

**Section 16721**  
**Fire Alarm Infrastructure - Structured Cabling**

**PART 1 GENERAL**

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### **Related Sections**

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| A. Section 16010 | Basic Electrical Requirements    |
| B. Section 16133 | Conduit                          |
| C. Section 16153 | Pre-Fabricated Ground Pull Boxes |
| D. Section 16071 | Support Devices                  |

### **1.01 Scope of Work**

- A. The contractor shall be responsible for providing a complete and functional fiber optic structured cabling system dedicated to support the fire alarm system
- B. The installation shall include fiber optic cable, fiber optic connectors, fiber optic patch cords and patch panels, cable management devices, equipment racks and cabinets as required.
- C. In addition to material and equipment, the contractor shall provide labor and any incidental material required for installation. All fiber strands shall be terminated with connectors and labeled on the fiber panel equipment. Upon completion of installation, the contractor shall test all fiber optic cable and record the test results as specified herein.
- D. The work performed under this specification shall be of good quality and performed in a professional manner. In this context, "good-quality" means the work shall meet industry technical standards and quality of appearance. The owner/engineer reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.
- E. Install/terminate fiber optic cable using home runs from the MDF to every IDF in the building or buildings. These runs shall be in a token ring configuration. These backbone cables shall be dedicated direct links between the MDF and the IDF. Provide rack mount fiber panels in each MDF/IDF and mount all equipment on a rack or cabinet, as required by this specification. NOTE: For existing system replacement project, the fiber optic cables may terminate in cabinets located in other than MDF/IDF rooms. See drawings.
- F. Conduit, ground pull boxes, and cabling to be provided by the contractor.
- G. Coordinate all requirements with other trades prior to submitting shop drawings.
- H. The contractor shall provide (at Substantial Completion) AutoCAD drawings with outlet numbers reflecting the room numbers. The contractor shall have all cabling terminated and successfully tested at the Substantial Completion.

### **1.02 General**

- A. It is the responsibility of the contractor to verify all aspects of the installation. The guidelines used shall include the TIA/EIA 568B.1, B.2, B.3; TIA/EIA 569-A; TIA-EIA 606-A, as well as. IEEE 802.3 FOIRL, IEEE802.3 10BASE-F, IEEE 802.3 1000BASE-SX/LX, and IEEE 802.3z specifications for gigabit ethernet over multimode and single mode fiber.
- B. It is the intent of these specifications that all TIA/EIA and IEEE standards adopted at time of the bid opening be met.
- C. The fire alarm infrastructure is to include all equipment, materials, and labor required to provide, install and test the complete system, as described herein.
- D. Provide adequate air conditioning for all equipment in each communications room. Room temperature should be less than or equal to 72 degrees in each communications room.

### **1.03 Standards and Specifications**

- A. The contractor shall install all voice/data infrastructure in accordance with industry standards, specifications and practices including all of the following;
- B. ANS/ICEA S-80-576 - Communications Wire and Cable for Wiring Premises, 1994
- C. TIA/EIA 568B.1 - Commercial Building Telecommunications Standard Part 1, General Requirements, 2001
- D. TIA/EIA-568-B.2-3 - Additional Considerations for Insertion Loss and Return Loss Pass/Fail Determination, 2002
- E. TIA/EIA-568B.3 - Commercial Building Telecommunications Wiring Standard, Optical Fiber Cabling Components Standard.
- F. IEEE 802.3z - Specification for Gigabit Ethernet over Fiber Optic Cable
- G. EIA.TIA-606-AAAdministration Standard for Telecommunications Infrastructure of Commercial Buildings
- H. TIA/EIA-758 - Customer-Owned Outside Plant Telecommunications Cabling Standard
- I. ASTM D 4566-98 - Standard Test Methods for Electrical Performance Properties of Insulations and Jackets for Telecommunications Wire and Cable, 1998
- J. IEC 60603-7 - Connectors for frequencies below 3 MHz for use with printed boards – Part 7, Detail specifications for connectors, 8-way, including fixed and free connectors with common mating features, with assessed quality, 1996
- K. NEC - National Electric Code

