

SECTION 27 10 00

STRUCTURED CABLING SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section of the specification includes the furnishing, installation, connection and testing of a complete Structured Cabling System (SCS). The SCS is defined as all required equipment and cabling including hardware, termination blocks, cross connect wire, patch panels, patch cords, telecommunication outlets, UTP fiber optic cable, and video cable installed and configured to provide a computer data, voice and video connectivity from each data, voice or video device to the network file server or voice network/switch designated as the service point of the local area network. Provide all equipment required to form a complete, operative, and coordinated system as shown on the drawings and specified herein. Components of the SCS shall include, but are not limited to, the following:
1. Optical fiber cable.
 2. Optical fiber connectors.
 3. Optical fiber patch panels
 4. Telecommunications data network racks.
 5. Network patch panels.
 6. Telecommunications data network outlet jacks.
 7. Intra-building telecommunications cable.
 8. Network patch cords.
 9. Video cable.

1.2 RELATED SECTIONS

- A. Section 27 00 00 – General Communications Requirements.
- B. Section 26 05 26 – Grounding.
- C. Section 26 05 29 – Supporting Devices.
- D. Section 26 05 33 – Raceway and Boxes for Electrical Systems.

1.3 REFERENCES

- A. ANSI/TIA/EIA 568A - Electronic Industries Association Telecommunications Industry Association - Commercial Building Telecommunications Wiring Standards.
- B. ANSI/TIA/EIA 568-A1 - Propagation Delay and Delay Skew specifications.
- C. ANSI/TIA/EIA 569 - Commercial Building Standard for Telecommunications Pathways and Spaces.
- D. ANSI/TIA/EIA TSB-67 - Transmission Performance Specifications for Field Testing of Unshielded. Twisted Pair Cabling Systems, October 1995.

- E. ANSI/TIA/EIA TSB-72 - Centralized Optical Fiber Cabling Guidelines, October 1995.
- F. ANSI/TIA/EIA TSB-75 - Additional Horizontal Cabling Practices for Open Offices.
- G. ANSI/TIA/EIA 607 - Grounding and Bonding Requirements for Telecommunications in Commercial Buildings.
- H. ANSI/TIA/EIA 606 - Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
- I. Institute of Electrical and Electronics Engineers (IEEE)

1.4 QUALIFICATIONS

- A. **Installer:** Company specializing in the installation of telecommunications systems, including installation and certification of “Category 6” cabling and optical fiber cable. Company shall have five (5) years (minimum) documented experience on completed projects. All work shall be performed and supervised by telecommunications technicians who are qualified to install voice, data and image cabling systems and to perform related tests. The telecommunications technicians employed shall be fully trained and qualified by the manufacturer of the test equipment for the installation. Evidence that the Contractor is a current certified installer of the manufacturer must be provided in writing prior to commencing work.
- B. **System:** The cabling system shall conform to the current of industry standard ANSI/TIA/EIA 568A. Certification shall be provided that the system will support applications for which it is designed including Category 6 intra-building telecommunications cable performance.

1.5 QUALITY ASSURANCE

- A. **Contractor Quality Assurance:**
 1. Provision of all manufactured components, installation, wiring, and testing shall be the responsibility of a single contractor.
 2. Maintain the same person in charge of work throughout installation.
 3. Supply and install any incidental equipment needed in order to result in a complete and operable system.
 4. Verify correctness of parts lists and equipment model numbers and conformance of each component with manufacturer's specifications.
 5. Unless otherwise specified, supply only new equipment, parts and material, and operate only as required for testing as part of installation procedure.
- B. **Manufacturer Quality Control for Telecommunications Data Network Systems**
 1. All systems components and products specified shall be supplied by a single manufacturer, with the exception data racks and other hardware that is not defined as part of the channel test configuration by TIA/EIA TSB67, Transmission Performance Specifications for Field Testing of unshielded Twisted-Pair Cabling Systems and shall be as specified herein. Unless the words “Or Approved Equal” are included, only the manufacturers listed will be considered.
 2. Each system is to be fully tested upon completion of installation in accordance with PART 3 - EXECUTION of this specification.

