

SECTION 27 00 10 - GENERAL PROVISIONS FOR COMMUNICATION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the contract, including General and Supplementary Conditions, Division 01 Specification sections, apply to this section.

1.2 SUMMARY

- A. Section includes:
 - 1. Definitions and abbreviations
 - 2. Contract documents
 - 3. Code requirements
 - 4. Permits & fees
 - 5. Alternates
 - 6. Submittal requirements
 - 7. Prior approval requests
 - 8. Schedule of Values
 - 9. Warranty
 - 10. Construction phasing
 - 11. Project closeout requirements

1.3 DEFINITIONS

ADA	Americans with Disabilities Act
Ampacity	Capacity expressed in amperes
ASTM	American Society for Testing & Materials
Concealed	Hidden from sight as in trench, chases, slabs, furred spaces or ceilings
Contractor	Shall mean the General Contractor who signs the contract with the Owner
EMT	Electrical Metallic Tubing
Exposed	'Not concealed' as defined above
Furnish	Supply
IBC	International Building Code
IFC	International Fire Code
IEEE	Institute of Electrical & Electronic Engineers
IPCEA	Insulated Power Cable Engineers Association
Indicated	Indicated on drawings
Install	Install or apply
Mfg.	Manufacturer
NBFU	National Board of Fire Underwriters Pub. 70 (latest edition)
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NRTL	Nationally Recognized Testing Lab
Provide	Furnish and install
UL	Underwriters Laboratories, Inc.
WAC	Washington Administrative Code
WISHA	Washington Industrial Safety Health Act

1.4 GENERAL SCOPE OF WORK

- A. It is the intention of the Division 27 Contract Documents to provide complete and fully operational limited energy systems for telecommunications cabling, audio/visual, sound reinforcement, intercom, master clock and communications hereinafter specified and/or as shown on the drawings. The work shall include all materials, appliances and apparatus not

specifically mentioned herein or noted on the plans, but which are necessary to make a complete working installation.

- B. Reference the Technology system matrix at the end of Division 28 for owner provided materials.

1.5 CONTRACT DOCUMENTS

- A. All limited energy systems, mounting hardware, labor and other items indicated on the Division 27 drawings, schedules and/or in the specifications shall be included in the Contractor's bid, unless specifically indicated otherwise. The specifications, schedules, diagrams, details and plans are complementary and what is indicated on any is as binding as if indicated on all. Where a conflict exists between what is shown and what is specified, the more stringent shall govern.
- B. The contract drawings indicate the extent and the general character and approximate location and arrangement of material and equipment. The documents do not necessarily show the total number of conductors, raceways, boxes, support, access panels, actual routing, block outs, cable sleeves, exact device or equipment locations or other such detailed information for the work required. The Contractor shall provide all necessary materials as required by applicable code and product specification for a complete and fully operational installation in accordance with the true intent of the drawings and specifications.
- C. All dimensions indicated in the Division 27 drawings are approximate and are indicated as a guideline only. The Contractor shall adjust the exact rough-in locations as necessary to avoid conflict with structural components or other materials and to assure that devices, boxes, etc., can be installed as close to the intended location as possible. Working measurements shall be taken from the building and checked with the Architectural and Structural drawings. If conflicts are found the Contractor shall request verification from the Architect before proceeding with that work.
- D. The Division 27 documents do not separate work or responsibilities of sub-contractors. The General Contractor is responsible for defining the scope of work of each contractor. This specification recognizes only one contractor. That is the General Contractor who signs the contract with the Owner. Where the term 'The Contractor' is used, it applies to the contractor responsible for the installation of the work described.

1.6 CODES

- A. The installation of this work shall comply in every way with the requirements of the laws, ordinances and rules of the State of Washington, the National Board of Fire Underwriters, the National Electrical Code, WISHA and the City of Richland, WA.
- B. If any conflict occurs between these rules and this specification, the rules shall govern. Nothing in these drawings and specifications shall be construed to permit work not conforming with governing codes. This shall not be construed as relieving the Contractor from complying with any requirements of the plans or specifications which may be in excess of requirements of hereinbefore mentioned rules and not contrary to same.

1.7 PERMITS & FEES

- A. Obtain and pay for all licenses, permits, registration fees and inspections required by laws, ordinances and rules governing the work specified herein. Arrange for inspection of the work by inspectors and give the inspectors all necessary assistance in their work of inspection.
- B. The Division 27 bid shall include all Labor and Industries permit, inspection, licensing, registration or any other fees associated with the work specified under this Division.

1.8 SUBMITTALS

- A. It is understood that before the manufacture or installation of any of the work under this contract is carried forward, shop drawings of such work shall be submitted for review.
- B. Submittals shall be provided in accordance with specification Section 26 0010.
- C. The Contractor shall provide quantities of submittals and shop drawings as required by Division 1. The Owner, Architect and Electrical Engineer will retain a minimum of one set each.
- D. Shop drawings shall be submitted in ample time to avoid delay in any of the work. Items requiring immediate attention due to long lead delivery time or for early construction rough-in,

are to be identified and may be submitted separately in advance of the remainder of the submittal binders. The review of these items will be expedited.

- E. The Architect and Engineer's review of the submittals/shop drawings is intended as a check for general conformance with contract documents only. Failure by the Architect or Engineer to discover an error on a submittal does not relieve the Contractor of the responsibility for compliance with requirements of the drawings and specifications.
- F. Upon request from the Architect or Engineer, provide material samples for examination, color selection and/or quality control. These samples shall be delivered to the Architect's or Engineer's office as directed.
- G. Prior to forwarding to the Architect, the Contractor shall review the submittals; mark them with their comments, corrections and approval stamp. The Contractor shall verify that all of the specified requirements are indicated and ensure that the intended items have been identified on the submittal. Submittals shall be clearly marked as to which items, options, colors; models, etc. are being provided. Only the items marked or indicated will be considered as being submitted. If no marks or indications are present on a page then it will be assumed that nothing applies to this project and the submittal will be rejected. Indicate additional information necessary for the Architect and Engineer to determine the Contractor's intention, such as the method of feeding panel boards (top or bottom), color selection, equipment options, etc.
- H. For material requiring color or finish selection 'by Architect', provide separate copies marked 'ATTENTION (ARCHITECTS NAME) – COLOR/FINISH SELECTION REQUIRED'.
- I. Provide brochures and shop drawings on the following materials:
 - 1. Extra voice/data receptacle log with fair cost estimate
 - 2. Intercom/Clock System
 - 3. Audio/Visual Systems
 - 4. Sound Reinforcing Systems
 - 5. Premise Wiring:
 - a. Certification of Contractor
 - b. Cable
 - c. Jacks
 - d. Cable support devices
 - e. Patch Panels
 - f. Racks
 - g. Wire Management
 - h. Fiber Optic Cable, Connectors, etc.

1.9 PRIOR APPROVAL SUBSTITUTION REQUEST

- A. Items specified are intended to represent quality and general requirements. It is not the intent of these specifications to prohibit other manufacturers from submitting on substitute materials for review as an acceptable equal. Approval granted for substitution requests is made under the assurance that the manufacturer, vendor or sales representative guarantees that the substituted product meets or exceeds the minimum requirements of the specified product.
- B. Submittals shall be provided in accordance with specification Section 26 0010.
- C. If prior approval has not been requested and granted, then the product manufacturer shall be as specified in the contract documents. The Architect/Electrical Engineer reserves the right to reject any product that has not been prior approved or specified.
- D. The Contractor shall be responsible for checking equipment dimensions of proposed substitute equipment and be responsible for it fitting the space allowed.
- E. Approval of substitution requests are granted with the understanding that any additional cost involved with the installation, re-design or replacement of the substituted material (as a result of the unacceptable performance of that product) shall be paid for by the Contractor.
- F. Approved substitutions will be listed in Addenda. Any item listed by addenda may be provided under this contract.
- G. Substitution after the bid will only be allowed for any one of the following reasons:
 - 1. The Architect, Engineer and Owner approve the substitute product as a better product, at no increased cost.

2. The substitute product is approved as an equal by the Architect, Engineer and Owner and a credit is offered to the Owner. Reference Division-1 documents for substitution request procedures.
3. The reason for unavailability is discontinuance by the manufacturer.

1.10 SCHEDULE OF VALUES

- A. Within 30 days of the Notice to Proceed the Contractor shall furnish a breakdown of the Division 27 work as indicated in the following Schedule of Values:
 1. Mobilization
 2. Closeout
 3. Intercom/Clock, Material
 4. Intercom/Clock, Labor
 5. Telecommunications Wiring, Material
 6. Telecommunications Wiring, labor
 7. A/V, Material
 8. A/V, labor
 9. Sound System, Material
 10. Sound System, Labor

1.11 GUARANTEE

- A. This Contractor shall guarantee the satisfactory operation of all material, equipment and installations provided under this specification. Make good, repair or replace, as may be necessary, any defective work, materials or equipment which fail or become defective within one year after date of Owner occupancy. The beginning of the warranty period is to be determined by the Architect at the time of substantial completion.
- B. Provide extended warranty for the voice/data communications cable backbone (Premise Wiring) system: fifteen years (material and labor).

PART 2 - PRODUCTS

2.1 GENERAL MATERIAL EQUIPMENTS

- A. All materials shall be new and must be equal to the quality herein specified and as shown on the drawings or a reviewed and accepted equal.
- B. Reference the Technology Component System Matrix following the Division 28 specifications for an outline of materials that are CFCI, OFCI & OFOI.
- C. All materials shall be the standard products of manufacturers regularly engaged in the production of such equipment and shall be the manufacturer's latest standard design and shall be manufactured in accordance with applicable standards of NEMA, ANSI or UL.
- D. All material, equipment and devices shall be listed by Underwriters Laboratories, Inc. and shall be manufactured for use with the system specified and the intended application.
- E. Materials and equipment shall be delivered to the project and stored in original containers or cartons and shall be properly protected from the elements, theft or vandalism. Items subject to moisture damage shall be stored in dry spaces.
- F. Material damaged during construction shall be replaced or repaired to the Owner's satisfaction.
- G. All material shall be provided and installed per the requirements for seismic zone D.
- H. All cabling provided under Division 27 shall be rated for the location installed. Cabling installed in wet locations shall be rated for such and installed in conduit the entire run. Provide metallic enclosures to splice from outside plant to riser cable in accordance with the Washington State Administrative Code.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS FOR INSTALLATION

- A. Workmanship shall be of the best quality and none, but competent mechanics shall be employed and shall be under the supervision of a competent foreman. All work shall be complete and present a neat and symmetrical appearance. Non-professional workmanship shall be removed and replaced if so directed by the Architect at no additional cost to the Owner.
- B. All equipment and material shall be installed to comply with all applicable codes and industry standard work practice.
- C. All work and materials shall be subject to inspection at any and all times by representatives of the Owner and/or Architect.
- D. The documents do not show all necessary transitions, offsets, changes in direction or every pull or junction box required. Provide all boxes necessary to install work to conform to the structure.

