**Note to Editor: this is a master specification and needs to be edited to become project SPECIFIC. please remove all highlights and text boxes and make all text black once editing is complete.**

##### SECTION 27 10 00

##### STRUCTURED CABLING - EXISTING

1. **GENERAL**
   1. **SUMMARY**
      1. This section describes the structured cabling system which shall include permanently installed backbone and horizontal pathway cabling, outlet assemblies, hardware for terminating and interconnecting.
      2. Products Installed Under this Section: Only new equipment and material, produced by manufacturers that are recognized nationally by the technology industry and approved by Underwriters Laboratory shall be used as specified in this Section or on the Drawings.
         1. All mounting hardware
         2. All mounting brackets
         3. All power cords
         4. All fiber and copper patch cords

**NOTE TO EDITOR: UPDATE AND COORDINATE RELATED SECTIONS FOR SPECIFIC PROJECT**

* 1. **RELATED SECTIONS**
     1. Division 01
     2. Section 23 09 00: Instrumentation and Control for HVAC – Building Automation System
     3. Section 26 05 00: Common Work Results for Electrical
     4. Section 26 50 00: Lighting
     5. Section 27 30 00: Voice Communications
     6. Section 27 41 16: Audio Visual Systems
     7. Section 27 41 33: Master Antenna & TV Systems
     8. Section 27 50 00: Digital Intercom Clock & Bell System
     9. Section 27 51 26: Assistive Listening System
     10. Section 28 16 00: Intrusion Detection System
     11. Section 28 23 00: Digital Surveillance System
  2. **REFERENCES**
     1. NEMA – National Electrical Manufacturer’s Association
     2. ANSI – American National Standards Institute
     3. NEC – National Electric Code
     4. RSEF – Relevant State Electrical and Fire Codes
     5. IEEE – Institute of Electrical and Electronic Engineers
     6. UL – Underwriters Laboratories, Inc.
     7. TIA – Telecommunications Industry Association Standards
     8. ANSI/TIA – 568-C.0, Generic Telecommunications Cabling for Customer
     9. ANSI/TIA – 568-C.1, Commercial Building Telecommunications Cabling Standard
     10. ANSI/TIA – C-2, Balanced Twisted-Pair Telecommunications Cabling and Components Standard
     11. ANSI/TIA – C.2-1, Transmission Performance Specifications for 4-pair 100-ohm Category 6 Cabling, providing the accuracy requirements for Level III field testers; Category 6
     12. ANSI/TIA – C.3, Optical Fiber Cabling Components Standard
     13. ANSI/TIA – 569A Commercial Building Standard for Telecommunications Pathways and Spaces
     14. ANSI/TIA – 606 The Administration Standard for the Telecommunications Pathways and Spaces
     15. ANSI/TIA – 607 Commercial Building Grounding and Bonding Requirements for Telecommunications
     16. ANSI/TIA – 598 Color Coding of Optical Fiber Cables
     17. BICSI – Building Industry Consulting Service International publications:
         1. Telecommunications Distribution Methods Manual
         2. LAN and Internetworking Design Manual
         3. Telecommunications Cabling Installation Manual
         4. Customer Owned Outside Plant Design Manual
         5. Manufacturer’s recommendations and installation guidelines
     18. All cabling shall comply with all appropriate requirements of NEC Articles 770 and 800 and shall comply with the State Fire Codes as interpreted by the State Fire Marshall’s Department.
     19. All publications referred to in this document shall be the latest publicized edition1.3 Definitions.
  3. **DEFINITIONS**
     1. Contractor – The entity responsible for performing or overseeing the installation and configuration of the system.
     2. District – Long Beach Unified School District
     3. District Approved Equal – A product that the Contractor submitted as equal to or greater than the product specified, which subsequently received District approval for use on the intended project. Refer to Division 01s for additional information
     4. District Standard – a design or brand that has been selected by the District Board as the acceptable product.
     5. District Technology Representative – An individual from the District’s Facilities Technology Group. They should possess an official @lbschools.net email address.
     6. District Representative – An authorized individual representing the District, for example a project manager or construction manager.
     7. Hard Lid – A fixed ceiling where the ceiling material is affixed directly to the underside of roof framing.
     8. Integrator – The entity performing the physical installation and configuration of the system, who may be a sub-contractor of the Contractor.
     9. Intermediate Distribution Frame (IDF)
        1. An intermediate termination points for horizontal wiring and cross connections normally within another structure separate from the MDF.
     10. Main Distribution Frame (MDF)
         1. A physical concentration or central location for terminating backbone cables to interconnect with local exchange carrier (LEC) equipment at the activity minimum point of presence. The MDF includes vendor specific components to support voice and data circuits, building surge protector assemblies, main cross connects blocks, equipment support frames, and plywood backboard (if MDF is wall mounted). Depending upon local site conditions, the MDF and IDF may be identical.
     11. Owner – The District’s Technology Information Services Branch (TISB), who will oversee the system after turnover.
