

# Perris Union High School District

Information Technology Services



## MASTER SPECIFICATION FOR DATA CABLING INFRASTRUCTURE

*Prepared By:*

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SECTION 27 10 00

STRUCTURED CABLING SYSTEM

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. The work under this section includes all final design, material, equipment, supplies, labor, testing, and accessories required to furnish and install a complete Structured Cabling System (SCS) as indicated on the drawings and as specified herein. These systems shall be defined as all cables, equipment, products, etc, as indicated on the drawings, and mentioned in these specifications.
- B. It is the intent of the Drawings and Specifications, which are presented in a "design-build" format, for the Contractor to design, provide and install a complete, fully operational, and tested system.
- C. All miscellaneous system components including, but not limited to, cables, cable supports, termination equipment, punch blocks, patch panels, patch cords, device outlets, ladder runway, backboards, equipment racks, equipment cabinets, enclosures, terminal cabinets, equipment grounding, and any other related items shall be furnished and installed complete under this section, such that the system shall perform all functions listed herein in compliance with all of the specified requirements.
- D. Schedule is paramount to the project's success. With this, the SCS Contractor will have to be a team player, continually working with the team to facilitate expeditious design, procurement, and construction processes.
- E. This project will be performed in a phased construction format. Each phase of construction will be completely installed, labeled and tested, to the greatest extent physically possible, before moving to the next phase.
- F. It is a mandatory requirement that a single Contractor perform the work described in the following specification sections:
  - 1. Section 27 10 00 Structured Cabling System

1.2 RELATED WORK, STANDARDS, DOCUMENTS AND PUBLICATIONS

- A. Each agency's relative codes, standards, and recommended practices apply to the voice/data cabling systems and their components as specified herein:
  - 1. American National Standards Institute (ANSI)

- a. ANSI T1.404 Network and customer installation interfaces – DS3 and metallic interface specification
2. Building Industry Consulting Service International (BICSI)
  - a. Telecommunications Distribution Methods Manual (TDMM) – latest edition.
  - b. Customer Owned Outside Plant Design Manual (CO-OSP) – latest edition.
3. Federal Communications Commission (FCC)
  - a. FCC Part 68 Rule
4. American Society for Testing and Materials (ASTM)
  - a. E814-02 Standard Test Method for Fire Tests of Through-Penetration Fire Stops
5. International Electrotechnical Commission (IEC)
  - a. IEC 61935-01 Generic Cabling Systems - Specification for the testing of balanced communication cabling in accordance with ISO/IEC 11801 Part 1: Installed Cabling
  - b. IEC 61935-02 Generic Cabling Systems - Specification for the testing of balanced communication cabling in accordance with ISO/IEC 11801 Part 2: Patch Cords and Work Area Cords
6. Institute of Electrical and Electronics Engineers (IEEE)
  - a. IEEE 802 Specification for Local Area Networks, latest edition.
  - b. IEEE 802.3an Specification for 10GBASE-T Ethernet, latest edition.
  - c. ANSI/IEEE C62.41 – Guide on the Surge Environment in Low-Voltage (1000V or less) AC Power Circuits, latest edition.
7. International Organization for Standardization (ISO)
  - a. ISO/IEC 11801 Information Technology – Generic Cabling for Customer Premises, latest edition.
  - b. ISO TR 24750 Technical Report
8. National Fire Protection Association (NFPA)
  - a. ANSI/NFPA-70 National Electric Code – Current version as adopted by AHJ(NEC)
  - b. ANSI/NFPA-75 Standard for the protection of information technology equipment

9. National Electrical Manufacturers Association (NEMA)
10. Occupational Safety and Health Administration (OSHA)
11. Telecommunications Industry Association (TIA)
  - a. Optical Fibers Suitable for Manufacturing OM4 Cabled Optical Fiber.
  - b. TIA-526-7 Optical Power Loss of Installed Single-Mode Fiber Cable Plant.
  - c. TIA-526-14-B Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant; IEC 61280-4-1 Edition 2, Fiber-Optic Communications Subsystem Test Procedure- Part 4-1: Installed Cable Plant- Multimode Attenuation Measurement.
  - d. TIA-568-C.0 Telecommunications Cabling for Customer Premises, latest edition.
  - e. TIA-568-C.1 Commercial Building Telecommunications Cabling Standard
  - f. TIA-568-C.2 Twisted-Pair Telecommunications Cabling and Components Standard, latest edition.
  - g. TIA-568-C.3 Optical Fiber Cabling Components Standard, latest edition.
  - h. TIA-568-C.4 Broadband Coaxial Cabling and Components Standard
  - i. TIA-569-C Telecommunications Pathways and Spaces, latest edition.
  - j. TIA-598-C Optical Fiber Cable Color Coding.
  - k. TIA-606-B Administration Standard for Commercial Telecommunications Infrastructure, latest edition.
  - l. TIA-607 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, latest edition.
  - m. TIA-758-B Customer Owned Outside Plant Telecommunications Infrastructure Standard, latest edition.
  - n. TIA-862-A Building Automation Systems Cabling Standard, latest edition.
  - o. TIA-942-A Telecommunications Infrastructure Standard for Data Centers
  - p. TIA-1152 Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling, latest edition.
12. Underwriters Laboratories Standards (UL)
  - a. UL 5 Surface Metal Raceways and Fittings, latest edition.

- b. UL 5A Nonmetallic Surface Raceways and Fittings, latest edition.
  - c. UL 5B Strut-Type Channel Raceways and Fittings, latest edition.
  - d. UL 5C Surface Raceways and Fittings for Use with Data, Signal, and Control Circuits, latest edition.
  - e. UL 514A Metallic Outlet Boxes, latest edition.
  - f. UL 514B Conduit, Tubing, and Cable Fittings, latest edition.
  - g. UL 514C Nonmetallic Outlet Boxes, Flush-Device Boxes, Covers, latest edition.
  - h. UL 514D Cover Plates for Flush-Mounted Wiring Devices, latest edition.
  - i. UL 1685 Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables, latest edition.
  - j. UL 1863 Communications-Circuit Accessories, latest edition.
- 13. Intetek Testing Services ETL SEMKO (ETL)
  - 14. Perris Union High School District, Master Standards for Data Cabling Infrastructure, latest edition.
- B. The Contractor shall be responsible for obtaining and utilizing the latest Structured Cabling, Architectural, Security and Electrical plans.

### 1.3 GENERAL REQUIREMENTS

- A. Manufacturer: The term “manufacturer” shall be defined as the company, or group of companies, that actually produces the products meeting the requirements of Section 2 of this document. The manufacturer shall have a minimum of seven (7) year’s experience in manufacturing products of this type and shall be ISO 9001 Certified. The products, summarized in this specification, shall be supplied by a single manufacturer, with the exception of:
  - 1. Data racks and other hardware that is not defined as part of the copper cable channel test configuration by TIA-568-C.
  - 2. Fiber Optic Cable and Outside plant (OSP) fiber optic cable.
  - 3. Channel solutions consisting of cabling and connectivity hardware independently tested as by UL or ETL and that are listed Section 2 of this document.
  - 4. Cables manufactured by another manufacturer specifically called out on the drawings.
- B. Contractor: The term “Contractor” shall be defined as the company, or group of companies, that actually provides the products per Section 2 and installs the products per Section 3 of this

document. The Contractor selected to provide the installation of this system shall be certified by the manufacturer in all aspects of design, installation and testing of the products described herein.

1. The Contractor shall hold a valid State of California C-7 Low-Voltage license, shall have completed at least ten (10) projects of equal scope, shall have been in business of furnishing and installing systems of this scope and magnitude for at least the past five (5) consecutive years, and capable of being bonded to assure the District's Project Manager of performance and satisfactory service during the guarantee period.
2. The Contractor shall have a minimum of one (1) Registered Communications Distribution Designer (BICSI RCDD) and a minimum of two (2) BICSI Technician level installers on staff as full time employees.
3. All work shall be performed under the supervision of a company accredited and trained by the manufacturer and such accreditation must be presented with the bid submittal. Contractor must be accredited a minimum of 180 days prior to bid submittal date.
4. The Contractor shall be a manufacturer's Authorized Installer and Warranty Station for the equipment offered and shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment.
5. All personnel performing work on this project must have successfully completed the manufacturer's training course prior to performance of any work on this project. Accreditation will consist of individual employee certifications issued by the manufacturer. All personnel engaged in the testing of fiber optic and category-6 metallic premise horizontal and distribution systems must have successfully completed the test equipment manufacturer's training. Certification of such training must be presented with the bid submittal.
6. The Contractor selected for this Project shall adhere to the engineering, installation and testing procedures and utilize the authorized manufacturer components and distribution channels in provisioning this Project.
7. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of fiber optic cable, and Category 6 metallic premise horizontal and distribution systems, and have personnel who are manufacturer trained in the use of such testing tools and equipment.
8. The Contractor shall hold all other licenses required by the legally constituted authorities having jurisdiction (AHJ) over the work.
9. The Contractor shall maintain and provide appropriate liability and worker's compensation insurance coverage.
10. For additional Contractor requirements, see Section 1.06.A.1 (b) of this document in its entirety.

#### 1.4 QUALITY ASSURANCE

- A. It is the intent of these specifications to establish an installation standard of quality for labor and materials. For any proposed product substitution or when the Contractor intends to include an “or equal” product in the bid pricing, the Contractor shall provide a “Substitution/Or-Equal Request” submittal to the District’s Project Manager for review no later than fifteen (15) calendar days prior to Bid submittal. This report shall include *all* of the following items:
  1. Description of how the proposed product(s) will impact meeting the project completion date, indicate all item(s) with lead times and expected delivery date(s).
  2. Itemized cost comparisons between the proposed product(s) and the listed product(s).
  3. Detailed technical analysis of the electrical and mechanical specification differences between the proposed product(s) and the listed product(s).
  4. ETL “Verified” or UL “Verified” test lab documentation for the proposed product(s) and assemblies proposed.
  5. Proposed product identification, manufacturer literature (specifications and cut sheets).
  6. Name, address and contact information of several similar projects where the substituted product(s) have been used.
  7. Name, address and contact information of the proposed product(s) manufacturer’s local representative.
  8. Sample proposed product(s) manufacturer’s lifetime component and application warranty. Detailed warranty requirements are described in Section 1.10 General System Product Warranty of this document.
- B. Failure to provide *all* items listed in Section 1.4.A.1 through 8 for review by the District’s Design Team shall result in rejection of the substitution/or-equal request.
- C. The District’s Design Team/Project Manager must approve any proposed product(s) substitution/or-equal item in writing. The District’s Design Team/Project Manager reserves the right to require a complete sample of any proposed product(s) and may request a sample tested by an independent testing consultant to prove equality. The decision of the District’s Design Team/Project Manager regarding equality of proposed product(s) items will be final.
- D. If a proposed product(s) is given final acceptance by the District’s Project Manager, the Contractor shall reimburse the District’s Design Team/Project Manager for the costs to review the proposed product(s) substitution(s), and for any additional engineering charges, and shall pay all charges of other trades resulting from this products use, at no cost to the District.

#### 1.5 GENERAL SUBMITTAL REQUIREMENT

- A. Submittals shall be presented and formatted per the guidelines in the Division 1 section of this bid package.
- B. All cut sheets shall represent the latest version, part number, and revision of the product. Where multiple products or part numbers appear on a page, a bold arrow or circle shall indicate which product or part numbers are to be used as part of the installation. The submittal shall include all descriptive pages associated with the product, not just the page showing the part number. Contractor submittal shall include a materials list. Cut sheets shall be numbered by and match page numbers of each item included on the material list.