### **1.04 Contractor Qualifications**

- A. The installing communication contractor shall be able to submit proof that they meet the following qualifications upon request from the engineer.
  - 1. Performance History; the contractor must have successfully preformed at least three local projects for similar scope and size within two years of the date of this bid. The proof of performance shall be in the form of reference sheets which shall include a brief description of the project, the beginning/ending contract price, the project foreman's name, the superintendent's name, the name, address, and telephone number of the project contact. The superintendent proposed for this project shall have been responsible for at least two of these projects under the employment of the contractor.
  - 2. Fiber optic experience; the contractor must be able to prove to the satisfaction of the owner/engineer that it has significant experience in the installation of fiber optic cable systems. Installation must include installation of fiber optic cable, fiber termination, a knowledge of interconnect equipment, and a thorough knowledge of testing procedures.
  - 3. Time in business; the contractor must have been in business under the current name in the business of installing communication systems, continuously, for a period of at least three years prior to the date of this bid. Journey level installers or technicians must perform the installation. By submitting the names of these personnel, the contractor is committing them to the execution of the project outlined in this specification.
  - 4. Required License; the contractor shall possess a State of Florida Limited

Energy Systems Specialty License.

5. RCDD on Staff; the contractor shall have a BICSI certified Registered Communications Distribution Designer (RCDD) on staff. Contract RCDDs shall not be acceptable.
6. Office Location; the Contractor shall maintain a permanent office within 50 miles of the project site.

#### **1.05 Definition of Acronyms**

AWG – American wire gauge; standard measurement for electrical conductors.

BEP- Building entrance protection; equipment used to terminate and surge protect inter- building burial cable.

CAD – Computer assisted drawing; computer software application for schematics, diagrams, and plans.

CER – Communications equipment room; the central voice and data distribution point. ELFEXT – Equal level far end cross talk; FEXT with the attenuation factor removed. EMS – Energy management system; system used to monitor and control heating, cooling, and electrical systems.

FEXT – Far end cross talk; mixed signals between cable pairs at the remote side. FISH – Florida Instructional School House; report with official school room numbers. HCSB – Hernando County School Board; the owner.

IDF – Intermediate distribution frame; the secondary voice and data distribution point. LAN – Local area network; campus voice and data communications infrastructure.

LCL – Longitudinal conversion loss;

MDF – Main distribution frame; the primary voice and data distribution point.

NEXT – Near end cross talk; Mixed signals between cable pairs at the local side. NVP – Nominal velocity of propagation; the speed of signals on cable pairs used for calibration of test equipment.

OTDR – Optical time domain reflectometer; test equipment used to check returned light signal due to cable imperfections.

PBX – Private branch exchange; the telephone switch or control unit.

RCDD – Registered communications distribution designer – certified voice and data infrastructure planner.

TTB – Telephone terminal board; the backboard used to wall mount telephone equipment.

UTP – Unshielded twisted pair; voice and data cable with each pair spun together, no metal sheath.

VCSEL – vertical cavity surface emitting laser; type of light source used in multimode fiber optic cable.

#### **1.06 Owner Provided Electronic Equipment**

- A. The fire alarm infrastructure electronic equipment will be provided by the installing contractor. It is necessary for the contractor to become familiar with the location, space requirements, and specific mounting requirements of the electronics. All required equipment and information shall be known before building out the MDF or IDFs. The MDF shall have two racks reserved for owner provided electronics. For all IDFs, 50% (i.e. the lower half) of at least one rack shall be reserved for owner provided electronics.

### **1.07 Pre-Bid Substitutions**

- A. Submit any request for substitution or deviations prior to bid opening. Only those requests that are complete and approved by the engineer in a written addendum for shall be accepted.