     12. UPS - Uninterrupted Power Supply
  4. **SUBMITTALS**
     1. Product Data and Shop Drawings
        1. Integrator to submit shop drawings with device locations and cable routes prior to installation.
        2. Submit product data and manufacturer’s installation instructions.
     2. Certificates
        1. Contractor shall hold and maintain, through the completion, commissioning, closeout, and warranty period of the project, manufacturer's certification for the Structured Cabling System.
           1. Installers shall be CommScope Systemax certified or TE/AMP ND&I certified, Hubbell-Premise certified, or District Approved Equal for Fiber. Include written certification from users that systems have performed satisfactorily for not less than 18 months.
        2. The contractor must be certified with the manufacturer for the Structured Cabling System for at least twelve (12) months prior to bid.
        3. The Contractor shall provide proof of manufacturer’s certification to the District during bid time.
        4. At minimum, the contractor’s qualifications for manufacturer’s certification shall include:
           1. For moves, and changes to existing installed structured communications cable systems, the Contractor shall be certified by the same manufacturer as the existing system.
        5. Provide BICSI Registered Communications Distribution Designer (RCDD) approved drawings complete with wiring diagrams and details required to prove that the distribution system shall properly support connectivity from the MDF to the IDF to the work area outlets.
        6. Submit specific experience in installing and testing structured cabling distribution systems using fiber optic and Category 6 or higher, cabling systems. Provide current certification for installing technicians.
        7. Contractor shall furnish documentation providing proof of calibration and the latest software version of all test equipment.
        8. Provide a complete and detailed test plan for the structured cabling system including a complete list of test equipment for the Category 6, Category 6a and fiber optic cable components and accessories. Include procedures for validation, and testing. Provide current certification for testing technicians.
           1. Submit factory reel tests for fiber optic cables.
           2. Cabling shall be fully terminated from end to end (installed in faceplates and installed into patch panels NEMA rated wall boxes and/or raceway). Prior to finalized testing, pretests will not be accepted as the final report.
           3. Submit certification of staff to utilize listed testing equipment
           4. Submit factory test results for patch cords.
           5. Include specific experience in installing and testing structured cabling distribution systems using fiber optic, Category 6, Category 6a cabling systems.
     3. Qualification Statements
        1. Provide Contractor's experience and qualifications, which shall include three (3) years of projects of similar complexity. Include names and locations of two projects successfully completed.
        2. Provide documentation indicating Contractor has been in the telecommunications contracting business for a minimum of five (5) years under the same name and is located within two hundred (200) miles of the District.
        3. Installers shall be CommScope Uniprise certified or a District Approved Equal for copper systems and Corning NPI certified, CommScope, or a District Approved Equal for fiber systems. Include written certification from users that systems have performed satisfactorily for not less than 18 months.
        4. Include specific experience in installing and testing structured telecommunications distribution systems using fiber optic, Category 6 and Category 6a cabling systems.
     4. Refer to Section 01 33 00 Submittals for additional requirements.
  5. **CLOSEOUT SUBMITTALS**
     1. Documentation to be submitted upon completion:
        1. Upon completion of installation, the Contractor shall prepare and Submit "as-built" drawings of the system. As-builts shall be of each floor plan indicating exact device locations, panels, cable routes and wire numbers as tagged.
        2. Provide Electronic copy of “as-built” drawings in AutoCAD and PDF (Portable Document File) formats.
        3. O&M: Submit complete operations and maintenance manuals. Include required maintenance and maintenance schedule.
        4. For each campus, provide electronic PDF (portable document file) showing schematic of structured cabling system including cabling, IDFs, MDFs, and equipment rooms. Drawings shall depict the following:
           1. Shop and As-Built drawings shall depict District Approved Equal structured cabling system identifications and administration labeling scheme.
           2. As-Built drawings shall depict all final structured cabling configurations, including locations, cable counts and IDF locations after completion of structured cable installation.
        5. Electronic copies of Certification Test Results shall be provided in both native (csv, comma delineated, excel, text) and PDF (Portable Document File) format to the District Representative within ten (10) days of cable installation completion.
        6. 25 Year Warranty of Structured Cabling System shall be provided to the District Representative within ten (10) days of final Test Results. Coordinate with District Representative.