#### 1.6 PRE INSTALLATION SUBMITTAL REQUIREMENTS

- A. Within fifteen (15) calendar days after the date of award of the Contract, the Contractor shall submit the following:
  - 1. Submittal Binder: Submit one (1) hard copy and one (1) electronic copy (on compact disk) of the complete Submittal Binder to the Project Engineer for review. The binder shall consist of five (5) major sections with each section separated by Index Tabs. Each page in the binder shall be numbered sequentially and shall be summarized in the Index.
    - a. The FIRST section shall include the following items:
      - 1) The TITLE SHEET which shall include the Submittal Date, Project Title and Address, Contractor's Name and contact information, and name of the District.
      - 2) The INDEX sheet which shall list each item included in the binder along with the page number where it may be found.
    - b. The SECOND section shall include the following items:
      - 1) CONTRACTOR'S LICENSE: A copy of the low voltage Contractor's valid State of California C-7 Low-Voltage license.
      - 2) PROOF OF EXPERIENCE: Proof (written documentation) that the low voltage Contractor has been regularly engaged in the business of low voltage contracting consisting of, but not limited to, engineering, fabrication, installation, and servicing of communication systems of the type specified herein for at least the past five (5) consecutive years.
      - 3) PENDING LITIGATION: Provide a statement summarizing any pending litigation involving any officer or principal of/or the company, the nature of the litigation and what effect the litigation may carry as it relates to this work in the worst-case scenario. Non-disclosure of this item, if later discovered, may result, at the District's discretion, in the Contractor bearing all costs and any cost related to the associated delays in the progress of the work.



- 4) **INSURANCE CERTIFICATES:** Copy of low voltage Contractor's current liability insurance, workers compensation, and state industrial insurance certificates in conformance with the contract documents.
- 5) **PROJECT LIST:** A List containing at least ten (10) California installations completed within the last five (5) years by the low voltage Contractor that are comparable in scope and nature to that specified in the contract document. Provide up to date contact information for each project listed including contact name, title, email address and phone number.
- 6) **SERVICE CAPABILITY:** Documentation indicating in detail that the low voltage Contractor has competent engineering, installation, service personnel and facilities with reasonable stock of service parts within 75 air miles of the job site. Do not submit a sales brochure as documentation.
- 7) **AUTHORIZATION LETTERS:** Letters from the low voltage equipment manufacturer stating that the low voltage bidding Contractor is a Factory Authorized Distributor/Installer, and is trained and certified for the equipment he proposes to use on this project, and is licensed to purchase and install software required to provide the specified functions.
- 8) **CERTIFICATION:** Copy of the following current BICSI certifications. Provide proof that the certificate holders are full time employees of the low voltage Contractor's local facility servicing this project and will be actively involved on site for the duration of this project.
  - a) **BICSI RCDD,** minimum of (1). Mandatory requirement: Shall be on site a minimum of one (1) day per workweek.
  - b) **BICSI TECHNICIAN,** minimum of (1). Mandatory requirement: Shall be on site a minimum of five (5) full 8-hour days per workweek.
- 9) **PROOF OF TRAINED PERSONNEL:** Documentation that the Contractor has full time on-staff personnel, manufacturer trained and BICSI certified, for the equipment proposed for this project, and on-staff manufacturer trained and certified by the Test Equipment manufacturer in the proper use of the test equipment required on this project. Provide copies of all manufacturers' training/certification documentation, and Test Equipment manufacturer's training/certification documentation. Provide a statement that personnel meeting these qualifications are in the local facility, and will be maintained at that facility throughout the project and the warranty period.
- 10) **DOJ FINGERPRINTING:** A fingerprint check must be provided for all personnel working on school sites, performed by the Department of Justice, pursuant to California Education Code Section 45125.1. Fingerprinting shall be performed prior to start of project. All costs associated with DOJ fingerprinting/background checks shall be the full responsibility of the Contractor.

- c. The THIRD section shall contain a detailed bill of materials including the quantity, product Manufacturer, product part number, product description, and corresponding specification section number or drawing sheet number where that product is referenced. Also listed in the Contractor's bill of materials shall be each item of test equipment to be used to test the optical fiber, copper and coax components. Include all patch cords and other specialized components. See example format below:

| <b>Description</b>    | <b>Part #</b>     | <b>Quantity</b> | <b>UoM</b> | <b>Spec</b> | <b>Test Equip.</b> |
|-----------------------|-------------------|-----------------|------------|-------------|--------------------|
| CAT6<br>Station cable | BerkTek<br>#12345 | 100<br>boxes    | 1000ft/box | 2.03        | Fluke<br>DTX-1800  |

This information may be used by the District to evaluate the Contractor's general understanding of the project scope during the bid evaluation. Errors or omissions from this bill of material do not relieve the Contractor from providing all material, components, labor, etc., as outlined in this specification and on the drawings to provide a complete and useable structured cabling system.

- d. The FOURTH section shall contain original manufacturer cut sheets for all of the materials that meet the requirements listed in Section 2 of this specification and all materials described on the construction drawings. Also include manufacturer's cut sheets for all testing equipment to be used for completion of the project. All pages shall be numbered sequentially corresponding to the bill of materials. On each cut-sheet, provide an indicating arrow next to each part number of proposed material.
- e. The FIFTH section shall contain a designation schedule for each system component location and complete full size 30" x 48" (unless otherwise specified) bond drawings (shop drawings), showing system wiring plans. The professionally drafted drawings shall be generated on AutoDesk AutoCAD 2010 (or later) computer design software. These drawings shall also include:
- 1) MDF and IDF Diagrams - Including:
    - a) Cable routing
    - b) Position of all devices, components and apparatus
    - c) Detailed elevation layout of the wallfield(s)
    - d) Labeling plan (see District labeling requirements)
  - 2) Site Plan – Including:
    - a) Conduit routing of all site conduits including size and quantity

- b) Building designations
    - c) MDF and IDF locations
    - d) Campus cabling and conduit between MDF and IDF racks including cable type and quantity
  - 3) Work Area Floor Plans - Including:
    - a) Detailed cable routes including cable type and quantity
    - b) Device locations and quantities with labeling
    - c) Work area labeling plan (see District labeling requirements)
  - 4) Cross Connect Documentation - Including:
    - a) Cross-connect records for all voice and data devices
    - b) Cross-connect records may be in either Excel or Word format
  - 5) Riser Distribution Plan
  - 6) Rack elevations of all MDF and IDF equipment
  - 7) ¼-inch scale floor plans of all data rooms (MDF, IDF, MPOE, etc.)
    - a) Identify all equipment racks, cabinets, terminals, cross connect locations, ground bus bar, and all other components in room(s).
  - 8) Cable Tray, Conduit, and Raceway Plans (if applicable)
    - a) Provide ¼-inch scale ladder runway plan for all data rooms.
    - b) Provide scaled plans for all in-building conduit and raceway.
- B. Failure to comply with any of the requirements listed above may result in the rejection of the entire submittal package.

## 1.7 PROJECT DIRECTION

- A. Single Point of Contact: Contractor shall provide an English-proficient, single point of contact, i.e., Project Manager, to speak for the Contractor and shall provide the following functions:
- 1. Initiate and coordinate tasks with District's Project Manager, and others as specified by District's Project Manager.
  - 2. Provide day-to-day direction and on-site supervision of Contractor personnel.

3. Shall be readily available to the District / District's Project Manager 24 hours a day / 7 days a week throughout the duration of the Project.
4. Shall have full time cellular phone capability, and the ability to send/receive email correspondence, accessible by the District's Project Manager.
5. Ensure conformance with all Contract provisions.
6. Participate in weekly site project meetings and construction meetings.
7. Provide detailed and written weekly status reports to District's Project Manager. The content shall be substantive enough to bring about a full understanding of all situations current and situations future. Weekly reports shall include but are not limited to detailed progress report, RFI status log (Request for Information), Change Order Log (pending and approved), Project Addendum log, and a two-week look ahead work calendar. Each of the above must show assigned responsibilities and event history. Weekly reports shall include milestone information, resource updates (staff and materials), and any conditions or incidents that may impact the Project Schedule.
8. This individual shall remain as Project Manager for the duration of the project. The Contractor may change Project Managers only with the District's Project Manager's written approval.

#### 1.8 PLANNING

- A. Planning meetings and schedule: Within fifteen (15) calendar days after the date of award of the Contract, an initial planning meeting will be held with the successful bidder to clarify all requirements (systems, services, distribution methods, etc.), identify responsibilities, and schedule the events that will transpire during the implementation of the project. Within seven (7) calendar days of this initial meeting, the Contractor shall provide a written report and project schedule to clearly document the events and responsibilities associated with the project. Contractor's project schedule shall conform to the overall Project Construction Schedule issued by the Construction Management Company or the District. Contractor is required to attend all planning and other construction meetings as requested by the District, Architect, or Engineer.

#### 1.9 POST INSTALLATION SUBMITTAL REQUIREMENTS

- A. Within fifteen (15) calendar days after the completion of work, the Contractor shall submit the following:
  1. Record Documentation:
    - a. Final Test Results – Test results for each cable indicating tests performed, results obtained and values measured. Test results shall be provided in electronic format with the associated application (if required) for viewing. Contractor shall provide individual test results for each cable tested, and a summary sheet listing all cables,

test summary, lengths, and the total cable count. Provide test reports for all copper cables and fiber optic cables. Testing shall be conducted in accordance with Section 3.06 of this document.

- b. As-Built records – Contractor shall create and provide all backgrounds and floor plans in AutoCAD or Revit file format. Sheet borders shall be either provided by, or approved by, the Architect. Contractor's as-built records shall include all of the items described and listed in section 1.6.A.1.e of this document.
- B. After as-built submittal is approved by District, the Contractor shall provide two (2) sets of CDs containing all post-installation submittals and close out documentation in AutoCAD (or Revit) format; and in PDF, Word, or Excel formats as required elsewhere in this document.
- C. As-Built Documentation Display in Each MDF and IDF: Within fifteen (15) days after the completion of work, the Contractor shall install a complete Contractor-provided, professionally drafted as-built floor plan in color in each MDF and IDF mounting frame. Each floor plan, generated on AutoDesk AutoCAD computer design software and printed in color, shall depict all jack locations in each modular furniture cubicle and all other areas. Also depicted shall be speaker, clock, wireless access point, terminal cabinets, MDF, IDF, pull boxes, vaults, CCTV cameras, television jack locations, or any other communications outlet cables by the SCS Contractor. All jack locations shall be color coordinated with the District's labeling scheme as described elsewhere in this specification. Contractor's device symbols shall match the device symbols utilized on the bid documents. The Contractor will provide to District two (2) sets of CDs containing all as-built records in AutoCAD (.dwg) or Revit (.rvt) format, and full size PDF format.
- D. Warranty Documentation:
  - 1. Contractor shall apply for all Manufacturers' Extended Warranties on behalf of the District. Contractor shall present to District all product Warranty documents per General System Product Warranty Section of this document. Warranty shall commence after final acceptance of System and Project Close Out by the District.

#### 1.10 GENERAL SYSTEM PRODUCT WARRANTY

- A. The horizontal communications cabling system installed shall be eligible for coverage by a Limited Lifetime Warranty to the District.
  - 1. Horizontal channels shall be completed with Leviton Network Solutions factory-terminated copper and/or fiber optic patch cords in order to be eligible for the applicable Berk-Tek or Leviton Warranty with Channel Performance guarantees.
  - 2. Approved product shall be listed on the most recent version of the applicable Berk-Tek Leviton Technologies data sheets for each Berk-Tek Leviton Technologies solution.
- B. Optimized Installer/Optimized Integrator shall provide labor, materials, and documentation in accordance with Berk-Tek and Leviton Network Solutions requirements necessary to ensure that the District will be furnished with a Limited Lifetime Warranty.

- C. The installed structured cabling system shall provide a warranty guaranteeing installed channel performance above the ANSI/TIA 568-C requirements for Category 5e, Category 6, and/or Category 6A cabling systems or ISO 11801 requirements for Class D, Class E, and/or Class Ea. Standards-compliant channel performance tests shall be performed in the field with a Berk-Tek Leviton Technologies approved certification tester in the appropriate channel test configuration. See 1.10. A.1 above for channel requirements.
- D. Necessary documentation for warranty registration shall be provided to the manufacturer by the installer within 10 days following 100 percent testing of cables. Contractor shall submit test results to Leviton Network Solutions or to Berk-Tek, in the certification test analyzer's original software files. Installer shall ensure that the warranty registration is properly submitted, with all required documentation within ten (10) days of project completion. Optimized Installer / Optimized Integrator must adhere to the terms and conditions of the respective manufacturer's warranty programs.
- E. Installer shall ensure that the District receives the manufacturer issued project warranty certificate within sixty (60) calendar days of warranty registration.
- F. The first usage date shall be agreed to be in writing by the District and Contractor within five (5) working days of first usage. During this time, the entire system must be kept in proper operating condition at no additional cost to the District.
- G. Cable Manufacturer "site certifications" are prohibited.