1.6 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 27 00 00 and Division 01.
- B. Submit for review prior to the submission of any Submittal, an itemized list of manufacturers of material and equipment and of Subcontractors proposed to be used under this Section. Include a Schedule of anticipated submittal and anticipated lead times after release of reviewed Submittal.
- C. Provide a Submittal Index, with column headings, that clearly identifies the information requested herein, for each and every item submitted. Each and every specification sheet submitted shall include a page number in the lower outside corner of the sheet, double sided specification sheets shall be identified by two (2) separate page numbers. The Submittal Index Column Headings shall identify the following minimum information: Submittal *Page Number(s)* of specification sheet(s) for each item, *Description* of each item, *Manufacturer's Name* for each item, *Manufacturer's Model Number* for each item, *Quantity* of each item being provided.
 - 1. Any submittal which does not include a submittal index that provides a minimum of the information requested herein shall be rejected without further review and returned to the applicable parties.
- D. Equipment shall be of proper size for its allotted space. Equipment may be disassembled as required, where it does not invalidate the manufacturers' warranty, so that it can be installed through available window, door, or louver openings.
- E. Indicate clearly all equipment, components or assemblies that are not Nationally Recognized Testing Laboratory (NRTL) listed or labeled. Failure to indicate otherwise implies NRTL listing or labeling. Products found not to be NRTL listed or labeled where such listing or labeling is available shall be replaced.
- F. Product Data: Submit catalog data sheets or other published materials showing appearances, electrical ratings characteristics and connection requirements, performance characteristics, dimensions, weights, installation methods, and space requirements of equipment and their accessories, as listed below and required by the individual paragraphs:
 - 1. Identification Methods
 - 2. Grounding and Bonding
 - 3. Test Report Formats
 - 4. Test Equipment
 - 5. Test Procedures

1.7 TRAINING

- A. Give detailed instructions, prior to the Substantial Completion of the work, to the responsible personnel designated by the Owner in the operation and maintenance of all work installed under this Section. A letter with two copies containing the name of the person or persons to whom the instructions were given and the dates of the instruction period shall be submitted to the Architect-Engineer at the completion of the project.

1.8 PROJECT RECORD DOCUMENTS

- A. Submit record documents under provisions of Section 27 00 00 and Division 01.

- B. Accurately record location of telecommunications outlets.

1.9 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions. Include wire and cable lengths within 10 feet of length shown for all local data outlets.
- C. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.
- D. PRIOR TO BEGINNING ANY WORK the Contractor shall coordinate the proposed layout of each IDF Closet and the MDF room as well as intended wiring layouts to confirm maximum allowable wiring drop distances as specified herein.

1.10 OPERATION AND MAINTENANCE DATA

- A. Submit data under provisions of Section 27 00 00 and Division 01.
- B. Provide name, address and telephone number of the manufacturer's representative and Service Company for all items supplied so that the source of replacement parts and service can be readily obtained.
 - 1. Include copies of manufacturer's and Installer's warranties and maintenance contracts and performance bonds properly executed and signed by an authorized representative.
- C. Include copies of all test reports and certifications.

PART 2 - PRODUCTS

2.1 UNSHIELDED TWISTED PAIR (UTP) CABLING SYSTEM

- A. Approved Manufacturers:
 - 1. *Belden*
 - 2. *CommScope*
 - 3. *Berk-Tek*
 - 4. *General Cable*
 - 5. *Mohawk*
 - 6. Substitutions: Or Approved Equal.
- B. UTP Pin/pair Termination Assignment: The UTP cabling systems shall have TIA/EIA T568B pin/pair termination assignment. All conductors provided shall be properly and consistently terminated at both ends throughout the entire systems.
- C. Horizontal Cable -Voice & Data:
 - 1. Voice Cable shall be TIA/EIA Category 6 Unshielded Twisted Pair (UTP) cable, as specified.

2. Electrical Characteristics for 24 AWG Extended Frequency Category 6 cable:
 - a. DC Resistance (max) 8.9
 - b. DC Resistance Unbalanced (max) 3.0
 - c. Input Impedance, 1.0 to 100 MHz = 100 +/- 15, 100 to 350MHz = 100 +/- 22
 - d. Characteristics Impedance, 1 to 350 MHz = 100 +/- 15%
 - e. ACR @ 100KHz, db (min) of 21
 - f. PS-ACR @ 100MHz, db (min) of 19
 - g. Delay Skew (max) ns/100m is 25
 - h. Nominal Velocity of Propagation (NVP), % speed of Light, 70
3. Electrical Characteristics:

Frequency	Max. Atten. Db/100m	ELFEXT bd (min)	PS-ELFEXT bd (min)	PS-NEXT bd (min)	NEXT bd (min)	ACR Db/100m	Return Loss db (min)
1MHz	2.0	67.8	64.8	72.3	74.3	72.3	20.0
4MHz	3.8	55.8	52.7	63.3	65.3	61.5	23.0
10MHz	6.0	47.8	44.8	57.3	59.3	53.3	25
16MHz	7.6	43.7	40.7	54.2	56.2	48.6	25.0
20MHz	8.5	41.8	38.7	52.8	54.8	46.3	25.0
31.25MHz	10.7	37.9	34.9	49.9	51.9	41.2	23.6
62.5MHz	15.4	31.9	28.9	45.4	47.4	32.0	21.5
100MHz	19.8	27.8	24.8	42.3	44.3	24.5	20.1
250MHz	32.8	19.8	16.8	36.3	38.3	5.5	17.3
350MHz	39.8	16.9	13.9	34.2	36.2	-	16.3

4. Compliance of 24 AWG Extended Frequency Category 6 cable:
 - a. ISO/IEC 11801
 - b. ANSI/TIA/EIA 586-5 (Category 6)
 - c. ANSI/ICEAA S-90-661 (Category 6X-100)
 - d. NEWA WC 63.1 (Category 6)
 - e. UL Listed Type MPR/CMR
 - f. (UL) CMG

D. Riser Cable-Voice & Data (Category 6)

1. TIA/EIA Category 6 Unshielded Twisted Pair (UTP)
 - a. Able shall meet or exceed all current specifications for Category 6 cable per EIA/TIA, 24AWG, 4-pair cable.
 - b. Riser rated cable – CMR rated jacket for Riser applications.

E. Patch Panels

1. Patch panels shall be EIA nineteen inch (518mm), rack mounted, TIA/EIA Category 6, UL Category 6 type patch panels with integral printed circuit board, color-coded, high density, IDC type terminations and 8 position modular jacks. Keyed jacks are not allowed. Jacks shall be able to withstand at least a minimum of 2000 mating cycles without any transmission degradation.

2.2 110 WIRING BLOCKS/CROSS CONNECTOR BLOCKS

- A. Cross Connector Blocks Manufacturers:
 1. *Ortronics* model OR-30600150/OR-110ABC6050
 2. Substitutions: or approved equal
- B. Description: 200-pair 19" x 7" rack mount panel with 110 wiring blocks. Provide termination kit and termination labels.

2.3 OPTICAL FIBER CABLE SYSTEM

- A. Approved Manufacturers:
 1. *Belden*
 2. *CommScope*
 3. *Berk-Tek*
 4. *Siecor*
 5. *Optical Cable Corp.*
 6. Substitutions: Or Approved Equal.
- B. Fiber Optic Backbone Cable
 1. Multimode fiber optic cable: Cable shall be NRTL certified to TIA/EIA 492CAAA, 492AAAA EIA/TIA 568B Series standard, TSB72 and ANSI X3T9.5 fiber optic specifications, 62.5/125 micron, 1300 nm, graded video, dual window 6 pair (12 strand) tight buffer, multimode distribution cable.
 - a. Riser-rated multi-mode cable - OFNR jacket, distribution cable for Riser applications.
 - b. Plenum rated, multi-mode cable - OFNP jacket, distribution cable for Plenum applications.
 - c. The maximum attenuation measured at 23 degrees C. shall be 3.75 dB/km @ 850 nm and 1.5 dB/km @ 1300 nm. The minimum bandwidth shall be 160 MHZ @ 850 nm and 500 MHZ @ 1300 nm.
 2. Modular Connectors and Couplers
 - a. Fiber optic modular connectors/couplings shall be NRTL listed and TIA/EIA compliant, type "SC" terminations. Connectors and couplings shall be able to withstand at least a minimum of 2000 mating cycles without any transmission degradation. Maximum optical loss budget shall not exceed .75 dB per termination and 1.5 dB per mated pair.
 - b. The connectors and couplings shall be compatible with the installed fiber optics: multi mode 62.5/125 micron optics.
 - c. Fiber optic connectors shall be terminated by the following methods:
 - 1) Hot Melt
 - 2) Heat Cured Epoxy
 - 3) Ultra Violet Cured Epoxy