* + 1. Refer to Section 01 77 00 Contract Closeout and Final Cleaning for additional requirements.
  1. **DELIVERY, STORAGE, AND HANDLING** 
     1. Store materials such that they are protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
     2. Repair or replace damaged components prior to Substantial Completion of the project.
     3. Refer to Section 01 66 10 Delivery, Storage and Handling for additional requirements.
  2. **WARRANTY**
     1. The installation must be certified to meet the latest available manufacturer system warranty program requirements for an extended warranty of twenty-five (25) years minimum duration. The performance warranty shall warrant the installed horizontal and backbone copper portion of the system and, as applicable, the installed horizontal and backbone fiber optic portions of the system. All such links and segments shall be warranted in accordance with the latest applicable requirements as defined by TIA.
     2. The Contractor shall warrant the workmanship and installation of the system for one (1) year.
     3. All major component failures must be replaced within a four-hour period. A major component shall be considered any component that affects fifty or more user devices.
     4. The Contractor must provide a four-hour response time to problem calls. Response time is defined as on-site presence of authorized maintenance personnel equipped with appropriate spare parts and diagnostic tools.
     5. During the warranty period, the Contractor shall maintain adequate stock of potential replacement parts to service the system should component failure occur.
     6. Refer to Section 01 78 36 Warranties for additional requirements

1. **PRODUCTS** 
   1. **SYSTEM DESCRIPTION**
      1. All new fiber optic cable and fiber optic patch cords, hardware and termination equipment shall be manufactured by Corning, or District Approved Equal.
      2. All new horizontal cabling, patch cords, hardware and terminating equipment shall be manufactured by CommScope Uniprise, or District Approved Equal.
      3. All existing fiber optic cables, patch cords, hardware and termination equipment to be re-used shall be pulled back, bagged and protected in place. Testing parameters shall be followed according to Section 3.5 Testing.
      4. The horizontal and backbone cabling system includes the interconnecting cabling and sleeves between rooms, terminal hardware for connectivity between the MDF and/or IDFs and the work area outlet.
      5. The backbone system shall be wired in a star topology with the MDF at the center or hub of the star.
      6. Hardware and terminating equipment shall consist of UL approved; Category 6 and Category 6a patch panels, jacks, and fiber optic terminating equipment
      7. Backbone cable shall consist of indoor/outdoor plenum-rated, tight-buffered single mode fiber optic cable. Fiber optic cable shall be OS2 Single Mode. All single fiber optic backbone shall not exceed a maximum distance of 5 kilometers (approximately 3.1 miles). All indoor/outdoor rated fiber optic cable shall be U.L (Underwriters Laboratories) listed.
   2. **STRUCTURED CABLING** 
      1. Cabling shall be UL listed for the application and shall comply with TIA/EIA-568 (most current) standards and NFPA 70. Provide a labeling system for cabling as required by TIA-606 (most current) standards and District Standards. Cabling manufactured more than 12 months prior to date of installation shall not be used.
      2. Horizontal Cabling
         1. Shall consist of Category 6 and Category 6a UTP four pair cables.
         2. Shall match criteria and performance ratings of the existing horizontal cables.
         3. Shall be plenum rated or OSP rated when installed in underground conduits.
         4. The maximum distance between the telecommunications outlet and the horizontal cross connect shall be no more than 90 meters. The maximum total length of all patch cords and jumpers in the telecommunications closet and at the work area shall be no more than 10 meters.
         5. Shall comply with NFPA 70 and performance characteristics in TIA-568 (most current) standards, four-pair ohm.
         6. All jumpers, patch cords, equipment cords, connecting hardware and connectors shall meet all applicable standards as specified in ANSI/TIA 568-C.2 and C.3.
         7. Category 6a rated cable for local area networks shall exceed ANSI/TIA-568 (most current) standards.
         8. Cable jacket shall be Blue (CommScope Uniprise or District Approved Equal) Category 6a for Structured Cabling System.
         9. Cable jacket shall be Aqua (Belden, Hubbell or District Approved Equal) Category 6 for Intercom and Clock system.
         10. Cable jacket shall be Yellow (CommScope Uniprise or District Approved Equal) Category 6a for Security Camera system.
         11. Cable jacket shall be Purple (CommScope Uniprise or District Approved Equal) Category 6a for Extron AV system.
         12. Cable jacket shall be Orange (CommScope Uniprise or District Approved Equal) Category 6a for Electronic Locks system.
      3. Fiber Optic Single Mode Backbone Cabling
         1. Shall be indoor/outdoor (plenum rated only where required by code), loose tube 12 strands minimum, Gel-Free Cable, Riser OS2 /
      4. Fiber Optic Cabling
         1. All indoor/outdoor rated tight-buffered fiber optic cable shall be plenum rated and U.L. (Underwriters Laboratories) listed.
         2. New fiber optic backbone cable shall consist of indoor/outdoor plenum rated Single Mode OS2fiber optic cable.
         3. Backbone cable over 275 meters (902 feet) shall consist of indoor/outdoor, plenum rated cable.
      5. Category 6a Patch Cables
         1. UTP Patch Cables. Patch cables for unshielded twisted pair cable shall be Category 6a and shall be same manufacturer as horizontal cabling and shall be equipped with factory-attached connectors to interconnect equipment mounted on the racks of the distribution frame and to connect computer stations to outlet locations.
         2. Quantity of patch cords required for 100% port population at both ends with 15% spare.
         3. Patch cord footage shall be determined by the Contractor and verified with the District Representative.
         4. Unless otherwise stated, the Structured Cable Contractor shall deliver:
            1. MDF/IDF Patch Cords