3.2 WORK NOT INCLUDED

- A. Unless noted elsewhere, the following is owner furnished owner installed:
 - 1. VOIP Telephone headend (existing district wide system).
 - 2. Computer station patch cords.
 - 3. Telephone handsets and patch cords.
 - 4. Network Equipment; servers, switches
 - 5. Video projectors
 - 6. Software and licensing

3.3 PHASING & SCHEDULING REQUIREMENTS

- A. Construction phasing and scheduling unless specifically indicated elsewhere in the bid documents is the responsibility of the General Contractor. The Electrical and Communications trades shall coordinate their work with the General Contractor.

3.4 MEETINGS AND FIELD OBSERVATION

- A. A representative of the Electrical Consultant shall attend monthly construction coordination meetings and conduct an observational walk-through.
- B. At the time of monthly walk-through, the project foreman shall (upon request) accompany the observation party, and remove cover plates, panel covers, ceiling tiles, access panels and unlock doors for the Electrical Consultant, to allow complete observation of the entire electrical system in an efficient manner.
- C. The Contractor shall provide all ladders, tools, and hard hats required by the Electrical Consultant. The Contractor shall open any switchboard, panel, box, etc. as requested for the Architect/Engineer's inspection.
- D. The Contractor shall bring the red line (mark-up) set of Record Drawings to each monthly meeting attended by the Electrical Consultant for review.

3.5 PROJECT CLOSEOUT

- A. Prior to final acceptance of the project the Contractor shall provide Division 27 record drawings and operation and maintenance manuals (O&M) for all work included in this contract
- B. Submittals, record drawings, O&M manuals and deliverables shall be provided in accordance with specification Section 26 0010.
- C. The Contractor shall leave the job in complete order ready for use. All refuse shall be removed, all devices and equipment shall be secure, fully equipped, completely cleaned and in good working order. The owner's maintenance & operational personnel shall be thoroughly indoctrinated in the maintenance & operation of each system provided under this division. All spare and remaining items not used in the project, but paid for by the owner shall be delivered in like new condition to an on-site storage facility as directed by the owner.

END OF SECTION 27 00 10

SECTION 27 05 00 - COMMON WORK RESULTS FOR COMMUNICATIONS

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. Section Includes:
 - 1. Communications equipment coordination and installation.
 - 2. Sleeves for pathways and cables.
 - 3. Sleeve seals.
 - 4. Grout.
 - 5. Common communications installation requirements.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 COORDINATION

- A. Coordinate arrangement, mounting, and support of communications equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. So, connecting pathways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

PART 2 - PRODUCTS

2.1 SLEEVES FOR PATHWAYS AND CABLES

- A. Provide sleeves in accordance with the requirements of specification Section 260500.
- B. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter, less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter, equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications' equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.
- F. All material and equipment shall be installed symmetrical, level, plumb, parallel and perpendicular to other building systems and components, except where otherwise indicated.
- G. Devices shall be mounted in compliance with the Americans with Disabilities Act (ADA) or as specified within the limits described below.
 - a. High forward reach limits, without obstruction; between 15" and 48".
 - b. High forward reach limits, with obstruction less than 20"; between top of obstruction and 48".
 - c. High forward reach limits, with obstruction between 20" & 25"; between top of obstruction and 44".
 - d. Clear floor space, parallel approach; between 9" and 54".
 - e. Side reach over a 24" wide by 34" maximum obstruction; 46".

3.2 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Communications penetrations occur when pathways or cables penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and pathway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants".
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- K. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- L. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between pathway or cable and sleeve for installing mechanical sleeve seals.

3.3 FIRESTOPPING

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- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 27 05 00SECTION 27 15 00 - TELECOMMUNICATIONS CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This section is a Division-27 Basic Electrical Materials and Methods section and is part of each Division-27 section.
- B. Drawings and General Provisions of the contract, including General and Supplementary Conditions, Division-1 Specification sections and all Division-26 & 27 sections, apply to this section.

1.2 DESCRIPTION OF WORK

- A. Provide all labor, materials, tools, equipment and services for a complete TIA/EIA 568, Riser Rated Category 6, local area network (LAN) Telecommunications transmission cable systems installation.
- B. Provide all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a secure and complete installation whether specifically indicated in the contract documents.
- C. Systems requiring telecommunications cable as specified in this section include data network, VOIP telephone, Audio/Visual systems, Video Surveillance, Access Control, IP Clock, IP Intercom, WAP, and site reader board.
- D. Each jack cable shall run to the closest TR (MDF, IDF-1, or IDF-2) as appropriate in a star topology from each room.
- E. Provide Telecommunications Room (TR) backbone cabling consisting of multi-mode fiber optic cable between the MDF and each IDF.
- F. Contractor Furnished Contractor Installed (CFCI) materials:
 - 1. Category 6 UTP horizontal cable
 - 2. Multimode optical fiber
 - 3. Workstation outlet, devices, jacks & plates
 - 4. Network and communications connections & devices for A/V, IP camera, IP clocks, IP speakers, WAP, DDCS, Access Control, Intrusion, Networked Lighting Control and FA systems
 - 5. CAT 6 patch cords for IP cameras
 - 6. Device rough-in
 - 7. Open cable support hooks
 - 8. Equipment racks with ladder tray, patch panels, horizontal & vertical cable management, equipment shelving, optical fiber patching, optic cable connectors, accessories and miscellaneous rack hardware & components, seismic support =
 - 9. Fire treated backboards
 - 10. Labeling and identification
 - 11. Grounding and bonding
 - 12. Fire stopping for all IT pathways
 - 13. Provide labor, instrumentation and documentation for O&M manuals for permanent link testing of all terminated cables in the structured cabling system.
 - 14. Power Distribution Units (PDU) for IT racks
 - 15. Uninterruptable Power Supplies (UPS) for IT racks
- G. Owner Furnished Contractor Installed (OFCI) equipment:
 - 1. Wireless Access Points (WAP)
- H. Owner Furnished Owner Installed (OFOI) equipment:

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1. Network servers
2. Network switches
3. Network programming & QOS scheduling
4. Network licensing
5. Network software (except where specified in other Division 27 sections)CAT 6 patch cords for workstations and patch panels

1.3 SUBMITTALS

- A. Richland School District has standardized on a unified, end-to-end copper and optical fiber cabling system design based on Leviton jacks, patch panels, patch cords, fiber cords, fiber connectors, trunk cables, fiber enclosures and modules, as well as Berk-Tek field-terminable copper and fiber cables. Richland School District is satisfied that the products specified herein are qualified for the purpose intended and has performed due diligence in establishing a consistent set of standards based on performance and feature set.
- B. Pre-construction submittal:
 1. Provide a complete submittal of all materials furnished and installed per this specification section.
 2. Provide electronic PDF files.
 3. Provide product data sheets clearly marked with model type and ratings of the material intended.
 4. Provide a copy of contractor's certification of training and partnership with the specified solution.
 5. Provide an example of a typical classroom outlet/jack identification labeling plan.
 6. Provide project manager and field Forman certifications.
- C. Test reports:
 1. Provide electronic PDF files of each cable's test report to the owner within 10 days of substantial completion.
 2. Test reports shall be burned to a CD-ROM or DVD.
 3. Provide hard copies of each cable's test report in a separate volume of the O&M manuals.
- D. Record Drawings:
 1. A complete set of all telecommunications drawings shall be kept in the job-site office to show the actual installation of cables, equipment and outlet/jack identification during construction.
 2. Indicate the home run destination for each cable.
 3. These drawings are for the contractor's use to record the as-built installation. These drawings are to be made available to the Architect, Engineer and/or owner for review during construction.
 4. Within 10 days of substantial completion, provide an electronic set of PDF files with all as-built installation changes and outlet/jack identifications drafted in AutoCAD, to the owner's representative for review. Revise the documents per review comments and provide a final version of the record drawings in both PDF and AutoCAD release 2012 or newer to the owner's representative. The architectural x-reference backgrounds shall be bound to each drawing file. These documents shall be incorporated into the overall final set of construction record drawings.
 5. Provide a CD-ROM or DVD with the final record drawings for inclusion into the O&M manuals.
- E. O&M Manual Materials:
 1. Provide hard copies of test reports.
 2. Provide the system warranty.
 3. Provide CD-ROMs or DVDs with the electronic files of test reports and record drawings.

1.4 REFERENCE CODES AND STANDARDS

- A. Installation Standards: Cable and equipment installation shall comply with the following standards. All publications must be of the latest issue and addenda:

1. NEC®2022: National Electric Code®, 2022
 2. ANSI/TIA-492.AAAC-B – Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers
 3. ANSI/TIA-492.AAAD – Detail Specification for 850-nm Laser- Optimized, 50-µm Core Diameter/125-µm Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers Suitable for Manufacturing OM4 Cabled Optical Fiber
 4. ANSI/TIA-492.CAAB – Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers with Low Water Peak. Current Edition
 5. ANSI/TIA-568.0-D – Generic Communications Cabling for Customer Premises
 6. ANSI/TIA-568.1-D – Commercial Building Communications Cabling Standard
 7. ANSI/TIA-568-C.2-1 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards
 8. ANSI/TIA-568.3-D – Optical Fiber Cabling and Components Standard
 9. ANSI/TIA-569-D – Telecommunications Pathways and Spaces
 10. ANSI/TIA-606-B.1 – Administration Standard for the Commercial Telecommunications Infrastructure.
 11. ANSI/TIA-607-C – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
 12. ANSI/TIA-862-B – Structured Cabling Infrastructure Standard for Intelligent Building Systems
 13. ANSI/TIA-942-A – Telecommunications Infrastructure Standard for Data Centers
 14. NFPA 70 – National Electrical Code (NEC).
 15. BICSI – TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM)
- B. Telecommunications contractor shall have read the above documents and shall be familiar with the requirements that pertain to this installation. The documents may be obtained from:
1. Global Engineering Documents, 15 Inverness Way East, Englewood, CO, 80112-5776, 800-854-7179, <http://global/ihs.com/>
 2. BICSI, 8610 Hidden River Parkway, Tampa, FL, 33637, 800-242-7405, www.bicsi.org
- C. Materials:
1. All materials shall UL Listed and labels indicating so shall be affixed where labeling is normally visible.
 2. Equipment shall be regularly catalogued items of the manufacturer and shall be supplied as a complete unit in accordance with the manufacturer's standard specifications with any optional items required for proper installation unless otherwise noted.
 3. All telecommunications connectivity and cabling shall be independently tested to meet current TIA standards.
- D. Governance:
1. The Electrical Code referred to in these specifications is the National Electrical Code as currently adopted by the State of Washington. All work will be provided in strict compliance with the Electrical Code and all regulations that may apply.
 2. Where standards exist, for a particular category, products used on this project will be listed by an OSHA approved Nationally Recognized Testing Laboratory (NRTL) and be approved or listed for the intended service and application.
 3. These specifications do not undertake to repeat the requirements of codes, regulations or NRTL listing or labeling instructions. The Specifications or Drawings may require items or work beyond the requirements of applicable codes or regulations. The stricter, higher quality, greater quantity or higher cost will be allowed, and accommodations must be approved by Richland School District prior to procurement or installation. It is incumbent on the Installer, material and equipment suppliers to meet these specifications, applicable codes, regulations, and NRTL listing agency restrictions.
 4. The word "Manufacturer" will include the Manufacturer, the Manufacturer's Representative, the Distributor, the Fabricator, and the Supplier of the particular classification of equipment, system, product, and material.
 5. All work, equipment, and systems will be manufactured, provided, repaired, installed, and

tested in accordance with the latest edition and all current amendments of the applicable publications and standards of the organizations listed below as of the date of the Contract Documents. When the Specification requirements exceed the requirements of these publications and standards the Specifications will govern:

