SECTION 271116 - COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This section includes the minimum requirements for the installation of communications racks and ladder racking within the communications closets.

B. This section includes, but is not limited to the following:

1. Floor standing racks

2. Ladder racking

C. Provide all labor, materials, and equipment for the completion of work called for in the Contract Documents.

D. The Contractor shall be responsible for providing the services necessary to furnish, configure, deliver, install, integrate, and test all specified equipment. All work shall be in accordance with the intent of these specifications, and as required to leave the infrastructure components complete and in manufacturer certified operating conditions, excluding those items listed under “Work by Others.”

E. The Contractor shall provide any additional items, not specifically mentioned herein or on the drawings, necessary to meet system requirements as specified, without claim for additional payment.

F. Errors or Omissions in Drawings or Documentation

1. If any errors or omissions appear in Drawings, Specifications, or other documents, the bidding Contractor shall notify the Engineer no later than ten (10) days prior to submitting the bid.

2. Should conflict occur in or between Drawings and Specifications, the bidding Contractor is deemed to have estimated the more expensive way of doing the work, unless the bidding Contractor has asked for and obtained written decision (addendum) before submission of the bid as to which method or materials will be required.

G. Related Sections

1. Section 271323 Communications Optical Fiber Backbone Cabling

2. Section 271513 Communications Copper Horizontal Cabling

1.3 DEFINITIONS

A. Main Distribution Frame (MDF): This technology space houses main network distribution equipment and acts as the main connection point between the Core/Network and the TR/IDF/access zones for all connections.

B. Telecommunications Room (TR)/Intermediate Distribution Frame (IDF): is the location for the termination of backbone cables and for termination of horizontal cables, and for the interconnection of each. The space also hosts access–layer switches and user network connections within each floor.

C. Building Backbone: cabling system consisting of media and termination hardware interconnecting MDFs to IDFs.

D. Horizontal: cabling system consisting of media and termination hardware interconnecting the Telecommunication Outlets (TOs) and the TRs.

E. Bonding: permanent joining of metallic parts to form an electrically conductive path which will assure electrical continuity and the capacity to conduct safely any current likely to be imposed on it.

F. Cabinet: free standing, floor–mounted or wall–mounted modular enclosure designed to house and protect rack–mounted electronic equipment and passive terminations.

G. Rack: an open, free standing, floor–mounted or wall–mounted structure, typically made of aluminum or steel, used to mount equipment; usually referred to as an equipment rack.

H. Grounding: a conducting connection to earth, or to some conducting body that serves in place of earth.

I. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

J. UTP: Unshielded Twisted Pair.

K. FO: Fiber Optic

L. Patch Panel: system of terminal blocks or connectors used with patch cords that facilitate administration of cross–connect fields.

M. Riser Backbone: The Riser Backbone subsystem links the main cross connect (MDF) in the equipment room to the distribution rooms (TRs).

N. Structured Cabling System (SCS): A SCS is defined as all required cabling including hardware, termination blocks, cross connect wire or cordage, patch panels, patch cords, telecommunication outlets, work area cords, UTP and fiber optic cable installed and configured to provide computer data and voice connectivity from each data or voice device to the network file server or voice network/switch designated as the service point of the local area network.

1.4 QUALITY ASSURANCE

A. The contractor shall adhere to the most current applicable rulings of the Federal Communications Commission (FCC). Provide the FCC registration number with the equipment submittal. All components and installations shall bear an Underwriters' Laboratories (UL) listing and shall conform with the latest edition or revision of the following codes and standards:

1. ANSI: American National Standards Institute
2. ASTM: American Society for Testing and Materials
3. BICSI: Building Industry Consulting Service International
4. CSI: Construction Specifications Institute
5. EIA: Electronics Industries Alliance
6. FCC: Federal Communications Commission
7. ICEA: Insulated Cable Engineers Association
8. IEC: International Electro Technical Commission
9. IEEE. Institute of Electrical and Electronics Engineers
10. ISO: International Organization for Standardization
11. NEC: National Electrical Code
12. NEMA: National Electrical Manufacturer's Association
13. NFPA: National Fire Protection Association
14. TIA: Telecommunications Industry Association
15. UL: Underwriters Laboratories, Inc.

B. All materials shall be manufactured and tested by manufacturers who are regularly engaged in the production of the components of similar systems for a minimum of five (5) years.

C. The Contractor shall maintain service facilities in the installation area. The facilities shall include a permanent source of factory trained service technicians on twenty-four (24) hour call experienced in servicing this type of cabling system and shall provide warranty and routine maintenance service to afford the Owner maximum coverage. The Contractor shall also provide a central source of support to guarantee immediate answers to Owner's problems and questions.

D. The Contractor selected for this project must be certified by the manufacture(s) specified within their submittals, adhere to the engineering, installation, and testing procedures, and utilize the recommended components in provisioning the voice and data aspects of this Project.

E. Any sub-contractor who will assist the Contractor in performance of this work shall have the same training and certification as the Contractor.

F. The Contractor shall procure and pay for all necessary permits, licenses and inspections and observe any requirements stipulated therein. The Contractor shall conform in all trades with all local regulations and codes.

G. The Contractor shall guarantee at the time of the bid that all cabling and components meet or exceed specifications of TIA-568.0, TIA-568.1, TIA-568.2, and TIA-568.3, TIA-569, TIA-606 and TIA-607.

H. The Contractor shall provide as part of the bid proposal a complete bill of materials, including catalog cuts, line item and extended pricing, and equipment configurations for all technologies noted in this section. This is in addition to the requests on the bid form.

I. The components shall be new, of modern design, and current standard production of the various manufacturers.

1.5 REFERENCE STANDARDS

A. The code or standard establishing the more stringent requirements shall be followed where areas of conflict occur between codes and standards or between codes and standards and drawings and specifications.

1. BICSI Telecommunications Distribution Methods Manual, Latest Edition

2. BICSI Cabling Installation Manual, Latest Edition

3. CSI Master Format Latest Edition – Division 27 - Communications

4. National Electric Code (NEC)

5. NFPA 255 Standard Method of Test of Surface Burning Characteristics of Building Materials

6. NFPA 70 - National Electric Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements

7. TIA-568.0-E – Generic Telecommunications Cabling for Customer Premises

8. TIA-568.1-E – Commercial Building Telecommunications Infrastructure Standard

9. TIA-568.2-D – Balanced Twisted-Pair Telecommunications Cabling and Components Standard

10. TIA-568.3-E – Optical Fiber Cabling and Components Standard

11. TIA-569 – Telecommunications Pathways and Spaces

12. TIA-606 – Administration Standard for Telecommunications Infrastructure

13. TIA-607-E – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

14. ISO/IEC 11801 – Information Technology – General Cabling for Customer Premises

15. ISO/IEC 11801 – Information Technology – Pathways and Spaces for Customer Premises Cabling

16. UL Cable Verifications Program

17. UL Testing Bulletin

1.6 DELIVERY, STORAGE, AND HANDLING

A. To prevent damage, theft, soiling, and misalignment, protect equipment during transit, storage, and handling.

B. The contractor shall coordinate the secure storage of equipment and materials on site, or, if no on-site storage is available, shall provide their own secure storage at the Contractor’s expense.

C. Do not store equipment where conditions fall outside the manufacturer's recommendations for environmental conditions.

D. Do not install damaged equipment. Remove damaged equipment from the site and replace with new equipment.

E. If off-site storage of materials is necessary, this shall be at the Contractor’s expense.

PART 2 PRODUCTS

2.1 GENERAL

A. The proposed major components shall have a consistent architecture to reduce total cost of ownership for on-going support, maintenance, and training.

B. The Contractor shall provide all equipment, miscellaneous cables, terminators, materials, parts, software, and labor for a complete and satisfactory operating environment.

C. Systems shall be in full accordance with the recommendations of the equipment and software manufacturers, with the requirements of the specifications, and with all current edition or revision of all applicable codes and standards as listed under references in this section of the specifications.

2.2 MANUFACTURERS

A. Equipment Rack

1. Basis of Design

a. Legrand OR-19-84-T4SDA2132 rack

2. Approved equipment rack manufacturers:

a. Legrand

b. Panduit

c. Hoffman

d. Or Pre-Approved Equivalent

B. Power Distribution Unit

1. Horizontal PDU

a. Basis of Design

1) Eaton Tripp Lite PDUMH20ATNET Horizontal PDU

b. Approved equipment rack manufacturers:

1) Eaton / Tripp Lite

2) Schneider Electric / APC

3) Or Pre-Approved Equivalent

C. Ladder Racking

1. Approved ladder racking manufacturers

a. Eaton / B-Line

b. nVent / Hoffman

c. Chatsworth

d. Or Pre-Approved Equivalent

2.3 EQUIPMENT RACKS

A. Basis of Design

1. Legrand OR-19-84-T4SDA2132 rack

B. Floor standing 4-post rack

C. Adjustable Dual Equipment Rack, 84"H x 20.19"W x 21.00" - 32.00"D

D. 45 Rack Units (RUs)

E. 1000 lb. load rating

F. Black in color

G. Self-supporting and self-squaring base

H. Depth adjust in 1/2-inch increments

I. Mounting holes are roll threaded for 12-24 hardware

J. Mounts 19" equipment and includes cross-recessed black panels mounting screws

K. 5/8", 5/8", 1/2" universal mounting hole pattern

L. Equipped with standard 1/2" junctioning holes for securing multiple-rack lineups

M. Constructed of 6061-T6 structural grade aluminum

N. Meets EIA-310 standards

O. Listed to the UL 1863 Standard for Communication Circuit Accessories

P. Quantities:

1. Provide and install one (1) equipment rack total.

a. One (1) equipment racks in the MDF

2. Provide and install one (1) 19” W x 15.5” D equipment shelf in each equipment rack.

3. Provide and install all necessary hardware to gang the racks together, and properly bond and ground the rack.

2.4 POWER DISTRIBUTION UNIT (PDU)

A. Vertical PDU

1. Basis of Design: Eaton Tripp Lite Series PDUV20 Vertical PDU

2. Provide and install one (1) 1.9kW single-phase PDU in each equipment rack.

3. 20A 120V

4. Vertical rack mount

5. (14) NEMA 5-15/20R outlets

6. (1) NEMA L5-20P input with 5-20P adaptor

7. 15 foot (457.2 cm) cord

2.5 LADDER RACKING

A. Provide 12 inch (304.8 mm) wide, 1-1/2 inches (38 mm) high sectional ladder rack under the ceiling and above all new rack locations, as required.