#### 1.11 GENERAL ENGINEERING AND DESIGN GUIDELINES

##### A. Cabling System Installation Practices

- 1. Plastic cable tie (tie wrap) devices shall *not* be utilized at any time. Only Velcro-type hook-and-loop strap devices are permitted. In the MDF and IDF rooms, all vertically run cables and conductors shall be secured with Velcro at a maximum interval of eighteen (18) inches, and all horizontally run cables and conductors shall be secured with Velcro at a maximum interval of eighteen (18) inches.
- 2. In the MDF and IDF rooms, all vertically run innerduct shall be secured with Velcro at a maximum interval of eighteen (18) inch intervals. Innerduct installed on ladder runway shall be supported horizontally and vertically at a maximum of eighteen (18) inch intervals.
- 3. All horizontally run innerduct shall be secured with Velcro at a maximum interval of forty-eight (48) inches when installed horizontal above accessible ceiling spaces or open ceiling spaces.
- 4. All cables installed above accessible ceiling spaces shall be independently supported.
- 5. All pull ropes are to be installed and/or replaced in all pathways for future use.

6. All intra-building cabling shall be routed either parallel or at right angles to the building structure and/or walls.
7. No cabling is to be pulled through electrical Condulet bodies (L-bend) devices. If Condulet devices are pre-existing and it is determined, at the review of the District's representative, that sufficient space in the conduit is available and the District provides written approval to utilize the Condulet, the Contractor shall remove the Condulet cap, pull the cable to and beyond the cap then carefully reinstall the cap.
8. Communications cabling shall never be tied or attached to the exterior of electrical conduits, power cables or devices, lighting systems, or co-exist inside any pathway with power cabling.
9. Any visible damage to a cable such as kinks or bends in violation of the minimum bend radius shall render the cable segment defective and shall be removed and replaced by the Contractor at no additional cost to the District.
10. All materials shall be new, unused, and delivered to job site in original manufacturer or distributor cartons or packages. No previously installed material shall be used at any time.
11. Reference Part 3 of this document for additional installation guidelines and requirements.

#### 1.12 SPECIFIC SYSTEM REQUIREMENTS

##### A. Backbone Infrastructure Cabling

1. Backbone Fiber Optic Cabling
  - a. Contractor shall provide (1) 12-strand 50/125 micron multimode OM4 fiber optic cable and (1) 6-strand single mode OS2 fiber optic cable for backbone connectivity between the Main Distribution Frame (MDF) location and each Intermediate Distribution Frame (IDF) location, where indicated on the plan drawings. Cable may be composite (MM/SM) type utilizing one overall sheath.
  - b. At the MDF, provide a 20-foot slack loop neatly coiled and secured. At each IDF, provide a 10-foot slack loop neatly coiled and secured.
  - c. Splicing of fiber optic cable shall not be permitted unless specifically called out on the bid documents and authorized in writing by the District's engineer.
  - d. All exposed fiber optic cable shall be enclosed in innerduct. Innerduct is not required within inter-building conduits.
  - e. Provide 2-meter LC to LC duplex 50 micron fiber optic patch cords at each MDF and IDF. A minimum of two (2) per 6-strands of fiber optic cable installed.

- f. Refer to Part 2 of this document for fiber optic cable specifications.

## 2. Backbone Multipair Copper Cabling

- a. Contractor shall provide (1) 25-pair category-5E multipair cable for backbone connectivity between the local telephone company's minimum point of entry (MPOE) demarcation point and each building on campus, where indicated on the plan drawings.
- b. Provide a 10-foot slack loop neatly coiled and secured at both ends of the cable.
- c. Splicing of multipair copper backbone cable shall not be permitted unless specifically called out on the bid documents.
- d. The multipair backbone cable shall be outdoor-rated and installed in conduit.
- e. Provide building entrance protectors at both ends of the backbone multipair cable. Terminate all pairs on the protectors and properly bond the protectors to ground. Refer to section 2.12 PROTECTORS in this document for additional requirements.
- f. Contractor shall label backbone cable sheath with a machine generated weatherproof label identifying the cable number, system type (Tele) total pair count, and origination/destination locations. Refer to Labeling Requirements section of this document for additional labeling requirements.
- g. Refer to Part 2 of this document for multipair copper cable specifications.

## 3. MDF/IDF UTP Termination Equipment

- a. The horizontal cross-connect for data circuits shall consist of Category-6 patch cords from the horizontal Category-6 termination panels to the network equipment within the same or adjacent racks.
- b. The MDF and IDF horizontal data cross-connects shall be contained in 19"x 7' rack(s) or free standing lockable cabinet(s) as described in Part 2 of this document, and as detailed on the bid documents/plan drawings.
- c. Seven foot high 4-post open racks shall be installed with seven foot high vertical wire management on each side. Patch panels shall be 24 or 48 modular jack ports, wired to T568B wiring scheme, and include 1RU (1.75" high) horizontal wire management immediately below each 24 port patch panel, and include 2RU (3.5" high) horizontal wire management immediately below each 48 port patch panel.
- d. Category 6 and category 6A patch cords shall be provided by the Contractor. See Part 2 of this document for additional patch cord requirements.
- e. See Part 2 of this document for category 6 and category 6A copper cable specifications.



## PART 2 – PRODUCTS

### 2.1 STRUCTURED CABLING SYSTEM

- A. Acceptable Manufacturers - all equipment listed herein will be by:
  - 1. SCS components: Leviton, BerkTek.
  - 2. Cabinets, Racks, Ladder tray: Chatsworth, or UL Listed and approved equal.
  - 3. Riser and Outside Plant (OSP) Fiber Optic Cable: BerkTek
  - 4. Riser and OSP Copper Cable: Leviton and Berk-Tek exclusively, or approved equal.
  - 5. Protectors: Circa, Emerson or Marconi.
- B. It is the responsibility of the bidder to insure that the proposed product meets or exceeds every standard set forth in these specifications and the equipment's technical data sheets.
- C. The functions and features specified are vital to the operation of this facility; therefore, inclusion of a component's manufacturer in the list of acceptable manufacturers does not release the Contractor from strict compliance with the requirements of this specification.

### 2.2 OUTLETS

- A. Telecommunications outlets (TO) shall consist of one- or two-gang utility outlet boxes equipped with 8-pin modular (RJ-45) jacks utilizing the T568B wiring scheme and a faceplate. All outlet cabling shall terminate on patch panels at their associated Main Distribution Frame (MDF) room, Intermediate Distribution Frame (IDF) Rooms, or as otherwise indicated on the drawings.
- B. Faceplates
  - 1. All Faceplates shall be available in duplex, quad, or six-plex configuration in a single-gang form.
  - 2. Surface mount boxes shall be available in dual, quad, and six-plex configuration.
  - 3. Modular furniture faceplates shall be available in dual and quad configuration for the District's modular existing and/or new modular furniture. Faceplates shall be flush-mounted in the modular furniture. Surface mounted boxes/faceplates are unacceptable. The Contractor is responsible for coordinating with the District's modular furniture Contractor to determine faceplate requirements. The Contractor shall provide and install all parts/fittings necessary to meet the requirements of this section.
  - 4. Wall mounted phone jack faceplates shall be single gang configuration, constructed of stainless steel and have two standard phone mounting posts located above and below the

jack opening. Wall mounted phone faceplates will consist of 8p8c modular (RJ-45) jacks.

5. Faceplates shall have two (2) designation windows, one located at top and one located at bottom. Designation windows shall be equipped with clear plastic covers.
6. Color of faceplates shall match adjacent electrical faceplate color, unless otherwise noted.
7. Provide blank faceplate inserts for all unused outlet locations within the faceplate.

C. Category 6 Gigabit jacks

1. All voice and data jacks shall be 8-position/8-conductor (8p8c) modular RJ-45 jacks incorporating 110-style rear termination lugs for termination of Category 6 cable, utilize a T568B wiring scheme, and be constructed of high impact thermoplastic housing rated for Category 6 service.
2. All Category 6 jacks shall meet or exceed Category 6 transmission requirements for connecting hardware, as specified in TIA-568-C Commercial Building Telecommunications Cabling Standard.
3. Category 6 jacks shall be channel-rated.
4. Category 6 jacks shall be capable of being in a modular patching situation or as a modular telecommunication outlet (TO) supporting current 10Base-T, Token Ring, 100 Mbps TP-PMD, 155 Mbps ATM, 622 Mbps ATM using parallel transmission schemes and evolving high-speed, high-bandwidth applications, including Ethernet, 1000BASE-T and 1.2 Gbps ATM.
5. Category 6 jack color shall be Grey.
6. The jacks shall accommodate UTP cable and work in concert with non-metallic Wiremold 2300 or 5400 series raceway.
7. Product Specification: Leviton eXtreme Cat 6+ quick port connector, #61110-RG6.

D. Category 6A 10-Gigabit jacks

1. All category 6A jacks shall be 8-position/8-conductor (8p8c) modular RJ-45 jacks incorporating 110-style rear termination lugs for termination of Category 6A cable, T568B wiring type, with a connector body made of high-impact fire-retardant plastic.
2. Category-6A jacks shall be channel-rated.
3. All Category 6A jacks shall meet or exceed TIA-568-C.2 component Cat 6A requirements for connecting hardware from 1MHz to 500MHz, 10Gb/s.
4. Cable entry can be 90-degree or 180-degree orientation.

5. Category 6A jacks shall include a pair separation tower to facilitate required conductor separation.
6. The jacks shall incorporate a Cone of Silence, a metalized body, and a printed circuit board to suppress alien crosstalk.
7. Category 6A jack color shall be Yellow.
8. Category 6A jacks shall be utilized for all wireless access point outlet locations.
9. Category 6A jacks shall only be terminated on Category 6A cables.
10. Product Specification: Leviton eXtreme Cat 6A quick port connector, #6110G-RY6.

## 2.3 STATION CABLE

- A. Station cables shall extend between the station location (TO) and its associated MDF/IDF.
- B. Category 6 station cable:
  1. The Category 6 cable shall consist of 4-pair, 23-AWG bare copper twisted pairs, unshielded, UTP, and shall be of the traditional round design.
  2. The cable jacket shall be rated for the environment in which it is installed. Install CMP cable in plenum-rated spaces, CMR cable in riser-rated spaces, and OSP cable in outdoor and underground conduit spaces.
  3. Color of cable shall be Grey.
  4. Category 6 cable shall be utilized at all voice and data designated outlets.
  5. Product Specification: BerkTek LANmark-6 #10136338 (CMR), BerkTek LANmark-6 #10132983 (CMP)
- C. Category 6A station cable:
  1. The Category 6 augmented (6A) cable shall consist of 4-pair, 23-AWG bare copper twisted pairs with a UTP design.
  2. The cable jacket shall be rated for the environment in which it is installed. Install CMP cable in plenum-rated spaces, CMR cable in riser-rated spaces, and OSP cable in outdoor and underground conduit spaces.
  3. Category 6A cable shall be ETL verified to TIA-568-C.2-10 Category 6A, and support 10GBASE-T IEEE 802.3an standard of 10Gb/s.
  4. Color of cable shall be Yellow.

5. Category 6A cable shall be utilized for all wireless access point outlet locations.
6. Category 6A cable shall only be terminated on Category 6A-rated jacks and patch panels.
7. Product Specification: BerkTek LANmark-10G2 Cat6A #10137706 (CMR), BerkTek LANmark-10G2 Cat6A #10137385 (CMP)

## 2.4 MODULAR PATCH PANEL SYSTEM

- A. The termination block shall support the appropriate emerging high-bandwidth applications, including 1 Gbps Ethernet, potentially 1.2 Gbps ATM and 2.4 Gbps ATM, Multi-Tasked Split Screen Computing, Virtual Holographic Video Conferencing, Instant Access Telemedicine, 3D CAD/CAM Engineering, and Internet-Intranet Communications/ Commerce, as well as all 77 channels (550 MHz) of analog broad band video, including 1000 Mbps Ethernet and potentially 1.2 Gbps ATM, and facilitate cross connection and inter connection using modular patch cords.
- B. All Modular jack panels shall be wired to ANSI/TIA/EIA 568-C using T568B wiring scheme.
- C. The wiring block shall be able to accommodate 23 AWG cable conductors.
- D. The Category 6 modular jack panels shall meet or exceed the Category 6 standards requirements in ISO/IEC 11801 and ANSI/TIA/EIA. They shall also be UL Listed.
- E. Contractor shall provide Category 6 modular patch panels in sufficient quantities to terminate all category 6 cables.
- F. Contractor shall provide Category 6A modular jack panels in sufficient quantities to terminate all category 6A cables.
- G. All patch panels shall have two (2) cable strain relief/management bars (Leviton #49005-CMB or equal) installed at the rear of the panel to support the terminated horizontal cabling.
- H. Contractor shall provide and install a 2RU horizontal wire manager immediately below each 2RU patch panel. Contractor shall provide and install a 1RU horizontal wire manager immediately below each 1RU patch panel. A 1RU space shall be left open immediately below the horizontal wire manager before mounting the next patch panel. This space is reserved for installation of a 1RU network switch to service all ports on the patch panel immediately above the horizontal wire manager.
- I. Product Specification: Leviton, (Cat-6) #69586-U48, (Cat-6A) #6A586-U24.

