

**NETWORK EQUIPMENT & WIRING
LAKELAND MIDDLE PREPARATORY SCHOOL**

Scope of Work

All Classrooms and Offices will receive one (1) data drop and others are marked on the Plans in section E4.1a-f

| Drop Counts | Section A | Section B | Section C | Section D | Section E | Section F | |
|----------------------|------------------|------------------|------------------|------------------|------------------|------------------|-------------------------|
| Wall | 19 | 11 | 32 | 61 | 14 | 39 | |
| AP | 12 | 7 | 11 | 21 | 8 | 18 | |
| Projector | 3 | 2 | 4 | 20 | 7 | 21 | |
| Phone | 9 | 5 | 19 | 1 | 3 | 1 | |
| | | | | | | | |
| <i>Total Per Sec</i> | 43 | 25 | 66 | 103 | 32 | 79 | |
| | | | | | | | Total Drop Count |
| | | | | | | | 348 |

Equipment

Quantity

| | |
|--|----|
| Connectors - 10G Transceivers | 4 |
| Racks – 4 Post Floor | 3 |
| Battery Backups - Tripp Lite, SMART2200RM2UN | 3 |
| Fiber - 10G MM 12 Strand OM3 | 2 |
| Switches - Extreme Networks, 16704, X460-G2-48p-10G, includes 10941, 10945, 16713, 10099 | 9 |
| Access Points - Extreme Networks, 30912, AP3805i, includes all licensing, support and controller | 63 |
| Access Points - Extreme Networks, 31012, AP3935i, includes all licensing, support and controller | 7 |

PART 1 – GENERAL

1.1 SUMMARY

- A. Section includes products and execution requirements pertaining to Division 27 systems. Copper and fiber backbone and horizontal cabling along with support systems are covered under this document.
- B. Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities for all structured cabling products shall be provided as required to complete the horizontal cabling for all work stations as shown on floor plans.
- C. The same manufacturer's product shall be utilized throughout the entire project for all copper and fiber optic structured cabling.
- D. Substitutions: No substituted products shall be installed except with written approval by Lakeland School System.

1.2 DATA AND VOICE COMMUNICATIONS CONTRACT WORK

- A. General:
 - 1. Furnish all labor, materials, tools, equipment and services for the installation in accordance with general provisions of specifications and the Contract Drawings.
 - 2. Report percentage of work completed on a monthly basis.
 - 3. Completely coordinate with work of all other trades.
 - 4. Provide all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation, whether or not specifically indicated in the Contract Documents.
 - 5. Provide all floor penetrations, floor sleeves, conduit raceways, wall penetrations, etc. not shown on the electrical plans but needed for the routing of cabling provided herein.
 - 6. Provide labor for work area patch cord installation at designated workstations.
 - 7. Provide labor for equipment patch cord installation at patch panel to Ethernet switch port.
 - 8. Provide labor for voice patch cord installation at horizontal patch panel to voice cross-connect patch panel in MDF and IDF.
 - 9. Provide labor for testing horizontal and backbone cabling.
 - 10. Provide fire stopping.
 - 11. Provide labor for Wireless LAN Access Point and Antennas installation and system testing.
 - 12. Provide Telecommunications bonding and grounding system.
- B. Provide complete installation for Structured Telecommunications Cabling and Physical Support System including but not limited to:
 - 1. Category 6+ UTP horizontal cables.
 - 2. 50 micron Multimode optical fiber backbone cables.
 - 3. Work area telecommunication outlets.
 - 4. Wall mounted outlets.
 - 5. Equipment mounting racks and rack enclosures.
 - 6. Category 6+ modular and discrete patch panels.
 - 7. Optical fiber enclosures.
 - 8. Optical fiber connectors.
 - 9. Category 6 patch and equipment cords
 - 10. Optical fiber patch cords.
 - 11. Wire management
 - 12. Field testing.
 - 13. Conduit floor sleeves, conduit and supports required for installation of all cabling.
 - 14. Fire stopping.

1.3 SUBMITTALS

- A. Submittals shall be submitted in one (1) single package. Partial submittals will not be considered.

