

**(3) RELOCATABLE CLASSROOM BUILDINGS**

AT

**RICHARDSON PREP-HI MIDDLE SCHOOL  
455 SOUTH K STREET  
SAN BERNARDINO, CALIFORNIA 92410**

**SAN BERNARDINO CITY USD  
956 W. 9<sup>th</sup> STREET.  
SAN BERNARDINO, CA 92410  
909-388-6100**

**BID NO.  
F13-06**

**ADDENDUM NO. 3  
TO  
BIDDING AND CONSTRUCTION DOCUMENTS  
DATE: 02-25-14**

NOTE TO BIDDING CONTRACTORS:  
THE ATTACHED CLARIFICATIONS / ADDENDUM  
ARE TO BE INCLUDED IN THE  
CONSTRUCTION BIDDING COSTS AND  
ARE PART OF THE CONSTRUCTION  
DOCUMENTS.

This addendum must be signed and returned with the bid as proof that you (Contractor) received it. Please make a copy for your records.

Company Name \_\_\_\_\_

By \_\_\_\_\_

Title \_\_\_\_\_

Date \_\_\_\_\_

The following changes and/or additions shall be made to the plans and specifications and all other conditions shall remain the same:

**GENERAL REQUIREMENTS AND INFORMATION:**

**BID REQUESTS FOR INFORMATION:**

The following are questions received during bidding:

- Q1. Are projectors shown on project Drawings provided and installed by Contractor?  
Or District provided Contractor installed. If by contractor which Contractor?  
A1: Projectors are to be provided by the contractor and included in the bid.
- Q2. Will mounting backing be required for projectors? If required, which Contractor is providing and installing backing?  
A2: Mounting is required and provided by the contractor.
- Q3. Project Specifications indicate the existing Intercom system is a Bogen System. Wasn't the Dukane Intercom System installed during the recently completed Modernization?  
A3: Dukane is the existing intercom system. Provide necessary amplifier or expansion module for complete and operable system. Refer to revised specifications.
- Q4. Project Specifications indicate Plenum Rated Cat 6A Data Cabling being provided and installed. Is this the case? Even if there is no plenum areas?  
A4: Refer to revised specifications.
- Q5. Is there any Active Data Equipment? If so is Active Data equipment provided and installed by the Data Contractor? Or is Active Data Equipment to be District provided, Contractor installed? Or District provided District Installed? Who is responsible for programming the Active Equipment, if required?  
A5: Equipment to be provided and installed by the data contractor.
- Q6. It is stated in the specifications that Fireworks programming is part of this project. Just to make this clear, Is ALL Fireworks programming part of this project?  
A6: Yes

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- Q7. Could we have contact information now for communication sub-contractor that was recommended on job walk which is capable of connecting software to new portables?  
A7: District does not have that information available. Provide costs from approved sub-contractor as shown in the specifications.
- Q8. On the bid form you are calling for a contract 1 and contract 2. It said that scope is on the plans page. T2.0.  
A8: Disregard mention of contract 2 on the bid form. Provide costs for one contract only.
- Q9. Check list is calling for Supplemental Bid Information # 7. Should it be included on the bid?  
A9: Supplemental bid information is not applicable, please disregard.
- Q10. Please clarify if the contractor is to provide the Base bid amount of item (B) Contract Two in Bid Form, this work is classified to be work performed by the District per Sheet T-2, Item 1.  
A10: Refer to answer for Q#8 above.
- Q11. Who is responsible for providing new power to the classrooms?  
A11: Contractor shall coordinate with power company before removing existing distribution board and re-connecting new distribution board.
- Q12. Is the existing power to the site correct on the single line diagram?  
A12: Existing available utility voltage is 120/240V, 3-ph, 4W in lieu of 120/208V, 3-ph, 4W.
- Q13. Please clarify scope of work for new distribution board.  
A13: Existing circuits labeled as AC#1 and AC#2 shall be disconnected. Remove conduits and conductors. Contractor shall verify existing unused circuit(s) on existing distribution board and remove conduit(s) and conductors.
- Q14. Sheet E3.1 shows the distribution board as being existing; Is it existing or provided by the contractor?  
A14: Provide new distribution board as shown on Sheet E0.1 in lieu of existing shown on Sheet E-3.1.
- Q15. What is to be done with the existing irrigation control circuit?  
A15: Re-connect existing circuit feeding existing irrigation control behind existing relo #RC-2. Verify exact location and circuit in field.

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Q16. What is the extent of demolition and repaving at Lincoln ES after the relocatables are removed? During the scope walk the area looked to be larger than what is shown on the plans.

A16: The area will be the footprint of 3 rows of 3 relocatables back to back or an area roughly 76'x150'.

Q17. According to Note#65 on Sheet T2.0, is painting limited to only the siding, trim, and door?

A17: No, painting shall include the entire classrooms and complete painting of the doors (inside and out). Use Vista Paints, colors to be specified by the District.

**SPECIFICATIONS:**

1. Specification Section 16740 - Voice Data System  
A. Replace existing section with section attached herewith.
2. Specification Section 16770-Audio Visual System  
A. Replace existing section with section attached herewith.

END OF ADDENDUM "3"

## SECTION 16740

### VOICE and DATA NETWORK SYSTEM

#### PART 1 – GENERAL

##### 1.1 SCOPE OF WORK

- A. The work under this section includes all labor, materials, equipment and accessories required to furnish and install a complete Data Cabling System as indicated on the drawings and as specified herein.

##### 1.2 APPLICABLE DOCUMENTS

- A. The system design described in this document and depicted in the attached drawing package is derived in part from recommendations made in industry standard documents. The list of documents below are incorporated by reference:
1. This Technical Specification
  2. ANSI/EIA/TIA-568-B series of standards
    - ANSI/EIA/TIA-568-B-1 Commercial Building Telecommunications Cabling Standard – April 2001.
    - ANSI/EIA/TIA-568-B-2 Commercial Building Telecommunications Cabling Standard - April 2001
    - ANSI/EIA/TIA-568-B-3 Optical Fiber Cabling Components Standard – April 2000
  3. ANSI/EIA/TIA-568 Commercial Building Wiring Standard - July 1991, and Standards Proposal No. 2840-A, Proposed Revision of EIA/TIA-568 Commercial Building Cabling Standard (published as TIA/EIA-568-A)
  4. ANSI/ TIA/ EIA- 492AAAA (multi-mode 62.5/ 125 μm fiber specifications)
  5. ANSI/ TIA/ EIA- 83- 596 (indoor multi-mode optical cables)
  6. ANSI/ TIA/ EIA- 87- 640 (indoor multi-mode optical cables)
  7. ANSI/ TIA/ EIA- 492CAAA (single-mode fiber specifications)
  8. ANSI/ ICEA S- 83- 596 (indoor single-mode optical cable)
  9. ANSI/ ICEA S- 87- 640 (outdoor single-mode optical cable)
  10. EIA/TIA-TSB-36 Technical Systems Bulletin, Additional Cable Specifications for Unshielded Twisted-Pair Cables - November, 1991
  11. TIA/EIA-TSB-40 Telecommunications Systems Bulletin, Additional Transmission Specifications for Unshielded Twisted-Pair Connecting Hardware - January, 1994
  12. TIA/EIA-TSB-75 Telecommunications Systems Bulletin, Additional Transmission Specifications for Unshielded Twisted-Pair consolidation points and cabling - January, 1997
  13. ANSI/EIA/TIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces - October 1990
  14. ANSI/EIA/TIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings - February 1993
  15. ANSI/TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications - August, 1994
  16. Building Industries Consulting Services, International (BICSI)Telecommunications Distribution Methods Manual (TDMM) - 1996
  17. National Fire Protection Agency (NFPA) - 70, National Electrical Code (NEC) -1997
- B. If a conflict exists between applicable documents then the order in the list above shall dictate order of precedence in resolving conflicts. This order of precedence shall be maintained unless lesser order document has been adopted as code by local, state or federal entity, and is therefore enforceable as law by local, state or federal inspection agency.
- C. If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. It is important to note, that all documents listed above are believed to be the most current releases of the standards at the time of this writing, however, the vendor is totally responsible for determining and adhering to the most recent cable standards when developing the proposal for installation.
- D. Contractors bidding on District projects shall have as a minimum, the following qualifications:
1. Contractor must be a Panduit Value Added Reseller (VAR) if installing Panduit products. **Site certifications are not allowed.**
  2. Must have a current and in good standing, California C-10 and C-7 contractors licenses.
  3. Must have completed at least 10 projects of similar size and scope for public entities within the past 3 years.

