT - VERTICAL

A. Vertical cable managers shall be installed on both sides of a single equipment rack. Where two (2) or more racks are positioned in a row, vertical cable managers shall be installed between each rack and each end of the row.

3.03 LADDER RACKS

A. Ladder rack system shall be installed straight, level, and perpendicular to walls and ceiling slabs.

B. Ladder racks shall be supported at 5' intervals maximum.

C. Provide all hardware, accessories, fasteners, anchors, threaded rods and support channels required to provide a complete ladder rack system.

D. See Drawings for ladder rack system details.

E. Provide Engraved Nameplates: 1/2 inch high black letters on yellow laminated plastic nameplate, engraved with the following wording:

WARNING! DO NOT USE CABLE TRAY AS WALKWAY, LADDER, OR SUPPORT. USE ONLY AS MECHANICAL SUPPORT FOR CABLES!

3.04 VELCRO STRAPS

A. Velcro straps shall be installed around cables at intervals of 12" minimum -24" maximum.

B. Do not over-cinch cables.

3.05 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 271123

SECTION 271126 - COMMUNICATIONS RACK MOUNTED POWER DISTRIBUTION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Rack Mounted Power Distribution.

C. Product Specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

D. Refer to drawings for managed/switched PDUs model number if specified, if not provide PDUs as indicated in this section.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Power Distribution Unit Manufacturer(s)

1. APC
2. Eaton
3. Leviton
4. Chattsworth
5. SurgeX
6. No Exceptions

2.02 POWER DISTRIBUTION UNITS

A. Power Distribution Unit

1. The power distribution unit shall be equipped with a minimum of eight (8) 3-prong, 120 VAC outlets, and 8' cord.

2. The power distribution unit shall be equipped with surge protection with a 20 Amp current limit.
3. The power distribution unit shall be equipped with a bracket that enables it to be mounted on a 19" rack, cabinet, or wall mount bracket without modification.
4. Match PDU plug type to UPS output plugs.

PART 3 - EXECUTION

3.01 POWER DISTRIBUTION UNITS

A. Power distribution units shall be installed as per the requirements specified by the manufacturer's installation guidelines.

B. See Drawings for installation location on rack(s)/cabinet(s).

3.02 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 271126

SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Copper Horizontal Cabling.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Horizontal Copper Cable Manufacturer(s)
1. Belden.
2. Berk-Tek.
3. CommScope.
4. General Cable.
5. Leviton.
6. Ortronics (Legrand).
7. Windy City Wire
8. No Exceptions

2.02 HORIZONTAL COPPER CABLE

A. 100 OHM Category 6 Balanced Twisted Pair Cable

1. The horizontal balanced twisted pair cable shall meet or exceed the Category 6 transmission characteristics per issue of ANSI/TIA-568 with all addendums and capable of preforming capable of performing to a minimum of 250 MHz.

2. Cable jacket shall be CMR or CMP rated (according to the space it occupies). Cable installed in slab or in exterior conduit shall be OSP reated.
3. Jacket color shall be:
   a. Blue for voice/data
   b. Yellow for wireless access points
   c. Purple for security / intercom
   d. Green for A/V

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS FOR HORIZONTAL CABLES

A. Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.

B. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

C. Maintain manufacturer's twisting of wire pairs to termination point. Do not attempt to restore, modify, or add to manufacturer's twisting of cable. Do not untwist more than 1/2 inch of the stripped cable

D. A plastic or nylon pull cord with a minimum test rating of 90 Kg (200 lb.) shall be co-installed with all cable installed in any conduit.

E. Cable raceways shall not be filled greater than the ANSI/TIA-569-E maximum fill for the particular raceway type.

F. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.

G. Riser rated cable shall be installed in metallic conduit when installed in a plenum space.

H. Where transition points or consolidation points are allowed, they shall be located in accessible locations and housed in an enclosure intended and suitable for the purpose.

I. The cable's minimum bend radius and maximum pulling tension shall not be exceeded. Refer to manufacturer's requirements.

J. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of 48 to 60 inch (1.2 to 1.5 meter) intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.

K. Horizontal distribution cables shall be bundled in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.

Dress cable to final location, remove sheath to point allowing splaying of conductors, and terminate. Make each termination uniform and precise. Hook and loop cable straps shall be

used for bundling and dressing all cabling. No nylon zip ties shall be used for cable bundling or attachment.

L. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

M. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the Contractor shall install appropriate carriers to support the cabling.

N. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor prior to final acceptance at no cost to the Owner.

O. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA-568-with all addendums document, manufacturer's recommendations and best industry practices.

P. Leave a minimum of 12" of slack for twisted pair cables at the outlet. Cables shall be coiled in the in-wall box, surface-mount box or modular furniture raceway if adequate space is present to house the cable coil without exceeding the manufacturers bend radius. In hollow-wall installations where box-eliminators are used, excess wire can be stored in the wall. Excess slack shall be loosely coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.

Q. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.

R. Cables shall be neatly bundled and dressed to their respective termination device. Each terminating device shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

S. Each cable shall be clearly labeled on the cable jacket behind the termination device at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.02 SEPARATION FROM EMI SOURCES

A. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.

B. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
1. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches
2. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches
3. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches

C. Separation between open communications cables or cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
   1. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches
   2. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches
   3. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches

D. Separation between open communications cables or cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
   1. Electrical Equipment Rating Less Than 2 kVA: No requirement
   2. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches
   3. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches

E. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).

F. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.03 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

3.04 FIRE STOPPING

A. Refer to Section 27 05 10 – Firestopping for Comm Systems for firestopping information.

END OF SECTION 271513

SECTION 271543 - COMMUNICATIONS FACEPLATES AND CONNECTORS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Faceplates and Connectors.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Copper Connectivity Manufacturer(s)

1. Berk-Tek
2. CommScope
3. Panduit
4. Hubbell
5. Leviton
6. Siemon
7. Hubbell
8. Connector shall match cable manufacturer when possible.
9. No Exceptions

B. Approved Faceplate Manufacturer(s)

1. Berk-Tek
2. CommScope
3. Panduit
4. Hubbell
5. Legrand
6. Leviton

7. Siemon
8. Hubbell
9. Approved electrical faceplate manufacturer shall supersede above manufacturers, when faceplate option does not exist from electrical faceplate manufacturer selected style shall match as close as possible.
10. No Exceptions

C. Approved Surface Mount Box manufacturer(s)

1. Berk-Tek
2. CommScope
3. Panduit
4. Hubbell
5. Legrand
6. Leviton
7. Siemon
8. Hubbell
9. Approved electrical surface mount box manufacturer shall supersede above manufacturers, when box option does not exist from electrical faceplate manufacturer selected style shall match as close as possible.
10. No Exceptions

2.02 COPPER CONNECTIVITY

A. Voice/Data Jacks

1. Category 6, 8-Position, 8-Contact (8P8C) Modular Jack
   a. The connector module shall meet or exceed the Category 6 performance criteria per ANSI/TIA-568-C.2.
   b. The eight-position connector module shall accommodate six-position modular plug modular cords without damage to either the cord or the module.
   c. The connector module shall be designed for use at the work area (WA), communications room (TR) and/or equipment room (ER) without modification.
   d. The connector module shall be available and wired in the T568B wiring configuration.
   e. The connector module shall have an insulation displacement connection featuring insulation slicing of 22 to 24 AWG plastic-insulated solid copper conductors forming a gas-tight connection.
   f. Icons shall be used if offered from the manufacturer.
   g. Jack/Icon colors shall be:
      Blue for data/voice

B. COAXIAL CONNECTORS
1. Connectors shall be solderless, 75-Ohm impedance and be designed for the specific type of cable used.

2. Series-6 connectors shall be one piece. Series-11 connectors shall use the cable's center conductor as the connector's center pin.