- B. Material lists, schedule of values, lists of subcontractors, and proof of Contractor qualifications shall be provided to Lakeland School System - upon request and shall follow the guidelines as stated in the General Requirements (Division 1 of the specification).
- C. Any required Performance Bonds, Payment Bonds, and insurance certifications shall be submitted by the Contractor prior to execution of the contract.
- D. Shop drawings shall be submitted to Lakeland School System. All communication system shop drawings shall include:
 - 1. Manufacturer's data (specifications, "cut sheets").
 - 2. Wiring diagrams for all installed cabling.
 - 3. Equipment rack/cabinet layouts.
 - 4. Proposed labeling schemes and labeling method.
 - 5. List of cabling distances (typical and maximum) for all structured cabling
 - 6. Submit copies of certifications for all technicians and the project manager who will support this project.
 - a. A list of managers and technicians certified
 - b. Approved manufacturer classes satisfactorily completed.
 - 7. Contractor shall submit a test plan with the submittal package that defines the tests required to ensure that the system meets technical, operational, and performance specifications. The test plan must also meet manufacturer's certification requirements.
 - 8. Work shall not proceed without the Lakeland Schools approval of the submitted items.
- E. Drawings & Inspection of Site:
 - 1. Communications floor plan drawings are to scale and typically are not dimensioned. The Contractor shall not scale drawings for equipment placement and clearances. Dimensions given on drawings shall always take precedence over scaled drawings.
 - 2. Any existing wires, utilities, or equipment shown on the drawings are shown for general information and to the best knowledge of the Lakeland Schools. The Contractor shall field verify all existing wires, utilities, or equipment.
 - 3. The Contractor shall field verify distances and equipment placements coordinating locations with other trades, construction managers, and general Contractor prior to installation.
 - 4. The Contractor shall review all site conditions prior to submitting a bid on this project. Any obvious discrepancies between the site conditions and bidding documents shall be brought to the attention of the Lakeland Schools at the time of bidding so clarification can be made by addendum.
 - 5. Change order requests for additional costs related to the contractors misunderstanding related to the amount of work involved and lack of knowledge related to the site conditions will not be allowed.
 - 6. Convene pre-installation meeting 2 weeks prior to start of installation of horizontal communications cabling. This meeting will review installation timeline and allow for coordination with additional contractors on site.
- F. Test Reports: Submit copies of complete reports of all testing performed to the General Contractor, with copies to the Lakeland Schools prior to job completion.

1.4 QUALITY ASSURANCE

- A. Installation Reference Standards (all codes and standards compliance will be to the most current revision available, including applicable addendums): Cable installation shall comply with the following:
 - 1. NEC® 2014: National Electric Code®, 2014.
 - 2. ANSI/TIA-568.0-D - Generic Communications Cabling for Customer Premises.
 - 3. ANSI/TIA -568.1-D - Commercial Building Telecommunications Infrastructure Standard
 - 4. ANSI/TIA-568-C.2 - Balanced Twisted Pair Telecommunications Cabling and Components Standards
 - 5. ANSI/TIA-568-C.3 - Optical Fiber Cabling Components Standard
 - 6. ANSI/TIA-568-C.3-1 – Optical Fiber Cabling Components Standard – Addendum 1, Addition of OM4 Cabled Optical Fiber and Array Connectors
 - 7. ANSI/TIA-569-D - Telecommunications Pathways and Spaces
 - 8. ANSI/TIA-606-B - Administration Standard for the Telecommunications infrastructure of Commercial Building
 - 9. ANSI/TIA-607-C – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
 - 10. ANSI/TIA-758-B – Customer Owned Outside Plant Telecommunications Infrastructure Standard
 - 11. TIA-527 – Optical Power Loss Measurements of Installed Single Mode Fiber Cable Plant – OFSTP-7

12. TIA-526-14-A - Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant-OFSTP-14A.
13. TIA-598-D – Optical Fiber Cable Color Coding
14. BICSI-TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual Revision 13 (use most current revision)