## 2.5 PATCH/STATION CORDS

- A. Provide Category 6 Modular Patch/Station cords for each assigned port on the patch panel and for each outlet in the station locations. Cords shall be equipped with an 8-pin 8-conductor modular connector on each end and shall conform to the length(s) specified. All cords shall be

wired to T568B wiring scheme. All cords shall be factory-built by the cable manufacturer. Fabrication of cords in the field is prohibited.

- B. All category 6 patch cords shall exceed ANSI/TIA/EIA and ISO/IEC Category 6/Class E specifications. Category 6A patch cords shall exceed ANSI/TIA/EIA and ISO/IEC Category 6A specifications.
- C. At the MDF and each IDF, provide one (1) 3-foot cat-6 patch cord for each cat-6 cable terminated in the patch panels, and provide one (1) 3-foot cat-6A patch cord for each cat-6A cable terminated in the patch panels. At the workstations, provide one (1) 10-foot cat-6 patch cord for each cat-6 cable terminated at a cat-6 outlet. At wireless access point locations, provide one (1) 3-foot cat-6A patch cord. In instances where longer cords are required, the Contractor shall clarify the requirement with the District before installing any longer cords. Where the specifications and the plan drawings conflict, the more stringent requirement will apply.
- D. Category 6 patch cords shall be Grey in color. Category 6A patch cords shall be Yellow in color.
- E. All patch cords shall be channel-rated and include a snagless boot.
- F. Category 6 patch cords shall be UL Verified for ANSI/TIA/EIA 568-C Electrical Performance.
- G. Category 6A patch cords shall be provided at all Category 6A patch panels and outlets.
- H. Product Specification:
  - 1. Leviton Cat 6, #62460-3S (3ft) #62460-10S (10ft), Grey
  - 2. Leviton Cat 6A, #6210G-3Y (3ft), Yellow

## 2.6 FIBER OPTIC CABLING

- A. 12-strand, OM4, multimode, graded-index, laser optimized fibers with 50/125 micron core/cladding diameter.
- B. 6-strand, OS2, single mode fibers with 8.3 micron cores only.
- C. Fiber optic cable shall meet or exceed ANSI/EIA/TIA-492 specifications and ISO/IEC 11801 standards.
- D. All fibers shall be color coded to facilitate individual fiber identification.
- E. Fibers will have dual wavelength capability; transmitting at 850 and 1300nm ranges.
- F. Multimode fiber shall be designed to support 10Gb/s applications up to 550 meters at 850 nm.
- G. Multimode fiber maximum attenuation @ 850/1300 nm: 3.0/1.0 dB/KM.

- H. Single mode fiber maximum attenuation 0.40 dB/km @ 1310 nm: 0.30 dB/km @ 1550 nm.
- I. Multimode EMB bandwidth: 4700 MHz-km @850 nm, and OFL bandwidth: 500 MHz-km @1300 nm
- J. All fiber in a cable run shall be from the same manufacturer and shall be the same type. A mix of fibers from different manufacturers is prohibited.
- K. All fiber optic cable installed inside buildings shall be installed within contractor-provided innerduct. Innerduct shall be rated for the environment in which it is installed. Innerduct shall be orange in color, unless otherwise noted in the bid documents/plan drawings.
- L. Outdoor-rated and installed cables shall be loose tube construction. Indoor-rated and installed cables shall be tight buffered construction.
- M. Loose tube cables shall be gel free and indoor/outdoor rated.
- N. The use of “indoor-outdoor-plenum-rated” cable is acceptable for backbone cable runs between buildings, as long as it meets the cable specifications listed in section 2.6.A through J of this document.
- O. Tight buffered cables shall be gel free, riser rated, and plenum rated when installed in a plenum rated environment.
- P. Provide buffer tube fan out kits as required.
- Q. Product Specification:
  - 1. Outside Plant Cables: BerkTek bend-insensitive fiber
  - 2. Building Cables: BerkTek bend-insensitive fiber

## 2.7 FIBER OPTIC PATCH CORDS

- A. Fiber patch Cords shall be available in Single mode and Multimode.
- B. Construction shall be either 3.0 mm cordage or 1.6 mm cordage.
- C. Connectors shall be available in Duplex LC to LC.
- D. The 50-micron multimode fiber optic solution and single mode fiber optic solution shall utilize factory- made patch cords.
- E. At the MDF and at each IDF room, provide a minimum of two (2) 2-meter LC to LC duplex OM4 50/125 micron multimode fiber optic patch cords for every 6-strands of multimode fiber optic cable installed. Provide one (1) 2-meter LC to LC duplex single mode fiber optic patch cord for every 6-strands of single mode fiber installed. Verify patch cord length with District prior to ordering product.

## 2.8 FIBER DISTRIBUTION CENTER (FDC)/FIBER PATCH PANEL

A. Fiber Patch Panels/Enclosures: A rack mount or wall mount enclosure that terminates, provides cross connection, interconnection, splicing and fiber identification from 18 to 360 fiber strands. The shelf will provide protection from mechanical stress on the cable and fibers and from macro-bending losses.

1. The shelf shall be wall or rack mountable depending on the location requirement. The units must fit into a 19" wide frame arrangement and have an integrated jumper routing trough.
2. When wall mounted, the shelf shall consist of a modular enclosure with front and side access, and can be fully administered from the front. Wall mount enclosure shall include adjustable fiber management rings, and be constructed of 16-gauge steel, power coated black.
3. The rack mounted enclosure shall provide front and rear access doors and can be fully administered from the front and rear. The unit shall have integrated sliding tray to allow bulkhead to glide forward or backward after installation.
4. The rack mounted enclosure shall have a transparent hinged front cover to allow visibility of interior after install.
5. Rack mount enclosures shall be available in 1U, 2U and 4U sizes for 19" wide racks, and made of 16-gauge steel power coated.
6. The adapter/connector plates shall snap into the front of the enclosure and accommodate LC connectors as required. Adapter plates shall utilize ceramic sleeves. Multimode adapter plates shall be aqua in color. Single mode adapter plates shall be blue in color.
7. Provide one (1) 6-port LC duplex aqua adapter panel for every 12-strands of multimode fiber optic cable installed. Provide (1) 6-port LC duplex blue adapter panel for every 6-strands of single mode fiber optic cable installed.
8. Fiber patch panel/shelf shall be labeled according to the District's specific requirements.
9. Provide quantity of enclosures and adapter panels as required to terminate all strands.
10. Include all buffer tube fan out kits as required.
11. Product Specification:
  - a. Leviton #5R1UH-S03 (1RU), #5R2UH-S06 (2RU), #5R4UH-S12 (4RU)
  - b. Leviton #5W110-00N, 5W310-00N
  - c. Adapter plate 50µm aqua duplex LC Leviton #5F100-2QL

- d. Adapter plate single mode duplex LC Leviton #5F100-2LL

## 2.9 FIBER OPTIC CONNECTORS

- A. Fiber Optic Connectors: Provide a field installable single mode or multimode type connectors to terminate fiber optic cables from cable-to-cable, cable-to-equipment or equipment-to-equipment, and to make jumpers.

- 1. The connector must:
  - a. Be pre-polished and field installable.
  - b. Have a ceramic zirconia ferrule.
  - c. Be capable of mounting on either 250 um or 900 um buffered fiber.
  - d. Single mode shall be rated OS2, and multimode shall be rated OM4.
  - e. Average connector insertion loss: multimode 0.1dB, single mode 0.2dB. Maximum insertion loss: multimode 0.5dB. single mode 0.5dB.
  - f. Be available in LC style for single-mode and multimode.
  - g. Have a locking feature to the coupler and assure non-optical disconnect.
- 2. Product Specification:
  - a. Single mode blue LC, Leviton #49991-SLC
  - b. Multimode aqua LC, Leviton #49991-LLC

## 2.10 COPPER CABLING

- A. Outside Plant Multipair Copper Cables
  - 1. All outside plant multipair copper cables shall support analog voice circuits (fire alarm, intrusion alarm, elevator phone, etc.) and building energy management systems.
  - 2. All copper cable placed in the outside environment shall be 24 AWG, solid annealed copper, twisted pair, and multi-conductor. Refer to section 1.12.A.2 of this document for additional requirements.
  - 3. The outside plant cable shall be resistant to mechanical damage, lightning or damage from wildlife.



4. The outside plant cable shall have an aluminum shield, conductors surrounded by FLEXGEL III filling compound (or other water-blocking compound), and have a black polyethylene jacket.
5. All outside plant cable shall be installed in conduit. Direct-bury cable is prohibited.
6. Multi-pair voice grade copper cables installed in underground conduit shall be minimum category-6 rated.
7. Product Specification: Berk-Tek's LANmark-6 OSP, or equal.

B. Indoor Multipair Copper (Riser) Cables: In multi-story buildings, shielded or unshielded 24 AWG multipair copper cables shall be used as vertical riser cables between floors. The inner-building cable shall support analog voice circuits (fire alarm, intrusion alarm, elevator phone, etc.) and building energy management systems. The bending radius and pulling strength requirements of all backbone cables shall be observed during handling and installation. The multi-pair copper cables shall be in plenum or riser rated form and placed in conduit as required by code, or as noted on the bid documents/plan drawings.

1. Shielded: The shielded cable, 25 pair or more, shall consist of solid-copper conductors insulated with expanded polyethylene covered by a PVC skin, be conformance tested to meet ANSI/TIA/EIA 568-C for Category 5E cables, be UL and Listed as CMR. The core shall be overlaid with a corrugated aluminum sheath, which is adhesively bonded to an outer jacket of PVC plastic to form an ALVYN sheath.
  - a. The cable shall be available in 25, 50, 100, 150, 200, 300, 400, 600, 900, 1200, 1500, and 1800 pair counts.
  - b. Product Specification: BerkTek, ARMM type cable.
2. Non-shielded: The non-shielded non-plenum cable shall consist of 24-AWG solid-copper conductors insulated with color coded PVC, UL Verified to ANSI/TIA/EIA 568-C for Category 5E. The non-shielded cable shall be available in 25, 50, 75 and 100 pair.
  - a. Product Specification: BerkTek, ARMM type cable, or equal.

## 2.11 INDOOR MULTIPAIR RISER CABLE TERMINATIONS

- A. The multipair riser cable wiring block shall be 110-type (unless otherwise noted) and support analog voice circuits (fire alarm, intrusion alarm, elevator phone, etc. ) and building energy management circuits, be Category 5E or 6 rated, and facilitate cross connection and interconnection using either cross connect wire or the appropriate category patch cords.
  1. The wiring blocks shall be fire retardant, molded plastic consisting of horizontal index strips for terminating 25 pairs of conductors each. These index strips shall be marked

with five colors on the high teeth, separating the tip and ring of each pair, to establish pair location.