## **2.PART 2 - PRODUCTS**

### **2.1 ASSOCIATED REFERENCES**

- A. This document describes a system to be installed in accordance with recognized telecommunications industry cabling standards. Although the intent of the standard is to provide an application independent cable system, one or more of the following documents, describing specific network types and topologies, may be pertinent to the overall operation of the system and should be considered associated reference materials.
1. ISO/IEC 8802-3 (IEEE 802.3)
  2. ISO/IEC 8802-5 (IEEE 802.5)
  3. ANSI X3T9.5 Fiber Distributed Data Interface (FDDI) Physical Medium Dependent (PMD)
  4. ANSI X3T9.5 Twisted Pair Physical Medium Dependent (TP-PMD)

### **2.2 CABLING SYSTEM**

All components of the copper horizontal system and entire fiber optic cabling system shall be of the same manufacturer or manufacturer partnered system in order to provide one single product component and cabling system performance warranty direct from a single point of contact to the San Bernardino City Unified School District. The factory warranties must include a product component warranty and a system performance warranty to the Category 6 standard and revision in force at the time the system is installed. The factory warranty period shall be not less than 20 years.

The San Bernardino City Unified School District has established Panduit as the standard for the network structured cabling plant (to eliminate additional training time and costs as well as reduce spare parts costs and database information); or District-approved equal.

### **2.3 CABLE TYPES**

- A. The new planned cable system shall utilize the following cable types for horizontal distribution. Each cable shall meet or exceed the mechanical and electrical performance characteristics listed below.
1. Horizontal Distribution Cable--Unshielded Twisted Pair Cable: construction shall be 23 AWG, 4-pair, Category 6 Enhanced, with a bandwidth of not less than 350mhz.
  2. 50/125 multi-mode optical fiber cable with dual bandwidth minimums of 850nm and 1300nm at 500mhz. Optical fiber cable shall provide a maximum attenuation of 3.5 dB/km @ 850 nm and 1.5 dB/Km @ 1300 nm.
- B. For MDF to IDF connections longer than 800 feet, use Single-mode fiber for the medium.

When new data cabling is specified for a room or office location at any District site, and there is existing data cabling in the room or office location then designated site personnel and designated IT personnel must approve the exact placement for each new data jack, the removal of any existing data jacks, the terminations into existing patch panels for each new data jack, and the data connection to any existing electronics equipment such as switches or hubs. Additionally, if new data jacks are required in a room or office location with no existing data jacks, but the new data jacks will be terminated into an existing IDF or MDF then designated IT personnel must approve all connections into existing equipment and any new patch panel and cabinet installations at that IDF. Furthermore, any new equipment required to support the new data cabling must be calculated and incorporated into the cost of the new cabling. This standard should be followed exactly, and any deviation needs to be approved by IT management prior to implementation of the deviation.

### **2.4 COPPER SYSTEM**

#### **A. JACKS AND PATCH PANELS**

1. Eight-wire, eight-position modular jacks shall be used for all telecommunications outlets. Each jack shall be fed by a separate four pair cable sheath. All four (4) pair shall be wired to the jack using TIA/EIA-568-B wiring scheme. The jacks shall employ PC board mounted (110 or IDC) contacts for termination of the wire.
2. The jacks shall be matched to the Category rating of the attached horizontal distribution cable which will all be enhanced Category 6 compliant or better.
5. Patch panels supporting Category 6 enhanced cabling shall be 24 or 48 ports as needed. Panels

shall be factory assembled with eight-wire, eight-position modular jacks that employ PC board mounted (110 or IDC) contacts for termination of the wire. Panels shall be wired to the TIA/EIA-568-B wiring scheme.

B. TELECOMMUNICATIONS OUTLET PLATE

1. The outlet shall be configured so that the interconnect couplings are at an acute angle to, or parallel with, the wall surface.
2. The outlet plate shall be affixed to an in-wall or surface mount box with two screws, which match the color of the outlet plate, or a previously installed floor mount device.
3. To meet district standards faceplates shall be two port, four port, six port or duplex mounting straps as required in any floor box or surface raceway application.

C. OUTLET INSTALLATION

1. All outlets shall be installed in the following manner:
  - a. Wall mount boxes shall be attached to (*box eliminators, 4"X4" boxes, old work boxes*) provided by the (*contractor providing raceway and boxes*).
  - b. Wall mount boxes shall be installed with the center of the plate at (*15" IAW ADA requirements or match existing*) above finished floor (AFF). The faceplates shall be installed in a horizontal or vertical orientation.
  - c. Any unused faceplate positions shall be covered/filled with a blank insert made of the same or compatible material as the faceplate and shall be molded in the same color. Blank spaces shall be incorporated between populated positions on the faceplate.
  - d. Cables shall be coiled in the in-wall or surface-mount boxes. In hollow wall installations where box-eliminators are used, excess wire can be stored in the wall.
  - e. No more than 12" of slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. Excess slack for these situations shall be neatly coiled in the ceiling above drop location. The amount of cable slack in the ceiling is not to exceed 4 feet per horizontal run. Enough slack must be provided, however, for at least one jack re-termination at the outlet plate.

D. HORIZONTAL DISTRIBUTION CABLE

1. Horizontal distribution cables shall be installed from the MDF and IDF to the designated locations in the Work Area Information Outlet (IO). Horizontal distribution cables shall be manufactured in compliance with the mechanical and electrical specifications detailed in the TIA/EIA-568-B document, as applicable. Cables not supported under the current revision of the standard shall be of recent design and manufacture and be capable of supporting the application (e.g., broadband coaxial, baseband coaxial).
2. All cables shall be furnished by the contractor in full, factory packaged reels or pull boxes. The packages shall be marked with the respective cable part number and lot number by the manufacturer. Upon request by the Owner, the contractor shall provide manufacturer's proof of compliance with the required manufacturing guidelines presented in the aforementioned standards. Each reel shall be visually inspected upon receipt and prior to installation to ensure that no damage was incurred during shipment. Any damaged cable shall be returned to the vendor/manufacturer for replacement of the entire reel. The cost for replacement cable shall be borne by the contractor. Any residual cable, in lengths greater than 500 feet, shall be delivered to the Owner and the Owner shall decide the disposition of the cable.

E. HORIZONTAL DISTRIBUTION CABLE SHALL BE INSTALLED AND TERMINATED AS BELOW

1. 100  $\Omega$  Unshielded Twisted Pair—Jacks/Patch Panels
2. Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-B document, manufacturers' recommendations and/or best industry practices.
3. Pair untwist at the termination shall not exceed one-half an inch.
4. Bend radius of the cable in the termination area and at any point along the distribution path shall not exceed four (4) times the outside diameter of the cable.
5. The cable jacket shall be maintained as close as possible to the termination point.
6. All modular jacks shall be oriented with the locking tab towards the floor.
7. Voice jacks shall be located in the top or top left position of each faceplate. In instances where there is more than one voice jack per faceplate, then the second shall occupy the top right or second position, continuing top to bottom or left to right. Voice jacks in horizontally oriented faceplates shall occupy the left-most position. Modem jacks shall be considered the last voice jack in the sequence.
8. Data jacks that are in surface metal/plastic raceway (Panduit/Wiremold) shall be mounted in the proper termination plate compatible with manufacturer of the raceway to ensure that the District receives a professional end installation. These termination plates and trim are to be provided by the

electrical contractor installing the raceway and power outlets to ensure that all outlets and trim will match. The mounting straps shall be provided by the data contractor.