B. Materials:

1. All materials shall be UL or ETL listed and verified and shall be marked as such.
2. Products 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. Material shall be delivered to the site in the original packing.
4. Approved Products

| | |
|---|------------------------------------|
| a. 4-pair UTP Cable: | CommScope 65N4+ |
| b. Optical Fiber Cable: | Corning OM3 12 Strand |
| c. UTP Modular Keystone Jacks: | Hellermann Tyton RJ45FC6 |
| d. Fiber Optic Cabinets: | Hellermann Tyton or approved equal |
| e. Fiber Optic connectors/splices/couplers: | Hellermann Tyton or approved equal |
| f. Rack and Cabinet: | Vericom or approved equal |
| g. Patch Panel: | Hellermann Tyton or approved equal |
| h. UTP Patch Cords: | Hellermann Tyton or approved equal |
| i. Fiber Optic Patch Cords: | Hellermann Tyton or approved equal |

C. Contractor Qualifications:

1. The Contractor shall have experience in the installation and testing of similar systems as specified herein and shall have completed at least two projects of similar size and scope within the last 24 months. The Contractor shall provide references upon request (including the project name, address, date of implementation, client name, title, telephone number, and project description.)
2. The Contractor must maintain a state Contractor's license as required by the state.
3. The Contractor shall provide copies of certificates for proof of manufacturer's training and manufacturer's certified installers certificate in the shop drawing submittal and at the request of the Lakeland Schools to verify compliance with specification prior to recommendations for awarding bid.

1.5 MAINTENANCE

- A. All materials used on this project shall be new. Used and refurbished equipment is not permitted. Provide equipment to site in original packaging whenever practical.
- B. The contractor is responsible for scheduling all deliveries and providing proper receipt, handling, and storage of all materials. Protect all equipment from physical damages (dents, scratches, dust, water, paint, chemicals, and temperature extremes) and vandalism, or theft. The Contractor shall replace any damaged or stolen equipment. The Contractor is responsible for all equipment until final project acceptance by Owner.

1.6 WARRANTY

- A. All cabling to receive a minimum of 25-year warranty.

PART 2 – PRODUCTS

2.1 LOCAL AREA NETWORK (LAN) INFRASTRUCTURE

- A. Category 6+ Horizontal Cable:
 1. CommScope Cable
 - a. UL listed CMP or CMR as required by installation location.
- B. Optical Fiber Backbone Cable:
 1. Corning OM3 Multimode 12 Strand
 - a. UL listed OFNP or OFNR as required by installation location; aqua jacket

- b. Optical fiber cable shall have an attenuation value not to exceed 3.5 dB per kilometer at 850 nm and 1.5 dB per kilometer at 1300 nm. Minimum Bandwidth 1500 MHz per kilometer at 850 nm and 500 MHz per kilometer at 1300 nm.
- C. Communication Outlets/Modular Jacks: Where indicated on drawings,
- 1. Category 6 Jacks: Hellermann Tyton with T568B configuration standard to terminate Category 6 UTP cables as specified herein.
 - 2. Flush Mounted Outlets or approved equal:
 - a. Faceplate, color: Stainless Steel.
 - b. Blank Outlets as needed, color: Stainless Steel.
 - 3. Wireless LAN Outlets
 - a. Provide two-port surface biscuit box above ceiling grid.
 - 4. Flush Floor Box Outlets:
 - a. Stainless Steel Faceplate.
 - b. Blank Outlets as needed: Stainless Steel.
 - c. Mount in floor box flange.
- E. Equipment Mounting Racks: Equipment as detailed on the Drawings.
- 1. Provide 4 post racks for all communications closet equipment.
 - a. Provide racks as indicated on Drawings for rack mounted connecting hardware and Owner furnished equipment. Racks shall be assembled as a 19" width x 7' tall.