### **1.08 Shop Drawing Submittals**

- A. The shop drawing submission shall consist of five (5) major sections with each section separated with insertable index tabs.
  - 1. The first section shall be the index which shall include the project title, address, and name of the firm. The contents of each section shall be listed on the index.
  - 2. The second section shall include a copy of the contractor's valid State Low Voltage license, and a list of instrumentation to be used for system testing.
  - 3. The third section shall contain the equipment specifications. The equipment specification submittal shall include a cover page listing manufacturer, part number and description of each product to be provided. Also, include in this section, original specification data sheets for each product. Photocopies of catalog pages shall not be accepted.
  - 4. The fourth section shall contain samples of proposed cable labeling.
  - 5. The fifth section shall contain a scaled, complete, detailed MDF/ IDF layout with rack elevations, scaled floor plans with equipment locations shown, and a layout of any wall mounted equipment. NOTE: The floor plans provided must show the rooms where fire alarm equipment is located if located other than MDF/IDF rooms.
  - 6. Attach the following; one CD-ROM copy and three hard copies of an AutoCAD drawing showing the outlet numbering at each outlet location with the patch panel outlet numbering per room with FISH room numbers.
- B. The contractor shall provide the shop drawing submittals within 60 days of receipt of contract. No work shall begin nor equipment be ordered without an engineer accepted shop drawing submittal.

### **1.09 Function and Operation**

- A. The intended function of the communications structured cable system is to transmit data signals from the Primary Fire Alarm Control Panel to Fire Alarm Sub-Panel locations. Upon completion of the work outlined in this specification, the system shall be capable of supporting gigabit ethernet data signals per IEEE 802.3ab and 802.3z. Fiber optic cable shall be Vertical Cavity Surface Emitting Laser (VCSEL) optimized.
- B. The maximum backbone distance shall be based on LAN equipment transmission wavelengths;
  - 1. @850nm- 550 meters for VCSEL optimized multi-mode (50-125) fiber.
  - 2. @1310nm- 1,000 meters for VCSEL optimized multi-mode (50-125) fiber.
- C. The fiber cable bandwidth at 850nm should be 500 Mhz.
- D. The performance verification and documentation shall be as specified herein.

## PART 2 EQUIPMENT

### 2.01 Equipment Racks (Relay Racks, Frames)

- A. Where shown on the drawings, install one (at minimum) 19" X 84" two post rack in each communications room containing the IDF. At least one rack in each IDF communications room should have 50% of its total capacity available for future Hernando County School Board provided equipment.
- B. Securely mount the racks to the floor with required front and rear clearances. Provide ladder rack, as shown in drawings. Racks shall be constructed of extruded aluminum with standard EIA hole pattern on front and rear. Finish shall be black unless otherwise noted on drawings.
- C. Install one 120 VAC quad receptacle with a dedicated circuit breaker for each rack mounted on the rack (not on wall).
- D. Install one 12 outlet power strip in each rack in each communications room.
- E. Provide a backup power source from the emergency power generator for commercial power outages to each 120 VAC receptacle in each rack in each communications room.
- F. Provide racks/frames with the following accessories/features;
  1. Connect separate, solid, #6 AWG, insulated grounding wire between the ground bus and the building's grounding system.
  2. Provide rack/frame with mounting hardware and all accessories required to complete installation. Provide support for each rack, as required.
  3. Provide cable management system for rack. Per rack, provide single sided, solid metal channel, vertical cable section at each side of rack- in the case of a single rack or between racks and on each end – in the case of multiple joined racks (reference drawing for quantities and configurations). Vertical cable management is intended for front of the rack cable management. Per rack, provide aluminum, horizontal cable management (split ring), one above and one beneath each patch panel and between each switch (reference drawing for quantities and configurations). Per rack, provide stand-off tie bracket for management for backbone and horizontal cable management at rear of rack (10 per rack). Provide Velcro tie wraps for cable management within racks. Nylon tie wraps shall not be used on racks.
  4. Provide one (1) power strip per rack or frame. Provide rack mounted twelve (12) outlet power strip with fifteen (15) foot power cord. Coordinate electrical service requirements with electrical contractor.
  5. Approved manufacturer for two post rack – ICC, approved model – ICCMSR1984