2. The wiring blocks shall accommodate 22- through 26-AWG conductors and shall be able to mount directly on wall surfaces either with backboards.
  3. Clear label holders with the appropriate colored inserts shall be provided with the wiring blocks. Labels shall be color-coded and machine labeled/numbered according to District's requirements.
  4. The wiring blocks shall be available in 100, and 300 pair sizes with mounting legs. The space created by the feet, on each side of the block, allows it to be used as a vertical jumper trough.
  5. For each wiring block shown on the drawings, provide and install 110-type 5-pair connecting blocks for each horizontal index strip on each wiring block. For example, a 100-pair wiring block serving station cables requires twenty (20) 5-pair connecting blocks.
- B. MPOE/MDF/IDF Rooms, or as otherwise indicated on drawings, shall be equipped with 110-type termination blocks for termination of analog station cables. Termination blocks shall consist of a minimum 100-pair. All blocks shall be securely fastened to the room backboards or equipment racks – refer to bid documents/plan drawings. Provide all required D-rings or other approved cable guides as required to provide a neat installation. All cables shall terminate in numerical sequence. Contractor shall provide District with spare 4-pair (C4) and 5-pair (C5) clips, for future use, in sufficient quantity to terminate all unused positions on all 110-blocks.

## 2.12 PROTECTORS

- A. All outside plant underground backbone multipair copper cables shall be provided with protection between each building with an entrance cable protector panel(s). All building-to-building multipair copper cables shall be routed through this protector(s). The protector(s) shall be connected with a #6 AWG copper bonding conductor between the protector's ground lug and the MDF/IDF telecommunications ground busbar (TMGB/TBG).
- B. Plug in Surge Protection Modules shall be provided for each pair terminated on the protector chassis. Protector module shall be solid-state type unless otherwise noted.
1. 240VDC/300VDC solid-state protector modules shall provide transient and power fault protection for standard telephone line applications. The modules shall be fast acting, self-resetting current limiters to protect against sneak current type faults. These modules shall be UL Listed with integrated test points and Black in color.
  2. 30VDC/75VDC solid-state protector modules shall provide transient and power fault protection for digital and data line applications. The modules shall be fast acting, self-resetting current limiters to protect against sneak current type faults. These modules shall be UL Listed with integrated test points and Red in color.

3. In the event that protector modules are not called out in the drawings, SCS Contractor shall include all costs in base bid to provide the 75v solid-state modules w/sneak current protection. Confirm module color with District's Engineer prior to ordering. In all cases, SCS Contractor is responsible to coordinate appropriate module with District prior to ordering material.

C. Product Specification: Circa, Emerson or Marconi.

## 2.13 GROUNDING SYSTEM AND CONDUCTORS

- A. The SCS Contractor shall utilize a Telecommunications Bonding Backbone (TBB) as provided by the Electrical Contractor. The SCS Contractor shall terminate TBB cable(s) on SCS Contractor provided ground bus bars located at each MDF/IDF Room, or as otherwise indicated on the drawings. Ground bus bars shall be ANSI-J-STD-607-A compliant and UL Listed. MDF telecom main ground bus bar (TMGB) shall be Chatsworth #40153-020. IDF telecom ground bus bars (TGB) shall be Chatsworth # 40153-012, or as noted on the drawings. Wall mounted cabinets require a horizontal rack bus bar (Chatsworth #10610-XXX) (equal by Harger). All communication system bonding and grounding shall be in accordance with the ANSI-J-STD-607-A (current edition), the NEC/CEC, and NFPA.
- B. Horizontal cables shall be grounded in compliance with ANSI/NFPA 70 and local requirements and practices.
- C. Horizontal equipment including cross connect frames, patch panels, cable trays, equipment racks, ladder trays, conduits, active telecommunication equipment, test apparatus and equipment shall be bonded to the ground bus bars utilizing a #6-AWG solid copper green insulated conductor and 2-hole crimp type grounding lugs. All connections shall be bare metal to bare metal using appropriate antioxidant compound. Burndy mechanical-type grounding lugs and terminals are prohibited. Minimize the length and number of bends of the grounding conductors to the busbar. Attachment to every rack and cabinet shall be made by one of the following methods:
  1. Wall mounted IDF cabinets- Attach ground conductor's 2-hole compression lug to the rear rail's top holes of the rack, or front rail's top hole of the cabinet, using either two (2) tri-lobular thread-forming screws (not self-tapping or sheet metal screws) or by using two (2) standard bolts with two (2) "Type B" internal-external tooth lock washers per bolt. If thread-forming screws are not used, remove paint at the connection point and use an approved anti-oxidant prior to attaching the ground conductor.
  2. Floor Mounted Cabinet/Racks - Install a dedicated copper horizontal ground busbar strip at the top of the rear rail of each rack and cabinet. Attach ground conductor's 2-hole compression lug to this ground strip using either tri-lobular thread-forming screws (not self-tapping or sheet metal screws) or by using two (2) standard bolts with two (2) "Type B" internal-external tooth lock washers per bolt.
- D. The SCS Contractor shall be responsible for providing an approved ground at all newly installed distribution frames, and/or insuring proper bonding to any existing facilities. The SCS

Contractor shall also be responsible for ensuring ground continuity by properly bonding all appropriate cabling, cable sheaths, circuit protectors, closures, cabinets, service boxes, and framework.

- E. SCS Contractor shall label both ends of each grounding conductor as close as practical to the point of termination in a readable position. Ground tag must indicate the location of both ends of the ground conductor (e.g. Rack#1 to TMGB) and tag must include the warning "If this connector or cable is loose or must be removed, please call the District's Telecommunications Manager".

## 2.14 EQUIPMENT RACKS

- A. When shown on drawings, communication closets shall be equipped with floor mounted equipment racks provided by the SCS Contractor to house shelves, patch panels, power strips, LAN electronics, UPS, etc. The racks shall be made of aluminum and include mounting hardware for mounting specified termination equipment to the frame.
- B. Dimensions shall be 7' H x 19" W x 29" D.
- C. Contractor shall provide vertical and horizontal wire managers for patch and equipment cords.
- D. Equipment racks and rack mount accessories shall be Black in color, unless otherwise noted.
- E. Floor mounted open racks shall be secured from the base to the structural floor to prevent movement, and secured to ladder tray sections installed above. Contractor shall provide and install a minimum of four (4) fasteners/anchors per floor mounted rack. Fasteners installed to the structural floor shall be torqued to the "fastener manufacturer's" recommendation.
- F. Racks mounted on raised floors shall be seismically braced to the structural floor below the raised floor to the satisfaction of DSA, and all local, state and federal requirements.
- G. Floor mounted open racks shall be secured to the overhead ladder tray/ladder runway.
- H. All racks shall be individually grounded to the dedicated telecommunications ground busbar (TMGB, TGB) within the equipment room using a 2-hole compression ground lugs and #6 AWG stranded green jacketed conductor. This ground conductor shall be run as straight as possible, with the length kept as short as possible. Ground wire shall be neatly secured to the rack and ladder runway. Daisy chaining a ground conductor between racks or to other components is not allowed.
- I. Product Specification: Chatsworth QuadraRack, 4-post frame, #50120-703.

## 2.15 EQUIPMENT CABINETS

- A. When shown on drawings, cabinets shall be provided by the SCS Contractor to house shelves, patch panels, power strips, LAN electronics, UPS, etc. The cabinets shall be made of lightweight aluminum, UL Listed, and include mounting hardware for mounting specified

termination equipment to the frame. In addition, the mounting hardware must provide vertical and horizontal wire managers for patch cords and equipment cords.

- B. Dimensions shall be 48"Hx24"Wx30"D.
- C. Contractor shall provide vertical and horizontal wire managers for patch and equipment cords.
- D. Equipment cabinets and accessories shall be Black in color unless otherwise noted.
- E. Wall mounted cabinets shall be secured to plywood backboard at locations indicated on the plan drawings. Contractor shall provide and install fasteners and anchors that are designed and rated for the determined mounting surface and building construction type. Contractor shall provide and install fasteners and anchors that are designed and rated for the combined weight of the equipment support cabinet and its contents. Contractor shall be responsible for determining correct cabinet mounting and anchoring methods that will safely support the combined weight of the cabinet and its contents. Contractor shall install cabinet in such a manner that a minimum of four (4) fasteners and/or anchors are attached directly into wall framing studs, or if applicable, masonry or concrete wall. Anchoring methods shall comply with DSA requirements and all local, state and federal safety codes.
- F. Cabinets shall be configured per the District's Project Manager's direction.
- G. All floor and wall mounted cabinets shall be individually bonded to the isolated ground busbar (TMGB, TGB) within the equipment room using a 2-hole compression ground lug and #6 jacketed green cable. Wall mounted cabinets require a horizontal rack bus bar (Chatsworth #10610-XXX, equal by Harger) installed at the top position of the front rails. Attach ground lug to this horizontal busbar. Ground wire shall be run as straight as possible, with the length kept as short as possible. Ground wire shall be neatly bundled and secured to the cabinet and ladder tray. Daisy chaining of ground wire between cabinets or to other components is prohibited. The use of screw-type mechanical ground lugs or connections are prohibited.
- H. Cabinets mounted on raised floors shall be seismically braced to the structural floor below the raised floor to the satisfaction of DSA and all local, state and federal requirements.
- I. Cabinets shall come equipped with a locking Plexiglas front door.
- J. Product Specification: Chatsworth, Cube-IT #12419-748

## 2.16 OUTDOOR ACTIVE EQUIPMENT ENCLOSURES

- A. When shown on drawings, Contractor shall provide and install outdoor enclosure(s) in quantity and locations as shown on the plan drawings. Enclosure shall house active and passive equipment as noted on the plan drawings.
- B. The enclosure shall have two (2) 19" rails at the front and rear, TS system chassis, with a standard texture solid front door with 130-degree hinge on the right side. Door shall include comfort handle with push button lock.

- C. The enclosure shall come equipped with internally fastened side panels, and with a NEMA type 4X AC unit mounted and centered in both directions on the rear door.
- D. A NEMA 4 solid base, and include an 8" plinth shall be included.
- E. The enclosure shall include a horizontal rack bus bar (Chatsworth #10610-XXX, equal by Harger) and be bonded to ground, per the plan drawings.
- F. Enclosure dimensions shall be 31.5"W (800mm) x 70.8"H (1800mm) x 23.6"D (600mm).
- G. Product Specification: Rittal

#### 2.17 BACKBOARDS

- A. Where indicated on plan drawings, provide new plywood terminal backboards. Use Douglas Fir plywood, A/C grade, finished A-side facing out, with prime coat painted on all surfaces (front, back and sides), and a finish coat of fire retardant white enamel paint. On each plywood sheet leave one (1) Fire Marshal Stamp unpainted for inspection. Unless otherwise indicated, use 8'-0" high x 3/4" thick plywood x length as shown on the plan drawings.

#### 2.18 UNSPECIFIED EQUIPMENT AND MATERIAL

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

#### 2.19 FIRE RATED PATHWAY

- A. The firewall through-penetration shall be a manufactured, UL Classified, firestop device/system designed to allow cables to penetrate fire-rated walls with a built-in fire sealing system that automatically adjusts to the amount of cables installed.
- B. The firestopping device shall be capable of installation in new construction or retrofit in existing structures.
- C. The device shall be UL Tested and Classified in accordance with ASTM E814 (UL 1479) and with ratings up to and including 2 hours.
- D. Manufacturer: Specified Technologies Inc., EZ-Path (#EZDP33FW) or equal by Wiremold.

### PART 3 – EXECUTION

### 3.1 GENERAL INSTALLATION REQUIREMENTS

- A. The wiring of the system shall be executed in accordance with the drawings and the equipment manufacturer's wiring diagrams. Should any variations in these requirements occur, the Contractor shall notify the District's Project Manager before making any changes. It shall be the responsibility of the manufacturer-authorized distributor of the approved equipment to install the equipment and guarantee the system to operate as per plans and specifications.
- B. Furnish all conductors, equipment plugs, terminal strips, etc., and labor to install a complete and operable system.
- C. The cables within the rack or cabinets shall be numbered for identification using machine generated labels wrapped around the cable jacket within six (6) inches of termination point. Refer to Labeling Requirements section of this document for additional requirements. Permanent hand written labels are prohibited.
- D. Splices of cables are not acceptable.
- E. The labor employed by the Contractor shall be regularly employed in the installation and repair of communication systems and shall be acceptable to the District's Project Manager to engage in the installation and service of this system.
- F. The system must meet all local and other prevailing codes.
- G. All cabling installations shall be performed by qualified and manufacturer-trained technicians.
- H. Cable lubricants (i.e. Polywater) shall be used to reduce the cable pull tension stated by the cable manufacturer during cable installation in conduits and innerduct. Contractor shall verify the acceptability of the lubricant to be used with the cable manufacturer, prior to using such a lubricant. Lubricants that harden after installation are not allowed. Submit all proposed lubricants for approval PRIOR to use on low voltage, A/V, coax, fiber, and data cable installation. Cable lubricants shall be allowed to dry a minimum of fifteen (15) days before performing certification tests.
- I. Cables may be run exposed above accessible ceilings, provided the cabling is supported independent of other utilities such as conduits, pipes, and the ceiling support systems. The Contractor shall include all costs in base bid for any additional supports/seismic bracing required by the Local Authority having Jurisdiction. The cables shall not be laid directly on the ceiling panels.
- J. The cable jacket composition must meet local and all other prevailing fire and safety codes.
- K. All firewalls penetrated by structured cabling shall be sealed by use of a non-permanent fire blanket or other method in compliance with the current edition of NFPA and the NEC or other prevailing code and must be a system listed by UL. The Contractor must not use concrete or other non-removable substance for fire stopping on cable trays, wireways or conduits. Contractors who use this method will be required to replace all cables affected and provide the

original specified access to each effected area. This requirement also applies to maintaining fire ratings of all floors penetrated by conduits or devices designated for use by voice and data cabling.