B. All ladder rack components shall be black in color.

C. Ladder tray rung spacing shall be 9”.

D. Provide transitions, threaded rod, clamps, fittings, and supports as required for a clean and professional installation.

E. Provide cable management waterfalls at each location where cable exits or enters the ladder rack.

F. Ladder Racking shall be installed a minimum of one (1) foot above the equipment racks.

G. Quantities

1. MDF = 20 feet (914.4 cm)

2. Cable Waterfalls = 1 per equipment rack

PART 3 EXECUTION

3.1 INSTALLATION

A. General location and placement of equipment cabinet and racks is shown on the project drawings.

B. Verify exact placement of cabinets and racks with the Owner prior to final installation and mounting.

C. Equipment cabinets and racks shall be assembled and installed per the manufacturer’s printed instruction.

D. Do not install patch panels, cabling or equipment to the cabinets and racks until their installation has been accepted by the Owner.

E. Cabinets and racks are to be installed such that there are no obstructions or impediments to the full opening radius of the enclosure.

F. Cabinets and racks are to be mounted such that they do not obstruct access to any other junctions, pull boxes, control panels, cabinets, etc.

3.2 GROUNDING AND BONDING

A. Communication bonding and grounding shall be in accordance with the NEC and NFPA. Cabinets and ladder racking shall be grounded and bonded in compliance with TIA-607-E, NFPA 70, and local requirements and practices. Horizontal equipment includes cross connect frames, patch panels and racks, active telecommunication equipment and test apparatus and equipment. When required by local code, provide a Telecommunications Bonding Backbone utilizing a No. 6 AWG or larger bonding conductor that provides direct bonding between equipment rooms and telecommunications closets. This is part of the grounding and bonding infrastructure (part of the telecommunications pathways and spaces in the building structure) and is independent of equipment or cable.

3.3 CLOSEOUT

A. Punch List

1. The Contractor shall perform required remedial work, without claim for additional labor or other costs. Where required, the Contractor shall re-test and submit a revised Test Report.

2. The Contractor shall notify the Technology Designer of completion of the Punch List.

3. If after notification and inspection by the Technology Designer, the identified Punch List items have not been corrected the Contractor will be notified that remedial work is still required. Additional time spent by the Technology Designer, due to the failure of the Contractor to correct Punch List items and finish the project by the agreed upon completion date as set forth in the Contract Documents, will be charged to the Contractor at the rate of one hundred twenty-five dollars ($125) per hour and deducted from the Contractors retainage.

3.4 OWNER'S RIGHT TO USE

A. Acceptance of the Work of this Section will occur after completion of corrections and adjustments required by the "Punch List" (as generated during on-site inspections and review of testing documentation).

B. The Owner reserves the right to use equipment, material and services provided as part of Work of this Section, prior to Acceptance, without incurring any obligation to accept any equipment or completed systems until Punch List work is complete and systems comply with Contract Documents.

END OF SECTION 271116

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SECTION 271323 - COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This section includes the minimum requirements for the installation of optical fiber backbone cabling between telecommunications rooms.

B. This section includes, but is not limited to the following:

1. Optical fiber cabling
2. Optical fiber enclosures and terminations
3. Optical fiber patch cords
4. Testing
5. Administration

C. Provide all labor, materials, and equipment for the completion of work called for in the Contract Documents.

D. The Contractor shall be responsible for providing the services necessary to furnish, configure, deliver, install, integrate, and test all specified equipment. All work shall be in accordance with the intent of these specifications, and as required to leave the infrastructure components complete and in manufacturer certified operating conditions, excluding those items listed under “Work by Others.”

E. The Contractor shall provide any additional items, not specifically mentioned herein or on the drawings, necessary to meet system requirements as specified, without claim for additional payment.

F. Errors or Omissions in Drawings or Documentation

1. If any errors or omissions appear in Drawings, Specifications, or other documents, the bidding Contractor shall notify the Engineer no later than ten (10) days prior to submitting the bid.

2. Should conflict occur in or between Drawings and Specifications, the bidding Contractor is deemed to have estimated the more expensive way of doing the work, unless the bidding Contractor has asked for and obtained written decision (addendum) before submission of the bid as to which method or materials will be required.

G. Related Sections:

1. Section 271116 Communications Cabinets, Racks, Frames, and Enclosures

2. Section 271513 Communications Copper Horizontal Cabling

1.3 DEFINITIONS

A. Main Distribution Frame (MDF): This technology space houses main network distribution equipment and acts as the main connection point between the Core/Network and the TR/IDF/access zones for all connections.

B. Intermediate Distribution Frame (IDF): is the location for the termination of backbone cables and for termination of horizontal cables, and for the interconnection of each. The space also hosts access–layer switches and user network connections within each floor.

C. Campus Backbone: cabling system consisting of media and termination hardware interconnecting POE, Net–Pop's and Future onsite buildings.

D. Building Backbone: cabling system consisting of media and termination hardware interconnecting MDFs to IDFs.

E. Horizontal: cabling system consisting of media and termination hardware interconnecting the Telecommunication Outlets (TOs) and the TRs.

F. Cabinet: free standing, floor–mounted or wall–mounted modular enclosure designed to house and protect rack–mounted electronic equipment and passive terminations.

G. Rack: an open, free standing, floor–mounted or wall–mounted structure, typically made of aluminum or steel, used to mount equipment; usually referred to as an equipment rack.

H. Grounding: a conducting connection to earth, or to some conducting body that serves in place of earth.

I. UTP: Unshielded Twisted Pair.

J. FO: Fiber Optic.

K. Patch Cords: a length of wire or fiber cable with connectors on one or both ends used to join communications circuits at a cross–connect.

1.4 SUBMITTALS

A. Shop drawings: Within ten (10) calendar days after award of contract, the Contractor shall submit product data cut sheets and catalog information to the Technology Designer for approval. The Contractor shall not begin installation or fabrication without such approval. The Technology Designer will indicate approval of shop drawings, product data, and samples submitted to the Designer by stamping such submittals "APPROVED" with a stamp. All shop drawings shall be marked with the pertaining specification paragraph or drawing number when submitted. Submit one (1) electronic copy of each item to the Technology Designer.

B. Shop drawings shall be submitted on the following:

1. Bill of materials and cut sheets.

2. Project schedule including all major work components that materially affect any other work on the project.

C. A technical data sheet from the manufacturer shall be included with the response for each product proposed. This data sheet shall include the physical specifications as well as the following electrical and transmission characteristics if appropriate.

1.5 QUALITY ASSURANCE

A. The contractor shall adhere to the most current applicable rulings of the Federal Communications Commission (FCC). Provide the FCC registration number with the equipment submittal. All components and installations shall bear an Underwriters' Laboratories (UL) listing and shall conform with the latest edition or revision of the following codes and standards.

1. ANSI: American National Standards Institute

2. ASTM: American Society for Testing and Materials

3. BICSI: Building Industry Consulting Service International

4. CSI: Construction Specifications Institute

5. EIA: Electronics Industries Alliance

6. FCC: Federal Communications Commission

7. ICEA: Insulated Cable Engineers Association

8. IEC : International Electro Technical Commission

9. IEEE: Institute of Electrical and Electronics Engineers

10. ISO : International Organization for Standardization

11. NEC: National Electrical Code

12. NEMA: National Electrical Manufacturer's Association

13. NFPA: National Fire Protection Association.

14. TIA: Telecommunications Industry Association

15. UL: Underwriters Laboratories, Inc.

B. All materials shall be manufactured and tested by manufacturers who are regularly engaged in the production of the components of similar systems for a minimum of five (5) years.

C. The Contractor shall maintain service facilities in the installation area. The facilities shall include a permanent source of factory trained service technicians on twenty-four (24) hour call experienced in servicing this type of cabling system and shall provide warranty and routine maintenance service to afford the Owner maximum coverage. The Contractor shall also provide a central source of support to guarantee immediate answers to Owner's problems and questions.

D. The Contractor selected for this project must be certified by the manufacture(s) specified within their submittals, adhere to the engineering, installation, and testing procedures, and utilize the recommended components.

E. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical fiber distribution systems and have personnel who are trained and certified in the use of such tools and equipment.

F. Any sub-contractor who will assist the Contractor in performance of this work shall have the same training and certification as the Contractor.

G. The Contractor shall procure and pay for all necessary permits, licenses and inspections and observe any requirements stipulated therein. The Contractor shall conform in all trades with all local regulations and codes.

H. The Contractor shall guarantee at the time of the bid that all cabling and components meet or exceed specifications of the latest ANSI/TIA standards.

I. The Contractor shall provide as part of the bid proposal a complete bill of materials, including catalog cuts, line item and extended pricing, and equipment configurations for all technologies noted in this section. This is in addition to the requests on the bid form.

J. The components shall be new, of modern design, and current standard production of the various manufacturers.

1.6 REFERENCE STANDARDS

A. The code or standard establishing the more stringent requirements shall be followed where areas of conflict occur between codes and standards or between codes and standards and drawings and specifications.