### 2.02 Fiber Optic Cable Interconnect Panels

- A. Terminate all fiber optic cable on panels with type ST connectors.
- B. The fiber optic interconnect enclosures with panels/connectors shall be rack mounted. The fiber enclosures shall install in a 19" data rack with standard EIA hole spacing.
- C. Patching compartment shall be accessible through a front mount door (swing

- down to open).
- D. Provide six connector fiber panels preloaded with ST type connectors for fiber connections. Cover empty slots with blank adapter panels, if applicable.
  - E. Enclosures shall be equipped with fiber optic splice trays and cable management.
  - F. Approved panel manufacturer – ICC, approved model - ICFOPT16BK
  - G. Approved two panel enclosure manufacturer – ICC, approved model – ICFOR102BK
  - H. Approved four panel enclosure manufacturer – ICC, approved model – ICFOR204BK

### **2.03 Building Cable Routing System**

- A. Provide Velcro tie wraps for cable management throughout. Nylon tie wraps shall not be used.
- B. J-Hooks;
  - 1. From cable tray to stubbed outlet conduits, building shall be supplied cables through Category 6 compliant J-hook system located in the ceiling space. The J-hooks shall be adequate size to accommodate all cable specified herein plus 50% growth capacity.
  - 2. J-hook system shall be no closer that eighteen inches (18”) from sources of electromagnetic interference such as fluorescent light fixtures or shall be shielded from such interference by tray sections designed for that purpose.
  - 3. All efforts shall be made to keep transitions smooth and continuous to prevent excessive bending and turning of cables.
  - 4. Cabling shall be supported to the building structures at a maximum of 4 foot intervals with J-hooks. Cabling shall not be supported from the ceiling, ductwork, conduits, piping, or any other non-structural building member.
- C. Cable Trays;
  - 1. As indicated on drawing, provide cable tray system sized to accommodate all cable specified herein plus 50% growth capacity.
  - 2. Do not locate closer that 18” from all sources of electromagnetic interference such as fluorescent light fixtures.
  - 3. All efforts shall be made to keep transitions smooth and continuous to prevent excessive bending and turning of cables.
  - 4. All cable trays shall be grounded.

### **2.04 Fiber Optic Cabling**

- A. Install twelve count fiber optic homerun cable through inner duct from each IDF in each communications room to the MDF in the main communications room.
- B. Provide for all inter-building backbones; loose tubes, gel filled, moisture proof, outside plant, multi-strand fiber cable. Multimode 50/125 fiber strands shall be optimized for vertical cavity surface emitting laser (VCSEL) based systems. Fiber strands shall exceed TIA/EIA 568-B.3 and IEEE802.3z specifications. All fiber shall be installed with pull strings for future use.
- C. Provide for all intra-building backbones; tight buffer, plenum rated, multi-strand fiber cable. Multimode 50/125 fiber strands shall be optimized for vertical cavity

surface emitting laser (VCSEL) based systems. Fiber strands shall exceed TIA/EIA 568-B.3 and IEEE802.3z specifications. All fiber shall be installed with pull strings for future use.

- D. All outside plant fiber optic cable that is 50 feet or more inside a building shall be installed in no less than two inch (2") metal conduit above ceiling from entry point to termination point. NOTE: Fiber optic cabling installed above the ceiling is allowed to be installed in red innerduct in existing schools.
- E. Approved manufacturer and model – must exceed TIA/EIA 568-B.3 and IEEE802.3z specifications.