9. Cable raceways shall not be filled greater than the NEC maximum fill for the particular raceway type. New raceway installations should not be filled more than 60% of the NEC maximum to allow for growth. Conduit sizing shall be a minimum of 3/4 inch conduit for each outlet with no more than two outlets fed by one 1" homerun. If two outlets are fed by one homerun the conduit shall be 1" to the IDF or MDF and 3/4 inch to the end box. For conduits feeding a multiple outlet surface raceway the sizing shall be as follows: 1" for raceways 6' long and under, 1 1/4" for raceways 6' to 18' long and multiple conduits to meet this pattern for lengths greater than 18'. These specifications shall take precedence over conduit routing shown on the plans that deviate from this method. The data contractor shall bring any discrepancies to the attention of the owner before bid time.
  10. Cables shall be installed in continuous lengths from origin to destination (no splices) unless specifically addressed in this document.
  11. Where cable splices are allowed, they shall be in accessible locations and housed in an enclosure intended and suitable for the purpose.
  12. Maximum pulling tension shall not exceed 25 pounds for a single cable or for a cable bundle.
  13. When not installed in conduit, (per the plans and electrical specifications requirements), all horizontal cables shall be supported at a maximum of four-foot intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels, nor shall they be attached to ceiling grid wires. Horizontal distribution cables shall be bundled in groups not greater than 48 cables. Bundles shall be supported by cable tray, conduit, trapezes, or multiple support strap made by Erico, Caddy part # CAT21 and CAT32. Saddle supports are not allowed. Plenum rated cable is to be installed in plenum rated areas only and non-plenum cable to be installed in non-plenum areas.
  14. The cable system shall not be attached to the fire sprinkler 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.
  15. Cables shall not be attached to ceiling grid or lighting support wires. Where light support style wires for drop cable legs are required, the contractor shall install clips to support the cabling.
  16. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.
  17. Cables shall be identified by a computer generated, permanent, self-adhesive label in accordance with the System Documentation Section of this specification. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.
- F. IDF/MDF Data Labeling.
1. Data Patch Panel Labels at each IDF/MDF shall be labeled with 2 lines of information. The top line should indicate the drop number and the second line shall indicate the building and room number of the drop. The drop numbers shall be numbered consecutively beginning at one (1) through and including the total number of drops connected to all IDF/MDF patch panels. If a particular installation is an addition to an existing IDF/MDF, the newly added drops and patch panels shall continue the number sequence from the last number of the previous patch panel.
    - a. Example Line 1: Two (2) 48-port patch panels newly installed will be numbered one (1) through 96. Later, when a 48-port patch panel is installed, the number sequence on the newly installed patch panel shall begin at 97 and continue.
    - b. Example Line 2: Under drops 1 through 8 the label says B5, under drops 9 through 15 the label says Lib6. This indicates that drops 1 through 8 are located in the B building room 5, while drops 9 through 15 are located in the Library building, room 6.
- G. Drop Plate Labeling.
1. Each data drop plate shall list the following 2 items.
    - a. IDF/MDF name or number and the location of that IDF/MDF, ie "IDF-3 B-2" for IDF 3 in room B-2.
    - b. Each data drop port shall list the drop number that corresponds with their drop number as listed at the IDF/MDF patch panel. Example: 4 data drop ports should be numbered like d-110, d-111, d-112, and d-113.

## 2.5 FIBER OPTIC SYSTEM

### A. FIBER OPTIC CONNNECTORS

1. Fiber optic connectors shall be SC-style.
2. Connectors shall incorporate zircona ceramic ferrules. The same type shall be used throughout the installation.
3. All connectors provided by Contractor shall be of same manufacturer and termination method



throughout this contract.

4. Fiber optic connectors shall be rated for a mean loss not greater than 0.3 dB per mated pair.

B. OPTICAL FIBER COUPLERS

1. Multimode optical fibers shall be terminated with (duplex SC -style) connectors and attached to (duplex SC, duplex SC to duplex SC) feed-through couplers.
2. Single-mode optical fibers shall be terminated with (duplex SC) connectors and attached to (duplex SC) feed-through couplers.
3. All fiber optic terminations shall be installed in boxes with bend limiting provisions for fiber slack storage.

C. FIBER TERMINATION PANELS

1. Fiber termination panels shall be capable of handling a minimum of 24 fiber optic connectors with the appropriate number of connector panels and couplers. All unused locations shall be filled with blank panels.
2. Fiber termination panels shall be 19" rack mountable.
3. Fiber termination panels shall be hinged to provide complete access to connectors and slack storage from the front.
4. Fiber termination panels shall be complete with 12 SC-style interconnect couplers.
5. Fiber termination panels shall be equipped with cable strain relief brackets.
6. Fiber termination panels shall provide ample storage and handling for up to 36" of slack per fiber strand.
7. Fiber termination panels shall protect both the installed cable and patch cord cable interface when the panel is in the closed position.
8. Fiber termination panels must be of the same manufacturer as the fiber cable and SC connectors, as well as the horizontal cabling system to ensure the owner will not have any coordination problems in the future.

D. FIBER OPTIC CABLE

The optical fiber cable construction shall meet or exceed the requirements of the EIA/TIA-568-A Standard specification. Fiber runs **less than 800 ft** should be labeled **orange** at both IDF and MDF patch panels, and they should be **multimode** fiber. Fiber runs **greater than 800 ft** should be labeled **yellow** at both IDF and MDF patch panels, and they should be **single mode** fiber.

1. Optical fiber cables used outside shall be housed in an OSP indoor/outdoor jacket. Inside fiber shall be riser or plenum tight buffered.
2. Use OFNR construction if used as a riser cable.
3. Use Plenum construction if used in an air plenum of any kind.
4. Optical fiber shall be rated a minimum of 100 Mbps.
5. Each optical fiber component shall be surrounded by an individual aramid yarn strength member.
6. The optical fiber cable construction shall meet or exceed the requirements of the EIA/TIA-568-B Standard specification
7. Optical fiber cable shall withstand a minimum short term tensile load of 105 pounds without damage to the optical fiber
8. Optical fiber cable shall be able to withstand a minimum bend radius of 45 millimeters (mm) during installation without damage to the optical fiber elements
9. Optical fiber cable shall have a minimum crush resistance of 200 N/cm
10. Optical fiber shall be rated a minimum of 100 Kpsi.
11. Optical fiber cable shall withstand a minimum short-term tensile load of 448 pounds without damage to the optical fiber.
12. Optical fiber cable shall be able to withstand a minimum bend radius of 128 mm during installation without damage to the optical fiber elements.
13. All fiber optic cable shall be installed per industry standards. This includes using a proper *break-away swivel* and sealing the end of all cables before pulling through any conduit system. 10 feet of slack cable shall be left at each end of the cable run for future maintenance purposes.
14. OSP, loose-tube cables shall be properly prepared and protected per industry standards. All cables shall be properly cleaned. The cable ends shall be terminated through a breakout unit and a 900 micron buffer tube for each fiber strand. Each cable OSP buffer tube shall be labeled for strand counts contained therein. Provide proper break out kits as manufactured by AT&T, Corning, or equal.
15. When distribution style fiber cable is installed, strength members shall be mechanically secured to the outlet box and distribution enclosure.

16. A minimum of 12-inches of slack shall be stored at the drop end and 36-inches shall be stored at the TC termination enclosure.
17. Where 250-micron coated cable is field terminated, breakout kits that build up the fiber to a minimum of 900 microns shall be used.
18. Any splices, fusion only, shall be housed in fiber trays and an enclosure with splice tray organizers.