Blue in color for Structured Cabling (Category 6a)

Yellow in color for Security Camera System (Category 6a)

Aqua in color for Intercom/clock (Category 6)

White in color for Wireless access points (Category 6a)

Purple in color for Extron AV system (Category 6a)

Orange in color for Electronic Locks system (Category 6a)

Yellow in color for Aiphone system (Category 6a)

All new cables to match existing colors if existing cables are to remain

* + - * 1. Workstations – Category 6a, blue in color, 20-foot length.
        2. Security Camera System– Category 6a, yellow in color, footage determined by contractor
        3. Intercom/Clock – Category 6, aqua in color, footage determined by contractor
        4. Wireless Access Points – Category 6a, white in color, 2 feet in length
        5. Extron AV System – Category 6a, Purple in color
        6. Electronic Locks – Category 6a, orange in color
        7. Aiphone System – Category 6a, yellow in color
    1. Fiber Optic Patch Cables
       1. Fiber Optic Patch Cables shall be single mode patch cords pre-made to connect fiber optic equipment with fiber optic cross connects, interconnects and outlets.
       2. Shall be manufactured by Corning or CommScope.
       3. The patch cords (jumpers) shall be impact-resistant, duplex fiber cables with LC to LC connectors, of the same performance characteristics as the single mode fiber backbone being connected.
       4. Fiber patch cord footage shall be determined by the contractor and verified with the District Representative.
       5. These fiber optic patch panel connections shall provide 0.4 dB or less insertion loss and provide connection between the Active LAN devices and the Fiber Optic patch panel. Quantities for 100% fiber strand population at both ends plus 15% spares.
       6. Unless otherwise stated the Structured Cable Contractor shall deliver:
          1. IDF Patch Cords – LC - LC connectorized, single mode, duplex, fiber optic patch cord.
          2. MDF Patch Cords – LC - LC connectorized, single mode, duplex, fiber optic patch cord.
  1. **PATCH PANELS** 
     1. Copper Patch Panels
        1. Patch panels shall be rack mounted, rated to exceed TIA Standard for Category 6 and Category 6a modular patch panels, each wired to terminate modular jacks per the TIA T568B standard.
        2. Quantities of jacks are based on the number of Category 6 and Category 6a cables originating at wall outlets and terminating at the patch panel plus 15% spares.
        3. 48-port patch panels need to be equipped with label windows above each patch panel port.
        4. All patch panels shall be 48-port capacity unless there is insufficient rack space or district specifies otherwise.
        5. Patch panels shall be black in color.
        6. Copper Patch Panel Manufacturer: CommScope Uniprise.
  2. **CABLE MANAGEMENT** 
     1. All equipment cabinets shall be equipped with horizontal cable management organizers for each fiber optic patch panel and Category 6 and Category 6a patch panel.
     2. Horizontal cable managers shall be designed to extend past the frame to allow placement of equipment in any position within the rack. When mounted between equipment rack frame rails, they shall be securely mounted to equipment rack frame rails.
     3. All equipment cabinets shall be equipped with horizontal cable management organizers for each fiber optic and UTP patch panel.
     4. Horizontal cable managers shall be single sided with black finish and be 2 rack units (2U) in height. Horizontal cable equipment shall have cable pass-through, removable hinged cover and evenly spaced “fingers” designed to maintain and allow the entry and exit of jumper, patch or cross-connect cables and/or wires in place.
     5. Horizontal Cable Manager Manufacturer: CommScope Uniprise, or District Approved Equal.
  3. **FIBER OPTIC PATCH PANELS** 
     1. Provide Patch Panels for maintenance and cross connecting of fiber optic cables.
     2. Patch panels shall be constructed of 0.125-inch minimum aluminum and shall have connectors which interface the inside plant fiber optic jumper cable with the outside plant fiber optic cable.
     3. Patch panels shall be equipped with engraved laminated plastic nameplates above each connector.
     4. Rack-mounted fiber patch panels shall be equipped to terminate or splice the incoming inter-building fiber and any required backbone or interconnect cables.
     5. Each cable must be properly dressed.
     6. These patch panels will terminate the fiber optic cables, provide a place for jumper cables and will provide room to terminate additional optics.
     7. Patch panels shall provide capacity for a minimum of 12 fiber optic strands. Larger capacity patch panels shall be determined at site walks.
     8. Patch panels shall be 100% populated with type LC couplers and adapter plates. All connectors and couplers will be type LC.
     9. The fiber optic patch panel connections shall provide 0.4 dB or less insertion loss.
     10. Fiber Optic Patch Panel Manufacturer: Corning or CommScope
  4. **WALL MOUNTED EQUIPMENT SUPPORT CABINET**
     1. Cabinet shall be fully enclosed lockable, modular type steel construction and treated to resist corrosion.
     2. Cabinet shall have a minimum weight capacity of 300 lbs.
     3. IDF cabinets shall be wall mount/swing out type and provide 19” rack mounting.
     4. Rack shall be designed to allow for left or right-hand swing. Dimensions shall be a minimum of 36”H X 24” W X 30” D.
     5. Manufactures: Hoffman, Tripp Lite, or District Approved Equal.
     6. In selected cases, a 48” high cabinet will be used. Larger cabinet size will be determined on a project-by-project basis.
     7. Cabinet shall be mounted on a fire rated plywood backboard in location to be determined.
     8. Contractor shall be responsible for determining correct cabinet mounting and anchoring methods that will safely support the combined weight of the cabinet and data network components that will occupy the cabinet.
     9. Cabinet mounting and anchoring methods shall comply with the District Representative and State building and safety codes.
     10. When wall mounted cabinets are installed in classrooms, the contractor shall be responsible for providing and installing Acoustical Absorber foam material on inside, back of cabinet. Acoustical Absorber shall be flexible, ½” thick, polyurethane, adhesive backed foam.
     11. Drywall screws shall not be used for mounting cabinets.
     12. Contractor shall be responsible for ensuring that cabinet mounting and anchoring methods are per manufacturers recommendations. Manufacturer: Tripp-Lite, Hoffman Access Plus II Type 1 Double-Hinged Wall-Mount Cabinet, or District Approved Equal.
     13. Contractor shall be responsible for proper grounding of the cabinets per the most current ANSI/TIA 607 standard.