### **2.05 Fiber Optic Cabling Connections**

- A. Provide fiber optic connectors at each end of all fibers installed. Each installed connector shall not exceed – 0.5 dB @ 1300 nm of insertion loss per mated assembly. Provide connector covers at each connection point to prevent accidental damage to connectors (dust covers). Terminate all fiber on ST connectors.
- B. Protect all 50 micron fibers with fan out cable tray.
- C. Approved cable tray manufacturer – ICC, model – ICFOSTFM12

### **2.10 Fiber Jumpers and Patch Cords**

- A. Provide fiber jumpers of the proper lengths in order to prevent strain. Provide one (1) fiber jumper per IDF fiber strand pair connected between the fiber panel ST connector and the customer provided electronic equipment. Fiber jumpers shall be delivered to the school no later than two months prior to Substantial Completion for installation by owner.
- B. Approved fiber jumper - 50/125 multi-mode LC/ST 10GB OM3

### **2.11 Miscellaneous Equipment**

- A. As per the needs of the installation, miscellaneous equipment will be required at the contractor's expense. It is the contractor's responsibility to identify and bid all miscellaneous equipment necessary to provide a complete and properly functioning system.
- B. Approved cable manufacturer - General, Premier, Superior Essex
- C. Approved patch panel manufacturer – ICC, approved model - ICCMPP0XX60
- D. Approved outlet module manufacturer – ICC, approved model - IC1078L6BL
- E. Approved enclosure manufacturer – Great Lakes Case and Cabinet, approved model - GL2418WM

### **2.12 Labeling**

- A. Label all fiber optic cable connections on panels with the corresponding remote building and communications room number. Label each end (MDF and IDF) of the fiber cable at the fiber panel.
- B. Each cable shall be labeled with a unique identifier. All network system components shall be labeled, including rooms, racks, cabinets, patch panels, individual ports in each patch panel, and communication outlets.
- C. Labels shall be typed – not handwritten.
- D. Each patch panel shall be labeled sequentially left to right, top to bottom with the room number and port number, such that the ports can be located easily on the

panel.

- E. All fibers in each fiber optic cable shall be identified at each end on the interconnect panel with permanent labels. Fiber enclosure panels shall be identified with the building number and corresponding fiber number.

### **2.13 Grounding**

- A. Install a # 2 AWG (at minimum) ground wire at the MDF and IDF main ground terminal in each communications room.
- B. The MDF and IDFs shall be provided with a ground to the building's single point ground of five (5) ohms or less. Grounding shall be provided with no less than # 2 bare solid copper wire. A ground terminal shall be installed at each of these locations that is capable of terminating all equipment specified herein with an additional termination space of 50%.
- C. All protection equipment shall be properly grounded to the buildings ground system. Cable sheaths and splice cases shall also be grounded to the single point building ground.

## **PART 3 EXECUTION**

### **3.01 General**

- A. The contractor shall follow established guidelines for installation and termination of all cabling and equipment as established in EIA/TIA 568B.1, 568B.2, 568B.2-1, 568B.3, EIA/TIA-569, BICSI Telecommunications Distribution Methods Manual, and the National Electric Code (NEC)
- B. The work shall be of professional quality and shall not detract from the aesthetic qualities of the facility. The contractor shall ensure that the site is clean of construction debris prior to leaving the site unsupervised at the end of every work day.

### **3.02 Cabling**

- A. All cabling shall be installed in conduit only between buildings and within walls, as shown on the drawings and as per industry standards as outlined in the BICSI Telecommunications Distribution Methods Manual, EIA/TIA 568B.1, 568B.2, 568B.2-1, 568B.3, EAI/TIA 569.
- B. Care should be taken to insure the integrity of the cable installed. Provide wide conduit sweeps at all right angles.
- C. Install fire stop penetrations through fire rated walls in accordance with UL standards and EIA/TIA 569.
- D. All cable shall be free from tension at both ends, as well as over the length of each run. Pulling tensions shall not exceed manufacturer's specifications.
- E. Ground burial cable shields in accordance with applicable standards.
- F. One pull string shall be left in the ceiling, secured in the same manner as the station cabling, subsequent to installation running from the MDF to each classroom.
- G. Cables shall be terminated on the patch panels in order, the lowest room numbers first and lowest port numbers first (top left to bottom right).
- H. Three feet of spare cable shall be neatly coiled in an "s" configuration in the ceiling directly above the drop for each communications outlet.
- I. All fiber optic cables shall be installed in red inner duct with pull strings for future use.
- J. All cables shall be dressed to ensure a neat and organized appearance.