## 2.6 BACKBONE CABLING SUBSYSTEM

- A. The backbone cable subsystem is comprised of all cable, connecting hardware, pathways and cable management hardware required to form a continuous path from the Telecommunications Entrance Facility (EF) to the Equipment Room, from the ER (MDF) to each TC (IDF), and between TCs (IDFs) on the same floor.
- B. BACKBONE CABLE
  1. Backbone cables will be installed between the locations described in the scope of work and on the plans. An inner-duct shall be pulled in all backbone conduits along with the fiber-optic cable. This inner-duct shall be left with only a pull rope for future use and shall be of the size and quantity called out in other areas of this specification. All conduits shall be plugged with snug plugs and duct seal after inner-duct installation is completed.
  2. All cables shall be furnished by the contractor in full, factory packaged reels. The reels shall be marked with the respective cable part number and lot number by the manufacturer. Upon request by the Owner, the contractor shall provide manufacturers' proof of compliance with the required manufacturing guidelines presented in the aforementioned standards. Each reel shall be visually inspected upon receipt and prior to installation to ensure that no damage was incurred during shipment. Any damaged cable shall be returned to the vendor/manufacturer for replacement. The cost for replacement cable shall be borne by the contractor. Any residual cable, in lengths greater than 500 feet, shall be delivered to the Owner and the Owner shall decide the disposition of the cable.
- C. BACKBONE CABLE INSTALLATION: All backbone cables shall be installed in the following manner:
  1. Backbone cables shall be installed separately from horizontal distribution cables.
  2. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits or in separate inner-ducts within conduits.
  3. Where cables are installed in an air return plenum, the cable shall be installed in conduit, or plenum cable shall be installed in a plenum inner-duct to provide protection to the cable
  4. Where backbone cables and distribution cables are installed in a cable tray or wire-way, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.
  5. Backbone fiber cable shall consist of a six (6) strand count unless specified differently on the plans and in the scope of work. These cables shall emanate from the MDF to each IDF. These cables shall be of the same manufacturer of all the other fiber and copper cabling system and terminations. These cables shall be FDDI+ grade per EIA/TIA standards.
  6. All backbone conduit shall have (1) 3/4" inner-duct with pull ropes if in a 2" conduit, (2) 1" inner-duct with pull ropes if in a 3" conduit, and (4) 1" inner-duct with proper "Jack-moon" plugs if installed in a 4" conduit. This inner-duct will be for future use in the 2" and 3" conduits and one or as many as necessary will be utilized in the 4" conduit leaving the remainder for future use. All unused inner-duct shall have a rubber snug plug with rope tie off installed and all inner-duct occupied with cable shall have the appropriate cable seal.
- D. HORIZONTAL CROSS-CONNECT TERMINATION HARDWARE
  1. The backbone side of the horizontal cross-connect, and the main cross connect shall be terminated in the same termination panels as the horizontal cables. The backbone fibers shall be maintained in separate termination panels from the horizontal distribution fiber cables. The backbone termination panels shall be installed in the double swing enclosed rack. Termination details and rack elevations for fiber panel placement shall be provided in the contractor submittals.
  2. The contractor shall be required to install, secure and ground the racks. The Contractor shall only be required to install those fiber termination panels to fully terminate all newly installed fiber strands unless otherwise noted. Placement of the enclosures shall be detailed in the contractors working drawings.
  3. Each fiber optic cable shall be terminated in the telecommunications closet in a 12, 24, 48, or 72 fiber port rack mounted patch panel enclosure providing protection to the terminated fibers. The enclosures shall provide a strain relief bracket for attaching the optical fiber cable and support slack storage of a minimum of 36" per fiber cable. The enclosure shall provide a minimum of 12 ports for fiber

- terminations and fully enclose both the hardwired cable and the patch cord terminations when the shelf is closed.
4. Products for this installation shall be furnished in new and factory packaged condition. Each product shall be inspected by the Contractor to ensure completeness and that no damage was incurred during shipping. The contractor shall return to the manufacturer, any product found to be deficient. The cost of the return and replacement product shall be borne by the Contractor.
- E. CONDUIT AND TRENCHING.
1. Trenching. When no conduit pathway is available between an MDF/IDF and the proposed drop installations in another building, trenching should occur between buildings to install a 3" conduit to be a pathway for installing either Category 5e, Category 6e or appropriate fiber optic cables.
    - a. Trenching may occur within any single or any combinations of the following the physical mediums: dirt, turf, asphalt, concrete.
    - b. Conduit used in trenches should be rated appropriately for the environment and conditions.
  2. Conduit. Wherever and whenever possible during any data cable installations conduits and cable should be installed inside the walls. When this is not possible, use neutral colored surface mounted hinged raceway, such as Panduit Pan-Way Type LD Surface raceway, sized appropriately for the number of cables installed.
    - a. Dual Channel raceway can be used for approved locations when additional electrical power is also a consideration.

## 2.7 RACKS/CABINETS

- A. The products supplied shall meet the following specifications:
1. All MDF racks/cabinets shall be an APW or equivalent 7' open relay rack or a 7' enclosed cabinet manufactured by APW or equal.
    - a. Enclosed rack should be a minimum of 24" wide and 42" deep.
    - b. Cabinet must be adequately equipped with self-contained ventilation system such as fans or similar means.
  2. A cable trough shall be supplied at the bottom of each open rack to support patch cord routing between racks.
  3. Server Racks (minimum one per campus) shall be floor-mounted racks with (2) peripheral shelves, server sliding shelf (150lb capacity), and monitor and keyboard shelf all as manufactured by APW or equal. (More detail in Paragraph 2.12.C)
  4. Inter-bay and end-cap cable managers shall be a single piece full height unit supporting front and rear cable routing and attachment.
  5. The inter-bay manager shall have integral routing and slack storage loops supporting a 1.5" minimum bend radius.
  6. Inter-bay and end-cap management panels shall be supplied with adjustable routing guides.
  7. Both inter-bay and end-cap units shall have removable covers secured with 1/4 turn fasteners.
  8. Inter-bay and end-cap cable managers shall securely attach to the rear rail of the rack with #12-24 screws.
  9. All IDF locations shall be 2', 3' or 4' wall-mount enclosures manufactured by APW or equal. Size of IDF cabinet shall depend on the number of switches, cabling connectivity, and cable management devices for IDF, or as stated on plans and in scope of work. Each cabinet is to provide space for 25% equipment growth. Cabinets shall:
    - a. Be a minimum of 24" and a maximum of 30" deep
    - b. Be double-swing design and 3-piece construction
    - c. Provide in-field door hinge reversing
    - d. Shall include louvered sides
    - e. Shall include a solid metal door
    - f. Shall be mounted on 1" plywood back-board, anchored sufficiently to mount the cabinet.
  10. All cabinets and racks shall be keyed alike with key code ch751.
  11. All cabinets shall provide a minimum of two cooling fans in the top cover.
- B. CABLE MANAGEMENT
1. Horizontal cable management shall be provided in each rack. A minimum of two front wire-management panels shall be provided in each rack. One combination front and rear horizontal wire management shall be provided for each fiber termination box, for each 24 ports of RJ45 panels, and each 24 ports of switches. Cable dressing at all racks/enclosures shall utilize velcro straps. The use of cable ties is not permitted. All cables and their termination on each end shall be labeled per EIA/TIA

administration standards. All labeling schemes and label designations shall be reflected on the CAD drawings at the end of the project and in the submittals.

C. RACK MOUNTING AND HARDWARE

1. Vertical wire management shall be supplied for all open racks.
2. A TGMB ground buss shall be provided at the MDF and a TGB ground buss shall be provided at each IDF. All racks shall be grounded to the telecommunications ground bus bar. The buss bars will be installed by an electrical contractor and not part of the scope of work in this specification section.
3. Floor mount open racks shall be securely attached to the concrete floor using 3/8" hardware and a minimum of 3 feet and a maximum of 10 feet away from the most adjacent wall. The contractor shall install a 12" wide ladder tray system, as manufactured by APW or equal, from the most adjacent wall to the rack. Appropriate wall and rack mounting from the same manufacturer shall be installed as well. These racks should have a minimum of 30" clearance on all sides for access.
4. Rack mount screws (#12-24) not used for installing fiber panels and other hardware shall be bagged and left with the rack upon completion of the installation.
5. Inter-bay and end-cap managers shall be installed to the rear mounting rail of the rack using all available mounting holes.
6. Inner-ducts and cables shall be securely fastened to the cable managers.
7. Cable feeds shall alternate left and right to minimize congestion at the top of the rack.
8. Wall mounted racks shall be installed with a minimum of six 5/16" lag bolts or masonry anchors into structural building members.

2.8 OTHER NETWORK CABLING NOTES

- A. Data cabling shall not occupy the same conduits as other low-voltage systems to ensure the data network can be up-graded and expanded in the future without disturbing the other critical communications systems.
- B. Each RJ45 workstation outlet shall be provided with one (1) 3' patch cord for the rack location and one (1) 7' workstation cord for the future computer. These patch cords shall be of the same manufacturer as the cabling system. Patch cord shall be factory assembled and include *snagless* color-coded strain relief boot. No field assembled patch cords allowed.

