PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Conduit
B. Conduit Supports
C. Hangers and Cable Ties
D. Raceways
E. Ladder Racking
F. Innerduct
G. Cable Tray
H. Splice Cases - Indoor Copper
I. Fiber Optic Terminal Panels
J. Cable Tags and Labels
K. Communications Backboards
L. Station Outlets
M. Faceplates
N. Copper Cable Termination Blocks
O. Equipment Racks
P. Pull Boxes and Cabinets
Q. Wire Managers
R. Data Network Patch Panels
S. Protector Panels
T. Telecommunication Cabinets

1.2 RELATED SECTIONS

A. Contract General Conditions, Supplemental General Conditions, Special Conditions and Contract Terms
B. Section 07270 – Fire Stopping
C. Section 16710 - Telecommunications General Requirements

D. Section 16715 - Telecommunications Acceptance Testing

E. Section 16725 - Telecommunications Cable

F. Section 16730 - Underground Structures - Telecommunications

G. Section 16740 - Cable Antenna Television Distribution System

H. Section 16760 - Telecommunications Grounding and Bonding

1.3 APPLICABLE PUBLICATIONS

A. As defined in Section 16710 - Telecommunications General Requirements.

1.4 SUBMITTALS

A. The Trustees/University shall receive the following Contractor materials prior to the start of work. Submittal of this equipment and material simultaneously in a neatly bound format.

A. Product data for:

(1) Innerduct

(2) Cable trays

(3) Ladder Racking

(4) Splice cases

(5) Equipment racks and wire managers

(6) Fiber optic patch/termination panels, frames, enclosures, and hardware

(7) Copper terminals, hardware and management

(8) Cable and splice case identification tags

(9) Station hardware (outlets and jacks)

(10) Telecommunication Cabinets

(11) Protection blocks and modules

(12) Pull boxes

B. Telecommunication 19” racks (including rack mounted equipment) and 110 field wall-mounted devices on backboards have been shown on the construction drawings in a manner reflecting industry standard practices. If the basic wall or rack layouts are modified due to specific equipment supplied by the Contractor not conforming to the layouts provided in the Plans, Contractor shall provide 8.5” x 11’ sketches depicting
equipment and material being supplied by the proposed Structured Cabling System supplier design. Sketches shall specifically identifying equipment location, appropriate horizontal and vertical cable management needed to support this installation consistent with the latest EIA/TIA standards, location of splice cases in Building Distribution Frame rooms. Subsequent to final acceptance of the project, the Contractor shall submit these sketches shall be prepared in an approved electronic format for the campus’ use in administration and managing the system installed by this project.

PART 2 – MATERIALS

2.0 BASIC MATERIAL REQUIREMENTS

A. Where applicable, the Contractor shall install materials and equipment as part of a Structured Cabling System. The various sections of this specification naming specific products and/or installation requirements must conform to the extended Warrantee requirements of the proposed Structured Cable System supplier (refer to Specification Section 16720, Paragraph 1.5E (1-4) for the SCS warrantee requirements). These supplier’s shall Avaya Communications, Berktek-Ortronics, Belden-Panduit or AMP Communications (with an approved cable suppliers) and an equivalent SCS supplier as approved under the provision of the Special Conditions.

B. All UTP systems components shall be provide in a manner compliant with the EIA/TIA standards for installation, testing and acceptance of a Category 5e cabling.

2.1 CONDUIT

A. Rigid Steel Conduit

(1) Rigid steel conduit shall comply with Underwriter's Laboratories UL-6 Specification, ANSI C80.1 and Federal specification WW-C-581E or latest revisions. Conduit shall be hot dip galvanized on the exterior, with zinc or enamel on the interior.

(2) Couplings, locknuts, and all other fittings shall be galvanized or sheardized, waterproof and threaded type only. Rigid conduit shall terminate with two locknuts - one outside and one inside enclosures and specified bushings. No running threads or chase nipples shall be issued without approval. Manufacturer: Appleton, Crouse-Hinds or equal.

(3) Bushings shall be non-metallic for 1 inch and smaller and insulated metallic for conduits larger than 1 inch.

C. Intermediate Metallic Conduit (IMC)

(1) IMC shall comply with proposed Underwriter's Laboratories UL 1242 and Federal Specification WW-C-581E or latest revision. Conduit shall be hot dipped galvanized on the exterior, with corrosion inhibiting coating on the interior.

(2) Couplings, locknuts, and all other fittings shall be galvanized or sheardized, waterproof and threaded type only and shall be the same material as conduit. Manufacturer: Appleton, Crouse-Hinds or equal.
D. Electrical Metallic Tubing (EMT)

(1) EMT conduit shall comply with Underwriter's Laboratories UL 797, ANSI C80.3 and Federal Specification WW-C-563 or latest revision. EMT shall be galvanized or sheardized.

(2) Couplings and connectors for EMT shall be galvanized or cadmium plated and shall be of the compression type requiring the tightening of a nut on a gland ring. No die cast type shall be allowed. All connections shall have permanent insulated throats. Manufacturer: Appleton, Crouse-Hinds or equal.

E. Polyvinylchloride (PVC): PVC shall be rigid heavy weight type, Schedule 40, type C, complete with PVC fittings.

F. Conduit for communications shall be as defined in Division 16 electrical materials.

G. All communication conduits two inches in diameter and larger shall be equipped with a terminating bushing or collar to protect cables during placement.