1. BICSI Telecommunications Distribution Methods Manual, Latest Edition

2. BICSI Cabling Installation Manual, Latest Edition

3. CSI Master Format Latest Edition: Division 27 - Communications

4. National Electric Code (NEC)

5. NFPA 255 Standard Method of Test of Surface Burning Characteristics of Building Materials

6. NFPA 70 - National Electric Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements

7. TIA-568.0-E – Generic Telecommunications Cabling for Customer Premises

8. TIA-568.1-E – Commercial Building Telecommunications Infrastructure Standard

9. TIA-568.2-D – Balanced Twisted-Pair Telecommunications Cabling and Components Standard

10. TIA-568.3-E – Optical Fiber Cabling and Components Standard

11. TIA-569 – Telecommunications Pathways and Spaces

12. TIA-606 – Administration Standard for Telecommunications Infrastructure

13. TIA-607-E – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

14. ISO/IEC 11801: Information Technology - General Cabling for Customer Premises

15. ISO/IEC 11801 – Information Technology – Pathways and Spaces for Customer Premises Cabling

16. UL Cable Verifications Program

17. UL Testing Bulletin

1.7 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to end.

2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.

B. To prevent damage, theft, soiling, and misalignment, protect equipment during transit, storage, and handling.

C. The contractor shall coordinate the secure storage of equipment and materials on site, or, if no onsite storage is available, shall provide their own secure storage at the Contractor’s expense.

D. Do not store equipment where conditions fall outside the manufacturer's recommendations for environmental conditions.

E. Do not install damaged equipment. Remove environmental conditions from the site and replace damaged equipment with new equipment.

F. If off-site storage of materials is necessary, this shall be at the Contractor’s expense.

PART 2 PRODUCTS

2.1 GENERAL

A. The proposed major components shall have a consistent architecture to reduce total cost of ownership for on-going support, maintenance, and training.

B. The Contractor shall provide all equipment, miscellaneous cables, terminators, materials, parts, software, and labor for a complete and satisfactory operating environment.

C. Systems shall be in full accordance with the recommendations of the equipment and software manufacturers, with the requirements of the specifications, and with all current edition or revision of all applicable codes and standards as listed under references in this section of the specifications.

2.2 MANUFACTURERS

A. Approved optical fiber cabling and component manufacturers:

1. Corning
2. Optical Cable Corporation
3. Superior Essex
4. CommScope
5. Prysmian/General Cable
6. or pre-approved equivalent

2.3 OPTICAL FIBER CABLE

A. Single-mode 8.2 µm (OS2) tight-buffered, indoor/outdoor plenum armored interlocking optical fiber

B. Twelve (12) strand fiber count

C. 900µm buffered design

D. Mechanical and transmission performance specifications that meet or exceed ANSI/TIA-568.3-E.

E. NEC/CEC Type OFCP (NFPA 262) compliant for plenum

F. Outer jacket color: Yellow

G. Routing and Distance

1. The exterior route will be through an underground conduit with a pull tape supplied by Others.

2. Assume a total distance for the fiber optic cable run shall be 1,200 feet.

H. Approved Product:

1. Superior Essex L4012B401

2. Corning 012E88-33131-A3

3. General Cable AP0121PNU-ILPA

4. or pre-approved equivalent

2.4 OPTICAL FIBER ENCLOSURES AND TERMINATIONS

A. Enclosure shall be 1RU and hold a minimum of two (2) adapter panels.

B. Enclosure shall be black in color.

C. Enclosure shall have slidable access.

D. Enclosure shall have moveable mounting brackets that allow for flush or protruding mounting.

E. Install blank panels as required for all unused panel slots in the new IDF enclosure.

F. Adapter color: Blue

G. LC 8.2/125 µm OS2 single-mode fiber optic connectors, which meet or exceed the performance specifications in ANSI/TIA-568.3-E.

H. Approved Product:

1. Hubbell OptiChannel

2. Corning CCH series

3. Panduit OptiCom

4. CommScope

5. or pre-approved equivalent

2.5 OPTICAL FIBER PATCH CABLES

A. The Contractor shall provide twelve (12) 2-meter single-mode (OS2) LC to LC duplex patch cables.

B. Outer jacket color: Yellow

C. Fiber patch cables shall meet all requirements of the installed optical fiber backbone cable.

D. Approved Manufacturer:

1. Hubbell

2. Corning

3. Panduit

4. CommScope

5. Or pre-approved equivalent

2.6 UNSPECIFIED EQUIPMENT AND MATERIAL

A. Any item of equipment or material not specifically addressed on the drawings or in this document and required to provide a complete and functional installation shall be provided in a level of quality consistent with other specified items.

PART 3 EXECUTION

3.1 GENERAL

A. Upon completion of work, the Contractor shall submit as-built drawings to the Owner and Engineer.

B. Install all cables in accordance with project drawings.

C. Provide any screws, anchors, clamps, tie wraps, distribution rings, miscellaneous grounding, and support hardware, etc. needed to facilitate the installation of the cable plant system.

D. Provide and install J-hook cable supports attached directly to the building structure (structural steel) at intervals not exceeding 5 feet (1.5 m) along the entire cable route. Install additional supports as required at bends, transitions, and vertical drops to maintain proper cable support and prevent sagging, in accordance with BICSI and ANSI/TIA requirements.

E. Furnish any special installation equipment or tools required to properly complete the installation.

F. Do not roll or store cable reels without an appropriate underlay.

G. Failure to follow the appropriate guidelines may require the installer to provide the additional material and labor required to bring the installation back into alignment with the guidelines. This shall also apply to any and all damages caused to the cables by the installer during the implementation.

H. Provide fire stopping at all fire-rated ceiling, wall, and floor penetrations.

I. Plug conduits where cabling has been installed in the main equipment room, backbone, and other cable entrance locations with re-enterable duct seal of flame-retardant putty.

J. Provide bushings on all conduit ends.

K. All wiring, materials, and equipment must be listed and labeled by an NRTL. To certify that performance characteristics, meet ANSI/TIA 568 Standards, provide all Original Equipment Manufacturer (OEM) documentation to the Owner.

L. All of the pathways shown on the drawings are suggested routes for the Contractor to use as guidelines. Prior to construction, the Contractor shall coordinate in the field with other trades to determine the exact feeder, tie, and riser backbone cabling pathways. In any case where the communication pathway must be removed and re-routed, due to conflicts with other trades with which the Contractor did not previously coordinate, the Contractor is responsible for all costs associated with the removal and relocation.

3.2 OPTICAL FIBER BACKBONE CABLE

A. Install the optical fiber backbone in a continuous length from the new IDF Tech Room 2303 to the MDF in Wagar Middle School.

B. Leave a 3-meter maintenance loop at each end of the link, neatly contained in the cabinet or ladder rack in a “figure 8” loop at the rear of the OFE.

C. Throughout the length of the cable, maintain the minimum bend radius and pulling force recommended by the manufacturer and required by industry standards, both during installation and after termination and testing.

D. On each end, remove all outer jacket and strength member materials to expose the individual 900-micron buffering of the individual strands for a length of 0.5 m 18 inches (457.2 mm).

E. On each end, hold the cable ends securely in place with the cable clamping accessories in each OFE.

F. Route individual strands in the rear of the OFE in a neat and orderly fashion and place them so as not to create undue stress or micro bending of the strands.

G. Secure all cable bundles with proper bundling or securing materials so as to ensure that the cable runs are securely held in place both vertically and horizontally.

H. Do not tighten bundling materials or securing devices so tightly that they deform the inherent cable geometry or construction.

I. Do not use cable ties or hook-and-loop tape to secure cable runs to other building systems such as electrical conduit, Electric Metallic Tube (EMT), sprinkler pipes, ceiling suspension members.

J. In environmental air-handling spaces, only use appropriately listed materials.

3.3 LABELING

A. Uniquely identify all components of the installed system by location, function, unit, and sub-unit.

B. Identify each location with a unique alphanumeric identifier.

C. Assign a unique alphanumeric identifier for each equipment enclosure in the building.

D. Identify each adapter module in each distribution or interconnect enclosure with an alphanumeric identifier.

E. Identify all conduits, trays, and pathways with a unique alphanumeric identifier.

F. Identify optical fiber cables by a textual label that indicates its type, strand count, point of origin, and termination.

G. Supply a Cable Identification Matrix

H. Supply all records in compliance with ANSI/TIA-568.3-E

I. Before installing or terminating cable, confirm all specific labeling requirements with the Owner or the Owner's Engineer.

J. Mark each backbone cable at each endpoint and at all intermediate pull and access points and junction boxes with a label that indicates the origination and destination identifiers, the sheath identifier, and the strand or pair range.

K. Optical Fiber Enclosures (OFEs)

1. Mark each OFE with an adhesive label that indicates the range of circuits installed within it.

2. Label each port with the origination and destination grid identifier and the individual strand ID.

3. At each end of each cable, within 75 mm 3 inches (76.2 mm) of the end of the sheath, place a self-laminating label that surrounds the outermost jacket and bears the appropriate cable identifier.

4. On each equipment enclosure, affix self-adhesive labels, bearing the enclosure's identifier in block characters, at the top center of the front and rear doors or faces.

5. In all enclosures, place a label directly adjacent to the shortest side of each adapter that bears that adapter's identifier. Rotate the characters on the labels to maintain a left to right, top to bottom orientation.

3.4 GROUNDING AND BONDING

A. Communication bonding and grounding shall be in accordance with the NEC and NFPA. Horizontal cables shall be grounded in compliance with ANSI/TIA-607-E, ANSI/NFPA 70, and local requirements and practices. Horizontal equipment includes cross connect frames, patch panels and racks, active telecommunication equipment and test apparatus and equipment. When required by local code, provide a Telecommunications Bonding Backbone utilizing a No. 6 AWG or larger bonding conductor that provides direct bonding between equipment rooms and telecommunications closets. This is part of the grounding and bonding infrastructure (part of the telecommunications pathways and spaces in the building structure) and is independent of equipment or cable.

3.5 OPTICAL FIBER CABLE TESTING

A. Test all fiber (100%) using a bidirectional, power meter, and light source field test of all fiber strands in both directions.