- a. State Building Code (SBC)
 - b. Building Department Inspectional ServicesAmerican Society for Testing and Materials (ASTM)
 - c. Underwriter's Laboratories, Inc. (UL)
 - d. Insulated Cable Engineers Association (ICEA)
 - e. National Electrical Manufacturers Association (NEMA)
 - f. Institute of Electrical and Electronics Engineers, Inc. (IEEE)
 - g. American National Standards Institute, Inc. (ANSI)
 - h. National Fire Protection Association (NFPA)
 - i. Local Electric Code
 - j. Department of Public Safety (DPS)
 - k. Building Officials and Code Administrators International, Inc. (BOCA)
 - l. Department of Labor USA. Safety and Health Regulations for Construction (OSHA)
 - m. Energy Codes
 - n. National Electrical Contractors Association (NECA)
 - o. National Bureau of Standards (NBS)
 - p. Federal Communications Commission (FCC)
 - q. Utilities Serving Project.
 - r. Fire Department.
 - s. Americans with Disabilities Act Applications Guidelines (ADAAG).
 - t. Accessibility Guidelines for Buildings and Facilities.
 - u. Any and all Federal, State and Local Standards, Codes and Authorities having Jurisdiction.
6. In addition, all phases of the Structured Cabling System installation will adhere to applicable Local Area Network (LAN) Specifications of the IEEE, Electronics Industry Association/Telecommunications Industry Association (TIA/EIA) and Building Industry Consulting Service International (BICSI). The entire system and all components will be Nationally Recognized Testing Laboratory (NRTL) certified to appropriate TIA/EIA performance rating Category, Latest ANSI/TIA/EIA Standards 455-A, 492, 568, 569-A, 570, 606, 607 and 758 (latest revisions), and ANSI/TIA TSB 67, TSB 72, TSB 75, TSB 95 plus other standards as applicable.
 7. The Installer will have available at the job site at all times one copy of the latest edition of the Electrical Code, TIA and BICSI Standards applicable to the work as specified within this document.
 8. The above requirements will not in any way limit responsibility or requirements to comply with all other codes, standards and laws.
 9. Material, equipment, enclosures, and systems will be designed for use as required to suit the conditions, exterior or interior operation, dust tight, watertight, explosion-proof, or other special types.
 10. All materials shall be purchased from Distributors authorized by system Manufacturers to sell new and unused components.

1.5 PREMISE WIRING CONTRACTOR QUALIFICATIONS

- A. The contractor shall be fully conversant and capable in the cabling of low voltage applications such as, but not limited to data, voice and imaging network systems. The Contractor shall at a minimum possess the following qualifications:
 1. Possess a valid Washington EL06 Contractors License.
 2. Shall be a fully Certified Leviton **Premier** Network Contractor prior to proposal and must stay current till the completion of the project.
 3. All installation technicians must possess current Leviton Installers Certificates,

- and the contractor shall have a minimum of 6 Current Leviton Certified technicians in the local area with (50 miles) of where the work is being performed.
- 4. Personnel trained in fiber optic cabling, splicing, termination and testing techniques. Personnel must have experience using a light meter and OTDR.
- 5. Personnel trained in the installation of pathways and support for housing horizontal and backbone cabling.
- 6. Personnel knowledgeable in local, state, province and national codes, and regulations. All work shall comply with the latest revision of the codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall be followed.
- 7. Been in the Low Voltage or Telecommunications Installation business for a minimum of 5 years.
- 8. All Licensing and certification documents must be available and submitted before the time of bid.

1.6 WARRANTY

- A. A Leviton Network Solutions Limited Lifetime Product & Performance Warranty covering all components, equipment and workmanship shall be provided to Richland School District, submitted in writing with system documentation.
 - 1. Horizontal link shall be completed with Leviton/Berk-Tek Network Solutions to be eligible for the applicable Leviton Warranty with link performance guarantees.
 - 2. Approved product shall be listed on the most recent version of the applicable Leviton data sheets for each listed Berk-Tek Leviton Technologies solution.
 - 3. The Contractor must pre-register as a Premier Contractor with Leviton before the bid and through the installation. Following project completion, contractor is responsible for completing all warranty registration procedures on behalf of Richland School District.
 - 4. Should the cabling system fail to perform its expected operation within this warranty period due to inferior or faulty material and/or workmanship, the contractor shall promptly make all required corrections without cost to Richland School District.
- B. Certified Installer shall provide labor, materials, and documentation in accordance with Leviton Network Solutions requirements necessary to ensure that Richland School District will be furnished with the maximum available Manufacturer's Warranty in force at the time of this project.
- C. The installed structured cabling system shall provide a warranty guaranteeing the specified performance in the installed channel performance above the ANSI/TIA-568 requirements for Category 6 or ISO 11801 requirements for Class E_A.
 - 1. Standards-compliant channel or permanent link performance tests shall be performed in the field with a Leviton-approved certification tester in the appropriate channel or permanent link test configuration.
- D. Necessary documentation for warranty registration shall be provided to the manufacturer by the installer.
 - 1. Certified Premier Contractor must adhere to the terms and conditions of the respective manufacturer's warranty programs.
 - 2. Shall include a copy of all licensing and certification documents in deliverable package.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide a complete data cabling and device system as described herein.
- B. Work area connectors shall be of a non-proprietary "Keystone"-style port configuration, such that they fit into all furniture, panels, wall plates, raceways, floor monuments, poke-throughs and AV boxes without adapters. Maximum density of 6 outlets shall be available

in Decora footprint where required.

ACCEPTABLE MANUFACTURER SOLUTIONS:

- C. Subject to compliance with requirements, provide products of the following:
1. Leviton Manufacturing Co, Inc.
 2. Berk-Tek, a Nexans Company
 3. No substitutions allowed unless pre-approved in by Richland School Districts Director of Technology Glenn R. Whitcomb 90 days prior to bid

2.2 UTP PIN/PAIR TERMINATION ASSIGNMENT

- A. The UTP cabling system will have TIA/EIA T568B pin/pair termination assignment. All conductors provided will be properly and consistently terminated at both ends throughout the entire systems. Maintain proper untwist of pairs and removal of jacket per TIA, BICSI, and Manufacturer's recommendations.
- B. Category 6 Unshielded Twisted Pair (UTP) Systems
1. Category 6 UTP 24AWG copper cabling system shall be guaranteed to exceed all TIA-568 link and channel performance requirements and be capable of supporting 1000Base-T (802.3ab) and ISO/IEC 11801 Class E applications for a total distance of 100 meters with equipment cords.
 2. Basis of Design is Berk-Tek Leviton Technologies CX6050 Category 6 UTP System.
 3. Category 6 Performance Parameters, headroom over TIA-568 standard:

Insertion Loss	NEXT	PSNEXT	ACR-F (ELFEXT)	PSACR-F (PSELFEXT)	Return Loss	ACR-N	PSACR-N
3%	3 dB	3 dB	3 dB	5 dB	2 dB	3 dB	6 dB

2.3 HORIZONTAL CABLING SYSTEMS

A. CATEGORY-RATED DATA CONNECTORS (RJ45 JACKS)

1. Provide modular-type, information connectors/outlets (jacks) for 24-23 AWG copper cable. These connectors shall be individual snap-in style, and exceed compliance with TIA-568 specifications. The connectors shall comply with the following:
 - a. Shall be 8-position 8-conductor (8P8C) "RJ45"-style modular jack, Category 6, with IDC terminals, T568A/B wiring scheme (use T568B).
 - b. Shall be encased in a die-cast housing to protect from potential EMI/RFI, and utilize a universal Keystone-style insertion footprint as the manufacturer's main "flagship" line of products.
 - c. Category 6 Connectors shall exceed all component performance requirements for Category 6 in the ANSI/TIA-568-C.2 standard, as well as Class E requirements as described in ISO/IEC 11801, from 1 MHz to 250 MHz.
 - d. Shielded connectors shall utilize the same form factor, design, and tool-less installation process as the unshielded connectors in the product line.
 - e. Shall be tested by an independent testing body such as Intertek (ETL) for component compliance (i.e. "Component rated") to ANSI/TIA-568 and for POE+ applications. Test results shall be published and publicly available without special request.
 - f. Shall be in compliance with all National Electrical Codes; compliant with ANSI/TIA-1096-A (formerly FCC Part 68); UL Listed.
 - g. When used in the plenum spaces, shall be plenum-rated per UL 2043, and all plastic components shall be made of high-

- impact, fire-retardant plastic rated UL 94V-0.
- h. Shall have a maximum depth of 1.31”.
- i. Cable shall be terminated using a snap-on wire manager that holds individual conductors in place during termination and allows for termination without a complete untwist of each conductor pair. Cables shall terminate onto jack via a “clamshell” closure at rear of connector, affixing termination manager to connector IDC
- j. Shall be terminated without the need for any punch down tool or other specialized or proprietary termination tool.
- k. Shall be reusable and support a minimum of 20 termination and re-termination cycles and be facilitated by simple termination release levers.
- l. Shall utilize a method of line tensioning using polymer springs above the lines (“Retention Force Technology” or similar functionality) that prevents six-position modular plug insertion from damaging either the cord or the module and promotes return of lines to original position.
- m. Shall fit the full manufacturer’s range of telecommunications faceplates, outlets, and field-configurable patch panels. No separate product line or style of connectors shall be required for patch panels, faceplate, biscuit, furniture, raceway and/or floor feed applications.
- n. Shall be available in 13 TIA 606-B compatible colors and supplied with interchangeable icons (Voice, Data, A/V, and blank, color coded to match the connector face) for easy identification and tracking of data, voice, or other functions. Additional bulk Icons for the connector shall be available separately.
- o. Shall be available with an optional internal shutter to protect against dust and debris such as in above-ceiling and in-floor locations.