PART 3 – EXECUTION

3.1 INSTALLATION: GENERAL

- A. Open Cable Support installation:
- 1. The Contractor shall furnish and install all supports for cables specified in this section.
 - 2. Ensure complete raceway system is installed prior to cable installation. At no time shall cables be left unsupported
 - 3. Cable supports shall be spaced randomly, but no further than 5'-0" apart.
 - 4. Provide all additional cable management products, sleeves or conduit raceways as required to protect exposed cabling and complete the installation of cables in a neat manner.
 - 5. All floor penetrations shall be at columns, exterior walls or in equipment rooms.
 - 6. Cables shall be supported at height of bottom flange of structural beams using a rigid support method (i.e. threaded rod, beam clamps, etc.).
 - 7. Do not support cables from ductwork, sprinkler piping, water piping, waste piping, conduit, ceiling wire, or other system supports.
 - 8. Provide independent support system for each low voltage cabling system.
- B. Cable Installation:
- 1. All cabling shall be installed in accordance with manufacturers' written bend radius and pulling tensions. General industry guidelines recommend the following bend radius and pulling tensions:
 - a. Tensile loading on a single 4-pair copper UTP cable shall not exceed 25 lbf.
 - b. Bend radius of a single 4-pair copper unshielded twisted pair cable shall not exceed 4 times the diameter of the cable.
 - c. Bend radius of multi-pair copper unshielded twisted pair and optical fiber cable shall not exceed 10 times the diameter of the cable.
 - 2. All conduits and conduit sleeves shall have bushings or grommets shall be installed prior to the installation of communications cables to avoid damage and abrasions to cable sheathing and insulation. If bushings have been installed by the electrical Contractor, the communications cabling contract shall furnish and install bushings prior to pulling communications cabling.
 - 3. Horizontal cable length for 4-pair copper UTP cables shall not exceed 295 feet. Prior to bidding and installation, the contractor shall review the drawings and verify no cable run exceeds 295 feet and notify the communications designer of cable runs that may exceed 295 feet.
 - 4. Splices are not permitted in any copper cable.
 - 5. Avoid placing copper cables near sources of extreme heat (i.e. boilers, radiators, heat coils).
 - 6. Maintain cable twists for all UTP cables. For terminations cable sheathing shall be stripping back no more than 1/2" back from termination point for all Category 6 cables.

7. All cables shall be supported by J-hooks. When cables leave J-hooks, cables shall be supported by drop-outs or cable support hardware manufactured specifically for the purpose of supporting cables. J-hooks shall be installed a minimum of every 5 feet and cabling shall maintain minimal deflection and strain (less than 12" deflection). Cables shall not be supported from ceiling grid wires. Cables shall not run above iron joists.
8. All cables shall be separated and bundled into like groups by cable sheathing colors.
9. Service loops shall be provided at both ends of installed horizontal and backbone cabling. A 4' service loop shall be installed in the ceiling space near workstation outlets (excessive cable shall not be coiled in outlet boxes). A 10' service loop shall be provided in communication rooms and shall be installed to allow for future equipment rack/cabinet relocations without the need to re-terminate patch panels; the 10' service loop shall be neatly bundled and secured in ceiling space with large D-rings or place in cable trays. Service loops should be created in a figure-8 or staggered oval loops.
10. Any cabling installing in equipment rooms shall be neatly placed in cabling trays, cabling runways, or horizontal and vertical rack/cabinet cable managers. When tray, runways, or cable managers are not specified, cable shall be neatly installed with D-rings. Cables shall always be installed vertically/horizontally or at right angles to structure.
11. Hook and loop fasteners are recommended to secure permanently installed horizontal and backbone cabling; all cable fastening methods installed in plenum ceiling spaces shall be rated for use in plenum spaces. Hook and loop fasteners shall never be secured too tight whereby potentially changing the cable geometry.
12. Separation: Maintain the following distances between cables, other system cables and other building systems:
 - a. One (1) foot from fluorescent lights.
 - b. Four (4) feet from motors and transformers
 - c. Three (3) feet from hot water piping or other mechanical equipment.
 - d. One (1) foot from electrical conduits, other systems cables or other electrical equipment.
13. All low voltage cables shall be run parallel or at right angles to building structural framework. Do not run cables diagonally across ceiling space without written authorization by the Architect's Electrical Engineer.
14. Fire seal around all cables running through rated floors and walls. UL Systems should be contained in the submittal and available for review by building inspection.
15. All cabling that has been shipped or stored in an environment outside the manufacturer's recommended installation temperature range shall be conditioned per the manufacturer's recommendations immediately prior to installation.
16. All cables installed in underground conduit, conduit under slab on grade, or direct buried must be rated by the manufacturer for wet locations.