### **3.03 Excavation**

- A. The contractor shall provide excavation, backfill, and compaction in conformance with industry standards.
- B. The contractor shall provide dewatering as required to insure proper installation of duct bank or underground pathways.
- C. Jack and bore under existing concrete slabs, sidewalks, etc. is preferred for underground routing of pathways. Ensure safe re-routing of facility occupants during procedures or perform procedure after occupancy hours of the facility. However, if cutting of existing concrete slab, sidewalks, etc. is deemed to be

required, the cutting shall be from joint to joint (control of expansion). Final surface finish shall match surrounding conditions.

- D. Do not cut roots larger than 1.2" in diameter.
- E. Hand trenching is required in areas where there is known underground utilities.
- F. The contractor shall ensure that there are no open trenches prior to leaving the site unsupervised at the end of every work day.
- G. The contractor shall perform the required trenching and backfilling associated with the work under this specification.
- H. The contractor shall provide all material necessary and as required by OSHA to protect personnel working in trenches.

### **3.04 Penetrations**

- A. The contractor shall fire stop all fire wall penetrations in accordance with published UL standards. It is the contractor's responsibility to identify fire walls.
- B. All masonry penetrations to install materials shall be saw cut for square or irregular penetrations, masonry drilled for round penetrations less than 1" diameter, or core drilled for round penetrations larger than 1" diameter. Under no circumstances shall masonry penetrations larger than 1" diameter be masonry drilled. Under no circumstances shall masonry penetrations be chipped or hammered.
- C. The contractor shall provide necessary sleeves and chases where conduits pass through walls. Wall sleeves shall be installed above ceiling and be supported on both sides of the wall with strut and beam clamps. The contractor shall ream and bush both sides of sleeves.
- D. Conduit penetrations entering a building from the exterior, perpendicular to the wall shall be sealed with UV resistant silicone and shall be water tight.
- E. Conduit entering the building shall be sealed with approved duct seal to prevent intrusion of gas, water, or pests from outside the building.

### **3.05 Concrete Work**

- A. The contractor shall be responsible for replacing concrete pads, supports, piers, bases, foundations, and encasements damaged from the installation of the work under these specifications.

### **3.06 Painting of Damaged Areas**

- A. Raceways, conduit supports, hangers, and surface raceway, where exposed, shall be painted to match the mounting surface or surrounding surfaces. Panels and equipment with damage to painted surfaces shall be refinished to previous conditions.

### **3.07 Fiber Optic Cabling Testing**

- A. The results from the fiber optic cable testing shall be submitted at Substantial Completion.
- B. The contractor shall test each fiber link. The owner/engineer reserves the right to have a representative present during all or a portion of testing. A testing schedule shall be planned and agreed upon by the owner/engineer beforehand.