- 4) Anarobic
- 5) Mechanical Splice with Index Matching Gel
- d. Fiber optic connectors and couplers shall be provided by a single Manufacturer.
- e. Multimode connectors shall be beige in color.
- 3. Fiber Optic Patch Panels
 - a. Patch panels shall be capable of terminating 12 pair (24 strands) of a fiber optic cable.
 - b. Patch panels shall be rack mounted 1.75 inch (44mm) high EIA nineteen inch (518mm) wide, rack mounted, drawer type with integral cable management, patch panels pre-loaded with duplex SC couplings.
- 4. Fiber Optic Patch Cables
 - a. Provide NRTL certified EIA/TIA 492AAAA, EIA/TIA 568B Series standard performance tested patch cables as required for a complete operational system. Patch cables shall be factory pre-connectorized, two strand, "SC" type connectors, tight buffer. Patch cables connectors shall be provided by the same manufacturers as the fiber optic connectors and couplings.
 - b. Patch cables shall match the fiber optic system installed, multimode 62.5/125 micron.
 - c. One strand of the patch cable shall have a distinguishing mark throughout its entire length to simplify the distinction between Transmitting (Tx) and Receiving (Rx) at the patching area. Color coded factory marked (Tx-Rx) connectors are preferred.
- 5. Fiber Optic Cable Management
 - a. Each equipment rack shall have horizontal and vertical cable management panels and brackets.
- D. Horizontal cable management shall be EIA nineteen inch (482mm) rack mounted 1.75 inch (44mm) high drawer panel with integral cable management and shall be provided for each fiber optic patch panel. This cable management drawer panel is for the fiber optic patch cables and is separate from the fiber optic patch panel drawer.

2.4 VIDEO CABLE SYSTEM

- A. Approved Manufacturers:
 - 1. *Belden*
 - 2. *CommScope*
 - 3. *General Cable*
 - 4. Substitutions: Or Approved Equal.
- B. The video cable shall be coaxial copper-clad center conductor, foam polyethylene dielectric, quad-shield aluminum-Mylar-aluminum foil type, aluminum braid shield and non-contaminating polyvinyl chloride jacket. Cable shall have 75 ohm impedance with 80 dB shielding. No discontinuity shall exist within 54-216 MHZ and 470-890 MHZ bands. Cable shall be used as follows:
 - 1. Hardline backbone cable shall be equivalent to *CommScope* QR 540 Hardline Coax Cable.
 - a. The trunk/backbone cable shall be home run directly to video headend location. If field amplification is required to increase dB levels, the amplification hardware must be installed in applicable IDFs or MDFs.
 - b. Backbone cable shall meet or exceed the following nominal attenuation and shall not exceed 1000 feet from headend:

5mhz	.13db/100'
30mhz	.34db/100'
50mhz	.43db/100'
108mhz	.63db/100'
220mhz	.93db/100'
400mhz	1.26db/100'
750mhz	1.80db/100'
865mhz	1.90db/100'
1000mhz	2.10db/100'

2. Drop Cable shall be equivalent to *CommScope* RG-6/U, utilize quad-shielding
 - a. Plenum-Rated Cable: #2227K CMP rated jacket for Plenum applications.
 - b. Drop cable shall meet or exceed the following nominal attenuation specifications and shall not exceed 100 feet to tap on A/V Distribution Trunk/Backbone cable:

1mhz	.21db/100'
10mhz	.65db/100'
50mhz	1.46db/100'
100mhz	2.04 db/100'
200mhz	2.98db/100'
400mhz	4.46db/100'
700mhz	5.89db/100'
900mhz	7.47db/100'
1000mhz	8.02db/100'

3. Underground service cable shall be equivalent to *CommScope* RG-11.

C. Video Cable Connectors

1. Connector type shall be compatible with cable type.
2. Connector types:
 - a. "F" connector - 75 ohm with hexagonal 3/4 inch compression termination.
 - b. BNC" connector - 75 ohm with hexagonal 3/4 inch compression termination.