* + - 1. Rack / Cabinet horizontal busbar Hubbell # HGRKTHC or District Approved Equal.
      2. Device ground kit Hubbell # HGRKD##N (## - length in inches) or equal per device installed.
      3. Ground conductor Kit Hubbell # HGRKTDA##DA (## - length in inches) or equal for cabinet grounding to electrical service panel or building steel.
  1. **MDF EQUIPMENT CABINETS/FREE STANDING**
     1. The unit shall be designed to provide a secure, managed environment for computer and networking equipment.
     2. The unit shall conform to EIA-310D Standard for Cabinets, Racks, Panels and Associated Equipment and accommodate industry standard 19” rack mount equipment.
     3. The unit shall be designed with four (4) vertical posts to allow rack mount equipment installation utilizing four (4) vertical mounting rails.
     4. The unit shall provide 42U of equipment vertical mounting space (1U=1.75” or 44.45mm).
     5. The vertical mounting rails shall be adjustable to allow different mounting depths.
     6. The unit shall include at least 60 sets of mounting screws, caged nuts, bolts and cup washers, and caged nut installation tools for the mounting of equipment inside the unit.
     7. Both front and rear doors shall consist of quick release hinges allowing for quick and easy detachment without tools.
     8. The front and rear doors shall open a minimum of 180 degrees to allow easy access to the interior.
     9. The front and rear doors shall be reversible so that they open from either side.
     10. The base unit shall include removable side panels that are removed without tools using easy finger latches for fast access to cabling and equipment.
     11. All weight bearing components shall be constructed from steel no less than 0.9mm (20 gauges).
     12. All metal parts shall be painted using a powder coat paint process.
     13. Plastic materials shall comply with Underwriters Laboratory Specification 94 with V-1 rating (UL94 V-1) or better.
     14. Provisions shall be provided for all enclosure panels and rack-mounted equipment to be earthed or grounded directly to the frame.
     15. Unit shall include a grounding kit containing terminated green/yellow jumper wires and associated hardware.
     16. Units shall be equipped with vertical wire management rings, not to exceed 12” between rings, installed at both the front and rear of the cabinet.
     17. Each cabinet installed shall have one (19”W x 3”D x 3”H) horizontal wire manager installed at top/rear portion of the cabinet.
     18. Units shall be equipped with perforated front and rear doors, perforated top and solid side panels.
     19. Baying brackets shall be provided where multiple mounting cabinets are to be mounted together.
     20. Cabinet Frame with front and rear mesh doors.
     21. "Side Panels" required.
     22. Unit shall have base dimension of 84 inches in height by 31.50 inches in width by 41.86 inches in depth.
     23. Units shall be black in color.
     24. Cabinets shall be seismic/earthquake braced and anchored to floor.
     25. Each campus MDF shall include two free standing equipment server cabinets.
     26. Manufacturer: Trip-Lite SR2400 or District Approved Equal.
     27. Contractor shall be responsible for proper grounding of the cabinets per the most current 607 standard.
         1. Rack / Cabinet vertical busbar Hubbell # HGRKTVC or equal.
         2. Device ground kit Hubbell # HGRKD##N (## - length in inches) or equal per device installed.
         3. Ground conductor Kit Hubbell # HGRKTDA##DA (## - length in inches) or equal for cabinet grounding to electrical service panel or building steel.
         4. Ground conductor Kit Hubbell # HGRKTDA##DA (## - length in inches) or equal for cabinet busbar grounding to electrical service panel or building steel.
  2. **MDF EQUIPMENT CABINET POWER DISTRIBUTION STRIP**
     1. Each equipment cabinet shall come equipped with two 5-foot power distribution strips with (10) 20-amp (NEMA 5-20R) receptacles mounted 6 inches on center.
        1. MDF Cable Runway
           1. The cable runway shall be installed in MDF Rooms. Size: 12-inch-wide, plus side channel, as needed.
           2. Classified by Underwriters Laboratories (UL) as suitable for equipment grounding.
           3. The cable runway shall be used for voice and, or data and video communications cabling only. No electrical wiring shall be placed in cable runway with voice and data cabling.