- C. Each fiber in every multi-mode backbone cable run shall be tested with an optical light source and power meter as manufactured by Noyes Fiber Systems or Agilent Technologies. Each multi-mode fiber shall be tested at both 850nm and 1300nm.
- D. Maximum fiber strand attenuation shall be determined using the following link attenuation equation; Maximum link attenuation = Connector attenuation + Cable attenuation + Splice attenuation.
- E. The following are the maximum attenuations per component;
  - 1. Connector attenuation....0.75dB/1 mated connector pair
  - 2. Cable attenuation... .....3.5dB/km @ 850nm and 1.5dB/km @ 1300nm
  - 3. Splice attenuation..... 0.3dB/splice
- F. The contractor shall calculate the acceptance values for each fiber strand based on the above criteria. The fiber certification report shall be submitted listing the power loss budget dB value, the measured dB loss, and the dB margin of each measured fiber strand to the acceptance values per test limit; reference TIA Backbone Fiber Standard 568B.
- G. Back bone lengths shall be verified with an OTDR or Light Source/Power Meter with length base standard testing using a tester manufactured by Noyes Fiber Systems, Agilent, or pre-approved equal. Per this specification, maximum distance shall not exceed 500 meters to support LAN equipment operating at 850nm and 1,000 meters to support LAN equipment operating at 1300nm. Optical power meter and OTDR results shall be in the form of tester report print outs, hand written results will not be accepted. Photocopies of test results will not be accepted, only original signaled print outs will be accepted. These results shall be submitted to the engineer.
- H. Fiber backbone test results shall include; wavelength, fiber type, cable length, dB loss, power loss budget for measure of cable length, loss margin, continuity, attenuation specification, bandwidth specification, fiber\cable number, measurement direction, reference set up, test equipment model/serial numbers, test date, operator/tester.

**3.08 Documentation**

- A. The contractor shall provide documentation including test results and as-built drawings. Drawings shall be developed in CAD (i.e. AutoCAD R.14 or higher). The following documents shall be provided to the Engineer;
  - 1. Each MDF and IDF shall contain a copy of the building's as-built drawing affixed to an adjacent wall or located in an interior pouch for quick reference. Revised rack and equipment cabinet elevations shall be provided including serial numbers of all installed equipment.
  - 2. Three (3) sets of blue line as-built drawing sets.
  - 3. Provide a CD-ROM reflecting all the work with actual device and equipment locations. Drawings to be submitted in .dwg or .dxf format.
- B. The contractor shall provide the testing results database on the CD-ROM for the completed job (fiber and copper). The CD-ROM shall include the software tools required to view and print the test reports.
  - 1. Additionally, the contractor shall provide one (1) hard copy of the fiber optic cabling test results (printed version). These results shall be submitted to the engineer prior to the contractor calling for substantial

completion inspection.

2. The contractor shall provide in each communications room a notebook with the corresponding test reports for the fiber optic cabling in that room. Each notebook shall have a clear front pocket and be labeled with that communication's room number designation.
- C. The contractor shall provide a list of materials with all installed equipment containing the model and serial numbers of all installed equipment with rack and backboard equipment layouts showing placement of equipment.

### **3.10 Acceptance**

- A. The acceptance of the system by the owner shall be based on;
1. Copy of all test results; All fiber segments and all workstation communication cables must meet the criteria established above. The contractor is responsible for additional fiber strands to be installed if any show defective during testing.
  2. Copy of as-built drawings shall contain the following; changes and/or deviations from the construction (bid) plans, all communications outlet addresses and locations, horizontal cable routing, backbone cable routing
  3. Visual inspection (aesthetics); all work shall be performed in a neat and orderly workmanship fashion.

### **3.11 Project Completion**

- A. Upon completion of the work in this section, thoroughly clean all exposed portions of the installation, removing all traces of soil, label adhesive residue, grease, oil, or other foreign material, by using the type of cleaner recommended by the manufacture of the item being cleaned. The proper covers shall be placed on all exposed cabling and connecting devices.

### **3.12 Training**

- A. Provide a minimum of two HCSB personnel with training on the voice and data infrastructure cabling system for up to two hours on site. Training shall cover the labeling scheme, documentation structure and contents, documentation orientation, and system reconfiguration (i.e. reassignment of communications outlet function via patching). Training shall take place at the time of Substantial Completion before building is occupied by the owner.

### **3.13 Warranty**

- A. The contractor warrants all materials and equipment provided under this specification to be free from defects. All materials and equipment must function or operate satisfactorily for a period of one (1) year from the Substantial Completion of this project.

**\*\*\* END OF SECTION \*\*\***