B. PATCH PANELS

- 1. Telecommunications Room Patch panels shall be manufactured with industry-standard modular non-loaded jack type and shall hold 48 Category 6 terminations at IDF and MDF locations. Panels shall be:
 - a. All 48 ports.
 - b. Mount in a 2RU space.
 - c. Shall be sized to fit an EIA standard, 19-inch relay rack and hole pattern.
 - d. Shall come blank so the appropriate colored jacks can be installed.

C. FACEPLATES: Faceplates (wall plates) secure information outlets to the work area. Contractor shall provide and install single gang faceplate kits to house all jacks as required for all work area outlets, workstation base feeds, and furniture openings. Unused telecom back boxes shall receive a solid blank faceplate. Telecommunications faceplates shall:

- 1. Utilize a keystone-type (“QuickPort”) footprint to match the approved connectivity manufacturer and be made by the same manufacturer as the connectors.
- 2. Plastic and match the color of the power wiring device plates.
- 3. Support any connectivity media type, including fiber, AV and copper applications.
- 4. Have printable designation labels for circuit identification together with a clear plastic cover.
- 5. Be available in single-gang and double-gang configurations.
- 6. Have surface-mount boxes and standoff rings available for both single and double gang faceplates.
- 7. Have single-port matching color blank inserts available in packs of 10.
- 8. Color shall match nearby electrical devices exactly.
- 9. Furniture faceplates shall fit existing knockouts for telecom receptacles, and snap in without screw mounts.

D. SURFACE-MOUNT BOX (SMB)

- 1. Surface-Mount Box (SMBs) are used to protect terminated Category 6 cables at

the endpoints where they are not contained within walls or furniture. Example locations may be Wireless Access Points (WAPs), Group Work Areas fed by conduits run down columns, security cameras, or other network-enabled device locations.

2. Unless otherwise noted all wireless access points (WAP) shall consist of one category 6A jack (1) and a single 2-port plastic SMB.
3. Small Surface-Mount Boxes shall exhibit the following characteristics:
 - a. Outlet housings for WAPs and other devices shall be a high-density, low-profile design with (2) field-configurable ports, snap-lock cover, and cable knockouts on back.
 - b. Housing cover shall have raceway knockouts for top and bottom entry.
 - c. Base shall include Tie-wrap anchor points at all cable entrances.
 - d. The housing shall be mountable with screws, tape or a single magnet.
 - e. The cover shall provide the option of securing it to the base with a screw that is hidden under the outlet identification window.
 - f. Shall be constructed of high-impact self-extinguishing plastic rated UL 94V-0, and be UL Listed and compliant with FCC Part 68 and TIA-568 specifications.

E. DATA CABLES

1. Category 6 (100-Ohm, 24 AWG, Category 6 4-pair balanced unshielded twisted pair solid annealed copper conductors
2. Cable shall be characterized to 500 MHz and UL/ETL Listed by the Manufacturer printed on the cable jacket and package, as well as ETL Verified to TIA-568 Category 6 and ISO/IEC 11801 Class E.
3. Cable shall be Plenum-rated (CMP) for any location where plenum cable is required.
4. Outer Diameter: 0.224" max.
5. Cable shall be guaranteed to exceed all TIA-568 link and channel performance requirements and be capable of supporting 1000Base-T (802.3ab) and ISO/IEC 11801 Class E applications for a total distance of 100 meters with equipment cords
6. All category cabling manufacturers must be able to provide documentation from an independent third-party testing agency that verifies through random sampling that cable components perform at or above the levels contained on their product specifications, not simply at or above the standard.
7. Cable may be CMR rated for areas not running through air handling spaces. CMP cable must be used if cable passes at any point through an air plenum or supply/return air handling space.

2.4 BACKBONE CABLING SYSTEMS

A. GENERAL

1. Fiber optic backbone cables shall be 50/125µm Laser-Optimized Multimode Fiber. The cable shall support voice, data, and multimedia applications. The bending radius and pulling strength requirements of all backbone cables shall be observed during handling and installation.

B. OPTICAL FIBER CABLE

1. MULTIMODE FIBER OPTIC CABLE – FIELD TERMINATED

- a. Multimode fiber optical fiber cables shall meet all of the requirements delineated within the specifications of ANSI/TIA-568 and ANSI/TIA-492.CAAB (OM3 or OM4). Unless otherwise noted all fiber shall be 6 strands of Laser-Optimized 50 micron optical fiber. Cable jacketing must be appropriate for the environment in which it is installed.
- b. Unless otherwise noted all fiber optic cables will utilize Tight-Buffered cable construction and fiber strands with a 900 micron protective sheath.
- c. See plans and scope of work for total strand count between locations

and noted types of fiber that will supersede these specifications.

C. FIBER OPTIC ENCLOSURES, PANELS AND TRAYS

1. All Fiber enclosures shall provide cross connect, interconnect, and splicing capabilities and contain cable management for supporting and routing the fiber cables/jumpers.
2. Fiber Adapter panel openings shall accept Fiber Adapter Plates (bulkheads), Splice Modules, and plug-n-play MTP modules/cassettes or any combination thereof.
3. 1RU, 2RU, 3RU and 4RU enclosures shall hold up to 3, 6 or 12 adapter plates or cassettes.
4. All Fiber enclosures, panels and trays (units) shall provide cross-connect, interconnect, and splicing capabilities and contain cable management for supporting and routing the fiber cables/jumpers.
5. Fiber enclosures shall exhibit the following characteristics:
 - a. Fiber enclosure shall be available in 1RU, 2RU or 4RU versions to accommodate fiber adapter plates, MTP Modules, and/or termination and splicing of fiber as needed
 - b. Enclosure shall inherently accept a 1-panel integrated splice cassette.
 - c. Enclosures shall have a sliding tray which can be removed completely from enclosure (from front or rear) to facilitate field terminations and splicing. Sliding tray glides forward and backward providing accessibility to front and rear bulkhead after installation.
 - d. 17" depth for high density fiber termination and/or splicing.
 - e. Removable transparent hinged doors and slide away covers allow easy access during install and visibility of interior after installation.
 - f. Patch cord bend radius guides minimize macro bending.
 - g. Stackable and adjustable fiber rings simplify cable routing and organization
 - h. Fiber Jumper saddles pivot for improved patch cord routing and organization
 - i. Removable rubber grommets protect cable and minimize dust build-up
 - j. Multiple mounting bracket positions for 19" or 23" rack and cabinet installation (23" 1RU mounting bracket sold separately)
 - k. Constructed of durable polycarbonate plastic and 16 gauge steel, powder-coated black
 - l. Door lock option available on front, rear, or both doors
 - m. Fiber cable management shall allow for routing, storage, and protection of patch cords, tight-buffer fiber, and backbone cables.
 - n. Enclosure shall be available either empty or in custom pre-loaded configurations.

D. FIBER TERMINATION PRODUCTS

1. FIBER CONNECTORS

- a. Anerobic physical connect (PC) fiber optic connectors shall be the primary means of field-terminating individual fiber strands at the enclosure or faceplate location.
- b. Shall meet or exceed the requirements described in TIA-568 and ANSI/TIA-604-10 (LC) Connector Intermateability Standards
- c. Shall utilize a precision zirconia ceramic ferrule.
- d. Shall be provided in LC, multimode (laser optimized) configurations, terminated on 250 or 900 μ m buffered fiber and/or 2mm or 3 mm jacketed fiber.
- e. Maximum connector insertion loss shall be no greater than 0.75 db.

2. FIBER ADAPTER PLATES

- a. The fiber adapter plate shall be modular and functional for use in either a wall-mount or rack-mount enclosure. The adapter plate shall be provided

- in LC styles, in 12- or 24-fiber configurations. 12-fiber adapter plates are used to terminate 12-fiber cables, and 24-fiber adapter plates are used to terminate 24-fiber (or greater) cables. Do not utilize adapter plates with unused ports at the rear.
- b. The adapter plate shall be compliant to TIA-568 (for performance) and respective TIA-604-X (for intermateability) standards. Adapter plates shall use zirconia ceramic sleeves and be offered in standard fiber type colors pursuant to TIA-568 standards.
- c. LC adapter shall utilize 100% zirconia-ceramic ferrules. Adapter plates shall be offered in with Aqua bulk head adapters.
- 3. FIBER JUMPERS AND ARRAY CORDS
 - a. Fiber optic LC-LC Aqua patch cords for Multi-Mode or jumpers, will make LC connections from the rack termination points to the equipment. The jumpers will meet the following requirements:
 - b. Factory-manufactured using Single mode OS2 optical fiber. Field terminations on fiber jumpers are not acceptable.
 - c. Shall utilize A-B polarity.
 - d. Shall exhibit <0.3 dB insertion loss and -25 dB return loss.
 - e. Shall be available in standard lengths of 1, 2, 3, 5 and 10 meters and custom-orderable up to any length of feet or meters
 - f. Provide factory assembled patch cords meeting or exceeding all criteria specified in the horizontal cabling standard

2.5 FRAMES, RACKS AND CABINETS

- A. FLOOR-MOUNTED 2-POST RACKS & 4-POST RACKS
 - 1. Universal junction hole pattern matches most manufacturers racks. #12-24 panel mounting holes. UL Listed (File No. E140851) as a communications circuit accessory.
 - 2. Load Rating: 1000 Lbs. (453.6kg) weight capacity when evenly distributed for the height of the rack (84" (2133mm) and shorter).
 - 3. Add (1) front/rear vertical wire manager on each side or between racks. See Wire Management, below.
 - 4. Permanently stamped rack mount unit (RMU) markings included. Double sided universal (5/8" (16mm), 5/8" (16mm), 1/2" (13mm)) mounting spacing.
 - 5. Includes fifty (50) pilot point #12/24 mounting screws.
 - 6. Approved Manufactures
 - a. Chatsworth (CPI)
 - b. 2-Post Racks (55053-703)
 - c. 4-Post Racks (50120-703)
 - d. 4-Post Racks for Portables ONLY – Lowell (LER-4432)
- B. VERTICAL WIRE MANAGERS
 - 1. Provide full height, front-and-rear, 6"-8" wide Vertical Wire Managers at the side of and between each 2-post and/or 4-post termination rack or frame. If space will not allow, the 5" wide wire manager may be substituted at row ends only, leaving the 8" vertical wire manager between each rack. Richland School District approval in writing is required prior to this substitution.
 - a. Mounting hardware shall be included to insure the proper installation to infrastructure. It shall mount onto a standard TIA/EIA recognized equipment rack.
 - b. The management system shall offer an assortment of accessories, including a bend radius slack loop organizer, cable retainers, and shall accommodate top, bottom, side and pass-through cable routing. Dual hinged, cable concealing covers shall be included.
 - 2. Approved Products:
 - a. Chatsworth (CPI)