3.2 INSTALLATION: COMMUNICATIONS INFRASTRUCTURE

A. Category 6 Horizontal Cables:

1. Maximum cable lengths to be 295 feet (90 m) including service loop. Provide all necessary installation materials, tools and equipment to perform insulation displacement type terminations at all communications outlets.

B. Optical Fiber Cable:

1. Provide one 12-strand multimode optical fiber cable from the MDF to each IDF.
2. All optical fiber installations shall be installed using open cabling methods. Limit cable-bending radius to 20 times the cable diameter during installation, and 10 times the diameter after installation. Provide all required tools, materials, consumables, and equipment necessary for cleaning and field termination of optical fiber connectors. Label each end of each cable as to source and destination. Terminate optical fibers in consistent, consecutive manner at each end. Leave 10 feet of slack at each fiber termination point. Neatly coil slack optical fiber cable on top of rack above optical fiber patch and splice enclosure at each rack location.
3. Optical fiber cable terminations shall utilize enclosures and components in quantities consistent with the required fiber counts at each end of each segment. During field polish optical fiber connector termination, visually inspect all terminations with a 400-power microscope. Follow all of the connector manufacturer's recommendations. Unacceptable flaws in the terminations will include, but not limited to, scratches, full or partial cracks, bubbles, pits, epoxy residual, dirt, dust, oil, moisture, grinding and sanding debris. The

acceptable termination will show a connector tip that is free of all imperfections in 100% of the core and 80% of the cladding. All unacceptable connectors shall be inspected after rework.

4. During installation of optical fiber cable do not allow pulling tension to exceed cable manufacturer's specification for the cable being installed. Only the strength member of the cable shall be subjected to the pulling tension.
5. All optical fiber connector tips shall be cleaned with proper cleaning tools specifically designed for optical fiber prior to inserting them into matting receptacles or bulkheads.

C. Racks and Enclosures

1. Freestanding equipment racks and enclosures shall be protected free of all dust, debris and other environmental elements during construction until substantial completion walk-through.
2. Each rack, enclosure shall have a dedicated #6 AWG ground wire to a grounding busbar or building ground as defined by ANSI/TIA-569-D and NEC.
3. Secure all racks and enclosures to floor using rack installation kit that has been specified for the specific floor type,

3.3 INSTALLATION OF WIRELESS LAN SYSTEM

A. Access Point/Antenna (Owner Provided) Installation

1. Install all Access Points/Antennas at locations shown on the Contractor Drawings.
2. Install 7' cable coil to allow for final placement of access point.
3. Install Access Points in accordance with manufacturer's instructions.
4. Access Point configuration completed by Owner.

3.4 LABELING

A. General:

1. All labels shall be permanent, machine generated labels produced by a labeling machine.
2. Labeling information will be reviewed at Pre-Install Meeting, and the Owner shall approve the labeling scheme prior to the installation of any cabling.
3. Surfaces shall be cleaned before attaching labels. All labels shall be attached firmly and vertically plumb on equipment, faceplates, patch panels termination blocks, etc.
4. All labeling of cables, equipment, and components shall be included in as-built documentation, floor plan drawings, and schematic designs.

B. Cabling

1. All structured cables (horizontal and backbone) shall be labeled at both ends within 6" of cable termination point.

C. Labeling of Equipment Racks, Termination Hardware, and Faceplates; use labeling scheme below when a labeling program is not otherwise outlined.

1. All communications equipment racks, cabinets, fiber enclosures, and termination hardware shall be clearly labeled at the top, left-hand corner of the equipment.
2. Equipment Racks and Cabinets shall have 3/4" to 1" high lettering and shall be labeled with the telecommunications room number followed by an alphanumeric character in sequence for each rack/cabinet.
3. Fiber Enclosures shall have 3/8" to 1/2" high lettering and shall be labeled with the telecommunications room number followed by an alphanumeric character of the rack/cabinet and the enclosure number. Additionally, each strand of fiber shall be identified with the termination location of the opposite end and the fiber position number on the outside (or inside) front cover and top, left-hand corner of the enclosure under the enclosure label.
4. Modular Patch Panels shall have 3/8" to 1/2" high lettering and shall be labeled with the telecommunications room number followed by an alphanumeric character of the rack/cabinet and the patch panel number. Patch panels shall be labeled with sequential numbering starting with "01" for topmost patch panel and moving downward towards the bottom of the rack. Additionally, each jack position on the patch panel shall be identified with the jack position number (i.e. a 48-port patch panel shall have number 1 through 48 silk screen printed on the patch panel or shall have labeling strips with numbers 1 through 48 machine printed above/below corresponding jack position).