B. Bidirectional Power Meter testing shall be conducted on each strand. Provide test results and include as a minimum the following information for all cables:

1. Fiber cable label number

2. Fiber cable length

3. Attenuation (dB loss)

4. Test Date

5. Tester make and model number

6. Tester calibration date

7. Perform tests at both 1310nm and 1550nm wavelengths for single-mode

C. All cable testing shall be conducted by an experienced technician.

D. The test reports shall be in PDF format from the cable manufacturer's certified testing equipment. An electronic copy of all test reports shall be provided to the Owner with an electronic version on a USB drive. Additionally, this Contractor shall provide hardcopy documentation indicating test results for each cable installed by closet and in numerical order.

E. Any cable or component that does not meet the required operational tests or fails to meet installation standards as specified shall be repaired or replaced by the Contractor as directed by, and at no expense to, the Owner.

3.6 CLOSEOUT

A. Punch List

1. The Contractor shall perform required remedial work, without claim for additional labor or other costs. Where required, the Contractor shall re-test and submit a revised Test Report.

2. The Contractor shall notify the Technology Designer of completion of the Punch List.

3. If after notification and inspection by the Technology Designer, the identified Punch List items have not been corrected the Contractor will be notified that remedial work is still required. Additional time spent by the Technology Designer, due to the failure of the Contractor to correct Punch List items and finish the project by the agreed upon completion date as set forth in the Contract Documents, will be charged to the Contractor at the rate of one hundred twenty-five dollars ($125) per hour and deducted from the Contractors retainage.

3.7 OWNER'S RIGHT TO USE

A. Acceptance of the Work of this Section will occur after completion of corrections and adjustments required by the "Punch List" (as generated during onsite inspections and review of testing documentation).

B. The Owner reserves the right to use equipment, material and services provided as part of Work of this Section, prior to Acceptance, without incurring any obligation to accept any equipment or completed systems until Punch List work is complete and systems comply with Contract Documents.

END OF SECTION 271323

SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING

HPART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SECTION INCLUDES

A. This section includes, but is not limited to the following:

1. Copper cabling
2. Modular patch panels
3. Modular jacks
4. Faceplates and modules
5. Patch cables

1.3 SUMMARY

A. This section includes the minimum requirements for the installation of communications horizontal cabling between telecommunications rooms and outlets or devices.

B. Provide all labor, materials, and equipment for the completion of work called for in the Contract Documents.

C. The Contractor shall be responsible for providing the services necessary to furnish, configure, deliver, install, integrate, and test all specified equipment. All work shall be in accordance with the intent of these specifications, and as required to leave the infrastructure components complete and in manufacturer certified operating conditions, excluding those items listed under “Work by Others.”

D. The Contractor shall provide any additional items, not specifically mentioned herein or on the drawings, necessary to meet system requirements as specified, without claim for additional payment.

E. Errors or Omissions in Drawings or Documentation

1. If any errors or omissions appear in Drawings, Specifications, or other documents, the bidding Contractor shall notify the Engineer no later than ten (10) days prior to submitting the bid.

2. Should conflict occur in or between Drawings and Specifications, the bidding Contractor is deemed to have estimated the more expensive way of doing the work, unless the bidding Contractor has asked for and obtained written decision (addendum) before submission of the bid as to which method or materials will be required.

F. Related Sections:

1. Section 271116 Communications Cabinets, Racks, Frames, and Enclosures

2. Section 271323 Communications Optical Fiber Backbone Cabling

1.4 DEFINITIONS

A. Structured Cabling System (SCS) wiring is defined as all required equipment and cabling including hardware, termination blocks, cross connect wire or cordage, patch panels, patch cords, telecommunication outlets, work area cords, UTP and fiber cable installed and configured to provide computer data and voice connectivity.

B. Main Distribution Frame (MDF): This technology space houses main network distribution equipment and acts as the main connection point between the Core/Network and the TR/IDF/access zones for all connections.

C. Intermediate Distribution Frame (IDF): is the location for the termination of backbone cables and for termination of horizontal cables, and for the interconnection of each. The space also hosts access–layer switches and user network connections within each floor.

D. Horizontal: cabling system consisting of media and termination hardware interconnecting the Telecommunication Outlets (TOs) and the TRs.

E. Bonding: permanent joining of metallic parts to form an electrically conductive path which will assure electrical continuity and the capacity to conduct safely any current likely to be imposed on it.

F. Cabinet: free standing, floor–mounted or wall–mounted modular enclosure designed to house and protect rack–mounted electronic equipment and passive terminations.

G. Rack: an open, free standing, floor–mounted or wall–mounted structure, typically made of aluminum or steel, used to mount equipment; usually referred to as an equipment rack.

H. Grounding: a conducting connection to earth, or to some conducting body that serves in place of earth.

I. Jack: receptacle used in conjunction with a plug to make electrical contact between communications circuits, e.g., eight–position/eight–contact modular jacks.

J. UTP: Unshielded Twisted Pair.

K. Patch Cords: a length of wire or fiber cable with connectors on one or both ends used to join communications circuits at a cross–connect.

L. Patch Panel: system of terminal blocks or connectors used with patch cords that facilitate administration of cross–connect fields.

M. Pathway: facility for the placement of communications cable. A pathway facility can be composed of several components including conduit, wireway, cable tray, surface raceway, under floor systems, overhead systems, raised floor, ceiling support wires, etc.

1.5 SUBMITTALS

A. Shop drawings: Within ten (10) calendar days after award of contract, the Contractor shall submit product data cut sheets and catalog information to the Technology Designer for approval. The Contractor shall not begin installation or fabrication without such approval. The Technology Designer will indicate approval of shop drawings, product data, and samples submitted to the Designer by stamping such submittals "APPROVED" with a stamp. All shop drawings shall be marked with the pertaining specification paragraph or drawing number when submitted. Submit one (1) electronic copy of each item to the Technology Designer.

1. Shop drawings shall be submitted on the following:

2. Bill of materials and cut sheets.

B. Project schedule including all major work components that materially affect any other work on the project.

C. A technical data sheet from the manufacturer shall be included with the response for each product proposed. This data sheet shall include the physical specifications as well as the following electrical and transmission characteristics if appropriate:

1. Mutual capacitance

2. Impedance

3. DC resistance

4. Attenuation

5. Worst Pair-to-Pair Near End Cross Talk

6. Power Sum Near End Cross Talk

1.6 QUALITY ASSURANCE

A. The contractor shall adhere to the most current applicable rulings of the Federal Communications Commission (FCC). Provide the FCC registration number with the equipment submittal. All components and installations shall bear an Underwriters' Laboratories (UL) listing and shall conform with the latest edition or revision of the following codes and standards:

1. ANSI: American National Standards Institute

2. ASTM: American Society for Testing and Materials

3. BICSI: Building Industry Consulting Service International

4. CSI: Construction Specifications Institute

5. EIA: Electronics Industries Alliance

6. FCC: Federal Communications Commission

7. ICEA: Insulated Cable Engineers Association

8. IEC: International Electro Technical Commission

9. IEEE: Institute of Electrical and Electronics Engineers

10. ISO : International Organization for Standardization

11. NEC: National Electrical Code

12. NEMA: National Electrical Manufacturer’s Association

13. NFPA: National Fire Protection Association.

14. TIA: Telecommunications Industry Association

15. UL: Underwriters Laboratories, Inc.

B. All materials shall be manufactured and tested by manufacturers who are regularly engaged in the production of the components of similar systems for a minimum of five (5) years.

C. The Contractor shall maintain service facilities in the installation area. The facilities shall include a permanent source of factory trained service technicians on twenty-four (24) hour call experienced in servicing this type of cabling system and shall provide warranty and routine maintenance service to afford the Owner maximum coverage. The Contractor shall also provide a central source of support to guarantee immediate answers to Owner's problems and questions.

D. The Contractor selected for this project must be certified by the manufacture(s) specified within their submittals, adhere to the engineering, installation, and testing procedures, and utilize the recommended components.

E. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of Category 6A distribution systems and have personnel who are trained and certified in the use of such tools and equipment.

F. Any sub-contractor who will assist the Contractor in performance of this work shall have the same training and certification as the Contractor.

G. The Contractor shall procure and pay for all necessary permits, licenses and inspections and observe any requirements stipulated therein. The Contractor shall conform in all trades with all local regulations and codes.

H. The Contractor shall guarantee at the time of the bid that all cabling and components meet or exceed specifications of the latest TIA standards.

I. The Contractor shall provide as part of the bid proposal a complete bill of materials, including catalog cuts, line item and extended pricing, and equipment configurations for all technologies noted in this section. This is in addition to the requests on the bid form.

J. The components shall be new, of modern design, and current standard production of the various manufacturers.

1.7 REFERENCE STANDARDS

A. The code or standard establishing the more stringent requirements shall be followed where areas of conflict occur between codes and standards or between codes and standards and drawings and specifications.

1. BICSI Telecommunications Distribution Methods Manual, Latest Edition
2. BICSI Cabling Installation Manual, Latest Edition
3. CSI Master Format Latest Edition: Division 27 - Communications
4. National Electrical Code (NEC)
5. NFPA 255 Standard Method of Test of Surface Burning Characteristics of Building Materials
6. NFPA 70 - National Electric Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements
7. TIA-568.0-E – Generic Telecommunications Cabling for Customer Premises
8. TIA-568.1-E – Commercial Building Telecommunications Infrastructure Standard
9. TIA-568.2-D – Balanced Twisted-Pair Telecommunications Cabling and Components Standard
10. TIA-568.3-E – Optical Fiber Cabling and Components Standard
11. TIA-569 – Telecommunications Pathways and Spaces
12. TIA-606 – Administration Standard for Telecommunications Infrastructure
13. TIA-607-E – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

14. ISO/IEC 11801: Information Technology - General Cabling for Customer Premises

15. ISO/IEC 11801 – Information Technology – Pathways and Spaces for Customer Premises Cabling

16. UL Cable Verifications Program

17. UL Testing Bulletin

1.8 DELIVERY, STORAGE, AND HANDLING

A. To prevent damage, theft, soiling, and misalignment, protect equipment during transit, storage, and handling.

B. The Contractor shall coordinate the secure storage of equipment and materials on site, or, if no on-site storage is available, shall provide their own secure storage.