3. All Series-6 and Series-11 connections shall be made with compression-type connectors.

4. Screw-on connectors are not acceptable.

5. The coaxial adapter module that occupies the faceplate shall be a 75-ohm, F-type connector.

2.03 FACEPLATES

A. Faceplates

1. It shall be possible to install the connector modules in wall-mounted single- and dual-gang electrical boxes, utility poles and modular furniture (cubicle) access points using manufacturer-supplied faceplates and/or adapters.
2. The faceplate housing the connector modules shall have the option of being mounted on adapter boxes for surface mount installation.
3. The faceplate housing the connector modules shall have a labeling capability using built-in labeling windows, to facilitate outlet identification and ease network management.
4. The faceplate housing the connector modules shall provide flexibility in configuring multimedia workstation outlets that respond to present or future network needs such as audio, video, coaxial and optical fiber applications.
5. Color shall be same as electrical faceplates.

2.04 SURFACE MOUNT BOXES

A. The surface mount box shall accommodate connections of any type, UTP, optical fiber or coax.

B. The surface mount box shall have internal storage space for slack cabling and a built-in spool for controlling cable bend radius.

C. Color shall be same as electrical faceplates.

PART 3 - EXECUTION

3.01 COPPER CONNECTIVITY

A. 8-position, 8-contact (8P8C) modular jacks shall be installed in accordance with manufacturer's recommendations and installation guides, and best industry practices.

B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).

3.02 FACEPLATES

A. Blank inserts shall be installed where ports are not used.

B. The same orientation and positioning of jacks and connectors shall be utilized through out the installation.

C. Faceplates shall be installed straight and level.

D. Faceplates shall be installed at the same heights as electrical faceplates.

3.03 SURFACE MOUNT BOXES

A. Blank inserts shall be installed where ports are not used.

B. The same orientation and positioning of jacks and connectors shall be utilized through out the installation.

C. Surface mount boxes shall be installed straight and level.

D. Surface mount shall be installed at heights as electrical receptacles.

3.04 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 271543

SECTION 271619 - COMMUNICATIONS PATCH CORDS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Patch Cords.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Copper Patch Cord Manufacturer(s)

1. Berk-Tek
2. Belden
3. CommScope
4. Siemon
5. Legrand
6. Panduit
7. No Exceptions

B. Approved Copper Fiber Cord Manufacturer(s)

1. Berk-Tek
2. Corning
3. Commscope
4. AFL
5. OCC
6. Siemon
7. Fiber patch cord manufacturer shall be the same manufacturer furnishing the backbone fiber.

8. No Exceptions

2.02 COPPER PATCH CORDS

A. Category 6 Patch Cords

1. The Category 6 patch cord shall be 4-pair, with 24 AWG solid or stranded copper conductors and 8-position modular plug.
2. The Category 6 modular cord cable shall be UL Listed as Type CMR.
3. The Category 6 patch cord shall meet or exceed the requirements of ANSI/TIA-568-C.2.
4. Lengths shall be 3', 5', 7' and/or 10' as required by the application.
   a. The Category 6 patch cord color for voice shall be: Gray
   b. The Category 6 patch cord color for data shall be: Blue
   c. The Category 6 patch cord color for security cameras or other security devices shall be: Purple
   d. The Category 6 patch cord color for wireless access points shall be: Yellow
   e. The Category 6 patch cord color for A/V equipment shall be green

2.03 FIBER PATCH CORDS

1. All patch cord shall be factory terminated.
2. Patch cords shall be LC unless otherwise specified.
3. Complies with individual characteristics established in TIA-568-C including all addendums for fiber optic patch cable performance specification.
4. Lengths shall be 3', 5', 7' and/or 10' as required by the application.
5. Match performance characteristics of installed fiber optic backbone.

PART 3 - EXECUTION

3.01 COPPER PATCH CORDS

A. Copper patch cords shall be installed as per the requirements specified by the manufacturer's installation guidelines.

3.02 FIBER PATCH CORDS

A. Fiber patch cords shall be installed as per the requirements specified by the manufacturer's installation guidelines.

3.03 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 271619