5. Telecommunication outlets shall have 3/16" high lettering with the labeling method as indicated. Telecommunication outlets shall be identified with the telecommunications room where cables are terminated, the rack/cabinet number, the patch panel number, and the jack position number. The Contractor shall terminate all cabling in a sequential method.

3.5 Field Testing and Cable Certification

- A. Each permanent link or channel in the network must be field tested in accordance with the ANSI/TIA-568 series industry standard.
- B. Permanent Link Testing shall be completed on all horizontal (station) cables as a minimum requirement.
- C. Submit test reports to the General Contractor prior to active equipment installation.
- D. Category 6 Cable Testing:
 1. All wiring shall be certified to meet or exceed the specifications as set forth in ANSI/TIA-568C for Category 6 requirements.
 2. Field Testing shall include the following parameters for each pair of each cable installed:
 - a. Store number and name.
 - b. Test equipment manufacturer and model number.
 - c. Cable I.D. The test sheets will be in numerical order by cable ID.
 - d. Date of test.
 - e. Wire map (pin to pin connectivity and polarity check) i.e. near 12345678, far 12345678.
 - f. Length (in feet).
 - g. Insertion Loss.
 - h. Near End Crosstalk (NEXT).
 - i. Power Sum Near End Crosstalk (PSNEXT).
 - j. Equal-Level Far End Crosstalk (ELFEXT).
 - k. Power Sum Equal-Level Far End Crosstalk (PSELFEXT).
 - l. Return Loss.
 - m. Delay Skew.
 - n. Attenuation-to-Crosstalk ratio (ACR).
 - o. DC Resistance per 100 m/328 feet.
 - p. Impedance.
 - q. Capacitance.
 3. Record test results for each cable and turn over to the General Contractor two weeks prior to occupancy. Correct malfunctions when detected, and re-test to demonstrate compliance.
- E. Optical Fiber Testing:
 1. Preinstallation Testing:
 - a. Test each strand of every optical fiber cable on the reel with a light source and a power meter. Obtain the cable manufacturer power meter test results for each reel used on the project. Prior to completion of project, turn over the completed optical fiber test form, optical fiber cable reel ID tags and optical fiber cable manufacturer's test results.
 2. Acceptance Testing:
 - a. After terminating optical fiber cables the system shall be tested using Tier 1 test format. Tier 1 testing is mandatory. Tier 2 testing, (OTDR testing), is optional.
 - b. Multimode optical fiber attenuation shall be tested on all individual fibers of each cable segment with an approved certification tester using a LED light source. Test results should include location identification, link attenuation loss, link length and polarity. These tests shall be performed at the 850nm and 1300nm windows in both directions. Test set up and performance shall be in accordance with ANSI/TIA-526-14A, Method B, single jumper reference.
 3. Test Results: Must be completed and turned over to the General Contractor prior to active equipment installation. Specific due dates for optical fiber will be established at pre-install meeting.
 4. The Warranty Submittal must be completed online within 10 days of installation completion. Copies of all certification test reports must be submitted as part of the Warranty Submittal. Test results must be kept on file by the registrant to be resubmitted when requested by Supplier. Data must be saved and submitted in raw data and summary formats. The test data shall be submitted via online upload to contractor website. If online upload is unsuccessful, the data can be submitted via e-mail.

3.6 CLEANUP

- A. The communications Contractor shall clean up all debris related communications cabling installation on a regular basis. Protect all equipment from damage during construction. Equipment not protected shall be replaced at the Contractor's expense.

END OF SECTION