- L. All equipment racks and cabinets shall be bolted to the structural floor by the SCS Contractor in the location shown on drawings. Wall mounted relay rack and wall mounted cabinet kits shall be fastened to structural studs, not drywall or backboard only.
- M. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor before final acceptance at no cost to the District.
- N. The cable manufacturer's minimum bend radius and maximum pulling tension shall not be exceeded.
- O. Cable raceways, when required, shall not be filled greater than the NEC maximum fill for the particular raceway type. Innerduct fill shall not exceed 40-percent.
- P. Roof penetrations are prohibited. No conduit shall be installed on roofs or route horizontally on exterior walls.

### 3.2 SPECIFIC SYSTEM INSTALLATION REQUIREMENTS

- A. All communications cabling used throughout this project shall comply with the requirements as outlined in the NEC Articles 725, 760, 770, and 800 (or related CEC Articles), and the appropriate local codes. All copper cabling shall bear UL listed type CMP (Plenum Rated) and/or CM/G (General Purpose) and/or CMR (Riser Rated). All fiber optic cabling shall bear OFNP (Plenum Rated) and/or OFNR (Riser Rated) and/or OFN/G (General Purpose). The SCS Contractor is responsible for installing appropriately rated cable for the environment in which it is installed.
- B. Cable Pathways:
  - 1. In suspended ceiling and accessible ceiling areas where duct, cable trays or conduit are not available, the Contractor shall bundle cable, in bundles of 48 or less. Cable bundles shall be supported via "J" hooks attached to the existing building structure and framework at a maximum of five (5) foot intervals. In areas where two or more bundles are traveling in close proximity, utilize a Chatsworth Rapidtrak Cable support system. The Contractor shall adhere to the manufacturers' requirements for bending radius and pulling tension of all cables.
  - 2. Cables or J-hooks shall not be attached to lift out ceiling grid supports or laid directly on the ceiling grid.
  - 3. Cables or J-hooks shall not be attached to or supported by fire sprinkler heads, HVAC ducts, or delivery systems or any environmental sensor located in the ceiling air space.
  - 4. J-hook pathways and cable bundles shall be installed as high up in the accessible ceiling space as possible so as not to interfere with other building systems.



5. Where additional conduit(s)/sleeve(s) are required, but not provided by the electrical Contractor, the SCS cabling Contractor shall be responsible to provide such conduit(s)/sleeve(s). Conduit(s) and sleeve(s) shall be of suitable material, sized, installed, fire-stopped, and grounded as required by the NEC, TIA standards and all other applicable codes and standards. Any conduit(s) and sleeve(s) added by the SCS Contractor shall be approved by the District's Project Manager prior to rough-in.
  6. All J-hooks shall be rated and designed for Category 6 and 6A cabling.
- C. Sealing of openings between floors, into or through rated fire and smoke walls, existing or created by the Contractor for placement of new or removal of old cable into or through shall be the responsibility of the Contractor. Sealing material (Approved UL listed system) and application of this material shall be accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over this work. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of the Contractor's work. Any openings created by or for the Contractor and left unused shall also be sealed as part of this work.
1. Fire stopping work shall be performed by a single Contractor to maintain consistency and accountability on the project.
  2. The Contractor shall install penetration firestop seal materials in accordance with design requirements, and manufacturer's instructions.
  3. The Contractor's installer shall be certified, licensed or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements.
  4. All installed through penetration firestops shall be identified via label, or stencil. Label shall state that the fill material around the penetrating item is a firestop, and that it shall not be disturbed unless by an authorized Contractor. The label shall include the firestop brand name, and the classified system number for which it was installed.
    - a. Sample Label:
 

MANUFACTURER'S NAME:  
**ATTENTION**  
Fire Rated Assembly  
For Any Changes To This System, Please Refer To UL System Listed Below  
 PRODUCT:  
 HOUR RATING:  
 UL SYSTEM:  
 INSTALLATION DATE:  
 INSTALLED BY: (Contractor's Company name)  
 CONTRACTOR LICENSE NUMBER:  
 BUSINESS PHONE:  
 EMAIL ADDRESS:

- D. The Contractor shall be responsible for damage to any surfaces or work disrupted as a result of his work. Repair of surfaces, including painting, shall be included as necessary.
- E. Cable bundles within the MDF/IDF shall be dressed into bundles of no more than twenty-four (24) cables. Maintain each bundle with half-inch-wide hook and loop strips spaced every twelve (12) inches maximum.
- F. The Contractor shall provide and install all patch cords per direction of the District's project manager in a neat and systematic fashion. Prior to installing all patch cords, the Contractor shall install patch cords in a single rack to demonstrate work practices to the District's project manager. Only after any corrections/modification to the installation as directed by the District's project manager, may the Contractor continue installing the patch cords in the remaining racks.
- G. Each equipment cabinet and rack requires its own dedicated grounding connection to the grounding infrastructure. Grounding infrastructure shall consist of a dedicated #6 AWG (min.) green conductor from every rack/cabinet back to the TMGB/TGB. All ground conductor attachments to the TMGB/TGB shall utilize 2-hole compression lugs. See Section 2.13 Grounding System and Conductors of this document for more information.
- H. In raised-floor environments, the ground conductor shall attach to the lowest holes on the front rail of each rack/cabinet.
- I. Rack/cabinet mounted equipment shall be grounded via the chassis, in accordance with manufacturer's instructions. The equipment chassis shall be bonded to the rack/cabinet using one of the following methods:
  - 0. If the equipment has a separate grounding hole or stud, use a #10-AWG ground wire from the chassis ground hole/stud to the rack grounding bus.
  - 1. If the manufacturer suggests grounding via the chassis mounting flanges, use tri-lobular thread-forming screws (not self-tapping or sheet metal screws) to attach the equipment to the rack/cabinet rails. If the equipment mounting flanges are painted, remove the paint and apply an anti-oxidant, or use tri-lobular thread-forming screws and two (2) "Type B" internal-external tooth lock washers to safely ground equipment to the rack.
- J. Bonding of ladder tray sections- Attach bonding straps to each ladder tray section by utilizing either two (2) tri-lobular thread-forming screws (not self-tapping or sheet metal screws) or by using two (2) standard bolts with two (2) "Type B" internal-external tooth lock washers per bolt. If thread-forming screws are not used, remove paint at each connection point and use an approved anti-oxidant prior to attaching the bonding strap.
- K. Bonding and Grounding: All cable sheaths and splice cases shall be grounded to a Telecommunications Ground Bus. All grounding must be in accordance with the NEC, NFPA, TIA-607-B and all local codes and practices. The Electrical Contractor shall be responsible for providing a properly sized grounding conductor from the main electrical ground to the telecommunications ground bus in each MDF/IDF room. The SCS Contractor shall be responsible to provide the telecommunications busbar, attach the Electrical Contractor-provided

ground conductor, and bond all required equipment and components within each MDF/IDF to the busbar.

- L. Power Separation: The Contractor shall not place any distribution cabling alongside power lines, or share the same conduit, channel or sleeve with electrical apparatus. Maintain a minimum of 12 inch separation from light fixtures.
- M. Miscellaneous Equipment: The Contractor shall provide any necessary screws, anchors, clamps, hook & loop ties, distribution rings, wire molding (MDF & IDF locations), miscellaneous grounding and support hardware, etc., necessary to facilitate the installation of the System.
- N. Special Equipment and Tools: It shall be the responsibility of the Contractor to furnish any special installation equipment or tools necessary to properly complete the System. This may include, but is not limited to, tools for terminating cables, testing and splicing equipment for copper/fiber cables, communication devices, jack stands for cable reels, or cable winches.
- O. Labeling: The Contractor shall be responsible for printed labels for all pull boxes, conduits, cables, protectors, racks, cabinets, patch panels, connector panels, cords, distribution frames, and outlet locations, according to the specifications. Hand written labels are prohibited. See LABELING REQUIREMENTS Section 3.9 of this document for more information.
- P. Cable Storage: The Contractor shall not roll or store cable reels without an appropriate underlay and the prior written approval of District's Project Manager.
- Q. Cable Records: The Contractor shall maintain conductor polarity (tip and ring) identification at the main equipment room (switch room), risers, and station connecting blocks in accordance with industry practices, but only in locations authorized by the District's Project Manager. Contractor to provide spread sheet for all outdoor backbone and indoor riser backbone cables tested.
- R. All installation shall be done in conformance with TIA-568-C standards, BICSI TDMM guidelines and manufacturer's installation guidelines. The Contractor shall ensure that the maximum pulling tensions of the specified distribution cables are not exceeded and cable bends maintain the proper radius during the placement of the facilities. Failure to follow the appropriate guidelines will require the Contractor to provide, in a timely fashion, any additional material and labor necessary to properly rectify the situation to the satisfaction and written approval of the District's Project Manager. This shall also apply to any and all damages sustained to the cables by the Contractor during the implementation.

### 3.3 STRUCTURED CABLING GENERAL INSTALLATION DESCRIPTION

- A. The structured cabling system shall consist of any or all of the following subsystems:
  - 1. Work Area Subsystem
  - 2. Horizontal Subsystem

3. Administration Subsystem
  4. Backbone Subsystem
  5. Equipment Subsystem
- B. Work Area Subsystem: The Work Area Subsystem provides the connection between the telecommunications outlet (TO) and the station equipment in the work area. It consists of cords, adapters, and other transmission electronics.
1. Contractor shall supply the wiring or cords that connect terminal devices to telecommunications outlets. This includes mounting cords and connectors, as well as extension cords.
- C. Horizontal Subsystem: The Horizontal Subsystem provides connections from the horizontal cross connect to the telecommunications outlets in the work areas. It consists of the horizontal transmission media, the associated connecting hardware terminating this media and outlets in the work area. Each floor of a building is served by its own Horizontal Subsystem(s).
1. Horizontal Cabling
    - a. Contractor shall supply horizontal cables to connect each telecommunications outlet to the backbone subsystem as shown on the drawings.
    - b. Unless otherwise noted on the floor plans or within this document, the type of horizontal cables used for each work location shall be 4-pair unshielded twisted pair (UTP).
    - c. The 4pair UTP cables shall be run using a star topology format from the administration subsystem to every individual telecommunications outlet. All cable routes, other than those dictated on the drawings, are to be approved by District's Project Manager prior to installation.
    - d. The length of each individual run of horizontal cable from the administration subsystem to the telecommunications outlet shall not exceed 295-ft (90 m).
    - e. Contractor shall observe the bending radius and pulling strength requirements of the 4pair UTP cable during handling and installation.
    - f. Each run of cable between the termination block and the telecommunications outlet shall be continuous without any joints or splices.
    - g. All station cable shall be placed in the interior of walls unless otherwise noted in the bid documents/plan drawings.
    - h. In the event Contractor is required to remove ceiling tiles, such Work shall not break or disturb the ceiling grid. Removal of the ceiling grid must be coordinated with the District's Project Manager. All insulation shall be replaced in its original

location. Contractor shall be responsible to replace any ceiling tiles that they damage during the course of their work, at no additional cost to the District.