           4. Wall angle supports shall be steel angles. Ends to be smooth without hooks or projections. Brackets shall be able to support an end load of 600 lb. with a safety factor of 1.65.
           5. Elbows, Tee’s, 90-degree bends and crosses: All horizontal and vertical 90-degree elbows, tees, 90-degree bends and crosses shall be made with right angle couplings, which clamp to the runway without the need for drilling or cutting.
           6. At all horizontal 90-degree bends, tees, and crosses, provide adjustable junction splice kits for large radius cable bends.
           7. Seismically supported by end wall supports, angular wall supports and communications equipment racks.
           8. Black baked enamel finish.
           9. Manufacturer: Chatsworth Products (12”) or District Approved Equal.
  3. **OUTLET/CONNECTOR ASSEMBLIES**
     1. Jacks shall comply with FCC Part 68.5, and TIA/EIA-568 (most current) Standards.
     2. Jacks shall accommodate Category6, Category 6a or fiber optic cable and work in concert with Wiremold 5500 raceway or District Approved Equal.
     3. UTP jacks shall be RJ-45 designation T568B type, UL 1863 listed, eight position, constructed of high impact rated thermoplastic housing rated for 6 service.
     4. Jacks for data shall be Category 6, Category 6a hardware and shall comply with the attenuation requirements contained in TIA/EIA-568 (most current) Standard.
     5. Jacks shall be:
        1. Blue in color for structured cabling.
        2. Yellow in color for Security Cameras.
        3. Aqua in color for Intercom/Clock.
        4. White in color for Wireless Access Point.
        5. Purple in color for Extron AV.
        6. Orange in color for Electronic Locks.
        7. Yellow in color for Aiphone system.
     6. Telecommunications face plates shall comply with UL 514C, and TIA/EIA-568 (most current) standard; flush design constructed of high impact thermoplastic material.
     7. Structured cabling faceplate colors shall be ivory. Structured cabling faceplates shall be available in 2-port, 4-port, and 6-port single-gang configurations.
     8. All unused faceplate openings shall have blanks installed.
     9. Stenciled lettering for voice and data circuits shall be provided using thermal ink transfer process.
     10. Jacks shall be orientated on the patch panel staring at the top left and proceeding in a left to right top to bottom order.
  4. **NON-METALLIC SURFACE MOUNTED RACEWAY**
     1. Conceal cable sleeves within walls whenever possible.
     2. Unless otherwise indicated, raceway shall be three channel, Wiremold 5500 or District Approved Equal with all necessary brackets, adapters, connectors, hardware and equipment to install CommScope Uniprise, or District Approved Equal, certified Structured Cabling systems as described above.
     3. Raceway shall be ivory in color or as noted on drawings.
     4. Notching or modifications of the raceway will not be permitted.
     5. Proper screws and anchors shall be used to mount raceway.
     6. Manufacturer: Wiremold or District Approved Equal.
  5. **NON-CONTINUOUS CABLE SUPPORT**
     1. Material
     2. Contractor shall provide and install all non-continuous cable supporting hardware.
     3. Non-continuous cable supporting hardware consists of J-hooks, multi-function clips, beam clamps, etc. Bridle rings or zip ties are not permitted.
     4. Non-continuous cable supports shall provide a load bearing surface of sufficient width to comply with required bend radii of high-performance cables; UL Listed. Bridle rings are not permitted.
     5. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.
     6. Non-continuous cable supports sized 1 5/16” and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.
     7. Non-continuous cable supports shall have an electro-galvanized or G60 finish and shall be rated for indoor use in non-corrosive environments.
     8. Multi-tiered non-continuous cable support assemblies shall be used where separate cabling compartments are required. Assemblies may be factory assembled or assembled from pre-packaged kits. Assemblies shall consist of a steel angled hanger bracket holding up to six non-continuous cable supports, rated for indoor use in non-corrosive environments; UL Listed.
     9. If required, the multi-tier support bracket may be assembled to manufacturer recommended specialty fasteners including beam clamps, flange clips, C and Z purlin clips, etc.