2.9 ACTIVE COMPONENTS

- A. MDF GENERAL REQUIREMENTS "CORE" SWITCHES
    1. Core Switches vary by school. In general the follow the specifications listed below.
      - a. High Schools, Cisco Catalyst 6509, dual power supplies, populated with minimum boards so support 18 (LC) fiber ports, 48 GigabitEthernet ports (10/100/1000), Supervisor card and 64MB RAM.
      - b. Middle Schools, Cisco Catalyst 4507, dual power supplies, populated with minimum boards to support 16 (LC) fiber ports, 48 GigabitEthernet ports (10/100/1000), supervisor card and 64 MB RAM.
    - C Elementary Schools, Cisco Catalys 4506, dual power supplies, populate with minimum boards to support 16 (LC) fiber ports, 48 GigabitEthernet ports (10/100/1000), supervisor card and 64 MB RAM
  2. A true on-line battery backup UPS system shall be provided for each Core switch installed and shall provide a minimum of 60 minutes run time, and shall include a SNMP module with alert notification software as manufactured by TrippLite or APC.
  3. Core-switch will contain modules capable of providing gigabit Ethernet to each of the IDF's it supports.
  4. Core-switch will provide one (1) gigabit link for each (96) drops supported by the respective IDF.
  5. Contractor to supply and install all required patch cords as needed to fully support all Edge switches newly installed in order to facilitate a fully operational system. Fiber optic patch cords are to be 1 or 2 meters in length as required. The cords are to be Duplex SC or LC style connectors on 50/125 multimode fiber optic zip-cord style cable that meet the Category 5e or Category 6e standard. Cords must be the same manufacturer as the cabling system being installed. **No field terminated cords are allowed.**
  6. A 1U (1.75") front wire management panel shall be installed for every 48-ports of electronics with no less than one for each rack location.
- B. IDF GENERAL REQUIREMENTS "EDGE" SWITCHES
  1. Edge Switches, Cisco Catalyst 3750 power switch with 4 LC fiber ports, 1 gbic and patch cable, and stacking cable.
  2. Each switch at the IDF will be a minimum of forty-eight (48) 10/100Base-TX ports.

3. All IDF switches will be the Enterprise Edition switch.
  4. One 1000BaseSfp GBIC module will support no more than 96 drops before adding subsequent 1000BaseSX GBIC modules in the IDF for additional gigabit links to the MDF.
  5. Contractor to supply and install all required patch cords as needed to fully support all Edge switches newly installed in order to facilitate a fully operational system. Fiber optic patch cords are to be 1 or 2 meters in length as required. The cords are to be Duplex SC or LC style connectors on 50/125 multimode fiber optic zip-cord style cable that meet the Category 5e or Category 6e standard. Cords must be the same manufacturer as the cabling system being installed. **No field terminated cords are allowed.**
  6. A 1U (1.75") front wire management panel shall be installed for every 48-ports of electronics with no less than one for each rack location.
- C. SERVER RACKS GENERAL REQUIREMENTS (minimum one per campus)
1. Data contractor will provide one (1) enclosed 7 ft server cabinet which will be provided with proper shelving and ventilation (2 fans minimum) to support a minimum of two file servers (see rack specifications section).
  2. A true on-line battery backup UPS system shall be provided for each server installed and shall provide a minimum of 60 minutes run time, and shall include an SNMP module with alert notification software, as manufactured by TrippLite or APC.
  3. The server rack shall be compatible to house multiple modular HP file servers with associated mounting rails.
  4. The data contractor shall provide a 1U combination KVM switch with attached keyboard, mouse touchpad, and LCD monitor and sufficient cables to connect 2 servers. This unit should be capable to connect up to 4 workstations/servers.
- D. ROUTER
- Most routing is done through layer 3 switches. However, in site specified cases only, Cisco Catalyst 3745 router with dual power supplies and with 2 T1 ports and 2 Ethernet Ports, latest Enterprise IOS.

### **PART 3 - EXECUTION**

#### 3.1 CABLE SYSTEM TESTING

- A. All cables and termination hardware shall be 100% tested for defects in installation to verify cable performance under installed conditions. All conductors of each installed cable shall be verified as useable by the contractor prior to system acceptance. Any defect in the cable system installation including but not limited to cable, connectors, feed-through couplers, patch panels and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.
- B. Copper: Each cable shall be tested for continuity on all pairs and/or conductors. Coaxial cables shall be tested for continuity, opens shorts and resistance using a volt/ohm meter (VOM) and installed length using a Time Domain Reflectometer (TDR). Twisted-pair voice cables shall be tested for continuity, pair reversals, shorts, and opens using a "green light" type test set. Twisted-pair data cables shall be tested for the all of the above requirements, plus tests that indicate installed cable performance. All Category 6 cables shall be tested to ensure the Category 6 standard performance to 100Mhz is complied with. All tests shall be printed out in hard copy in the quantity called out in the general specifications for Maintenance & Operations turn-over documents as well as one CD copy for the owner's use. These data cabling links shall be tested with a Level III cable analyzer utilizing bi-directional swept frequency testing procedures.
- C. Continuity: Each pair of installed multi-conductor inter-building phone cable shall be tested using a "green light" test set that shows opens, shorts, polarity and pair-reversals. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test set in accordance with the manufacturers recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.
- D. Length: Category 5 and Category 6 unshielded twisted pair (UTP) data cable shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the TIA/EIA-568-B Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the longest pair length shall be recorded as the length for the cable.

- E. Performance Verification: Category 5 and Category 6 unshielded twisted pair (UTP) data cable shall be performance verified using an automated, electronic test set. This test set shall be capable of testing for the continuity and length parameters defined above, and provide results for the following tests:
1. Near End Cross-Talk (NEXT)
  2. Attenuation
  3. Ambient Noise
  4. Attenuation to Cross-Talk Ratio (ACR)
  5. Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the TIA/EIA Standard, and the result shown as pass/fail. Test results shall be printed directly from the test unit or from a download file using an application from the test equipment manufacturer. The printed test results shall include all tests performed, the expected test result and the actual test result achieved.
- F. Fiber: All fiber terminations shall be visually inspected with a minimum 200 X microscope to ensure that no surface imperfections exist after final polishing. This step is not necessary of factory pre-polished connectors are installed. In addition, each fiber strand shall be tested for attenuation with an optical power meter and light source. *Cable length and splice attenuation shall be verified and documented using an OTDR.*
- G. Attenuation:
1. Horizontal distribution multimode optical fiber attenuation shall be measured at either 850 nanometers (nm) or 1300 nm using an LED light source and power meter. Backbone multimode fiber shall be tested at both 850 nm and 1300 nm in one direction. Test set-up and performance shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, Method B. One 2-meter patch cord shall be used for the test reference and two 2-meter patch cords shall be used for the actual test. This test method uses a one jumper reference--two jumper test to estimate the actual link loss of the installed cables plus the loss of two connectors. This measurement is consistent with the loss which network equipment will see under normal installation and use. Test evaluation for the panel to panel (backbone) or panel to outlet (horizontal) shall be based on the values set forth in **the EIA/TIA-568-A** Annex H, Optical Fiber Link Performance Testing.
  2. 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 the Owner and the Contractor prior to the start of the test.
  3. Single-mode optical fiber attenuation shall be measured at 1310 nm and 1500 nm using a laser light source and power meter. Tests shall be performed at both wavelengths in one direction on each strand of fiber. The set-up and test shall be performed in accordance with EIA/TIA-526-7 Standard, Method 1A. Two meter patch cords shall be used as test references and for the actual test. This test method utilizes a one jumper reference, two jumper test to estimate the actual link loss of the install cable plus two patch cords.
  4. Test evaluation for the panel to panel (backbone) shall be based on the values set forth in the EIA/TIA-568-A Annex H, Optical Fiber Link Performance Testing.  
*\*For this application, the length based on cable length measurements marked on the jacket, will be suitable. OTDR testing is to be performed in accordance with 8.2.2, then the actual measured length shall be used. Conversion from metric to US Standard measurement shall use 3.2808 as a constant with the result rounded to the next highest whole number.*  
*\*\*The testing for this project is measuring the loss over the installed cable plus two jumpers which accounts for three mated pairs of connectors. Subtract one mated pair for the equipment interface to arrive at a total of two mated pairs under test.*
- H. Length and Splice Loss
1. Each cable shall be tested with an Optical Time Domain Reflectometer (OTDR) to verify installed cable length and splice losses. The OTDR measurements for length shall be performed in accordance with EIA/TIA-455-60. The measurements to determine splice loss shall be performed in accordance with manufacturers' recommendations and best industry practices. These tests shall be employed on all cables after installation and in addition where one or more of the following conditions exist.
  2. OTDR and power meter testing is specifically requested by the Owner.
  3. Each strand shall be tested on all outside plant and tight-buffered cables and/or where splices exist.

4. A representative strand of each fiber cable shall be tested to verify length if the estimated cable length is within 10% of the maximum length specified, respective to cable function, in the TIA/EIA-568-B Standard.