D. Video Cabling Splitting Devices

1. Cable tap/splitting devices shall be used in the system as required to meet specified signal strength at each jack location. These units shall utilize a die cast housing and RF shielding exceeding local cable company requirements (minimum -80dB) and be equipped with flanges to permit mounting on any flat surface and shall meet FCC specifications on radiation.
2. Passive Splitters shall have a rated frequency range of 5-1000 Hz and shall be equivalent to Blonder Tongue XRS series.
3. Two-way splitters shall have a maximum splitting loss of 3.8 dB. Four-way splitters shall have a maximum splitting loss of 8.4 dB. Directional couplers shall be available in nominal tap loss values of 8, 12, and 16 dB and the return loss of any terminal shall be 18 dB or higher.
4. Terminating Resistor: Terminating resistors with 75 ohm impedance shall be installed at unused ports and feeder line ends. Terminating resistors shall be designed to cover the frequency range from 5 MHZ to 890 MHZ with minimum return loss of 25 dB at UHF and 30 dB across the VHF band.
5. Directional Coupler Tap, Flush Mounted: Directional coupler type taps shall be provided as required for signal distribution. The taps shall be fully shielded and in compliance with FCC rules pertaining to radiation. The taps shall be available in isolation values of 3, 8, 12, 16, 20, and 24 dB. Frequency response through any port shall be from 5 MHZ to 890 MHZ.
6. The directional coupler taps shall provide a single RF outlet with a type "F" connector. A through match shall be 18 dB minimum and back match shall be in excess of 14 dB. Any combination of taps shall provide a minimum isolation between tap ports of 30 dB. Through connection to the tap shall be made by standard type "F" fittings. The tap shall be housed in a rugged cast aluminum case and shall be above first floor lay-in ceilings.
7. Directional Coupler Multi-Tap, Surface Mounted: Eight-way directional couple-type taps shall be provided as required for signal distribution. The taps shall be fully shielded and in compliance with FCC rules pertaining to radiation. All connections to the unit shall be by standard type "F" connectors. The taps shall be available in isolation value of 20 dB.
8. The frequency response shall be from 12 MHZ to 890 MHZ and the return loss at any port shall be no less than 14 dB. Isolation between any two tap outlets shall be no less than 30 dB from 5 MHZ to 400 MHZ and no less than 15 dB from 470 MHZ to 806 MHZ.
9. The tap shall be housed in a rugged cast aluminum housing provided with flanges to permit mounting on any flat surface.

2.5 VIDEO OUTLET BOXES

- A. Outlet Boxes: Sheet metal as specified in Section 26 05 33.

2.6 VIDEO OUTLETS

- A. Manufacturers:
 1. *Leviton* model Quickport Series
 2. *AMP*
 3. *Hubbell*
 4. Substitutions: Or Approved Equal.

- B. Recessed Single Outlet Wall Type: “F” style threaded coaxial cable connector suitable for back wiring and mounting in a standard electrical box. Jack shall include a plastic ivory faceplate and mounting lugs.
- C. Outlet Combined With Network Jacks: “F” style threaded coaxial cable connector to be included in multi-gang faceplate as specified under Section 27 10 00.

2.7 TELECOMMUNICATIONS DATA NETWORK RACK

- A. Description: EIA/TIA 19-inch wide telecommunications rack and accessories. Floor racks shall be constructed of heavy gauge metal with standard 4-post configuration. Provide adjustable leveling feet and earth grounding kit. Provide a complete assembly for mounting all telecommunications equipment within racks.
- B. Floor Rack Manufacturers:
 1. *Chatsworth* – Four-Post System
 2. Substitutions: Or Approved equal
- C. Free Standing Floor Equipment Racks: Free standing equipment racks shall be seven feet (2134mm) high, EIA nineteen inch (518mm) wide, fifteen inch (381mm) deep, open bay as indicated on the Drawings. Rack features shall include the following:
 1. Universal hole pattern on the front and rear flanges, and mounting holes on both sides of rack assembly for management brackets.
 2. Racks shall be extruded (not sheet metal) with 10 - 32 threaded equipment mounting holes. Mounting holes that require supplemental threaded clips are specifically prohibited.
 3. Shelves for electronic equipment with load carrying capacity to support at least 125 percent of each piece of electronic equipment weight. Shelves shall have adequate openings within them to dissipate heat and allow for adequate electronic equipment ventilation.
 4. Mounting brackets specifically designed to support the equipment installed within the rack.
 5. Hook and loop (Velcro) cable strain relief system on rear of rack to support horizontal and backbone cables. Tie-wraps are specifically prohibited.
 6. Hook and loop (Velcro) horizontal and vertical cable management on front of rack for dressing patch cable and cross connect wiring. Tie-wraps are specifically prohibited.
 7. Hook and loop (Velcro) cable management system independent of telecommunications cabling management to properly dress the electronic equipment power cords through the rack maintaining as much clearances between the two as possible. Tie-wraps are specifically prohibited.
 8. Bonding and grounding cables for all equipment not directly bolted to equipment rack (i.e shelf mounted electronic equipment, etc.).
 9. Bonding and grounding bus bar with individual set screw terminals for at least a minimum of six #6 Cu. bonding cables.
 10. Surge protected power strip as described in this specification.
 11. Patch panels as described in this specification.
 12. All hardware, supplementary steel, channel and supports as required to properly assemble the rack and support it to the building structure.
- D. All equipment racks and cabinets and their hardware shall be properly assembled and match in appearance and shall be provided by the same manufacturer.