C. If off-site storage of materials is necessary, this shall be at the Contractor’s expense.

D. Do not store equipment where conditions fall outside the manufacturer's recommendations for environmental conditions.

E. Do not install damaged equipment. Remove environmental conditions from the site and replace damaged equipment with new equipment.

PART 2 PRODUCTS

2.1 GENERAL

A. The proposed major components shall have a consistent architecture to reduce total cost of ownership for on-going support, maintenance, and training.

B. The Contractor shall provide all equipment, miscellaneous cables, terminators, materials, parts, software, and labor for a complete and satisfactory operating environment.

C. Systems shall be in full accordance with the recommendations of the equipment and software manufacturers, with the requirements of the specifications, and with all current edition or revision of all applicable codes and standards as listed under references in this section of the specifications.

2.2 MANUFACTURERS

A. Approved copper cabling manufacturers:

1. Belden

2. CommScope

3. General Cable

4. Superior Essex

5. Prysmian (Outdoor Cat 6 only)

6. or pre-approved equivalent

B. Approved component manufacturers:

1. CommScope

2. Hubbell

3. Panduit

4. or pre-approved equivalent

2.3 CATEGORY 6A CABLE

A. 100ohm balanced Unshielded Twisted Pair (UTP) (plenum rated) with four individually twisted-pairs, which exceed the mechanical and transmission performance specifications in TIA-568.2, 500 MHz

B. 23 AWG solid bare annealed copper

C. .265” maximum nominal cable diameter

D. NEC/CEC Type CMP (NFPA 262) compliant for plenum

E. Cable color specification:

1. Data - Blue

2. Security Cameras - Green

3. Wireless Access Points - Yellow

F. Approved Products:

1. Belden Cat 6A 10GXW

2. General Cable GenSPEED 10

3. Superior Essex 10Gain

4. CommScope GigaSPEED X10D

5. or pre-approved equivalent

2.4 INDOOR/OUTDOOR CATEGORY 6 DATA CABLE

A. Category 6 rated 100 ohm balanced with four individually twisted-pairs, which exceed the mechanical and transmission performance specifications in ANSI/TIA-568.2, 350 MHz.

B. 22 AWG solid bare annealed copper

C. NEC/CEC Type Outside Plant (OSP) Polyolefin compliant for outdoor installation

D. Cross-web separator and waterproof

E. Supports one (1) gigabit per second (Gbps) speeds and delivers PoE Type 1, 2, 3, or 4 at distances of up to 218.72 yards (200 meters).

F. Cable color specification:

1. Data - Blue

2. Security Cameras - Green

3. Wireless Access Points - Yellow

G. Approved Products:

1. Prysmian GenSPEED 6 MAX

2. or pre-approved equivalent

H. This cable is for the ticket booths only.

1. Install (4) data drops from the MDF to the east and west ticket booths.

a. One (1) Data

b. One (1) WAP

c. One (1) Interior camera

d. One (1) Exterior camera

2. Refer to the Electrical Power plans for counduit routing and lengths provided by others.

2.5 CATEGORY 6 JACKS

A. Data jacks shall be 8-position configuration and shall meet the transmission performance of Category 6.

B. The jacks shall be wired to ANSI/TIA 568B wiring scheme.

C. Keystone type module.

D. Jack color specifications:

1. Data - Blue

2. Security Cameras - Green

3. Wireless Access Points - Yellow

E. Jacks shall mount within 2-port surface mount backboxes at each Wireless Access Point (WAP) and Security Camera end.

F. Jacks shall mount within modular patch panels in MDF and IDFs.

G. Approved Manufacturers:

1. Hubbell

2. Panduit

3. CommScope

4. or pre-approved equivalent

2.6 CATEGORY 6A JACKS

A. Data jacks shall be 8-position configuration and shall meet the transmission performance of Category 6A.

B. The jacks shall be wired to ANSI/TIA 568B wiring scheme.

C. Keystone type module.

D. Jack color specifications:

1. Data - Blue

2. Security Cameras - Green

3. Wireless Access Points - Yellow

E. Jacks shall mount within 2-port surface mount backboxes at each Wireless Access Point (WAP) and Security Camera end.

F. Jacks shall mount within modular patch panels in MDF and IDFs.

G. Approved Manufacturers:

1. Hubbell

2. Panduit

3. CommScope

4. or pre-approved equivalent

2.7 PATCH PANELS

A. 19 inch (482.6 mm). rack mountable, 48-port, 2RU flush mount modular patch panels.

B. Keystone openings.

C. Patch panels shall have area for labels and identifications.

D. Patch panels shall be black in color.

E. Patch panels must include rear cable strain relief bar.

F. Approved Products:

1. Hubbell NSPJ48

2. Panduit NetKey

3. CommScope M-Series

4. or pre-approved equivalent

2.8 FACEPLATES AND INSERTS

A. Provide flush mount stainless steel faceplates at all locations, with numbers of modules, jacks and/or connectors, inserts and blanks as required.

B. Single or double gang as required.

C. All faceplates shall be stainless steel.

D. Faceplates must accept decora inserts. Decora inserts shall be white in color.

E. Provide inserts, jacks and/or connectors and blanks for all outlet ports. All white in color.

F. Contractor shall blank off all unused ports. Blank inserts shall be white in color.

2.9 SURFACE MOUNT BACKBOXES

A. Provide one (1) two-port surface box at each Wireless Access Point and Security Camera location as indicated on the project drawings. The box shall house and protect the jacks and terminations.

B. Surface mount backboxes shall accept keystone modules.

C. Surface mount backboxes shall be white in color.

D. Plenum rated.

E. Contractor shall blank all unused outlet ports.

F. Approved Products:

1. Hubbell ISB2W

2. Panduit NetKey NK2BX

3. CommScope SMB-2P

4. or pre-approved equivalent

2.10 COPPER PATCH CORDS - CLOSET END

A. The Contractor shall provide one (1) one foot (1') patch cord for each Cat 6A drop installed for the MDF/IDF end of the link.

B. Copper patch cords shall be of the Category 6A.

C. Copper patch cords shall match the color of the cable for which it is being supplied.

1. Data - Blue

2. Security Cameras - Green

3. Wireless Access Point- Yellow

D. Copper patch cords shall be small diameter, 28AWG, and have stranded conductors.

E. The copper patch cords shall meet or exceed TIA-568.2 standards for Category 6A cables.

F. The copper patch cords shall be non-booted.

G. The patch cables shall be labeled in accordance with TIA-606.

H. Manufacturer of patch cables shall be complaint with the manufacturer's connectivity requirements.

2.11 UNSPECIFIED EQUIPMENT AND MATERIAL

A. Any item of equipment or material not specifically addressed on the drawings or in this document and required to provide a complete and functional communications cabling system installation shall be provided in a level of quality consistent with other specified items.

PART 3 EXECUTION

3.1 GENERAL

A. Upon completion of work, the Contractor shall submit as-built drawings to the Owner and Engineer.

B. Install all cables in accordance with project drawings.

C. Provide any screws, anchors, clamps, tie wraps, distribution rings, miscellaneous grounding, and support hardware, etc. needed to facilitate the installation of the cable plant system.

D. Provide and install J-hook cable supports attached directly to the building structure (structural steel) at intervals not exceeding 5 feet (1.5 m) along the entire cable route. Install additional supports as required at bends, transitions, and vertical drops to maintain proper cable support and prevent sagging, in accordance with BICSI and ANSI/TIA requirements.

E. Furnish any special installation equipment or tools required to properly complete the installation.

F. Do not roll or store cable reels without an appropriate underlay.

G. Failure to follow the appropriate guidelines may require the installer to provide the additional material and labor required to bring the installation back into alignment with the guidelines. This shall also apply to any and all damages caused to the cables by the installer during the implementation.

H. Provide fire stopping at all fire-rated ceiling, wall, and floor penetrations.

I. Plug conduits where cabling has been installed in the main equipment room, backbone, and other cable entrance locations with re-enterable duct seal of flame-retardant putty.

J. Provide bushings on all conduit ends.

K. All wiring, materials, and equipment must be listed and labeled by an NRTL. To certify that performance characteristics, meet TIA 568 Standards, provide all Original Equipment Manufacturer (OEM) documentation to the Owner.

L. All of the pathways shown on the drawings are suggested routes for the Contractor to use as guidelines. Prior to construction, the Contractor shall coordinate in the field with other trades to determine the exact feeder, tie, and riser backbone cabling pathways. In any case where the communication pathway must be removed and re-routed, due to conflicts with other trades with which the Contractor did not previously coordinate, the Contractor is responsible for all costs associated with the removal and relocation.

3.2 COPPER HORIZONTAL CABLE

A. All horizontal cables shall be run continuous from Main Distribution Frame (MDF) or Intermediate Distribution Frame (IDF) to media outlet and free from splices, reverses, grounds, or other connections.

B. Provide and install J-hook cable supports attached directly to the building structure (structural steel) at intervals not exceeding 5 feet (1.5 m) along the entire cable route. Install additional supports as required at bends, transitions, and vertical drops to maintain proper cable support and prevent sagging, in accordance with BICSI and ANSI/TIA requirements.

C. The Contractor shall provide a one foot (1’) minimum service loop at the workstation jack end of each data drop.

D. The Contractor shall provide a ten foot (10') minimum service loop at each Wireless Access Point and Security Camera jacks above accessible ceiling to accommodate future changes. Wireless Access Points and Security Cameras provided and installed by others.

E. The Contractor shall provide a ten foot (10') minimum service loop in each closet to accommodate future changes.

F. The Contractor shall terminate all horizontal cable according to T568B jack pin assignments.

G. The Contractor shall remove only the amount of cable jacket necessary for termination. The Contractor shall maintain wire twist for all pairs of Category 6A cable to within one-half (1/2") of the termination point.