- b. Vertical Wire Managers 6" (13912-703)
 - C. HORIZONTAL WIRE MANAGERS
 - 1. Provide horizontal wire managers with doors above and below or between every 2RU of patch panel, as space allows.
 - a. Do not coil or wind patch cords inside wire managers.
 - b. Use recessed flat wire manager as needed within enclosed cabinets to route patch cords to opposite sides, where the rings of the flat wire managers would interfere with cabinet door closure.
 - c. Horizontal Wire Manager (ICCMSCMPK2)

2.6 CABLE SUPPORTS

- A. J-HOOKS
 - 1. All cable shall be supported above ceiling on dedicated cable support hardware.
 - 2. Cable saddles and J-hooks shall be used where cable tray or wire basket is not available. These must be supported on their own ceiling wires, threaded rod, or affixed to building structure by use of beam clamps (on metal beams) or wood screws (on wood beams). Affixing communication cable supports to existing ceiling support wires is not allowed.
- B. CABLE TRAY
 - 1. In Telecom Rooms, cable tray (ladder runway) shall be installed to support all cable running to racks and cabinets. Cable tray to be added to all Telecom Rooms in places where cable is run horizontally.
 - 2. Cable tray shall be aluminum, with 12" rung spacing.
 - 3. Cable shall be combed and bundled in all exposed runs outside walls, in TR/TE, and inside cabinets and wire managers.
 - 4. All appropriate cable tray support hardware including angle brackets, rack-to-runway brackets, wall-to-runway brackets, elevation kits, junction splices, butt splices, and grounding jumpers shall be used for a complete and professional installation.
- C. JACK/OUTLET BRACKETS
 - 1. Above-ceiling cable termination locations shall be either wall-mounted or suspended from structure above the drop ceiling. Cables or terminations shall not rest on ceiling grid or equipment above ceiling grid.
 - 2. For Wireless Access Points and other above-ceiling-mounted communications devices, cables shall land in an above-ceiling bracket which is affixed to dedicated cable support hardware.
 - 3. Two category-rated jacks may be installed in each above-ceiling bracket. Each above-ceiling bracket will hold a 2-port Surface-Mount Box or 1-U MOS SMB for multimedia applications.
 - 4. For wall-mounted device locations (above or below ceiling), devices needing to be mounted directly to a back box will utilize the in-wall mounting bracket to secure the jack inside the back box.
 - 5. One category-rated jack can be installed in each in-wall back box jack mounting bracket. For devices requiring (2) category-rated jacks, (2) in-wall brackets must be used.

2.7 FIRESTOPPING (Performed by Div 26)

- A. Fire rated pathway devices shall be the preferred product and shall be installed in all locations where frequent cable moves, add-ons and changes will occur. Such devices shall:
 - 1. Meet the hourly rating of the floor or wall penetrated.
 - 2. Permit the allowable cable load to range from 0% to 100% visual fill thereby eliminating the need to calculate allowable fill ratios.
 - 3. Permit multiple devices to be ganged together to increase overall cable capacity.
 - 4. Allow for retrofit to install around existing cables.

5. Include an optional means to lengthen the device to facilitate installation in thicker barriers without degrading fire or smoke sealing properties or inhibiting ability of device to permit cable moves, add-ons, or changes
 6. Not require any additional action on the part of the installer to open or close the pathway device or activate the internal smoke and fire seal, such as, but not limited to:
 - a. Opening or closing of doors.
 - b. Twisting an inner liner.
 - c. Removal or replacement of any material such as sealant, caulk, putty, pillows, bags, foam plugs, foam blocks, or any other material.
 7. Where single cables (up to 0.27 in. (7 mm) diameter) penetrate gypsum board/stud wall assemblies, a fire-rated cable grommet may be substituted. Acceptable products shall be molded from plenum-grade polymer and conform to the outer diameter of the cable forming a tight seal for fire and smoke. Additionally, acceptable products shall lock into the barrier to secure cable penetration.
- B. Where non-mechanical products are utilized, provide products that upon curing do no re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, pounding water or other forms of moisture characteristic during or after construction.
1. Where it is not practical to use a mechanical device, openings within floors and walls designed to accommodate telecommunications and data cabling shall be provided with re-enterable products that do not cure or dry.
 2. Utilize an EMT sleeve as a stub through all walls
 3. Surround annular space between EMT sleeve and wall material with a hardening intumescent caulk.
 4. Utilize re-enterable, non-hardening putty around cables inside a metal sleeve. Do not exceed 40% fill capacity of sleeve and follow all rated assembly requirements per Manufacturer, local codes, and AHJ.
 5. All sleeves to be install by Dev. 26.
- C. Cable trays shall terminate at each barrier and resume on the opposite side such that cables pass independently through fire-rated pathway devices. Cable tray shall be rigidly supported independent from fire-rated pathway devices on each side of barrier.
- 2.8 LABELING:
- A. Cables
1. Horizontal and backbone cables shall be labeled at each end according to Richland School District labeling standards (see below). The cable or its label shall be marked with its identifier.
 2. Cable labels shall be machine-generated labels with multiple cable ID's printed such that it can be viewable in place without turning the cable.
 3. Label cables within 6" of termination point at both ends.
- B. Faceplates
1. A unique location identifier shall be marked on each faceplate to identify its location in the cable plant.
 2. Each port in the faceplate shall be labeled with its own unique identifier.
- C. Racks, Panels, Blocks
1. A unique identifier shall be marked on each piece of connecting hardware to identify it as connecting hardware.
 2. Each port on the connecting hardware shall be labeled with its own identifier to match the other end of the cable.
- D. Ceiling Grid
1. All grid locations that are slated to be used for wireless access point drops above ceiling grid need to be labeled with white on black TZ type label tape to identify location of drop.

2.9 APPROVED PRODUCT LIST

- A. Leviton / Berk-Tek approved base product list
 - 1. Berk-Tek and Leviton approved material
 - a. 4-Pair Category 6 unshielded twisted pair cabling
 - i. Plenum
 - 1. Blue: 10136226
 - ii. Riser
 - 1. Blue: 10136339
 - b. 4-Pair Category 6A unshielded twisted pair cabling
 - i. Plenum
 - 1. Blue: 11141650
 - ii. Riser
 - 1. Blue: 11142398
 - c. Head End Termination
 - i. QuickPort Patch panel: 49255-L48
 - 1. Standard User Locations: Black
 - a. Black: 61110-RE6
 - 2. Wireless Access Points:
 - a. Green: 6110G-RV6
 - 3. Audio Visual and Projectors:
 - a. Blue: 61110-RL6
 - 4. Intercom Clocks:
 - a. White: 61110-RW6
 - 5. Cameras:
 - a. Yellow: 61110-RY6
 - 6. HVAC
 - a. Orange: 61110-RO6
 - d. User End Terminations
 - 4-Port QuickPort faceplate with identification windows matching electrical: 42080-4xS,
 - 1. Standard User Locations: Black
 - a. Black: 61110-RE6
 - 2. Wireless Access Points:
 - a. Green: 6110G-RV6
 - 3. Audio Visual and Projectors:
 - a. Blue: 61110-RL6
 - 4. Intercom Clocks:
 - a. White: 61110-RW6
 - 5. Cameras:
 - a. Yellow: 61110-RY6
 - 6. Heat Ventilation and Air Conditioning:
 - a. Orange: 61110-RO6
 - e. A complete Laser Optimize 10 Gigabit Optical backbone infrastructure
 - i. Laser optimized Indoor/Outdoor OM3
 - 1. 6 Strand Indoor/Outdoor Tight Buffered
 - a. Plenum: PDP006EB3010/25-I/O(BLA)
 - b. Riser: PDR006EB3010/25-I/O(BLA)
 - 2. 12 Strand Tight Buffered
 - a. Plenum: PDP012EB3010/25-I/O(BLA)

- b. Riser: PDR012EB3010/25-I/O(BLA)
 - ii. Laser optimized Indoor/Outdoor OM4
 - 1. 6 Strand Tight Buffered
 - a. Plenum: PDP006FB3010/25-I/O(BLA)
 - b. Riser: PDR006FB3010/25-I/O(BLA)
 - 2. 12 strand Optical fiber
 - a. Plenum: PDP012FB3010/25-I/O(BLA)

2.10 UNINTERRUPTABLE POWER SUPPLIES & POWER DISTRIBUTION UNITS

- A. MDF UPS (10kVA UPS shall only be used in MDF unless IDF posses a high density cable count)
Contact owner for approval.

- 1. Output:
 - a. 10kVA
 - b. Rack Mount
 - c. 120/208 single phase
 - d. Output connections:
 - 1) Four 6-20R
 - 2) (24) 5-15/20R
 - 3) Two L6-30R
- 2. Input: Hardwire input: 208V, single phase, 88.4A
- 3. Batteries: 40 minute with additional batteries
- 4. PDUs: 208V, single phase, 16A
- 5. PDU connection cords (P018-006 C14-C15)
- 6. Power cords
- 7. Remote monitoring web card
- 8. Cyber Power Model numbers:

TBD

B. IDF UPS

- a. Output:
- b. 3kVA
- c. Rack Mount
- d. 120/208 single phase
- e. Output connections:
 - 1) Twelve 5-15/20R
 - 2) Two L6-20R
 - 3) Two L6-30R
- f. Input:
 - a. 208V
 - b. NEMA L6-30P
- g. Batteries
- h. Power cords
- i. Remote monitoring web card
- j. Cyber Power Model numbers:

TBD

C. IDF UPS

- 1. Output:
 - a. 5kVA
 - b. Rack Mount
 - c. 120/208 single phase
 - d. Output connections:

- 1) Twelve 5-15/20R
- 2) Two L6-20R
- 3) Two L6-30R

2. Input:

- a. 208V
- b. NEMA L6-30P
 3. Batteries
 4. Power cords
 5. Remote monitoring web card
 6. **Cyber Power Model numbers:**
TBD
)

3.4 PRODUCTS PROVIDED BY DIVISION 26

- A. The following materials shall be provided under Division 26:
- a. Conduit rough-in for boxes in/out of telecommunications rooms and in/out of wall cavities at work stations.
 - b. Core drilled holes through masonry walls and concrete floors.
 - c. Conduit sleeves through walls and floors.
 - d. Pull cords for all conduits where telecommunication cable is to be pulled.
 - e. Outlet boxes (4-11/16" square) with single gang ring the depth required to be flush with wall trim.
 - f. 1" EMT conduit stub-ups into accessible ceiling spaces from outlet box.
 - g. Plastic end cap on stub-out ends.
 - h. Cable tray.
 - i. Telecommunication room plywood backboards.
 - j. Telecommunications grounding bus bars.
 - k. #2/0 CU. Ground from Telecommunications grounding bus bars to main electrical service ground.
 - l. Fire Retardant Plywood Backboards:
 - a. Provide 3/4" x 8' high fire retardant ACX plywood backboard to cover walls as shown on drawings. Backboard shall bear a seal identifying that plywood is fire rated.
 - b. Backboard shall be finished with flat latex, white anti-static sealer or overcoat paint. Paint plywood backboard on all sides and edges prior to mounting on walls. Area around fire retardant seal shall be unpainted so that seal remains exposed and visible.