- E. Equipment cabinets with cables entering from above shall have enclosed square raceway to above ceiling. Raceway shall be code gauge steel, sized per code, attached and terminated at equipment cabinet and building structure with approved bushed terminations. Raceway shall be painted to match equipment cabinets.
- F. Cable Management
 - 1. Each equipment rack and equipment cabinet shall have cable management panels with horizontal and vertical brackets.
 - a. Cable management shall be EIA nineteen inch (518mm) rack mounted 3.5 inch (88mm) high panel with horizontal and vertical patch cable, distribution rings, or approved equivalent and shall be provided above and below each patch panel in the equipment rack.
 - b. Equipment rack cable management shall be furnished by patch panel manufacturer.
 - c. Cable management for high density, IDC Type cross-connect block panels shall be distribution rings integral to the panel or approved equivalent. Cable management shall be provided above and below each cross connect block in the equipment rack.

2.8 SURGE PROTECTED POWER STRIP

- A. Manufacturers:
 - 1. *Wiremold*
 - 2. *Sentrex*
 - 3. *TrippLite*
 - 4. *S.L. Weber*
 - 5. Substitutions: Or approved equal
- B. Surge protected power strip shall be rack mount type.
- C. Surge protected power strip with six NEMA 5-15R outlets 15 amp capacity, 120 volts, UL 1449 listed, maximum surge current of 33,000 amps, clamping voltage of 260 volts, maximum 5 picosecond response time, resettable overload circuit breaker, surge suppression warning light, surge protection for line to neutral, line to ground, neutral to ground, EMI/RFI filters. One required for each load up to 1200 watts (total of individual equipment loads).

2.9 RACK MOUNTED UPS

- A. Manufacturers:
 - 1. *APC Model SUA1000RM2U.*
 - 2. Substitutions: Or approved equal.
- B. Description: Rack mounted uninterruptible power supply unit rated to operate 670 watts for 8.8 minutes or 335 watts for 29.9 minutes.
 - 1. Output Capacity: 670 watts/1000 VA.
 - 2. Nominal Output Voltage: 120 volts.
 - 3. Output Connections: (6) NEMA 5-15R.
 - 4. Input Voltage: 120 volts.
 - 5. Input Connections: NEMA 5-15P (8 foot cord).
 - 6. Battery Type: Maintenance-free sealed lead acid.

7. Battery Recharge Time: 3 hours.

2.10 TELECOMMUNICATIONS DATA NETWORK OUTLET JACKS

- A. Manufacturers:
 1. *Leviton* "Quickport" Series
 2. *AMP*
 3. *Hubbell*
 4. *Ortronics*
 5. *Panduit*
 6. Substitutions: Or approved equal.

- B. Each Outlet shall consist of the following:
 1. Single gang or dual gang face plate shall be thermoplastic (nylon) with number of voice, data, video and sound jacks as indicated in the Specifications and Drawings.
 2. Electrical Subcontractor shall provide 4" square backboxes for all Single gang and Dual gang outlet face plates. Provide single gang and dual gang plaster rings for the specified Single gang and Dual gang outlet face plates.
 3. Refer to Electrical drawings for placement of Work Area Outlets.
 4. Outlets:
 - a. Voice & Data Outlet - shall consist of two (2) white color modular Category 6 RJ-45 8-position connectors mounted on single gang faceplate, with the capabilities listed below. Provide blanks for faceplate
 - 1) One (1) RJ45 connector shall be used for data and cabled to relevant IDF/MDF patch panel with one (1) 4-pair Category 6 unshielded twisted pair cables.
 - 2) One (1) RJ45 connector shall be used for voice and cabled to relevant IDF/MDF patch panel with one (1) 4-pair Category 6 unshielded twisted pair cables.
 - b. Video Outlet – shall consist of a single video "F" style connector mounted on a single-gang faceplate.