### 3.2 FIRESTOP SYSTEMS

- A. A firestop system is comprised of: the item or items penetrating the fire rated structure; the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, heat, vapor and pressurized water stream.
- B. All penetrations through fire rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating items i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.
- C. Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed firestopped system, stamped/embossed by the cognizant PE shall be provided to the Owner's Technical Representative prior to installing the firestop system.
- D. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

### 3.3 GROUNDING AND BONDING

All grounding and bonding work is to be completed by an electrical contactor and not part of this scope of work. This information is placed here for reference only.

- A. The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential for acting as a current carrying conductor. The TBB shall be installed independent of the buildings electrical and building ground and shall be designed in accordance with the recommendations contained in the TIA/EIA-607 Telecommunications Bonding and Grounding Standard.
  1. The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding bus bar (TMGB). Each telecommunications closet shall be provided with a telecommunications ground bus bar (TGB). The TMGB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.
- B. Product Specifications
  1. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the TC or ER shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors. Where metallic panels attached to the rack to not have sufficient metal to metal contact to provide an adequate path to ground, they shall be bonded to the rack using a minimum #14 AWG copper conductor. The copper conductor size shall be upgraded based on the largest power conductor feeding any rack mount equipment. The conductor shall be continuous, attaching all isolated components in a daisy chain fashion from top to bottom and bonded to the rack using the appropriate compression connector.
  2. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables, and buss-bars shall be identified and labeled in accordance with the System Documentation Section of this specification.
- C. Ground System Installation
  1. The TBB shall be designed and/or approved by a qualified PE, licensed (actual or reciprocal) in the state that the work is to be performed. The TBB shall adhere to the recommendations of the TIA/EIA-607 standard, and shall be installed in accordance with best industry practices. Installation and termination of the main bonding conductor to the building service entrance ground, at a minimum, shall be performed by a licensed C10 electrical contractor.

### 3.4 SYSTEM DOCUMENTATION

- A. The following section describes the installation, administration, testing, and as-built documentation required to be produced and/or maintained by the contractor during the course of the installation. The documentation required will allow the owner to create a TIA/EIA 606 compliant administration system.
- B. Cable System Labeling
1. The contractor shall develop and submit for approval a labeling system for this cable installation. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. All data drops numbers shall be unique within each IDF/MDF and they shall be continuous from patch panel to patch panel. See sections 2.4 F and 2.4 G for drop labeling details. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme
  2. All label printing will be machine generated using indelible ink ribbons or cartridges. Self laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet labels will be the manufacturer's label provided with the outlet assembly.
- C. As-Built Drawings
1. The installation contractor will be provided with (two) set(s) of (D)-size drawings at the start of the project. One set will be designated for the central location to document all as-built information as it occurs throughout the project. The central set will be maintained by the Contractor's Foreman on a daily basis, and will be available to the Technical representative upon request during the course of the project. Anticipated variations from the building drawings may be for such things as cable routing and actual outlet placement. No variations will be allowed to the planned termination positions of horizontal and backbone cables, and grounding conductors unless approved in writing by the Owner. Contractor shall also redraw the site and floor plans showing all fiber, copper, racks, and information outlets as well as the labeling scheme for all items. These CAD drawings shall be on 8 1/2" x 11" sheets of paper and be turned over to the owner with the O&M manuals.
  2. The Contractor shall provide the central drawing set to the owner at the conclusion of the project in both electronic CAD format as well as hardcopy. The marked up drawing set will accurately depict the as-built status of the system including termination locations, cable routing, and all administration labeling for the cable system. In addition, a narrative will be provided that describes any areas of difficulty encountered during the installation that could potentially cause problems to the telecommunications system. The hardcopy drawings should be provided in an organized binder with tabular divisions.
- D. Test Documentation
1. Test documentation shall be provided in a three ring binder(s) within three weeks after the completion of the project. The binder(s) shall be clearly marked on the outside front cover and spine with the words "Test Results", the project name, and the date of completion (month and year). The binder shall be divided by major heading tabs, Horizontal and Backbone. Each major heading shall be further sectioned by test type. Within the horizontal and backbone sections, scanner test results (Category 3, 4, or 5), fiber optic attenuation test results, OTDR traces, and green light test results shall be segregated by tab. Test data within each section shall be presented in the sequence listed in the administration records. The test equipment by name, manufacturer, model number and last calibration date will also be provided at the end of the document. Unless a more frequent calibration cycle is specified by the manufacturer, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail test method used and specific settings of the equipment during the test.
  2. Scanner tests shall be printed on 8-1/2" x 11". Hand written test results (attenuation results and green light results) shall be *documented on an Excel spreadsheet. OTDR test results shall be printed or attached and copied on 8-1/2" x 11" paper for inclusion in test documentation binder.*
  3. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall collocated in the binder.

### 3.5 WARRANTY AND SERVICES

- A. The contractor shall provide a system warranty covering the installed cable system against defects in workmanship, components, and performance, and follow-on support after project completion.



- B. Installation Warranty: The contractor shall warrant the cabling system against defects in workmanship for a period of one year from the date of system acceptance. The warranty shall cover all labor and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after repairs are accomplished. This warranty shall be provided at no additional cost to the Owner.
- C. Cable System Warranty: The contractor shall facilitate a warranty between the manufacturer and the Owner that provides coverage of the installed cabling system to a minimum of 25 years. An extended component warranty shall be provided which warrants functionality of all components used in the system for a minimum of 25 years from the date of acceptance. All fiber cable, copper cable, fiber termination hardware and housings, copper termination hardware and trim shall be of one manufacturer to ensure the owner can establish one relationship for the warranty. A performance warranty in excess of 25 years shall also be provided which warrants the installed 100 MHz horizontal copper (HC to WA) and for both the horizontal and the backbone optical fiber (HC to WA, or cross-connect to cross-connect) portions of the cabling system. Copper links shall be warranted against the link performance minimum expected results defined in the TIA/EIA 568-B and/or TIA/EIA 568-A. Fiber optic links shall be warranted against the link and segment performance minimum expected results defined in the TIA/EIA 568-B and/or TIA/EIA 568-A. All fiber and copper cabling, termination components, and ancillary devices shall be of one manufacturer to insure no disputes can arise between different manufacturers if performance problems arise. Installers shall be factory trained technicians with a factory trained supervisor overseeing the project. Certificates of factory training by the manufacturer, or authorized representative, of the cabling system being installed must be made available if requested by the District or District's representative.

### 3.6 CABLE SYSTEM ACCEPTANCE

- A. The Owner's Technical Representative will make periodic inspection of the project in progress. One inspection will be performed at the conclusion of cable pulling, prior to closing of the false ceiling, to inspect the method of cable routing and support, and the fire-stopping of penetrations. A second inspection will be performed at completion of cable termination to validate that cables were dressed and terminated in accordance with TIA/EIA specifications for jacket removal and pair untwist, compliance with manufacturer's minimum bend radius, and that cable ends are dressed neatly and orderly.
- B. Final Inspection: Upon completion of the project, the Owner's Technical Representative will perform a final inspection of the installed cable system with the Contractor's Project Foreman. The final inspection will be performed to validate that all horizontal and backbone cables were installed as defined in the drawing package, and that the installation meets the aesthetic expectations of the District.
- C. Test Verification: Upon receipt of the test documentation, the Owner reserves the right to perform spot testing of a representative sample of the cabling system to validate test results provided in the test document. Owner testing will use the same method employed by the contractor, and minor variations will be allowed to account for differences in test equipment. **If significant discrepancies are found, the Contractor will be notified for resolution.**
- D. System Performance: During the three-week period between final inspection and delivery of the test and as-built documentation, the Owner will activate the cabling system as a validation of operation.
- E. Final Acceptance: Completion of the installation and in-progress and final inspections, receipt of the test and as-built documentation, and successful performance of the system for a two-week period will constitute acceptance of the system.