3.5 EXTRA MATERIALS

- A. Furnish and install the extra materials described in subparagraphs below that match products provided. These devices shall be installed as directed during construction. The contractor shall consider a difficult installation that may require ceiling tiles to be removed/replaced, cut-in boxes used and walls to be "fished" to install the devices where directed. Extra materials that are not installed during construction shall be turned over to the owner at the end of construction (closeout). Products that are not installed shall be packaged in their original containers with protective covering for storage and identified with labels describing contents. The contractor shall include the following in their bid:
- a. Field Located Data Drops: The contractor shall include in their bid 30 additional Telecommunication drops complete with 4-port faceplate, (1) Cat 6 jack, (3) snap-in blank fillers, 300 feet Cat 6 cable, installation, termination at each end and testing.
 - b. 30 rough ins including (1) 4" square, deep box with single gang ring and 30' of 3/4" EMT conduit with (2) sweeps.
 - c. Contractor shall provide an extra 24 port (spare) CAT 6 patch panel in each cable management telecommunications rack, in each telecommunications room for future

- terminations.
- d. Labor for installing all extra materials.
- B. Submit a fair cost value for these materials and labor with the Division 27 post bid submittals, on the form following this specification section. This fair cost estimate shall include all direct job expenses such as equipment rental, small tool expense, layout and supervision, etc. for a complete installation as if the material were shown on the drawings and taken off for bid. Breakout material and labor costs for each extra material indicated. Unused labor will be Architect or Engineer's option. This fair cost value may be applied to other work not included in the bid documents.

PART 3 – EXECUTION

3.1 PRE-INSTALLATION CONFERENCE

- A. Schedule a conference a minimum of five calendar days prior to beginning work of this section.
- B. Agenda: Clarify questions related to work to be performed, scheduling, coordination, etc.
- C. Attendance: Communications system installer, General Contractor, Richland School Districts Representatives and any additional parties affected by work of this section. Richland School District's Information Technology must be represented at a preconference meeting prior to scheduling of any work.
- D. Copy of Leviton warranty application will be provided by Contractor.
- E. Pre-Installation conference may be waived only by Richland School District.

3.2 INSTALLATION

- A. Proper cable handling is critical to maintaining the design integrity of high-performance cabling. Cable handling recommendations include:
 - 1. Cable must be conditioned above 32 degrees F for 48 hours prior to installation.
 - 2. Do not use excessive force when pulling cable. The maximum pull-force guideline for a 4-pair horizontal UTP should not exceed 110N (25lbf). Meeting this guideline avoids stretching conductors during installation and the associated transmission degradation.
 - 3. The minimum bend radius for UTP should not exceed 4 times the cable outside diameter (O.D.)
 - 4. The minimum bend radius for fiber should not exceed 10x the cable outside diameter.
 - 5. Traditional bundling of Category 6 cabling for a combed appearance is required in all exposed locations.
 - 6. In TR, use appropriate horizontal cable management for patch cords on front of patch panels. Also, use appropriate cable management bar(s) for support of terminated horizontal cable.
 - 7. Do not use vinyl or plastic cable ties due to the potential for over-cinching of cable bundles which can alter the cable geometry and degrade the system cabling performance. Use only hook and loop ("Velcro") fasteners for bundling of horizontal cables.
 - 8. Store cable slack in an extended loop configuration to alleviate cable stress. Excessive cable slack in bundled loops or traditional 'service loops' to provide additional cable length in TR has been shown to degrade cabling performance and are not recommended.
- B. Sleeves shall be provided in walls above ceilings to provide paths wherever cables are being routed.
- C. At fire walls provide EMT fitted with nylon throated threaded conduit fittings on each end. Provide fire seal wherever passage through any type of fire wall is required. Unused sleeves are to be provided with metal end caps on both sides.

3.3 SEPARATION OF POWER AND DATA CABLING

- A. Design cable pathways to avoid potential sources of EMI. Avoid installing cable near sources of EMI (X-ray equipment, large motors/generators, electrical power cabling and transformers,

- Radio frequency (RF) sources and transmitters, lighting, copiers, etc.).
- B. Physically separate power & data cabling according to relevant code and standard requirements when run in a common pathway.
- C. Never run data and Class 1 power cabling in parallel closer than 2".
- D. Avoid crossing cables if possible. If necessary, always cross cables at 90 degrees.
- E. Maintain a minimum of 5 in. separation between data cable and all ballast controlled lighting.
- F. Minimum separation distances of telecommunications cabling from potential sources of EMI exceeding 5kVA:
- G. 24" away from Unshielded power lines or electrical equipment in proximity to open or nonmetal pathways
- H. 12" away from Unshielded power lines or electrical equipment in proximity to a grounded metal conduit pathway
- I. 6" away from Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to a grounded metal conduit pathway
- J. 47" away from Electrical motors and transformers

3.4 INSTALLATION OF STRUCTURED CABLING SYSTEM

- A. PRE-INSTALLATION CONFERENCE
 - 1. Schedule a conference a minimum of five calendar days prior to beginning work of this section.
 - 2. Agenda: Clarify questions related to work to be performed, scheduling, coordination, etc.
 - 3. Attendance: Communications system installer, General Contractor, Richland School Districts Representatives and any additional parties affected by work of this section. Richland School District's Information Technology must be represented at a preconference meeting prior to scheduling of any work.
 - 4. Copy of Leviton warranty application will be provided by Contractor.
 - 5. Pre-Installation conference may be waived only by Richland School District.
- B. WARRANTY
 - 1. A lifetime performance warranty covering all components, equipment and workmanship shall be submitted in writing with system documentation. The warranty period shall begin on the system's first use by Richland School District.
 - 2. The project must be pre-registered with Leviton by the installation contractor before installation has begun, and shall be concluded by contractor with uploading of test results to Leviton and a full project closeout. Warranty paperwork will be delivered directly from Leviton to Richland School District.
 - 3. Should the cabling system fail to perform within its expected operation within this warranty period due to inferior or faulty material and/or workmanship, the Contractor shall promptly make all required corrections without cost to Richland School District.
- C. DRAWINGS AND SPECIFICATIONS
 - 1. The Contract drawings and specifications form an integral part of the contract documents. Neither the drawings nor the specifications shall be used alone. Drawings are generally diagrammatic and are intended to indicate the scope and general arrangement of work. Work omitted from the drawings but mentioned or reasonably implied in the specifications, or vice versa, shall be considered as properly and sufficiently specified and shall be provided. Misinterpretation of any

requirements on drawings, or specifications shall not relieve the Contractor of his or her responsibility of properly completing the Contract.

2. Richland School District's Project Manager has the option of changing the location of Electrical and Communication outlets to within 3 meters of designed location prior to rough-in stage at no extra cost to Richland School District. Richland School District and Richland School District's Representative requests a chalk/rough-in walk prior to installation to verify locations.
3. The Contractor is responsible to take field measurements where equipment and material dimensions are dependent upon building dimensions and to coordinate and provide a chalk/rough-in walk prior to installation to verify locations.
4. The Contractor shall coordinate with General, Mechanical and Electrical trades as well as Furniture Layout Designer for final workstation outlet locations.
5. Where conflict exists between drawings and specifications the Contractor shall, make allowance for provision of the component, system, or installation process in a manner which will provide the highest monetary cost components, systems, or installation process. Contractor shall inform Richland School District's Project Managers of the conflict and obtain approvals prior taking corrective measures.

D. RICHLAND SCHOOL DISTRICT REQUIREMENTS AND STANDARDS.

1. Unless otherwise noted a minimum of 1 Category 6 UTP cable and jack shall be installed in all work area outlet (with the exception of wireless access points) locations on a 4-outlet flush mounted faceplate, including offices, utility services, and other common telecommunications locations. The two center positions are to remain blank for future use.
2. All modular furniture will have a single workstation outlet per cubicle, unless specifically noted otherwise. All partition-wall or demising-walled areas have workstation outlets specifically noted on the Exhibit /Floor Plans.
3. One category 6 UTP cables and jacks shall be installed at all Wireless Access Point locations.
4. Wall-phone outlet locations require a single category 6 cable and category 6 jack on a stainless steel studded wall plate.
5. All termination wiring shall be T568B termination pattern.
6. A minimum of 2 each 4" inch sleeves must be installed in every IDF and MDF for the first one hundred cables. 2 each additional 4" sleeve must be installed if the cabling count exceed 100 cables and 2 additions per hundred from there (example: 120 cables will require 4 each 4" conduits while 220 cables will require 6 each 4" conduits).
7. Sleeves for penetration of walls and floors shall have a one hundred percent (100%) spare capacity and shall be fire-stopped as per code.
8. All sleeves shall be installed by Division 26.

E. PATHWAYS AND TOPOLOGY

1. Utilize "thin film" lubricants only! It has been shown that cable-pilling lubricants will affect your testing as the cable needs several weeks to dry before attenuation levels recover. Use of incorrect cable lubricants will erode cable jacket and void cable warranty.
2. All cable and wire shall be concealed in conduits, floor ducts, paneling, ceiling or similar areas except at mutually agreed upon areas.
3. Fill capacity in conduit, modular furniture and other horizontal pathways should not exceed 40%. A maximum of 60 % pathway fill is allowed to accommodate unplanned additions after initial installation. To calculate the fill ratio, divide the sum of the cross-sectional area of all cables, by the most restricted cross-sectional area of the pathway.