2.11 BONDING AND GROUNDING JUMPER CABLE

- A. Manufacturer: Provide products meeting the requirements of the Drawings and Specifications from one of the following manufacturers:
 1. *Belden* (No. 8669)

- B. Jumper cable shall be hollow braided, 60 amp capacity, copper.

- C. Provide equal conduct of as described in "B" above for aluminum equipment.

- D. Jumpers shall have compression or exothermic type terminals on both ends of cables. Terminals shall be compatible with jumper cable material and equipment material in order to not have any degenerative reaction.

2.12 EQUIPMENT/CABLE IDENTIFICATION

- A. All equipment and cabling shall be properly identified by means of clear and concise labels. All identification shall meet or exceed the minimum requirements of EIA/TIA568A, 606 and BICSI standards.
- B. Permanently label, using pre-printed labels, all cables and terminations. Handwritten or embossed type labels are specifically prohibited
1. Label all equipment racks, panels and cross connect blocks uniquely.
 2. Label patch panels and cross connect blocks numerically, top-to-bottom.
 3. Label cable segments by designated incoming cable.
- C. Labels
1. Provide color-coded labels with CODED identifiers as follows:
 - a. Conduits and other pathways shall be labeled at all end points including equipment rooms, telecommunications closets, pull boxes and the like. Provide adhesive labels on the conduit with at least one label within each space that the conduit passes through. Labels shall be attached by means of the label adhesive and color-coded pressure-sensitive tape wrapped around conduit at least one and one half times.
 - b. Cables shall have double lapped adhesive labels at all end points including Work Area Outlets, telecommunication closets and equipment rooms. Cables shall also have factory imprinted manufacturer's name, part number and the NRTL certified UL EIA/TIA category rating designation at a minimum of two foot (610mm) intervals along the entire length of the cable.
 - c. Termination hardware shall have adhesive labels on both the front and rear (if accessible) of the hardware.
 - d. Insert Labels shall be provided in each Work Area Outlet patch panel termination hardware (top of jack) cross connect blocks (edge of block) and the like.
 - e. Outlet boxes, junction boxes and the like shall have adhesive labels attached on the inside and located where visible from the outlet opening.
 - f. Grounding and bonding system shall have engraved labels at each ground bar and backbone grounding cable as it passes through each room. Each bonding jumper shall have heat shrink labels at all end points.
 2. Labels shall be constructed of approved material in order to meet the legibility, defacement, adhesion (adhesive labels only), and exposure requirements of UL 969. All labels shall be mounted horizontally in order to be read from left to right.
 - a. Adhesive Labels shall be constructed of color-coded paper with a clear polyester over laminate, Brady USA, Inc. PermaShield, RayChem TMS or approved equal. Adhesive material used shall be approved for material being attached to, typeface shall be medium density, Helvetica, 1/8 inch (3mm) high black characters unless indicated otherwise.
 - b. Heat-Shrink Labels shall be constructed of color-coded flame retardant, heat shrinkable polyolefin, Brady USA, Inc, RayChem TMS or approved equal. Typeface shall be medium density, Helvetica 1/8 inch (3mm) high black characters unless indicated otherwise.
 - c. Insert Labels shall be constructed of color-coded paper inserted behind clear plastic label holder. Work Area Outlets shall have white color labels inserted behind a flush mounted (recessed) plastic window. Patch panels and cross connect block may have continuous clear plastic insertion strips label holders with label strips. Label strips shall have distinct markings to indicate where one jack or cross connect

ends and the adjacent one starts. Typeface shall be medium density, Helvetica 1/8 inch (3mm) high black characters unless indicated otherwise.

- d. Each Network Interface Outlet shall have each of its eight-position modular jacks provided with a color-coded, embossed modular ICON. The telephone jack icon shall be red and shall have either the word "VOICE" or a telephone logo. The data jack icon shall be blue and shall have either the word "DATA" or a computer logo. The Network Interface Outlet jack provided shall also be able to have additional ICON types such as but not limited to "LAN1 " or "LAN2" and the like available for use. Coordinate with the Owner through the Architect-Engineer, the specific icon's required for this project.
- e. Handwritten or embossed labels are not allowed.

2.13 CABLE SUPPORTS

- A. Wiring cable supports shall be as specified under Section 26 05 29.