END OF SECTION

## SECTION 16770

### INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT

#### PART 1- GENERAL

##### 1.1 PROJECT SCOPE

- A. This section covers the requirements for an Integrator to design, provide equipment for, and install instructional classroom technology. This is intended to supply a complete instructional technology classroom that can be arranged in multiple configurations. There will be a multimedia display as primary projection. Flexibility, integration of multiple technologies and sources, and multiple user groupings are essential to this concept. As an example, all audio and image sources should be capable of being shown on the screen and heard in the classroom. The work covered in this document consists of furnishing all labor, material and services necessary to install a complete audiovisual system as indicated on the project drawings and in these specifications.
- B. Deliverables: Prior to ordering materials or commencing any construction activities, the Integrator shall provide the Owner with a complete bill of materials, including all quantities of components, devices, equipment, and wiring required to complete this work. Submit product data, including manufacturer's data sheets for all proposed system components. Submit three copies with all specific items that will be provided clearly indicated and any options highlighted.

#### 2 PART 2 - PRODUCTS

##### 2.1 SYSTEMS DESCRIPTION

- A. Provide a complete Audiovisual System for small to medium sized classrooms. The system switching and audio amplification equipment shall be securely mounted and concealed in an enclosure mounted in close proximity to the display device. Audio and image source equipment can be connected to the system and displayed via active (powered) interface panels located throughout the room. The audio and image signals from source devices shall be transmitted from the active interface panels over shielded UTP cabling architecture.
- B. Classroom Definition: A classroom that has fixed instructional media video projection capabilities, Internet connectivity at the teacher's station, student networking (usually wireless), a document camera, Blu-ray and/or other multimedia input devices, standard laptop interface, multimedia control system that is connected to the network and capabilities for additional add-on modular features.

Technology Enhanced Classrooms (TECs) use standardized control/interface systems and employ a standardized operational protocol. The principles of this recommendation are to establish desirable goals with respect to classroom design and installed technology. The TEC classroom standard includes control systems that have ADA, Section 508 compliant buttons that are discernible without activating the controls or buttons on the control panel, easily reached control panel locations, closed captioning, hearing assistance capability, and user friendly operator protocols among the features that are consistent with universal design principles.

All new construction general purpose classrooms will meet this minimum standard. The standard will be met in major renovations wherever possible. The standard will be retrofitted in existing general purpose classrooms according to an established upgrade plan.

##### 2.2 GENERAL EQUIPMENT REQUIREMENTS

- A. The room will be equipped with a standard easy to operate interface (a tactile button keypad layout). The audio system may be monaural or stereo for program sound. The instructional media system will be controlled by a control system with a control panel mounted near the instructor area. System parameters can be monitored, administered and controlled over the data network. The instructional media equipment will be located within close proximity to the instructor area or through a Graphical User Interface (GUI) on a computer to allow for ease of operation during instruction.

Acceptable functionality requirements are listed below categorized by type of equipment. Quantities are listed for movable, portable or loose equipment, and other selected entries. Where quantities are not listed, refer to the system drawings.

- B. The System components shall all be correctly listed and labeled by Underwriters Laboratories Incorporated (UL) for their intended use.
- C. All products shall be new and under warranty at the time of installation. B-stock, previously installed, refurbished or used equipment shall not be provided on this project.
- D. Where the specification lists several manufacturers for a major item, or group of items, the AV Integrator shall provide that entire item from one manufacturer only.
- E. The Integrator shall provide all options, accessories and hardware necessary to meet the function of the design even if they are not specifically listed (i.e. mounting kits, separate or additional power supplies, input modules, transformers, etc.).

## 2.3 FIXED EQUIPMENT

### A. CLASSROOM

Provide the following Audio Video System as an all-inclusive system as described below, one system for each room:

1. Mounting - The audio, video, data connectivity components and projector, if applicable, shall be mounted using the following components.

- a. Drop ceiling projector mounting

- (1) Projector Drop Ceiling Mount with Adjustable Pole

The projector drop ceiling mount must be capable of mounting to the structural ceiling (concrete or wood joists), above the suspended T-Bar ceiling, incorporating 2' x 2' or 2' x 4' ceiling tiles, via turnbuckles and tie wire or threaded rod. The mount shall include an integrated pole that provides up to 21.5" of vertical adjustment to accommodate various projector height requirements. One end of the pole will be finished with 1.5" NPT (National Pipe Thread Taper) for mating with the Universal Projector Bracket.

Check the structural ceiling to ensure that it can support a load four times the weight of the final setup. Check that the ceiling plate to be used is suitable for the angle of the ceiling where the projector is to be installed. Refer to local building standards and codes to verify that the installation meets all the relevant regulatory standards.

The mount shall be capable of supporting up to 50 pounds (23 kgs) of A/V equipment.

The mount must also include (1) single gang and (1) double gang knockout openings for junction boxes or for use as cable pass-throughs.

- (2) Universal Projector Bracket

The bracket shall be able to support projectors up to 25 pounds.

The projector bracket must have independent adjustments of horizontal tilt or roll ( $\pm 4$  degrees of horizontal tilt), vertical angle or pitch ( $\pm 25$  degrees of vertical angle), and rotation or yaw (360 degrees of rotation).

The projector bracket shall also use a 1.5" NPT threaded pipe adapter for mounting a projector pole.

The projector bracket should also maintain positioning adjustments even if the projector is removed for service.

The bracket should also feature security flanges that enable the entire unit to be locked to prevent theft.

b. Multi-Product Mounting Kit

- (1) The pole mount multi-product mounting kit houses the key electronic components of the AV system including the switcher, audio amplifier and power supply. The kit shall mount directly to the projector pole and protect the contained components from tampering and theft.

2. Media Source Switching:

a. System source selection and switching shall be provided by a PVS 405D Switcher.

- (1) The switcher shall have two (2) inputs that each support connection to a dual input switching wallplate via one (1) female RJ-45 connector.
- (2) Audio for switched video sources shall be carried on the same RJ-45 connections.
- (3) The switcher shall have a switched auxiliary audio input to support audio from video sources that are directly connected to the projector or sources that only offer audio content.
- (4) The switcher shall have one HDMI video output
- (5) Connection from the switcher to the display device shall be provided with one HDMI to HDMI video cable.
- (6) An onboard audio amplifier shall provide gain / volume adjustment from -10db to +10db, adjustable in 1 db steps. The speaker amplifier shall have two (2) channels, one (1) stereo (default) or dual (2) mono channels via one (1) 5.0 mm 4 pole captive screw connector. The output of the amplifier shall be 25 watts (rms) per channel at 4/8 ohms.
- (7) In addition to the stereo / mono speaker output, an additional audio output that will produce line level output shall also be available. This line level audio output must be capable for being set at either "fixed" or "variable" and with Balanced or Unbalanced settings.

3. Media Source Control:

a. Classroom media sources shall be controlled with a MediaLink Controller.

- (1) The MediaLink Controller shall contain six tri-color, multi-status LEDs push-buttons for device selection and projector on / off control. A rotary volume control knob with five (5) LED volume indicators shall permit system volume level control.
- (2) The MLC Controller shall feature Extron IP Link Ethernet for monitoring, scheduling and control. This IP technology shall enable the device to be controlled, scheduled and monitored over a LAN, WAN or the Internet using Extron Global Viewer or MLC controller software.
- (3) The Controller shall contain a serial host port which shall consist of one (1) bi-directional RS-232 front panel 2.5mm mini stereo jack. This host connection port shall be for configuration and control of the controller itself and to install device drivers for the equipment to be controlled.

- (4) The Controller shall also feature (2) bi-directional serial ports to provide device control. These two ports shall control the display device and PVS AV Switcher respectively via bi-directional RS-232 control via one (1) 3.5mm direct insertion captive screw connector.
- (5) The MLC Controller shall also have two (2) configurable (via software) digital input / outputs for devices such as sensors, switches, LEDs and relays via one (1) 3.5mm 4-pole direct insertion captive screw connector.
- (6) Connection from the MLC Controller to the display shall be provided by one (1) 50' Projector control cable.
- (7) Connection from the MLC Controller to the PVS AV Switcher shall be provided by one (1) 50' Switcher Control cable.