H. The Contractor shall not run cable longer than the maximum ninety (90) meter ANSI/TIA recommended length.

I. Copper splices in the horizontal distribution are prohibited.

J. All cables installed shall be plenum-rated.

K. The Contractor shall carefully lay all cable with appropriate radius of curvature and protect at bends and corners. The Contractor shall observe minimum bend radius and tension limitations as specified by ANSI/TIA for Category 6A.

L. Cable bundles shall not exceed 192 cables.

M. Equipment cabinets and patch panels shall be arranged to allow for natural wiring progression in functional fields, eliminate crossing of wires and allow for the easy access to each component.

N. The Contractor shall assure that at the completion of cable installation, cables are free from twists, kinks, sharp bends, cuts, gouges, or any other physical damage that might cause alterations to the electrical characteristics of the cables.

O. The Contractor shall seal both ends of all sleeves, including the outside perimeter with Nelson or 3M fire retardant caulk and putty after cable installation. The fire rating classification shall equal or exceed the fire rating of the wall.

3.3 LABELING

A. The Contractor shall provide cable number designations tags on the cables in each outlet box. All cable designations and color-coding shall be in full compliance with ANSI/TIA-606.

1. The Contractor shall clearly label cables at both ends with permanently applied, mechanically printed labels. Handwritten labels will not be acceptable. The Contractor shall use standardized colors and alphanumeric codes. The Owner shall approve the labeling system and method prior to installation.

2. Data: In work areas, the Contractor shall place cable ID labels around each new cable drop in the outlet boxes within two (2) inches of the jacks and on front of the faceplates at all new and existing locations. Use flexible vinyl or polyester labels that will flex as cables are bent. The Contractor must provide proof of concept labels for Owner approval before any work is performed.

3. In all MDF and IDF locations, the Contractor shall place ID labels around each cable. Labels shall be located within six (6) inches of the termination. Use flexible vinyl or polyester labels that will flex as cables are bent.

4. The Contractor shall front label each telecommunications room, rack, patch panel, and patch panel port and perform continuity, polarity, and map test for each port.

5. The specific labeling scheme for each facility will be determined by the Owner at the time of installation. The labeling scheme shall include closet, patch panel, and port designations.

3.4 GROUNDING AND BONDING

A. Communication bonding and grounding shall be in accordance with the NEC and NFPA. Horizontal cables shall be grounded in compliance with ANSI-J-STD-607, ANSI/NFPA 70, and local requirements and practices. Horizontal equipment includes cross connect frames, patch panels and racks, active telecommunication equipment and test apparatus and equipment. When required by local code, provide a Telecommunications Bonding Backbone utilizing a No. 6 AWG or larger bonding conductor that provides direct bonding between equipment rooms and telecommunications closets. This is part of the grounding and bonding infrastructure (part of the telecommunications pathways and spaces in the building structure) and is independent of equipment or cable.

3.5 UTP CABLE TESTING

A. The Contractor shall, at all times, permit and facilitate work inspection by the Owner Representative and by public authorities having jurisdiction. The Owner’s Representative shall have the authority to stop the work, if required, to insure proper execution.

1. Each UTP cable pair shall be tested end to end from the outlet termination to the patch panel.

2. Tests shall be permanent link only.

B. Cables and connectors comprising Category 6A must be certified compliant with the performance requirements listed in ANSI/TIA-568.2.

1. As a minimum, test documentation shall include:

a. Cable Identification Number

b. Worst Case Near End Cross Talk (NEXT)

c. Attenuation

d. PSNEXT

e. Resistance

f. Return Loss

g. ELFEXT

h. PSELFEXT

i. Propagation Delay

j. Propagation Delay Skew

k. Cable Length

l. Test Date

2. Each data circuit, including all connectors, shall be tested to verify all bandwidth performance and crosstalk specifications as outlined for Category 6A. Any cables not in one hundred percent (100%) compliance with the minimum performance criteria relating to Category 6A will be replaced with no additional cost to the Owner.

C. Each data circuit, including all connectors, shall be tested to verify all bandwidth performance and crosstalk specifications as outlined for Category 6A. Any cables not in one hundred percent (100%) compliance with the minimum performance criteria relating to Category 6A will be replaced with no additional cost to the Owner.

1. Cable testing will be conducted by a programmable, ISO/IEC 11801 Class D, E, F micro-computer-based tester capable of testing all specific standard requirements and generating completed printed test results.

D. Test equipment shall be a designed, and of such grade, so as to provide reliable certification and testing compliant with the SCS manufacturer's requirements.

E. The test reports shall be in PDF format from the cable manufacturer's certified testing equipment. An electronic copy of all test reports shall be provided to the Owner with an electronic version on a USB drive. Additionally, this Contractor shall provide test results for each cable installed by closet and in numerical order.

F. Any outlet, cable or component that does not meet the required operational tests or fails to meet installation standards as specified shall be repaired or replaced by the Contractor as directed by, and at no expense to, the Owner.

3.6 CLOSEOUT

A. Punch List

1. The Contractor shall perform required remedial work, without claim for additional labor or other costs. Where required, the Contractor shall re-test and submit a revised Test Report.

2. The Contractor shall notify the Technology Designer of completion of the Punch List.

3. If after notification and inspection by the Technology Designer, the identified Punch List items have not been corrected the Contractor will be notified that remedial work is still required. Additional time spent by the Technology Designer, due to the failure of the Contractor to correct Punch List items and finish the project by the agreed upon completion date as set forth in the Contract Documents, will be charged to the Contractor at the rate of one hundred twenty-five dollars ($125) per hour and deducted from the Contractors retainage.

3.7 OWNER'S RIGHT TO USE

A. Acceptance of the Work of this Section will occur after completion of corrections and adjustments required by the "Punch List" (as generated during on-site inspections and review of testing documentation).

B. The Owner reserves the right to use equipment, material and services provided as part of Work of this Section, prior to Acceptance, without incurring any obligation to accept any equipment or completed systems until Punch List work is complete and systems comply with Contract Documents.

END OF SECTION 271513

SECTION 271543 - COMMUNICATIONS CABLING UNIT PRICE SHEET

NOTE: UNIT PRICES ARE TO BE INCLUDED WITH BIDDER'S ORIGINAL SEALED PROPOSAL FOR THE WORK TO BE PER PROJECT SPECIFICATIONS. ALL UNIT PRICES SHALL INCLUDE INSTALLATION LABOR UNLESS OTHERWISE NOTED.

ITEM OR MATERIAL	UNIT PRICE REGULAR TIME
PROVIDE 1 – SINGLE CATEGORY 6A DATA DROP INCLUDING CABLE, JACKS, FACEPLATE, ETC.	$
PROVIDE 1 – DUAL CATEGORY 6A DATA DROP INCLUDING CABLE, JACKS, FACEPLATE, ETC.	$
PROVIDE 1 – SINGLE CATEGORY 6A DATA DROP IN THE CEILING FOR A SECURITY CAMERA OR WIRELESS ACCESS POINT INCLUDING CABLE, JACKS, SURFACE-MOUNT BOX, ETC.	$
PROVIDE 1 – CATEGORY 6A 24-PORT MODULAR PATCH PANEL, MOUNTED, UNPOPULATED	$
PROVIDE 1 – CATEGORY 6A 48-PORT MODULAR PATCH PANEL, MOUNTED, UNPOPULATED	$
PROVIDE 1 – CATEGORY 6A PATCH CABLE, 1-FOOT (DELIVERED, NO INSTALL)	$
PROVIDE 1 – CATEGORY 6A PATCH CABLE, 3-FOOT (DELIVERED, NO INSTALL)	$
PROVIDE 1 – CATEGORY 6A PATCH CABLE, 10-FOOT (DELIVERED, NO INSTALL)	$
PROVIDE 1 – 1" CONDUIT SLEEVE INCLUDING CORING, CONDUIT, BUSHINGS, FIRESTOP	$
PROVIDE 1 – 7 FEET OF WIREMOLD V2000 RACEWAY, 2-GANG BACK BOX, AND FACEPLATE	$
CABLING TECHNICIAN (HOURLY RATE)	$
CABLING TECHNICIAN (OVERTIME HOURLY RATE)	$
CABLING TECHNICIAN (HOLIDAY HOURLY RATE)	$

END OF SECTION 271543

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SECTION 272129 - NETWORK INFRASTRUCTURE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract Documents apply to work of this section.

1.2 SECTION INCLUDES

A. This section includes, but is not limited to the following:

1. Edge Network Switches
2. SFP+ Fiber Optic Modules
3. Stacking Modules and Cables

1.3 SUMMARY

A. This section includes the minimum requirements for the installation of network switches and associated components in the MDF and IDF-4 telecommunications rooms in Student Activity Center. In addition, installation of wireless access points in the two (2) building additions as indicated on the project drawings.

B. The Network Infrastructure (NI) will not only serve today's needs but also will ensure future capacity and expandability. The basic principles of the new NI are that they must be highly available, reliable, maintainable, and easily expandable.

C. Provide all labor, materials, and equipment for the completion of work called for in the Contract Documents.

D. The Contractor shall provide the services necessary to engineer, furnish, install, test, certify and provide maintenance support for a warranted and fully operational NI conforming to manufacturer specifications and acceptable industry standards. All work shall be in accordance with the true intent of these drawings and specifications, and as required to leave the NI complete and in satisfactory operating condition, excluding those items listed under "Related Work Provided by Others."

E. The Contractor shall verify dimensions and conditions at the job site prior to bidding, installation, and perform installation in accordance with these Specifications, manufacturers' recommendations and the latest edition or revision of all applicable codes and standards.

F. The NI includes providing and integrating the following principal systems:

1. An enterprise-grade Network Infrastructure
2. Edge Switches

3. Wireless Access Points

4. The NI Contractor shall install all Category 6A patch cords required for all switch ports, interconnection, and stacking.