4. Flat-rung and/or solid bottom cable tray shall be utilized for large, high-density installations. J-hooks and other specific cable support hardware shall be used at all locations outside of cable tray.
5. Pathway design should not exceed (2) 90-degree bends between pull points or pull boxes (PB). If more than (2) 90-degree bends are required, install a pull box between bends.
6. Provide NEC-sized pull boxes for any run greater than 100 feet, or with more than two ninety-degree bends.
7. J-hooks should be randomly spaced 60" or less. Do not exceed J-hook capacity for size and weight limitations.
8. Land wireless access cabling above ceiling, secured onto in-ceiling bracket. A slack loop in the horizontal cabling is not required. Utilize varying-length patch cords when installing wireless access point devices for flexibility in length.
9. Crimp-on modular plugs at wireless access points are not allowed. Terminate all category 6 cabling onto the approved jacks.
10. Mixing of various Category cables in the same pathway is allowed if the applications are appropriate for each category of cable used.
11. Prior to placing any cable pathways or cable, the contractor shall survey the site to determine job conditions will not impose any obstructions that would interfere with the safe and satisfactory placement of the cables. The arrangements to remove any obstructions with the Project Manager need to be determined at that time.
12. Maintain a distance of at least 12 inches from all power conduits and cables, and 6 inches from all fluorescent lighting fixtures. Do not install power feeders 100 amps or greater above or within 5 feet of telecommunications backboard. Do not install telecommunications conduits above power panels or switchboards.
13. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
14. The backbone subsystem shall include cable installed in a vertical manner between floor telecommunications room/closets (TCs or IDFs) and the main or intermediate cross-connect in a multi-story building and cable installed horizontally between telecommunications room/closets and the main or intermediate cross-connect in a long single story building.
15. Unless otherwise recommended by Richland School District, all fiber cables will be encased in interlocking armor. All fibers will be terminated in the Telecom Rooms or Cabinets in rack-mounted enclosures equipped with sufficient ports to allow for growth, slack storage space and splice trays if required to terminate and secure all fibers.
16. Adequate riser sleeve/slot space shall be available with the ability to ingress the area at a later date in all Telecommunications rooms/closets, such that no drilling of additional sleeves/slots is necessary. Sleeves may need to be provided and installed under the scope of this Project.
17. The backbone cables shall be installed in a star topology, emanating from the main cross-connect to each telecommunications room/closet. An intermediate cross-connect may be present between the main cross-connect and the horizontal cross-connect.
18. For voice or data applications, 4 pair UTP or fiber optic cables shall be run using a star topology from the telecommunications room/closet serving that floor to every individual information outlet.
19. Backbone and Horizontal pathways shall be installed or selected such that the minimum bend radius is maintained both during and after installation.
20. All horizontal pathways shall be designed, installed and grounded to meet applicable local and national building and electrical codes.

21. Install $\frac{3}{4}$ " x 4' x 8' fire-rated plywood across all walls in telecom rooms, from 6" AFF to 8'-6" AFF. Coat with 2 coats of white paint. Do not paint over fire rating stamp.
22. Contractor (shall firestop all used pathways which enter or leave the telecom rooms via conduit, cable tray or slot. Contractor is responsible for installing sleeves at each wall or partition penetration, and firestopping all fire-rated penetrations. Intumescent caulk shall be applied around the outside of each sleeve, and intumescent putty inside the sleeve or conduits around the cables. Appropriate fill ratios must be followed when penetrating fire-rated walls.
23. Do not run fiber cables in conduits which are less than 2" in diameter.
24. Abandoned cable shall be removed from pathways (i.e., from tunnels, manholes, plenum spaces, and conduit) under scope of this project. Previously unknown or unidentified cable which is apparently abandoned prior to work shall be brought to the attention of Richland School District for authorization prior to removal.

F. GROUNDING:

1. Refer to section 27 05 26 for specifications on Grounding and Bonding.
2. All grounding (earthing) and bonding shall be done to applicable codes, standards and regulations.
3. Shielded cabling channels shall include appropriate method of bonding shield to approved ground for proper EMI/RFI mitigation.
4. Shield Continuity Testing shall be enabled when shielded cabling channels are installed.
5. All shielded and armored cables shall be bonded to a telecom grounding system via shielded patch panels at the rack locations. Shielded Category-rated connectors must be properly installed to maintain electrical ground conductivity along entire length of cable and at both ends of the cable. UTP connectors shall not be used on shielded cables at either end.
6. Shielded Patch cords shall be provided for use and employed at each workstation location utilizing shielded cable. Shielded patch cords can be identified by their gray color and metallic RJ45 plug. Shielded patch cords are not required at the patch panels.
7. Telecom Contractor shall bond and ground all telecom room metals. Telecom Contractor shall provide and install TIA-rated Telecommunications Grounding Busbar (TGB) at all MDF and IDF locations, and an in-cabinet grounding busbar at each remote wall-mounted cabinet or telecom enclosure. All ground lugs shall be 2-hole make-up.
8. Division 26 will provide the all bus bars and the connection between the TGB and building ground.
9. Telecom installer will ground and bond all armored and/or shielded cables, racks, cabinets, cable tray, ladder racking, and shielded panels to telecom grounding busbar within the telecom rooms.

G. CABLES AND TERMINATIONS:

1. Check plans for final determination of faceplate colors or consult with the Electrical Engineer to Richland School District prior to install.
2. Install additional cables at drop locations and in quantities indicated on the drawings. Do not exceed manufacturers' recommendations for maximum allowable pulling tension, side wall pressure or minimum bending radius. Use pulling compound as recommended by cabling manufacturer.
3. All horizontal cables, regardless of media type, shall not exceed 90 m (295 ft) from the telecommunications outlets in the work area to the horizontal cross connect.
4. The combined length of jumpers, or patch cords and equipment cables in the telecommunications room/closet and the work area shall not exceed 10m (33 ft).
5. The Contractor shall observe the bending radius and pulling strength requirements of the 4 pair UTP and fiber optic cable during handling and

installation.

6. No run of UTP cable between horizontal portions of the cross-connect in the telecommunication closet and the information outlet shall contain splices.
7. In a false ceiling environment, a minimum of 3 inches (75 mm) shall be observed between the cable supports and the false ceiling. Minimum 6" is preferred.
8. J-hooks shall be provided for all suspended cable, at a semi-irregular spacing not to exceed 5 feet between supports. Cables shall be supported by dedicated low-voltage cable support hardware. Support of cables or hanging hardware by means of supports or surfaces related to other trades or applications is not allowed.
9. Provide a full-size service loop (at least once around the inside edge of the box) in each J-box in the communications system.
10. Install all cable in plenum spaces with J-hooks of at least 1" in width to disperse the weight on the bottom cables. Homerun all cable to nearest TR Cabinet.
11. Comply with ANSI/TIA-569 for conduit and splice box sizing.
12. Install modular jacks at all outlets shown; one data jack for each data cable at each faceplate or termination point. Install additional cables and modular jacks as indicated on the drawings. Do not "split pairs" between different jacks.
13. Terminate cables at each jack location and at termination board or patch panel. Follow industry guidelines and manufacturers' recommendations and procedures as required. All termination hardware shall be rated to exceed their associated Category rating as specified above.
14. For enclosed ceiling WAP locations, install and terminate one category 6A cable to approximate location as shown on plans. For open-ceiling environments, secure cables and surface-mount boxes to nearest appropriate support structure.
15. For in-ceiling WAP locations, secure jacks inside a surface-mount block mounted to in-ceiling metal assembly, and provide a 5' patch cord or longer, as needed, to connect device to its final determined location in ceiling.
16. Label and identify each outlet and cable for data circuits. Label at outlet end and at termination board or patch panel with matching designations.
17. Provide data outlets in surface raceway at 26" on center unless otherwise indicated.
18. Extreme care must be taken not to nick any of the copper conductors when removing jacket. Use rip cord to expose pairs for termination onto Insulation Displacement Contacts. You can also use a precision stripper that allows the technician to set the depth of the blade.
19. Maintain twists as close as possible to the point of termination. Untwisting of copper pairs should not exceed 1/4" to the termination point.
20. Manage the cable bundles in a symmetrical orientation. For example, in a 48-port patch panel, distribute 24 cables through the vertical cable management on the left rear side of the rack and 24 cables through the vertical cable management on the right rear side of the rack.
21. Do not dress cables in bundles larger than 24 cables. Multiple 24-cable bundles may be run in parallel with evenly spaced Velcro cable ties in an orderly sequence.
22. For cable management on rear of patch panel, cable shall sweep into termination points and be supported by appropriate rear cable management.
23. Horizontal patch cord management is required on all installations.
24. Maintain cable bend radius 4X outer diameter (UTP only) when mounting faceplate onto EMT backbox, box-eliminators or furniture knock-outs.
25. Faceplates and SMBs shall be fully installed and labeled prior to testing.

H. ABOVE-CEILING AND WALL-MOUNTED WIRELESS ACCESS POINTS AND DEVICES:

1. All WAP locations shall receive one Category 6A cable from the nearest TE or TR

- (IDF). Multimedia, security and other video devices shall receive (1) Category 6 cables as shown on drawings, documents and details.
 2. WAP and other communications cables shall terminate on patch panels in the TE/TR (IDF). WAP cables shall terminate on Category 6 information outlets and shall be terminated above *the* ceiling in a 1-port SMB.
 3. SMB, jacks, and patch cords used in plenum spaces shall be plenum-rated.
- I. FURNITURE CABLING:
1. The contractor will pull all voice and data cables in advance of the installation of the modular furniture workstations, and coil at base-feed or above ceiling for power pole feeds. Upon furniture arrival, the contractor will feed the cables through power poles or base feed/wall connected data/telecom conduit, and terminate as specified on the floor plans.
 2. Contractor to coordinate with Richland School District's furniture vendor for timing of the installation of systems furniture, and installation of electrical and voice/data cabling. Overtime may be required for this and other phases of the project work, and bids, plans and schedules must reflect actual work demands. Contractor shall consider all costs in their bids for installation.
- J. TERMINAL BLOCKS AND PATCH PANELS:
1. Arrange all terminal blocks in a manner that allows natural wiring progression and minimizes crossing of wires.
 2. Dress and comb all incoming cable bundles in groups of 24 cables each. Eliminate crossed cables and "divers".
 3. Ground all shielded patch panels to telecom ground source via paint-piercing washers to a grounded rack, or via direct ground wire to telecom bus bar.
 4. Racks need to be setup that all data is on the far left 2-post rack, switches/fiber will land on the center 2-post rack, and all systems (i.e. clocks, WAPS, av) on the right-hand 2-post rack, UPS' to be installed in the closest 4-post rack to the switches.
- K. IDF ROOMS:
1. The Data and Telco Rooms are a transition point between the backbone and horizontal distribution pathways. The rooms shall be able to contain data or telecommunications' equipment, cable terminations and associated cross-connection wiring. Closet spaces are not to be shared with electrical installations, other than those directly for telecommunications, video, security and information systems equipment. The rooms are not to be shared with other unrelated building service, for example plumbing. Any conflicts with these specifications require the approval of Richland School District's project manager.
 2. Contractor shall submit a drawing of the IDF room showing layout of all components including necessary and required electrical outlets, conduits, environmental requirements and wire termination fields prior to start of the job. Any jack densities noted in these specifications are estimates only. The drawing will designate the most effective, scalable, jack termination cabling design to facilitate data/telecom outlets shown on the lease exhibits. Richland School District's Project Managers must approve drawings prior to installation.
 3. All racks, panels, and equipment finished shall be anchored to meet local seismic zone requirements and industry standards. The equipment racks are to be anchored to the concrete floors via "Unistrut or equal metal framing strut systems", threaded rod, concrete anchors, bolts and washers.
 4. The overhead cable ladder system will provide a route for the Category 6, and other communication cables while providing stability to the equipment racks.
 5. The vendor is responsible to provide and install the specified count of 19" EIA rackmount 7' (45U) 2- post racks, Black, as required in the new IDF. The vendor is responsible for submitting IDF layout drawings to Richland School District for approval prior to installation.
 6. The contractor shall provide high capacity horizontal and vertical cable manager channels are required in all data and equipment racks, and the racks will contain

sufficient vertical and horizontal cable managers to facilitate the patch panel density and placement installed by the contractor.