4. Audio & Speech Reinforcement:

- a. Speakers - In suspended ceiling applications, one (1) pair of Extron FF120 speakers are used.
  - (1) These speakers feature a low profile, 3.25" deep, aluminized composite enclosure, rectangular shape with a metal grille.
  - (2) The coverage angle of the speaker offers an extraordinarily wide dispersion area of 170 degrees, providing a very wide room coverage pattern.
  - (3) Meeting the regulatory compliance safety specifications of NFPA90A, NFPA70; UL Listed for use in plenum airspaces: meets UL 2043 for heat and smoke release, meets UL 1480 for commercial and professional audio
  - (4) The speakers feature a frequency response of 68 Hz to 18 kHz – 10 db, half space.
  - (5) The power capacity is 16 watts of continuous pink noise or 32 watts of continuous program media.
  - (6) The nominal impedance is 8 ohms.
  - (7) The input connector uses (1) 5mm captive screw for 1 input
  - (8) Connection from the PVS AV switcher to the FF120 speaker is provided by Plenum rated 18 Gauge Speaker Cable Extron SPK-18.
- b. VoiceLift Wireless IR Microphone:
  - (1) The integrated wireless microphone is lightweight and designed to be worn around the neck with a lanyard or clipped on the belt or lapel. The instructor's voice is picked up by the microphone and transmitted wirelessly to the receiver mounted on the ceiling near the center of the room or on an unobstructed wall. The signal is then passed to the line level aux mix input of the amplifier. This is used to amplify the sound level in the classroom up to approximately 15 dB above ambient room noise.
  - (2) Speech is mixed with the program audio and distributed out of the two (2) each speakers for even room coverage. Each microphone shall have volume control, a power switch and an auxiliary input to use for a MP3 player or other audio source. The IR microphone system can operate on two IR frequencies.
  - (3) The microphone will have an instant alert feature that may be configured to allow the instructor to request assistance in the classroom.
- c. VoiceLift Wireless IR Receiver

- (1) The receiver has a round base with dome shaped translucent cover. This allows for surface mounting on the ceiling and concealed wiring above the ceiling using plenum rated cables run to the dedicated VoiceLift Receiver input of the PVS AV Switcher.
- (2) This device acts as the receiver of up to two room microphones and transmits their audio signal to the PVS AV Switcher for mix into the program content of presented material. The receiver has a contact closure that when wired and configured to the digital input of the MLC, can trigger instant alert messages to a designated text or email account.

d. VoiceLift Wireless IR Microphone Charging Station

- (1) This device is constructed of high impact ABS plastic and acts as a holding and charging station of up to two of the Extron VoiceLift wireless IR microphones. It ships with its own power supply that acts as a recharging station for the two microphones.

5. Media Source Interfacing:

The media source equipment shall be connected to the audiovisual system via one to two (1–2) Active (powered) dual input, switching wall plates. These wall plates shall enable the system to display video, graphic data and audio from Laptop computers, tablets, Blu-ray plates, document cameras, streaming devices, tuners, etc.

These active interface transmitters shall be placed in convenient locations throughout the classroom to facilitate easy connection of sources.

- a. One to two (1-2) PVT SW HDMI D, Dual HDMI Input Wallplate shall be used to connect two HDMI devices to the system and transmit the video and audio data from either source to the PVS AV switcher.
  - (1) Active Twisted Pair Transmitter shall transmit high resolution digital video and audio over shielded UTP cable to the PVS AV Switcher
  - (2) Wallplate shall offer two (2) female HDMI connectors for interfacing with video source devices
  - (3) Wall plate shall fit in a standard, 2-gang electrical box and feature Decora<sup>®</sup> type faceplates.
  - (4) One (1) stereo audio input on 3.5mm mini stereo jack shall be available for each video input
  - (5) The output of the interface shall be via one (1) female RJ-45 connector
  - (6) Connection to the PVS AV Switcher shall be via one (1) UL plenum rated shielded UTP cable.
- b. One to two (1-2) PVT SW HDMI RGB D, HDMI and VGA Input Wallplate shall be used to connect HDMI and VGA devices to the system and transmit the video and audio data from either source to the PVS AV switcher.
  - (1) Active Twisted Pair Transmitter shall transmit high resolution digital video and audio over shielded UTP cable to the PVS AV Switcher
  - (2) Wallplate shall offer one (1) female HDMI and one (1) female 15-pin HD connector for interfacing with video source devices
  - (3) Wall plate shall fit in a standard, 2-gang electrical box and feature Decora<sup>®</sup> type faceplates .

- (4) One (1) stereo audio input on 3.5mm mini stereo jack shall be available for each video input
- (5) Built-in VGA distribution amplifier output for local monitor shall be provide on one (1) female 15-pin HD connector
- (6) The output of the interface shall be via one (1) female RJ-45 connector
- (7) Connection to the PVS AV Switcher shall be via one (1) UL plenum rated shielded UTP cable.

#### 6. Data Connectivity

The audio video system shall incorporate features that expand access and connectivity to an existing data network

- a. The PVS Switcher shall incorporate a three port network switch, allowing a single network drop to provide connectivity for the switcher, the MediaLink controller, and one additional device.
- b. The audio video system shall include a IP Link enabled MediaLink controller, also connected to the network switch in the PVS Switcher, allowing remote monitoring, scheduling and control of the system over a network.

#### 7. Energy Efficiency

The audio video system shall incorporate energy conservation features to reduce consumption and lower operating costs.

- a. The system shall incorporate an Auto Power Save Mode with fast power-up that automatically deactivates the audio amplifier after 30 minutes of inactivity. It quickly returns to full power status in less than one second upon signal detection
- b. The system shall incorporate a Standby Mode that allows the amplifier and twisted pair transmitters to be deactivated when not in use.
- c. The system shall incorporate monitoring and scheduling of system peripherals, such as sources and displays, in order to deactivate them when not in use or alert to unauthorized use.

### 3 PART 3 - EXECUTION

#### 3.1 GENERAL

- A. All equipment and enclosures described in this specification shall be installed plumb and square per manufacturer's instructions.
- B. All equipment, except that designated as movable, portable or loose equipment, shall be secured and permanently attached to the permanent structure in a manner which will require the use of a tool (e.g.: screw driver, nut driver, etc.) for removal.
- C. All supports shall meet or exceed the load requirements of the intended application with a minimum safety factor of five.
- D. Provide support structure and hardware with a SAE Grade 8 load rating (min.).

#### 3.2 ACCEPTABLE MANUFACTURERS - SYSTEMS

- A. Manufacturer

Extron Electronics  
1230 South Lewis Street  
Anaheim, Ca 92805  
714.491.1500 or 800.633.9876

B. System

Wall Vault system with minimum of 3 inputs.

C. Substitutions: Exceptions to the specifications are not acceptable. No substitutions are permitted.

D. All equipment part numbers shall be listed in the bill of materials and the system drawings specifications.

3.3 EXAMINATION

A. Site Verification of Conditions: Verify that related conditions, including equipment that has been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

B. All devices connected to equipment specified in this section shall bear the UL label and comply with the applicable National Electrical Code (NEC) standards.

3.4 INSTALLATION

A. Integrator shall furnish all equipment, labor, system setup, and other services necessary for the proper installation of the products/system as indicated on the drawings and specified herein. System setup information shall include each components proper mounting and alignment and properly verified signal pathways and operation. Proper operational and network support control functions shall be verified.

B. Install in accordance with manufacturer's handling and installation instructions.

C. Install in accordance with all local and pertaining codes and regulations

D. Utilize an Integrator with demonstrated experience in projects of similar size and complexity.

E. Equipment shall be configured and in ready to use condition at the end of installation.

F. Energize and commission equipment in accordance with manufacturer's instructions. Commissioning the system shall at minimum, consist of the following:

Install Global Configurator software on PC

Download from [www.extron.com](http://www.extron.com), or install from Extron Software Products CD

Make the following MLC cable connections

Power

Local Area Network (LAN)

Classroom Source Devices

Configure MLC 104 IP Plus Series using Global Configurator

Download device drivers for all source and projection devices

Create a new Global Configurator project file



Add a device and set its IP address

Define the location of the new Media Link Controller device

Save the new Global Configurator file

Configure e-mail server

Configure e-mail messages

Configure contacts

Assign serial device drivers

Assign IR drivers

Configure the front panel (All buttons are required to have a function assigned: source or control)

Configure associated control modules

Create a shutdown schedule

Create a lamp hour notification

Create a disconnect notice

Build the Global Configurator file

Upload the Global Configurator file

Launch GlobalViewer

Test the MLC's setup for proper control and support of the classroom

Installation of the Extron system is covered in full detail at <http://www.extron.com/training/index.aspx>

### 3.5 PROTECTION AND CLEANING

- A. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
- B. Repair or replace damaged components before Substantial Completion of the project.
- C. Remove temporary tags, coverings, and construction debris from interior and exterior surfaces of the equipment. Remove construction debris from equipment area and dispose of properly.

END OF SECTION