5. Requirements for configuration and optimization of client devices.

6. Management Software

7. Testing

8. Documentation

9. Training

G. The Contractor shall furnish and install a NI incorporating the software, hardware, and services appropriate as hereinafter described. The Contractor shall provide a detailed testing methodology used to ensure the system and applications are functioning to manufacturer specifications, and these specification requirements, with its response. Other tests, specific to installed equipment, may be required.

H. This response must include complete itemization of all components including pricing itemization on all switches, modules, management software, wireless access points cabling, accessories, and any other required components. This is in addition to the requests on the Bid Forms.

I. The Contractor shall provide any additional items, not specifically mentioned herein, necessary to meet system requirements as specified, without claim for additional payment.

1.4 CONFLICT BETWEEN DRAWINGS AND SPECIFICATION

A. NIt is intended that the Contractor furnishing any materials or labor necessary for the completion of these specifications shall furnish them in compliance with these specifications. Where conflict exists with other specifications concerning such materials and labor, these specifications take precedence unless otherwise approved in writing by the Technology Designer.

B. Drawings pertaining to these specifications shall be considered as a part of said specification and shall be a part of the Contract Documents.

1.5 QUALITY ASSURANCE

A. The NI will adhere to the most current applicable rulings of the Federal Communications Commission (FCC). Provide the FCC registration number with the equipment submittal. All components and installations shall bear an Underwriters' Laboratories (UL) listing and shall conform with the latest edition or revision of the following codes and standards:

1. ANSANII: American National Standards Institute

2. ASTM: American Society for Testing and Materials

3. BICSI: Building Industry Consulting Service International

4. CSI: Construction Specifications Institute

5. EIA: Electronics Industries Alliance

6. FCC: Federal Communications Commission

7. ICEA: Insulated Cable Engineers Association

8. IEC: International Electro Technical Commission

9. IEEE: Institute of Electrical and Electronics Engineers

10. ISO: International Organization for Standardization

11. NEC: National Electrical Code

12. NEMA: National Electrical Manufacturer's Association

13. NFPA: National Fire Protection Association.

14. TIA: Telecommunications Industry Association

15. UL: Underwriters Laboratories, Inc.

B. The NI shall be manufactured and tested by manufacturers who are regularly engaged in the production of the components of similar NI systems for a minimum of five (5) years.

C. The supplier of the NI shall maintain service facilities in the installation. The facilities shall include a permanent source of factory trained service technicians on twenty-four (24) hour call experienced in servicing this type of system and shall provide warranty and routine maintenance service to afford the Owner maximum coverage. The Contractor shall also provide a central source of support to guarantee immediate answers to Owner's problems and questions.

D. The Contractor selected for this project must be certified by the manufacture(s) specified within their submittals, adhere to the engineering, installation and testing procedures and utilize the recommended components in provisioning the all aspects of this Project.

E. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of the NI and have personnel who are trained and certified in the use of such tools and equipment.

F. A resume of qualification must be submitted with the Contractor's proposal indicating the following:

1. A list of recently completed projects of similar type and size with contact names, email address, and telephone numbers for each.

2. A technical resume of experience for the Contractor's Project Manager and onsite installation supervisor who will be assigned to this project.

3. A list of technical product training attended, and certifications achieved, by the Contractor's personnel that will install the systems shall be submitted with the response.

G. Any sub-contractor who will assist the Contractor in performance of this work shall have the same training and certification as the Contractor.

H. The Contractor must be a company that is proposing and can demonstrate an installed system. It is preferred that the Contractor has experience installing the system in a K-12 educational environment. The Contractor must submit a minimum of three (3) verifiable references including contact names and phone numbers of projects that qualify.

I. The Contractor shall guarantee at the time of the bid that all cabling and components meet or exceed specifications of the latest TIA standards.

J. All materials shall be new and shall conform to applicable provisions of UL and the American Standards Association.

K. The Network Infrastructure components shall be new, of modern design, and current standard production of the various manufacturers.

L. The Contractor shall attend at bi-weekly onsite or virtual meetings, as required, throughout the duration of the project. The Contractor shall attend more frequent meetings as determined solely by the Owner.

1.6 REFERENCE STANDARDS

A. The code or standard establishing the more stringent requirements shall be followed where areas of conflict occur between codes and standards or between codes and standards and drawings and specifications.

1. BICSI Telecommunications Distribution Methods Manual, Latest Edition

2. BICSI Cabling Installation Manual

3. CSI Master Format Latest Edition – Division 27 - Communications

4. National Electric Code (NEC)

5. NFPA 255 Standard Method of Test of Surface Burning Characteristics of Building Materials

6. NFPA 70 - National Electric Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements

7. TIA-568.0-E – Generic Telecommunications Cabling for Customer Premises

8. TIA-568.1-E – Commercial Building Telecommunications Infrastructure Standard

9. TIA-568.2-D – Balanced Twisted-Pair Telecommunications Cabling and Components Standard

10. TIA-568.3-E – Optical Fiber Cabling and Components Standard

11. TIA-569 – Telecommunications Pathways and Spaces

12. TIA-606 – Administration Standard for Telecommunications Infrastructure

13. TIA-607-E – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

14. ISO/IEC 11801 – Information Technology – General Cabling for Customer Premises

15. ISO/IEC 11801 – Information Technology – Pathways and Spaces for Customer Premises Cabling

16. UL Cable Verifications Program

17. UL Testing Bulletin

1.7 SUBMITTALS

A. Shop Drawings: Within ten (10) calendar days after award of contract, the Contractor shall submit product data cut sheets and catalog information to the Technology Designer for approval. The Contractor shall not begin installation or fabrication without such approval. The Technology Designer will indicate approval of shop drawings, product data, and samples submitted to the Designer by stamping such submittals “APPROVED” with a stamp. All shop drawings shall be marked with the pertaining specification paragraph or drawing number when submitted. Submit electronically of each item to the Technology Designer.

B. Shop drawings shall be submitted on the following:

1. Bill of materials and cut sheets.

2. Project schedule including all major work components that materially affect any other work on the project.

3. Anticipated lead times on all major components

4. Specification schematic drawings required of, and submitted by, the Contractor shall depict function and require additional detail according to the specific components used. Drawings shall be provided indicating the addition of any components not detailed in these specifications but necessary to provide a properly functioning and complete system.

5. A technical data sheet from the manufacturer shall be included with the response for each product proposed. This data sheet shall include the physical specifications as well as the following electrical and transmission characteristics if appropriate:

C. Submittals shall include all manufacturers cut sheets for the following:

1. Edge Network switches

2. Wireless Access Points

3. Grounding and Surge Suppression System Components

1.8 EXISTING CONDITIONS

A. The existing switch VLAN assignments and configurations will be reviewed with the Owner and Technology Designer to optimize and simplify the network configuration of the new NI.

B. The contractor shall make any and all necessary adjustments to rack rails and equipment cabinets to permit doors to close without pinching or kinking cables in the front and rear of equipment, as required.

C. No subsequent allowance will be made due to failure to observe and verify conditions that may affect the work. The Contractor shall report to the Technology Designer any discrepancies between these specifications and existing conditions and similarly report omissions.

1.9 JOB CONDITIONS

A. The Contractor shall keep the job adequately staffed at all times. Unless illness, loss of personnel or other circumstances beyond the control of the Contractor, the Contractor shall maintain the same individual in charge throughout the Project.

B. The Contractor shall cooperate with all appropriate parties to achieve well-coordinated progress with the overall construction completion schedule and satisfactory final results.

C. The Contractor shall watch for conflicts with work of other contractors on the job and execute, without claim for extra payment, moderate moves or changes as are necessary to accommodate other equipment or to preserve symmetry and aesthetically pleasing appearance.

D. The Contractor shall immediately report to the Technology Designer any design or installation irregularities, particularly architectural elements that interfere with the intended systems operation, so that appropriate action may be taken.

E. The Contractor shall do all cutting, patching and painting necessary for proper and finished installation of the system and repair any damage done as a result of such installation.

F. The Contractor shall cleanup and dispose of trash from all NI work areas daily.

1.10 RELATED WORK BY OTHERS

A. Electrical power outlets in MDF and IDF's.

B. Equipment racks and cabinets.

C. Category 6A network cabling.

D. Category 6A patch cords for the MDF/IDF.

PART 2 PRODUCTS

2.1 GENERAL

A. The following are requirements for the Owner's Network Infrastructure. Capabilities must be demonstrated by the proposed manufacturer's equipment and software, and guaranteed by the Contractor, so that the new systems will not only serve today's needs but also allows for future growth.

B. The Contractor shall provide all network equipment, stacking modules, stacking cables, power supplies and cables, materials, parts, miscellaneous equipment and labor for a complete and satisfactory operating system.

C. The proposed equipment line shall have a consistent architecture to reduce total cost of ownership for on-going support, maintenance and training.

D. SYSTEMS SHALL BE IN FULL ACCORDANCE WITH THE RECOMMENDATIONS OF THE EQUIPMENT MANUFACTURERS, WITH THE REQUIREMENTS OF THE SPECIFICATIONS AND DRAWINGS, AND WITH ALL CURRENT EDITION OR REVISIONS OF ALL APPLICABLE CODES AND STANDARDS AS PREVIOUSLY LISTED UNDER "REGULATORY AGENCIES" OF THIS SECTION OF THE SPECIFICATIONS.

E. The NI shall provide access to the Internet, streaming video, voice over wireless, centralized databases, software and files for students, teachers, administrators, staff and the community. Communication of network traffic must adhere to Ethernet standards.

F. Network management software shall be supplied to monitor the status, condition and operations of the network hardware, as well as send alerts via email.

2.2 APPROVED MANUFACTURERS

A. The functions and features specified are vital to the operation of this NI, therefore; inclusion of acceptable manufacturers does not release the Contractor from strict compliance with the requirements of these specifications.