     10. Tee-bar support bracket with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments.
     11. Fastener to wire/rod with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments.
     12. Fastener to beam or flange with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments.
     13. Fastener to C or Z purlin with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments.
     14. Fastener to wall, concrete, or joist with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments.
     15. Fastener to threaded rod with one non-continuous cable support, factory or jobsite assembled, rated for indoor use in non-corrosive environments.
     16. The multi-tiered support bracket shall have a static load limit of 300 lbs.
     17. U-hooks and double J-hooks shall attach directly to threaded rod using standard nuts.
     18. Manufacturer: Copper B-Line, Erico Caddy, Doc’s J-Hooks or District Approved Equal.
  6. **BACKBOARDS**
     1. Provide fire rated plywood 3/4-inch-thick A/C Grade 36”H X 24” W for mounting of wall mounted cabinets.
     2. Backboards shall be painted with a light color, nonconductive fire-resistant overcoat. Backboards shall be free of voids; fill and sand prior to painting.
     3. Cabinet shall be mounted on a plywood backboard in location to be determined.
     4. Contractor shall be responsible for determining correct backboard mounting and anchoring methods that will safely support the combined weight of the backboard, cabinet and data network components that will occupy the backboard.
     5. Backboard mounting and anchoring methods shall comply with the District Representative and State building and safety codes.
     6. Contractor shall be responsible for ensuring that cabinet mounting and anchoring methods comply with manufacturers recommendations.
     7. Drywall screws shall not be used to mount plywood backboards.
  7. **GROUNDING AND BONDING PRODUCTS**
     1. Comply with UL 467, ANSI/J-STD-607 (most current) standard, and NFPA 70. Components shall be identified as required by TIA/EIA-606 (most current) standard.
        1. Manufacturer: Hubbell or District Approved Equal.
     2. MDF
        1. All MDF Racks shall be installed with a Grounding Busbar (TGB)
           1. The TGB shall be installed in accordance with ANSI/J-STD-607 (most current) standard.
           2. The TGB shall be grounded to the nearest access to the building ground with a #6 AWG insulated conductor.
        2. Building ground is identified as main building electrical ground, building structural steel, or ground rod. Water pipes, gas pipes and electrical conduits are not acceptable ground attachment points.
        3. Ground conductors are not to exceed 40 feet. If the building connection is beyond 40 feet, Contractor is to install a new ground round at the nearest outside location. Ground rod location shall be approved by District Representative prior to installation.
        4. Provide ohms testing for ground. Ground connections shall not exceed 5 ohms.
     3. IDF
        1. All IDFs shall be installed with a grounding busbar (TGB) the TGB shall be installed in accordance with ANSI/J-STD-607 (most current) standard. The TGB shall be grounded to the nearest building ground with a #6 AWG insulated conductor.
        2. Building ground is identified as main building electrical ground, building structural steel, or ground rod. Water pipes, gas pipes and electrical conduits are not acceptable ground attachment points.
           1. Ground conductors are not to exceed 40 feet. If the building ground connection is beyond 40 feet, Contractor is to install a new ground round at the nearest outside location. Ground rod location shall be approved by District Representative prior to installation.
           2. Provide ohms testing for ground. Ground connections shall not exceed 5 ohms.
  8. **FIRESTOPPING MATERIAL**
     1. Contractor shall provide all necessary fire stopping of openings through which cable is installed under this specification, in accordance with NFPA 70 and all local codes. This includes installation in conduits, raceways, or bare penetrations. Provide and install UL 1479 approved (Fire Barrier Caulk) firestop material.
        1. Manufacturer: 3M, STI or District Approved Equal.
  9. **POWER STRIP(S)**
     1. Install 12 outlet, 15A 120v horizontal rackmount Surge Protector at every equipment rack / cabinet in IDF. Tripp-Lite ISOBAR12ULTRA or District Approved Equal.