2.14 PATCH CORDS

- A. Patch cords shall match the characteristics of UTP cable and shall be in lengths as required. Provide terminations at each cable end.
 1. Test each cord according to the requirements listed under paragraph 3.4.
 2. Provide one patch cord for each switch service cable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Verify that field measurements are as shown on Drawings.
- C. Beginning of installation means installer accepts existing conditions.

3.2 TELECOMMUNICATIONS DATA NETWORK OUTLET JACKS

- A. Install and connect data outlet jacks in boxes at locations indicated on Drawings.
- B. Install outlet jacks in accordance with manufacturer's instructions.

3.3 TELECOMMUNICATIONS DATA NETWORK WIRING

- A. Provide continuous, unspliced, UTP horizontal drop cable from data/voice outlets to owner-furnished network switches located in the equipment rack in the Server Room.
- B. Optical fiber cable and intra-building telecommunications cable shall be handled, installed, and supported in conformance with manufacturer's recommendation and EIA/TIA 569. During the laying of cable, the Contractor shall take care not to over stress the cable. After cables are installed, the Contractor shall make sure that all parts of the cable are supported properly and are stress-free at both ends and throughout their length.

- C. The Contractor shall insure that the installed bending radius of optical fiber cable and intra-building telecommunications conforms to the manufacturer's requirements. At no location shall a cable's static or dynamic bending radius be exceeded.
- D. Conceal intra-building telecommunications cable above accessible ceilings or in walls where practical. Route intra building telecommunications cable in cable tray as indicated on the drawings. Where telecommunications cables are not concealed above ceilings or in walls, or run in cable tray, such cables shall be run in conduit.
- E. Do not make splices in optical fiber cable or intra-building telecommunications cable.
- F. All 4 pairs of each unshielded twisted pair (UTP) intra-building telecommunications cable shall be terminated on a single port. The splitting of cable pairs between different jacks is not permitted.
- G. Terminating intra-building telecommunications cable pairs (Category 6) shall have a maximum of 13mm (0.5 inches) of cable untwisted before termination.

3.4 CABLE TESTING

- A. Sub-contract with an independent testing company to test and certify all intra-building telecommunications cabling to identify pair reversal, crossed pairs, opens and shorts. Testing shall comply with ANSI/TIA/EIA 568A, TSB67. Perform test using a network analyzer, Microtest Penta scanner, or approved equal. Test results shall be documented, corrections implemented and re-testing conducted and documented. In addition, documentation shall be presented to show the length of the cable between outlet jack and the telecommunications rack. Submit written test results for review and acceptance.
- B. Attenuation testing for optical fiber cable shall be performed after the fiber is installed. Provide documentation of test results.

3.5 VIDEO CABLE OUTLETS

- A. Provide video outlet boxes and jacks as shown on Drawings.
- B. Provide recessed (flush) mounted video outlet boxes in all finished areas.
- C. Do not install recessed video outlet boxes back-to-back in walls; provide minimum 6-inch separation. Provide minimum 24 inches separation in acoustic rated and fire rated walls.
- D. Secure recessed video outlet boxes to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- E. Install video outlet boxes at height indicated on Drawings.
- F. Adjust video outlet jacks and wall plates to be flush and level.

3.6 VIDEO CABLE WIRING

- A. Route interior cable concealed in partitions above ceilings.
- B. Do not make splices of video cables.
- C. Provide video cables continuous from outlet jacks to cable taps and service point.
- D. Support video cables with telecommunications supporting devices as specified under Section 26 05 29.

3.7 GROUNDING

- A. Each equipment rack shall be connected to the telecommunications ground as specified in Section 26 05 26 and in accordance with applicable code requirements as per EIA/TIA 607. Communication bonding and grounding shall be in accordance with the NEC® and NFPA. Horizontal cables shall be grounded in compliance with ANSI/NFPA 70 and local requirements and practices. Horizontal equipment includes cross connect frames, patch panels and racks, active telecommunication equipment and test apparatus and equipment. Provide a Telecommunications Bonding Backbone utilizing a #6-AWG or larger bonding conductor that provides direct bonding between equipment rooms and telecommunications closets. This is part of the grounding and bonding infrastructure (part of the telecommunications pathways and spaces in the building structure), and is independent of equipment or cable. All data equipment shall be properly grounded in the Server Room per manufacturers requirements.

3.8 UPS UNITS

- A. Provide a rack mounted UPS unit for all telecommunications equipment racks.

END OF SECTION 27 10 00