- i. Avoid electromagnetic interference (EMI) by maintaining adequate physical separation between telecommunications cabling and possible sources such as, but not limited to, electric motors, electric erasers, electric pencil sharpeners, transformers, fluorescent lighting that share distribution space with telecommunications cabling, copiers that share work area space with line cords and terminals, large fax machines and power cords that supports such equipment. Minimum separation shall be six (6) inches.
- j. Contractor shall provide District's Project Manager with detailed cable run diagrams for cable runs within raised floors (if shown on plans) detailing exact locations of cable for review and written approval by District's Project Manager.
- k. Conduit runs installed above grade by the Contractor should not exceed one hundred (100) feet or contain more than two (2) 90-degree bends without utilizing appropriately sized pull box. Pull boxes are not to be used in lieu of a bend.
- l. Station cables and riser cables installed within ceiling spaces shall be routed through these spaces at right angles to electrical power circuits.
- m. Each station cable shall have 1 meter of service slack configured in an "S" shape via J-hooks at rack or wall field end and one (1) foot of service loop at station outlet end. Service slack shall be located within fifteen (15) feet of the MDF/IDF as required to maintain a neat and "workmanship like" installation.

D. Administration Subsystem: The Administration Subsystem links all of the subsystems together. It consists of labeling hardware for providing circuit identification and patch cords or jumper wire used for creating circuit connections at the cross connects. All wallfield layouts must be approved by District's Project Manager prior to rough-in and installation.

- 1. Separate termination fields shall be created for voice/data, wireless access points, paging, surveillance cameras, clocks, and building energy management system applications.
- 2. Termination blocks that require rotation after connection of horizontal/vertical wiring will not be allowed.
- 3. Contractor shall supply cross-connect wire, patch cords and fiber patch cords for crossconnection and interconnection of termination blocks and lightguide interconnection units.

E. Backbone Subsystem:

- 1. The main cable route between two or more buildings is called the Backbone Subsystem. It links the main distribution frame (MDF) in the equipment room to each intermediate distribution frame (IDF). It consists of the backbone transmission media between these locations and the associated connecting hardware terminating this media. It is normally

installed in a star topology, with first-level backbone cables beginning at the main cross connect. If needed, second-level backbone cables begin at intermediate cross connects.

2. The backbone subsystem shall include vertical runs (riser) of inbuilding cable between floors of a multi-story building, if applicable.
3. All backbone fiber optic cable(s) will be run in innerduct and terminated in the MDF/IDF Rooms, or as otherwise indicated on the plan drawings, with connectors, type as specified elsewhere, in rack mounted or wall mounted fiber patch panels equipped with sufficient panels, couplers and jumper storage shelves to terminate and secure all fibers. All innerduct (Carlton or equal) shall be corrugated and a minimum of 3/4" in diameter unless otherwise indicated on plans. Innerduct shall be plenum, riser or general rated as required by the environment in which it is to be installed. Innerduct capacity shall not exceed 40 percent fill.
4. All backbone multipair copper cable(s) will be terminated in the MDF/MPOE/IDF rooms, or as otherwise indicated on the plan drawings. Backbone multipair cable shall be terminated on building entrance fused protectors as specified elsewhere in this document. The minimum pair count for multipair copper cable between buildings shall be 25-pairs. Refer to bid documents/plan drawings for any additional required pairs.
5. In multi-story buildings, Contractor shall supply multipair copper cables and optical cables as the riser cables between floors. Reference this document and plan drawings for quantities. Contractor shall observe the bending radius and pulling strength requirements of all backbone cables during handling and installation.

- F. Equipment Room Subsystem: The Equipment Subsystem consists of shared (common) electronic communications equipment in the equipment room or telecommunications closet and the transmission media required to terminate this equipment on distribution hardware.

### 3.4 DAMAGES

- A. The Contractor will be held responsible for any and all damages to portions of the building caused by it, its employees or sub-Contractors; including but not limited to:
  1. Damage to any portion of the building caused by the movement of tools, materials or equipment.
  2. Damage to any component of the construction of spaces.
  3. Damage to the electrical distribution system.
  4. Damage to the electrical, mechanical and/or life safety or other systems caused by inappropriate operation or connections made by the Contractor or other actions of Contractor.
  5. Damage to the materials, tools and/or equipment of the District, its consultants, agents and tenants.

### 3.5 PENETRATIONS OF WALLS FLOORS AND CEILINGS

- A. Unless specifically shown on the drawings, the Contractor shall make no penetration of floors, walls or ceiling without the prior written approval of the District's Project Manager.
- B. Any penetrations through acoustical walls or other walls for cable pathways/cables shall be sealed by the Contractor in compliance with applicable code requirements and as directed by District's Project Manager.
- C. Any penetrations through fire-rated walls for cable pathways/cables shall be sealed by the Contractor as required by code and as directed by District 's Project Manager. The Contractor shall be required to work together with the General Contractor and the Electrical Contractor to coordinate and develop all fire stopping methods prior to any cable installation. The Contractor shall also, prior to the commencement of on-site activities, submit to District's Project Manager, details of any special systems to be used.
- D. Roof penetrations are prohibited. No conduit shall be installed on roofs or route horizontally on exterior walls.

### 3.6 TESTING/WARRANTY

#### A. Structured Cabling System

- 1. The Contractor shall provide competent, test equipment manufacturer-trained engineers and/or technicians, authorized by the manufacturer of the cabling system, to technically supervise and participate during all tests for the systems.
- 2. The Contractor shall test and certify the cabling system to minimum standards as set forth in the TIA-568-C specifications for 100BaseTX Ethernet and for Category 6 cable, token ring, and 1000baseT signals.
- 3. All cables and termination hardware shall be 100% tested for defects in installation and to verify cable performance under installed conditions. All conductors of each installed cable shall be verified usable by the Contractor before system acceptance. Any defect in the cable system installation including but not limited to cable, connectors, feed-through couplers, patch panels, splices, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.
- 4. Each cable shall be tested for continuity on all pairs and/or conductors. Twisted-pair voice cables shall be tested for length, continuity, pair reversals, opens, shorts, transpositions, presence of AC and DC voltages and opens. Twisted-pair horizontal cables shall be tested for the all of the above requirements, plus tests that indicate installed cable performance. Category-6 and catgegory-6A cables shall be tested using a TIA-568-C.2-1 Category 6A Level III/IEC 61935 Level III or better, ETL certified cable tester/analyzer.

5. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests.
6. 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 before final acceptance.
7. Each installed cable shall be tested for installed length using a Time Domain Reflectometer (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-568-C Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number.
8. Multi-pair cables, record the following tests on every cable pair in each multipair cable using a TDR type device: record the shortest pair length, continuity, pair reversals, shorts, opens, transpositions, presence of AC and DC voltage.
9. Enhanced Category 6 and 6A data cable shall be performance verified using an automated 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:
  - a. Attenuation (Insertion Loss).
  - b. Return Loss (RL).
  - c. Near End Crosstalk (NEXT) – measured at both ends of each cable pair.
  - d. Attenuation to Crosstalk Ratio (ACR).
  - e. Power Sum Near End Crosstalk (PSNEXT).
  - f. Power Sum Attenuation to Crosstalk Ratio (PSACR).
  - g. Far End Crosstalk (FEXT).
  - h. Equal Level Far End Crosstalk (ELFEXT).
  - i. Power Sum Equal Level Far End Crosstalk (PSELFEXT).
10. Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the ANSI/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.



11. Optical Fiber Cable Testing: All fiber testing shall be performed on all fibers in the completed end to end system by test equipment manufacturer-trained engineers and/or technicians. There shall be no splices unless clearly defined in Section 3 of this specification or on the plan drawings. Testing shall consist of a bi-directional end to end OTDR trace performed per ANSI/TIA/EIA 455-61 & ANSI/TIA/EIA 526 and a bi-directional end to end power meter test performed per ANSI/TIA/EIA 455-53A. The system loss measurements shall be provided at 850 and 1300 nanometers for multimode fibers and 1310 and 1550 for single mode fibers.
  - a. Pre-installation cable testing: The Contractor shall test all fiber optic cable prior to the installation of the cable. The Contractor shall assume all liability for the replacement of the cable should it be found defective during the warranty period.
  - b. Loss Budget: Fiber links shall have a maximum loss of: (allowable cable loss per km) x (km of fiber in link) + (.4dB) x (number of connectors) = maximum allowable loss.
  - c. Any link not meeting the requirements of the standard shall be brought into compliance by the Contractor, at no additional charge to District.
12. The Contractor shall provide test documentation to the District's Project manager in a three ring binder(s) and in CD format within three weeks after the completion of a specific 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 test type. A paper copy of the test results shall be provided that lists all the links that have been tested, and include link name, overall pass/fail evaluation, date and time of test, cable type and NVP value. Detailed test results shall be provided for each link tested and shall include length, propagation delay, delay skew, insertion loss, return loss, NEXT, ELFEEXT, ACR, PSNEXT, PSELFEXT, and PSACR. Detailed test results for each link will also include customer site name, name of standard selected to execute the tests, date and time test results were saved in memory of test unit, brand name model and serial number of tester and revision of the tester software and test standards database in the tester. Individual test data within each section shall be presented in the sequence listed in the test summary records. 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.
13. 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 be collocated in the binder.
14. The entire SCS system shall be warranted free of mechanical or electrical defects by the Contractor for a period of one year after final acceptance of the installation.
15. Any equipment that is not installed per the manufacturer's recommendation shall be replaced promptly and at no cost to the District.
16. Any material showing mechanical or electrical defects shall be replaced promptly at no expense to the District.

17. Provide all labor and material warranties for each system, as described elsewhere in this document.
18. At the District's direction, the Contractor shall perform additional random testing which shall consist of a random sample of up to 10% of each installation distribution system. The Contractor shall assume responsibility for providing the proper test equipment and staff to conduct tests. The District's representative shall witness the tests.
19. Should the initial 10% test not be 100% successful (all drops testing over Cat6 up to 250MHz), the Contractor shall assume responsibility to repair/replace non-passing links, at the direction of the District, and the links to re-verify and resubmitted. A 20% random sample shall then be conducted to ensure proper performance of the system.
20. Should there be failure in this re-test, the Contractor shall be responsible to repeat the re-test procedure until such time as all cabling is verified.

3.7

## COMPLETION OF WORK:

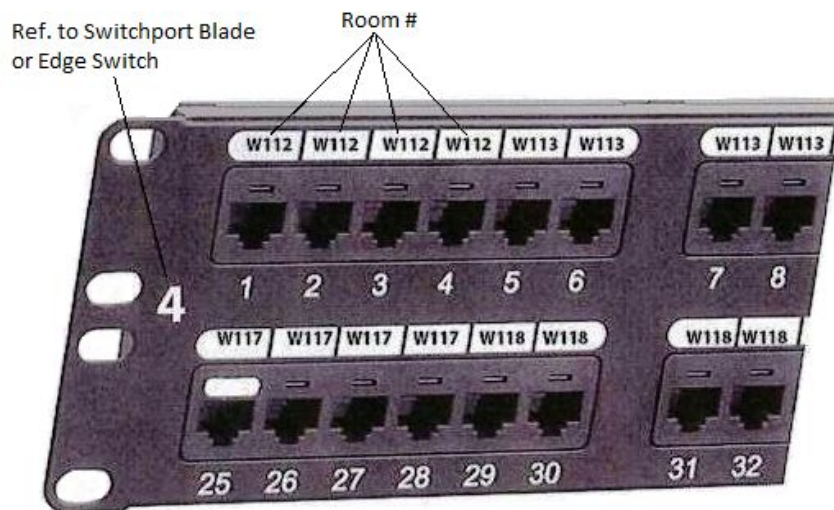
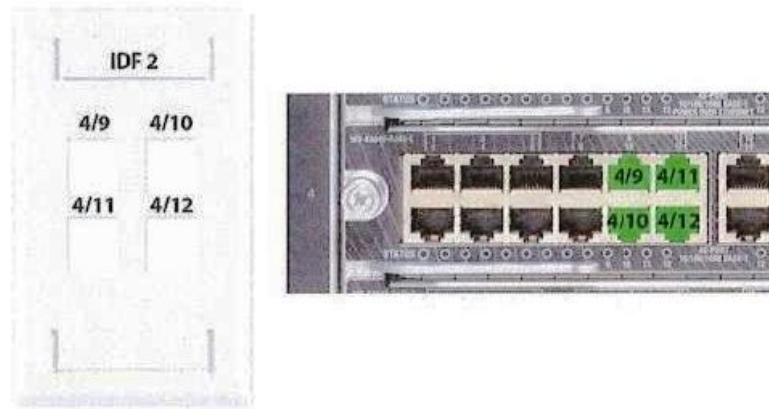
- A. At the completion of the Systems, the Contractor shall restore to its former condition, all aspects of the project site and on a daily basis, shall remove all waste and excess materials, rubbish debris, tools and equipment resulting from or used in the services provided under this Contract. All clean up, restoration, and removal noted above will be by the Contractor and at no cost to District. If the Contractor fails in its duties under this paragraph, District may upon notice to the Contractor perform the necessary clean up and deduct the costs thereof from any amounts due or to become due to the Contractor. It shall be the Contractor's responsibility to remove trash from the areas it is working in and bring trash and debris to the Contractor provided dumpster.