1. **EXECUTION**
   1. **EXAMINATION** 
      1. Coordinate layout and installation of voice, data, and video communication cabling with the District Representative, other contractors, and equipment suppliers.
      2. Structured Cable Contractor shall attend weekly project meetings.
      3. Meet jointly with other contractors, equipment suppliers, and the District Representative in order to exchange information and agree on details of equipment arrangements and installation interfaces.
      4. Record agreements reached in meetings and distributed to other participants in a timely manner.
      5. Adjust arrangements and locations of distribution frames, cross-connect and patch panels in equipment rooms and/or MDF/IDF rooms to accommodate and/or optimize the arrangement and space requirements of voice and LAN equipment.
   2. **INSTALLATION**
      1. Structured cabling systems, including the horizontal and backbone cable, outlet/connector assemblies, and associated hardware shall be installed in accordance with TIA/EIA-568 (most current) standard, TIA/EIA-569-A, NFPA 70, and UL standards as applicable.
      2. If MDF and/or IDF do not have adequate capacity to support additional cable and termination hardware, Contractor shall provide and install new MDF/IDF cabinet/rack or add to existing IDF equipment.
      3. Contractor shall provide all necessary tools and materials not specified, (Velcro wraps, “d” rings, screws, consumables, hardware, etc.) and equipment, (ladders, hydraulic lifts, storage containers, etc.) necessary to provide a complete and operating system.
      4. The designated District Representative shall be provided with progress reports.
      5. Periodic on-site inspections will be done during installation.
      6. Screw terminals shall not be used except where specifically indicated on plans.
      7. Do not untwist Category 6 or Category 6a UTP cables more than 1/4 inch from the point of termination to maintain cable geometry.
      8. Do not exceed manufacturers' cable pull tensions for copper and fiber optic cables. Provide a device to monitor cable pull tensions. Do not exceed 25 pounds pull tension for four pair copper cables.
      9. Do not chafe or damage outer jacket materials.
      10. Use only lubricants approved by cable manufacturer for outside rated cable. Lubricants for inside rated cable not approved.
      11. Do not over cinch cables, or crush cables with staples.
      12. For Category 6 and Category 6a UTP cable, bend radii shall not be less than four times the cable diameter.
      13. Contractor shall install new ¼” pull rope in all conduits at MDF/IDF.
          1. Pull rope shall be new ¼" polypropylene over polyester rope with a minimum 1700 lb. Tensile strength.
          2. Pull rope shall be new material that is free of knots, kinks, and abrasions and shall be placed as a single continuous length in every new conduit.
          3. Pull rope shall be secured at each end.
   3. **DATA SYSTEMS LABELING PROCEDURES**
      1. The labeling shall be in accordance with the TIA/EIA-606 (most current) standard.
      2. The labeling shall be computer software generated and printed with readable fonts and black ink.
      3. The ink and label shall be water and smear-proof for both indoor and outdoor use.
      4. Samples of each type of media showing label type, labeling format, font size and ink shall be submitted for District Representative approval.
   4. **DATA SYSTEMS LABELING**
      1. The data systems labeling shall include all related equipment, cables, racks, and work area outlets.
      2. Label all cables no more than 6” from each end of the cable designating the rack and room number.
      3. The labeling shall be delineated on any riser diagrams, floor plans and test reports.
      4. The labeling shall be computer software generated and printed with readable fonts and black ink on a white background.
      5. Patch Panels
         1. Patch Panels will be provided with factory lettering located above the ports with port numbers and factory installed field labels installed below the ports.
         2. The patch panel port labels will identify the room station end room number and outlet number.
      6. Outlets
         1. Outlets will be provided with factory labels identifying MDF or IDF and its room number, and related patch panel port number.
   5. **TESTING**
      1. Structured Cabling Testing
         1. Perform structured cabling inspection, verification, and performance tests in accordance with TIA/EIA-568 (most current) standard.
         2. Permanent link testing shall be performed on all cabling.
         3. All testing personnel shall be trained on testing equipment tools to assure that complete and accurate testing results are obtained/provided.
         4. All test equipment shall be calibrated no more than 12 months prior to cable test date. Test equipment shall have the latest software update/release from the test equipment manufacturer.
      2. Inspection
         1. Visually inspect cabling jacket materials for UL or third-party certification markings.
         2. Visually inspect plenum rated Category 6 and Category 6a UTP cable and Indoor/Outdoor plenum rated fiber optic cable jacket materials for UL or third-party certification markings.
         3. Inspect cabling terminations in MDF/IDF rooms and at workstations to confirm color code for tip and ring pin assignments and inspect cabling connections to confirm compliance with TIA/EIA-568 (most current) standard.
         4. Visually confirm Category 6 and Category 6a marking of outlets, cover plates, jacks, and patch panels.
      3. Verification Tests
         1. Perform 250 MHz for Cat.6a, near end cross talk (NEXT) and attenuation tests systems installations.
         2. Perform fiber optic end-to-end attenuation tests using a power meter light source and manufacturer's recommended test procedures. Perform tests in accordance with EIA/TIA-526-14, Method B for horizontal, single mode fiber. Perform verification acceptance tests and factory reel tests.
      4. Performance Tests
         1. Category 6 and Category 6a cable tests.
         2. Category 6 and Category 6a Perform UTP Permanent link tests in accordance with TIA/EIA-568 (most current) standard.
         3. Fiber Optic cable tests.
            1. Perform an OTDR reel test and submit reports to the district representative before installation of the cable.
            2. Perform a Certified bi-directional attenuation tests with a light source and power meter after installation is complete
         4. Perform a bi-directional OTDR test on all fiber optic cables exceeding 90m in addition to the certified attenuation test.
      5. Final Verification Tests
         1. Perform verification tests for Category 6 and Category 6a and fiber optic cable systems after the complete structured cabling and workstation jacks are installed.
         2. Provide District Representative with final test results within 10 days of completion of installation.
         3. Final test results shall include summary pages for each IDF/MDF as required.

**END OF SECTION 27 10 00**