B. Network Switches shall be manufactured by:

1. Ruckus Networks (CommScope, LLC)

2. or pre-approved equivalent

2.3 NETWORK SWITCH INFRASTRUCTURE

A. The edge switches shall include:

1. Basis of Design: Ruckus Networks ICX8200-48PF2 PoE

a. 48 ports full POE+ 10/100/1000 Mbps PoE+ ports

b. 4 x 1/10/25 Gbps uplink/stacking SFP28 ports

c. 1440 W PoE budget with two (2) PSUs

d. 296 Gbps switch capacity

e. Provide and install two (2) hot swappable power supplies with each switch.

f. Provide and install two (2) hot swappable fans with each switch.

g. Provide and install two (2) power cables with each switch.

h. Provide and install all neccessary licensing and accessories for all specified components.

i. Quantities:

1) Student Activity Center

(a) Three (3) network switches in the MDF. Patch the new Cat 6A cables in the MDF to new network switch ports.

(b) Provide and install uplink modules and optics as required to provide 10Gb connections from each network switch to the building aggregate or core switch in the MDF.

(c) Provide and install SFP+ optics provided and installed by the NI contractor.

B. The wireless access points shall include:

1. Basis of Design: Ruckus Networks R750 WiFi-6 Wireless Access Points

a. Ruckus R750

b. Wi-Fi 6 (802.11ax)

c. Radio/Spatial Streams: Dual-band, 8 streams (4x4:4 in 2.24 GHz and in 5 GHz)

d. Max Throughput: Up to 3.5 Gbps

e. Ethernet: 2.5 Gbps Ethernet

f. Client support: Up to ~ 1,024 devices

g. Additional Features: BLE/Zigbee, USB IoT, WPA3 encryption

h. Management: Cloud, on-prem SMartZone controllers

i. Quantities

1) Student Activity Center

(a) (10) Ten

2.4 PATCH CORDS

A. The Contractor shall install all Category 6A patch cords required to connect all components to the network switches.

B. The Category 6A patch cords shall be of appropriate length 12” only to connect components at the closet end only. Cables provided by the Structured Cabling Contractor.

C. The Contractor shall provide and install all single-mode fiber optic patch cords required to connect all components to the network switches. Cables provided by the NI Contractor.

D. All patch cords are to be color coded by the Contractor. Patch cords shall use the following color code scheme:

1. Blue – data and voice ports

2. Green - security ports

3. Yellow – wireless access points

2.5 LABELING

A. The Contractor shall install owner-provided asset tags on all switches and other rack mounted equipment.

B. The Contractor shall provide and install front labels on all switches. Label shall include school ID, Closet ID, Stack ID, and Switch ID. For example, SAC IDF-4 ST-1 SW-2. Student Activity Center, IDF-4, Stack 1, and Switch 2.

C. The Contractor shall provide and install a label on all wireless access points. Label shall include Cable ID and AP number. The labels shall be clearly visible from a standing position without the use of a ladder.

D. Final label shall be submitted to the Owner for approval prior to installation. Labels will be affixed to the equipment as directed by the Owner.

2.6 UNSPECIFIED EQUIPMENT AND MATERIAL

A. Any item of equipment or material not specifically addressed on the drawings or in this document and required to provide a complete and functional WLAN installation shall be provided in a level of quality consistent with other specified items.

PART 3 EXECUTION

3.1 GENERAL

A. During the installation, the Contractor shall ensure availability of all equipment not included in the base bid and any alternates, whether taken or not, so that items which are to be provided as alternates may be added to the system without rewiring or additional construction.

B. All miscellaneous equipment required for a complete, professional installation shall be included in the base bid. No allowances for additional equipment, hardware, cabling, or miscellaneous will be considered unless specifically excluded from the base bid.

C. The contractor shall remove all existing network equipment being replaced with the new NI and properly recycle or dispose of the equipment. Provide a certificate of proper recycling and/or disposal to the Owner. This includes all chassis, switches, controllers, modules, interfaces and patch cords.

D. Utilize new rack mount ears and new screws for all mounting of switches and other equipment. If a screw is stripped or damaged during installation, it must be replaced with a new screw.

E. Time shall be allocated in the bid response for the purpose of training the Owner's personnel in the proper use and maintenance of the NI equipment and final production configuration of the single directory domain.

F. All work materials shall be removed at the end of the workday and the work area left in the same condition as found including ceiling tiles.

G. The Contractor must be a manufacturer-authorized reseller and certified to design, configure and deploy the proposed NI.

H. The Contractor shall have a minimum of five (5) years of experience in the specific application of the equipment and software proposed for these systems.

I. Adherence to a schedule of working hours, which is agreeable with the Owner, will be required.

J. All cables must be routed and managed for a neat and aesthetically pleasing appearance. All work must be installed in a neat and workman like manner.

K. Communication bonding and grounding shall be in accordance with the NEC and NFPA. Equipment and cables shall be grounded in compliance with TIA-607, NFPA 70, and local requirements and practices. Horizontal equipment includes cross connect frames, patch panels and racks, active communications equipment and test apparatus and equipment.

L. Installation practices shall follow BICSI standard and guidelines. TIA will be strictly followed and practiced.

M. All new cabling in equipment cabinet shall be managed utilizing short Category 6A patch cords provided by Others. All cabling and patch cords beyond one-foot (1') in the MDF or IDF shall be secured using Velcro-style straps provided by the NI Contractor, as required.

N. The Owner reserves the right to reject any or all alternate equipment bids and to select the bid that is considered to serve "THE BEST INTEREST OF THE OWNER."

O. The Contractor supplying the equipment shall show satisfactory evidence, upon request, that they maintain a fully equipped service organization capable of furnishing adequate inspection and service to the system, including replacement parts. The Contractor shall be prepared to offer a service contract for the maintenance of the system after the warranty period. The Contractor shall produce evidence that they have a fully experienced and established service organization for at least five (5) years and proven satisfactory installations during that time.

3.2 SITE REQUIREMENTS

A. The Contractor shall work with the Owner to review any modifications to the existing Active Directory configurations to optimize network connectivity.

B. The Owner currently utilizes Access Control Lists (ACLs) and Active Directory.

C. The Contractor shall work with the Owner to review existing, and revise or implement new, access and security rules in the new NI environment.

D. The Contractor shall work with the Owner to review existing proxy, firewall, and remote access policies and procedures in the new NI environment.

E. All Administration training, for all equipment and manufacturer-specific Administration software, shall be completed three (3) weeks before substantial completion of the construction.

F. The Contractor shall mount all provided equipment in Owner supplied equipment cabinets. All patch cords are to be provided by Others. The Contractor shall not utilize wire management guides. Contractor will be responsible for providing slide rails for all new equipment, and to adjust or move vertical rails and mounted hardware to fit slide rails and device mounting, to allow cabinet doors to close completely.

G. The Contractor will develop a naming scheme acceptable to the Owner for labeling of equipment.

3.3 ACCEPTANCE TESTING

A. The Contractor shall conduct multiple tests to verify connectivity from the wireless client through the WAN to centralized systems and resources accessed through the NI.

B. The Contractor shall coordinate all testing with the Owner's IT Department, the Technology Designer and Building Personnel.

C. The Contractor shall test and troubleshoot the network switches and Internet access, as required, to provide an operational NI.

D. The Contractor shall test and measure network performance and document coverage.

E. The Contractor shall implement and test network security prior to system startup.

3.4 SUPPORT AND TRAINING

A. The Contractor shall provide personalized instruction, or (where applicable) instructional guidance, to appropriate Owner personnel (IT director, network managers, and technicians) that incorporates timely learning conducive to participation in pending project tasks.

B. The Contractor shall provide a minimum of two (2) hours of instruction and training to the Owner's technology staff on management, maintenance, and troubleshooting for hardware systems.

C. All hours of training performed shall be logged with each session and reported to the Owner. Remaining hours shall be available to the Owner for future training or support for a period of six (6) months from acceptance.

D. The Contractor shall submit the name of the instructional personnel and their professional resume with the bid proposal.

3.5 CLOSEOUT

A. Punch List

1. The Contractor shall perform required remedial work, without claim for additional labor or other costs. Where required, the Contractor shall re-test and submit a revised Test Report.

2. The Contractor shall notify the Technology Designer of completion of the Punch List.

3. If after notification and inspection by the Technology Designer, the identified Punch List items have not been corrected the Contractor will be notified that remedial work is still required. Additional time spent by the Technology Designer, due to the failure of the Contractor to correct Punch List items and finish the project by the agreed upon completion date as set forth in the Contract Documents, will be charged to the Contractor at the rate of one hundred twenty-five dollars ($125) per hour and deducted from the Contractors retainage.

3.6 OWNER'S RIGHT TO USE

A. Acceptance of the Work of this Section will occur after completion of corrections and adjustments required by the "Punch List" (as generated during on-site inspections and review of testing documentation).

B. The Owner reserves the right to use equipment, material and services provided as part of Work of this Section, prior to Acceptance, without incurring any obligation to accept any equipment or completed systems until Punch List work is complete and systems comply with Contract Documents.

END OF SECTION 272129

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SECTION 272143 - NETWORK INFRASTRUCTURE UNIT PRICE SHEET

NOTE: UNIT PRICES ARE TO BE INCLUDED WITH BIDDER'S ORIGINAL SEALED PROPOSAL FOR THE WORK TO BE PER PROJECT SPECIFICATIONS. ALL UNIT PRICES SHALL INCLUDE INSTALLATION LABOR UNLESS OTHERWISE NOTED.

ITEM OR MATERIAL	UNIT PRICE REGULAR TIME
PROVIDE AND INSTALL ONE (1) RUCKUS NETWORKS ICX8200-48PF2 SWITCH.	$
PROVIDE AND INSTALL ONE (1) RUCKUS NETWORKS SWITCH REDUNDANT POWER SUPPLY.	$
PROVIDE AND INSTALL ONE (1) RUCKUS NETWORKS SWITCH REDUNDANT FAN.	$
PROVIDE AND INSTALL ONE (1) RUCKUS R750 ACCESS POINT	$