## 3.8 INSPECTION

- A. On-going inspections shall be performed during construction by the District's representative. All work shall be performed in a high quality manner and the overall appearance shall be clean, neat and orderly. Any work that does not meet the District's representative's approval shall be removed and reinstalled by the Contractor at no additional cost to the District.

## 3.9 LABELING REQUIREMENTS

- A. Numbers must be assigned to each outlet location using a logical designation convention. Blueprints with the outlet placement and configuration information have been furnished to the Contractor. Contractor will provide the equipment as necessary to generate Panduit PAN-CODE (or Equal) laser printer generated self-laminating labels using the numbering convention shown below and as specified herein. Before any permanent labels are installed on blocks, face plates or cables, Contractor shall submit a sample label of each various type listed below to District's Project Manager for written approval to ensure compliance with the labeling scheme, legibility, etc. Contractor is responsible to provide the labeling scheme as described herein.
- B. Station Faceplate (Telecommunications Outlet) Labeling. The following is illustrative of the number convention to be used:
  1. Top Window: IDF-2. This identifies the IDF location where cable originates within the building (i.e., IDF room "#2").
  2. Bottom Window: blank. For future use.
  3. Faceplate jacks shall be numbered sequentially from top to bottom, and left to right. Individual jack labels shall indicate Patch Panel number / port number. (i.e., 4/9 represents patch panel #4, patch panel port #9).



- C. Network Switch Labeling. All rack mounted Ethernet edge switches shall be sequentially numbered. Number shall be printed and attached to the left edge and centered. Numbers shall be minimum 1/2" high and printed white on a black background.
- D. Patch Panel Labeling. All copper category 6 and 6A rack mounted patch panels shall be sequentially numbered, beginning with the uppermost panel in the rack. Patch panel number shall be printed and attached to both left and right edges and centered. Numbers shall be minimum 1/2" high and printed white on a black background. Patch panel ports shall be labeled with the corresponding room number where the cable's faceplate is located. Cables shall be terminated sequentially by room number and faceplate order.
- E. Station Cable Jacket Labeling. All Category 6 and Category 6A cables shall be labeled within six inches of each termination end (e.g., at both ends, outlet end and MDF/IDF end) using machine-generated, "P-Touch" type, self-laminating cable markers.
  1. Example: IDF2-4/9

2. IDF location where cable originates (i.e., IDF room “#2”).
  3. Patch panel and port numbers where cable terminates (i.e., patch panel #4, port #9)
- F. Backbone and Riser Multipair Cable Labeling. All backbone and riser cables (copper, fiber, coax, etc) will be labeled to reflect the origin and destination abbreviation for the cable and pair counts on large font (16 pitch) self-laminating labels, which shall be located within 18 inches of each end of the cable. Labels shall be placed on the cable to be visible without relocating surrounding cables.
1. Example #1: IDF2/IDF3/CP100/01
  2. IDF2: Cable Origination
  3. IDF3: Cable Destination
  4. CP100: Cable Type & Pair or Strand Count (ex. 100 – pair Copper Cable. Other possibilities include CX for coax, HB for hybrid fiber cable, MM for multimode cable, and SM for singlemode cable.)
  5. 01: Cable identification number (ex. cable 01). There may be more than one backbone or riser cable with the same origin, destination and pair count.
- G. Multipair Cable Termination Block Labels. All multipair cables will be labeled using appropriate terminal-block label strip with label holders. Termination blocks shall be labeled in such a manner to indicate Termination Block number (ex: W1, W2, etc) and type of cables (ex. Fire Alarm-FA, Security Alarm-SE, Paging-PA, FAX machine, etc.).
1. Termination Block Label:
  2. Example: W1 – Alarm Cables 1st Floor
  3. W1: Wall Field 100-pair 110-block #1
  4. Individual cable numbers on label strip:
  5. Example: 001
  6. Station #1
- H. Multipair Cable Termination Block Labels. All multipair riser blocks shall be labeled using appropriate terminal-block label strip with label holders and shall follow the labeling scheme outlined above. Building interconnect cable termination block labels shall be per ANSI/TIA/EIA-606-B. Final label scheme shall be determined by the District’s decision.
- I.

Fiber Enclosure Labels. All fiber enclosures and panels will be labeled using self-laminating laser label markers. Fiber labels shall include all information as specified by the District. Contractor is responsible to provide a labeling scheme that meets with the District's satisfaction. At a minimum, the fiber enclosure label card shall indicate: destination of connected cables, slash (/), origination of connected cables, slash (/), and the fiber enclosure number and port number.

1. Example: MDF/IDF2/1-1
2. MDF: Destination Patch Panel Location Designation
3. IDF2: Origination Patch Panel Location Designation
4. 1-1 Indicates fiber enclosure number and fiber port number on both origin and destination fiber enclosures.

J. Equipment Rack/Cabinet Labeling: All equipment racks/cabinets shall be labeled according to their room identifier and a two-digit number. The labels will be engraved plastic plates, with 1"-high white letters on black background. The labels will be attached to the cross member at the top front of each frame or rack with appropriately sized sheet metal screws. Self-adhesive strips, glues, etc. are unacceptable. Racks and cabinets within the same room shall be numbered sequentially from left to right, when facing the front of the racks/cabinets.

1. Example: MDF-01
2. MDF Room Designation
3. 01 Rack Identifier

K. Innerduct and Fiber Cable Warning Labeling. The Contractor shall provide and install tags of stamped plastic for tube cable and innerduct. The labeling convention described above within Paragraph E shall apply. Additionally, the Contractor will also install fiber optic warning tags (Panduit #PST-FO) every 12 feet on all exposed fiber optic cable and on innerduct containing fiber optic cable installed within the building, also on innerduct and cable visible in each pull box, manhole, and vault.

L. MDF/IDF Floor Plan Mounting Frame: Provide wall mountable floor plan mounting frame with removable Plexiglas front cover in each MDF/BDF/IDF. Frame and cover shall be sized to house 30"x42" floor plan drawing. Coordinate location of frame with District's Project Manager prior to installation.

M. Telecommunications Main Grounding Busbars (TMGB, TGB): All telecom grounding busbars shall be labeled using large font (16 pitch) self-laminating labels. Labels shall indicate "TMGB" or "TGB". If more than 1 busbar is in the room, include a numerical indication (ex: TMGB-1).

3.10

### MISCELLANEOUS PROJECT REQUIREMENTS

- A. Site Cleaning: Throughout the progress of the plant construction, the Contractor shall keep the working area free from debris of all types and remove from the premises all rubbish resulting from any work done by Contractor. On a daily basis and at the completion of its work, the Contractor shall, to the extent possible, leave the premises in a clean and finished condition.
- B. Conduits: All backbone cabling will run through dedicated conduits. All new conduits will be supplied with a pull string. Contractor shall supply pull string and pull rope for the installation of all cables in existing conduits. For all conduits left with available capacity, Contractor shall replace pull strings with ¼-inch pull rope during the course of his work. Contractor must seal all underground low voltage conduits within manholes, underground vaults/pull boxes, and underground conduits that enter a facility, with an approved mechanical water/gas/air tight plug. Unused conduits shall be sealed with a blank plug.
- C. Seismic Requirements: Contractor will install all equipment racks, equipment cabinet enclosures, cable runways, etc. according to DSA and local, state and/or federal code. Contractor will notify District's Project Manager of such requirements and shall provide such bracing as required. Contractor to coordinate all installation with the structural Engineer of Record.
- D. Safety Requirements: Contractor will utilize appropriate personnel and display warning signs, signals, flags and/or barricades at the work site to ensure adherence to safety regulations and as prudence requires.
- E. Specification/Drawing Status: All specifications and drawings related to this project will be "frozen" after shop drawing approval. The District reserves the right to negotiate any future changes with the Contractor at any time.

### 3.11 MISCELLANEOUS SUPPORT REQUIREMENTS

- A. Upon approval of shop drawings, Contractor shall immediately place orders for all required materials, components, and supplies. In addition, Contractor shall secure and forward written confirmations (including orders and shipping dates) direct from each manufacturer/vendor to the District's Project Manager.
- B. Contractor shall expedite shipment of all materials, components and supplies, as necessary to ensure the successful completion of the Project by the date required. All costs for expediting shall be included within Contractor's pricing as provided below.
- C.

The system cost herein shall include administration/maintenance training for at least five (5) District representatives with a minimum allotment of two (2) eight-hour sessions. All training shall include written and/or video materials that shall remain the property of District. If materials are written, they shall be provided in quantities sufficient for each person trained; if materials are video, one (1) copy of each will be required. The administration/maintenance training shall include, but not be limited to, the following:

1. Review of as-built documentation, including a site demonstration.
  2. All warranty information.
- D. Minimum standards for maintenance purposes shall include optional access to service on a 24 hour-a-day, 365 day-a-year basis. In addition, Contractor shall, upon notification, respond as follows:
1. Emergency Response: Contractor must respond by utilizing remote diagnostics capabilities (as applicable) within thirty minutes of notification. If necessary, Contractor must dispatch at least one certified technician for arrival on-site within two hours of notification.
  2. Non-Emergency Response: Contractor shall respond by utilizing remote diagnostics capabilities and or cause dispatch of at least one certified technician for arrival on-site within one business day of notification.
  3. Definition of "Emergency": For maintenance purposes, "emergency" shall be defined as one or more of the following conditions:
    - a. Defects of any riser pairs and/or components involving at least ten percent (10%) of any riser cable's capacity.
    - b. Defects of station cable pairs and/or components involving at least ten percent (10%) of any department or group of voice and/or data stations.
    - c. Defects significantly impairing any single attendant console.
    - d. Defects of any fiber optic cable and/or components involving at least ten percent (10%) of any department or group's fiber-based systems and/or stations.
    - e. Any pre-defined failure as submitted by District and agreed to be Contractor.

### 3.12 FINAL ACCEPTANCE

- A. The District or District's representative may visit the site during the installation of the system to ensure that correct installation practices are being followed.
- B. The District or District's representative will conduct a final job review once the Contractor has finished the job. This review will take place within one (1) week after the Contractor notifies the District.



- C. Two (2) copies of all certification data and drawings for all identifications shall be provided to the District before the District's review.
- D. The District or District's representative will review the installation and certification data prior to the system acceptance.
- E. The District or District's representative may test some of the systems features to ensure that the certification data is correct. If a substantial discrepancy is found, the District reserves the right to have an independent consultant perform a certification of the entire system. If such a procedure is undertaken, the cost of the testing will be billed back to the Contractor.
- F. In the event that repairs or adjustments are necessary, the Contractor shall make these repairs at his own expense. All repairs shall be completed within ten (10) days from the time they are discovered.
- G. The Contractor shall provide two (2) copies of an "operating and servicing manual" for the system within fourteen (14) calendar days of District's final acceptance of the system. The manuals shall be bound in flexible binders. All data shall be printed material or typewritten. Each manual shall include the following: instructions necessary for the proper operation and servicing of the system; complete as-built installation drawings of the system (11"x17"); equipment specification cut sheets, complete performance test data, complete warrantee information and replacement parts list with current prices listed, contact information for repair and warranty work requests.
  - 1. The Contractor shall mount a full size 30" x 48" bond copy of each scaled Site Plan within MDF room and each IDF room with removable Plexiglas front cover. Frame and cover shall be sized to house the site plan and floor plan drawings. Coordinate location of frame with District's Project Manager prior to installation.
  - 2. The Contractor shall hand to the District a copy of any applicable installation specific software configurations including all log-in passwords in CD format.

END OF SECTION