7. Contractor will install raceways, boxes, managers, and enclosures as indicated according to manufacturer's written instructions. Securely fasten each component to the surface to which it is mounted and remove burs and sharp edges from all cable tray.
8. A 12" ladder rack system is required and will be provided by the contractor and installed in the IDF to provide cable support to the rack system. This includes all the required ladder rack support items such as rack to runway kits, wall angle brackets, ceiling supports, splices (junction and butt), radius drops and j-bolts. The final ladder rack layout will be included in the IDF layout drawing described above.
9. Provide and install as needed in the IDF room 4' x 8" x 3/4" fire-rated plywood board and labeled with fire rating stamp facing into the room to accommodate rack ladder support, cabling support, grounding platform, data and voice equipment. Paint backboard white (leave stamp visible) to match existing backboard in room, if appropriate. Location of installation is to be determined with approval by Richland School District.

L. PATCH CORDS:

1. Owner Furnished Owner Installed (OFOI).
 - a. Install Category 6 patch cords at the equipment cabinet between Category 6 patch panel and Richland School District switches. Dress and bundle patch cords as appropriate for final installation.
 - b. Install fiber optic patch cords at the equipment cabinet between fiber patch panel and Richland School District switches. Dress and bundle patch cords as appropriate for final installation
2. Contractor Furnished Contracted Installed
 - a. If the wireless access points are part of the proposal, then the contractor will be required to install Category 6 patch cords between the work area outlet and the wireless access points. Neatly route, dress and bundle patch cords to assure they are esthetically please for Richland School District if patching is done by the contractor.

M. LABELING:

- a. Provide machine-generated labels appropriate for all components supplied and installed. Under no circumstances shall handwritten labels be used.
- b. Each faceplate, cable, or data outlet (drop) will be numbered with a unique identifier clearly indicating the voice and data jacks by Closet ID, Rack ID, Panel ID, and Port ID.
 - i. Ex: 128.1.A-24 (IDF1 / Rack 1 / Panel A / Port 24)
 - ii. Label at the panel to match
2. The labeling scheme shall not include duplicates of any new or existing cable identification across the entire cable plant.
3. Labeling procedure will meet TIA-568, TIA-606 (Class 2 Administration) and BICSI Standards.
4. The labeling scheme will be provided at all locations within the cable infrastructure:

N. All inspections which expose existing conditions not meeting Richland School District standards as described above must be reported to Richland School District prior to installation. Richland School District may require additional work to bring existing site conditions up to Standard. Areas to explore shall include, but not be limited, to the following items.

O. Insufficient or failed HVAC flow in the IDF with the appropriate exhaust system. Air temperatures shall not exceed 78 degrees sustained.

P. It is recommended to recess any existing or new fire sprinklers in the IDF to prevent

accidental damage and associated risks.

- Q. Lighting layout fixture pattern is to provide sufficient lighting over front and back of each equipment rack.
- R. In the IDF room, a minimum of (2) 20-amp, dedicated, duplex power outlets box must be provided to support network electronics. Outlet boxes must be installed on the top of the equipment rack in a location approved by Richland School District and the Network Support (IT) representative.
- S. All existing racks, cable tray, and metal structures shall be appropriately anchored and bonded to telecom ground and in sufficient size, quantity and configuration according to Richland School Districts standards as described above.
- T. Any penetration of fire and smoke barrier must be approved by the Lessor and/or Richland School District. Such penetrations must be properly treated according to industry standards, all applicable codes and with the current addition of the National Electrical Code. Minimally, metallic sleeves patched-in with fireseal putty, and filled with pliable intumescent materials meeting the applicable codes shall be used. In all cases, the Contractor shall be responsible for compliance with all federal, state and local regulations in effect.
 - 1. During installation, any penetration of fire wall shall be sealed with approved firestop material.

3.5 TESTING

A. COPPER TESTING:

- 1. Test all equipment and each outlet, horizontal cable, termination block, patch cords, etc. to verify compliance with requirements. Testing shall consist of attenuation and NEXT across all splices and devices installed in the field and shall meet latest requirements of EIA/TIA. Re-terminate any cable or connection found to be defective.
- 2. Tester is to be a Level IV device or better, and configured with the specific cable installed, and the Permanent Link test will be performed according to the Category's standard methodology. All parameters must exhibit a PASS test result prior to project completion. PASS*, FAIL* or FAIL test results will not be accepted.

B. FIBER OPTIC TESTING:

- 1. Cable length shall be verified using sheath markings. The guidelines and procedures established for Tier 1 testing in TIA/TSB-140 shall apply.
- 2. All fiber optic cables shall be tested from the site's MDF to each fiber terminals located in the IDF.
- 3. The Contractor shall conduct a bi-directional power meter (loss) test of each fiber optic station and riser cable at both wavelengths, 850/1300nm for MM and 1310/1550nm for SM.
- 4. No individual station or riser fiber link segment (including connectors) shall measure more than 2.0 dB loss for LC, and 1.5dB loss for MTP. LC links shall be tested with LC jumpers from the LC cassette to the tester. MTP links shall be tested either with an MTP tester and array cord, or with an MTP-LC breakout harness and LC duplex fiber tester.
- 5. Tests shall be conducted using ANSI/TIA-526-14A, Method B. Test results evaluation for the panel to panel (backbone) shall be based on the values set forth in ANSI/TIA-568.
- 6. The Contractor shall provide an electronic printout for each strand tested with the Power Meter and the OTDR.
- 7. Where concatenated links are installed to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. After the link performance test, has been successfully completed, each link shall be concatenated and tested. The test method shall be the same used for the test described above. The evaluation criteria shall be established between Richland School District and the Contractor prior to the start of the test.
- 8. All installed cables must meet or exceed the defined standards for performance.

The Contractor shall take all steps and all expense necessary to clean, repair or replace any optic link not meeting the standard.

C. TEST RESULTS:

1. Repair and resolve any shortcomings in the test results. Mitigation efforts may require re-termination or replacement of the jack, outlet or cable. Repairs or attempts to resolve test failures will be completed solely at the expense of the Contractor.
2. Provide test results to Manufacturer and Richland School District representative in native Tester format. Upon request, provide a copy of the tester software and license, if needed, at no charge to Richland School District representative.
3. Include PDF of full test results, summary index in electronic format on CD or memory stick in the O&M package upon project completion.
4. Cabling systems shall meet or exceed the electrical and transmission characteristics of the systems specified.
5. Cable segments and links shall be tested from both ends of the cable for each of the construction phases. (Verify that cable labeling matches at both ends).
6. The system shall not be considered certified until the tester has acknowledged that the performance of the physical layer of the system has been fully tested and is operational at the completion of the installation phase.
7. After the installation is complete, in addition to any other required testing as described herein, and at such times as Richland School District/Engineer directs, the Contractor shall be present while Richland School District conducts an operating test for approval. The installation shall be demonstrated to be in accordance with the requirements of this specification. Any defects revealed shall be corrected promptly at the Contractor's expense and the tests performed again.
8. The test results information for each link shall be recorded in the memory of the field tester upon completion of the test. The tester shall be capable of storing test data in either internal or external memory. The external media used shall be left to the discretion of the user.
9. Test results saved by the tester shall be transferred into a Windows based database utility that allows for maintenance, inspection and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered as well as any printed reports generated from the software application.
10. Test results shall be provided in both native Tester format as well as comma separated variable (.csv), Portable Document File (.pdf), plain text (.txt), or hypertext markup language (.html/.htm). A copy of the tester native test software must be provided to Richland School District or Richland School District's representative for comparison of results.
11. Test Results for CATEGORY 6 shall include the following:
 - a. Applicable room number of jack location (room number per Contract Documents)
 - b. Applicable Telecommunications Room number
 - c. Circuit I.D. number with corresponding jack identifier
 - d. Wire Map – shall include the following:
 - i. Continuity to the remote end
 - ii. Shorts between any two or more conductors
 - iii. Crossed pairs
 - iv. Reversed pairs
 - v. Split pairs
 - vi. Any other mis-wiring
 - e. Length
 - f. Insertion Loss
 - g. Near-end Crosstalk (NEXT) Loss
 - h. PS-NEXT (Power Sum Near End Cross Talk)

- i. FEXT (Far End Crosstalk)
- j. ELFEXT (Equal Level Far End Cross Talk)
- k. PS-ELFEXT (Power Sum Equal Level Far End Cross Talk)
- l. Propagation Delay
- m. Delay Skew
- n. Return loss
- o. PSFEXT (Power Sum Far End Crosstalk)
- p. PSACRF (Power Sum Attenuation to Crosstalk Ratio, Far End)

- 12. Completion of all wiring, projects, moves adds or changes will be considered complete when contract contacts RSD representative that work has been completed.

3.6 PROJECT CLOSEOUT

- A. Operating and maintenance manuals shall be submitted prior to testing of the system. A total of (4) manuals shall be delivered to Richland School District. Manuals shall include all service, installation, and programming information.
- B. Provide a full set of "as-built" (redline) drawings in PDF format. Drawings to depict final location and drop/cable identification numbers and labels which match the test reports. Include (1) hard copy paper format of all as-built drawings in 30"x42" size or equivalent, posted in each telecom room involved in the project.

3.7 TRAINING

- A. Offer four (4) hours training on the operation and installation of the data system, at job site, at no cost to Richland School District.

END OF SECTION 27 15 00

[illegible]

1. PROVIDE A FAIR COST ESTIMATE FOR EACH DEVICE. THIS ESTIMATE SHALL INCLUDE (1) 4 PORT FACEPLATE, (1) 8P8C CAT 6 JACK, (3) BLANK FILLERS, 300' OF CAT 6 CABLE, INSTALLATION, TERMINATIONS, TESTING AND ALL ASSOCIATED HARDWARE AND LABOR FOR A COMPLETE INSTALLATION. INSTALLATION SHALL BE CONSIDERED TO BE MADE UNDER NORMAL CONDITIONS PRIOR TO COVER.
2. AT THE OWNER'S OPTION THE FAIR COST VALUE OF THESE DEVICES MAY BE APPLIED TO OTHER WORK OUTSIDE THE CONTRACT OR REBATED IN THE FORM OF A CREDIT.