H. All station conduit shall be no smaller than one and one-quarter inch (1¼") in diameter.

2.2 CONDUIT SUPPORTS

A. Pipe hangers for individual conduits shall be factory made, consisting of a pipe ring and threaded suspension rod. The pipe ring shall be malleable iron, split and hinged, or shall be interlocked with the suspension rod socket.

B. Pipe racks for a group of parallel conduits shall be galvanized structural steel preformed channels of length as required, suspended on threaded rods and secured thereto with nuts above and below the cross bar. All offsets shall be in the same plane and shall be parallel.

C. Factory made pipe straps shall be one-hole malleable iron or two-hole galvanized clamps.

D. Manufacturer: Kindorf, Unistrut, T&B or equal.

2.3 HANGERS AND CABLE TIES

A. Materials: All hangers and cable ties shall be designed to support communications cable (including the fiber) without kinking or damage. Horizontal cable supporting hardware shall be UL Listed. The J-hook(s) shall provide a broad base for proper cable support, thereby reducing stress and bending of cabling. Contractor shall utilize the appropriate J-hooks per Manufacturer’s recommended cable capacities.

(1) Hangers shall be metal construction and shall provide a wire loop or elbow designed to support multiple communications cables.

(2) No more than twelve (12) station cables may be supported by a single hanger without using a saddle (3 inches wide at a minimum) to support the weight of the additional cables.
(3) Cable ties used within a rated ceiling plenum space shall be rated low smoke and shall be certified for use in a plenum environment.

B. Manufacturers: 3-M, Panduit, or approved equivalent.

2.4 SURFACE MOUNTED RACEWAYS

(1) The raceway and all of its fittings and system components shall be aluminum, UL Listed with nonflammable self-extinguishing characteristics tested to comparable specifications of UL94V-0.

(2) The raceway shall be a two piece, two channel design with a base and a snap-on cover. Total width shall be as shown in the Construction documents with an approximate thickness of 0.10”. Each channel must be large enough to support standard power and communications devices. Use Helman-Tyton, Carlon, Wiremold or approved equivalent.

2.5 LADDER RACKING

A. Materials

(1) Cable support ladder racks shall be installed as defined in the Contract Documents and in any location where additional pathways are required to support large numbers of station cables that are otherwise not supported.

(2) The racks shall be twelve inches wide unless otherwise noted.

(3) In some locations the ladder rack shall be equipped with a four-to-six inch fence on both sides to support bundles of patch or jumper cables. This fence shall mechanically attach to the side or bottom of the ladder, not the surface over which the cable will be placed.

(4) The racks shall be classified by Underwriters Laboratories (UL) as suitable for equipment grounding.

(5) The racks shall be earthquake braced; the zone shall be Seismic Zone 4.

(6) The Contractor shall provide manufacturer’s standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.

B. Manufacturer: Avaya Communications, Homaco, Square D or equal.

2.6 INNERDUCT

A. Materials

(1) Non-metallic, flexible raceway system manufactured specifically for routing of fiber optics cables. The raceway system shall be suitable for use in ladder type and solid bottom cable trays. It should exhibit low smoke generation and flame spread characteristics, and have a very high temperature service tolerance.
Overall construction shall be of corrugated riser-rated material. Innerduct installed within a building shall be at least a thin wall polyethylene meeting the Underwriters Laboratory (UL) Specifications 2024.

(2) All innerduct used to support fiber optic cable shall be orange in color.

B. Manufacturer: Endot, Carlon, and Ingraham.

2.7 CABLE TRAY – LATERAL RUNS FROM MAIN BUILDING PATHWAYS

A. Materials – Flex-type tray

(1) The cable trays, where required, shall be sized to accommodate 2 times the installed cabling at a fill ratio no greater than 40% and a minimum of 3” deep, unless otherwise noted.

(2) The tray shall be supported no less than every ten feet. Support attachments shall be made only to the building structure and shall utilize minimum 3/8” rod hanger supports.

(3) The cable trays shall be wire type tray cable of supporting 75 lbs per linear foot. Trays shall qualify under NEC Section 318-7(b) as equipment grounding conductor.

Manufacturer: GS Metals, Snake Tray or equal.

2.8 SPLICE CASES - INDOOR COPPER

A. Materials

(1) All indoor splices shall be contained within an approved splice case designed for multiple closures.

(2) All end plates shall be designed for the number and size of cables served by the splice case.

(3) All splices shall utilize those included in the Structured Cabling System supplier's package. All cases shall be equipped to provide a continuous bond of cable shields through all splices.

B. Manufacturer – SCS Supplier Standard having a level of quality consistent with Avaya Communications, Reliable, and 3M.

2.9 FIBER OPTIC TERMINAL PANELS

A. Materials

(1) The fiber optic terminals/patch panels shall be consistent with the Structured Cable System supplier's package. These include 144 (duplex), 48, and 24 port panels necessary to terminate the fiber optic strand counts indicated in the construction drawings.
(2) The terminals panel shall provide cross-connect, inter-connect, and splicing capabilities and contain the proper troughs for supporting and routing the fiber cables/jumpers consistent with the full capacity of the panel.

(3) The terminal panel shall consist of a modular enclosure with retainer rings in the slack storage section to limit the bending radius of fibers.

(4) The terminal panel shall have a "window" section to insert connector panels for mounting of connectorized fibers (SC style couplers and connectors).

(5) The terminal panel shall provide terminating capability of couplers, in the quantity noted on the contract drawings, in panels of 6 or 12 respectively.

(6) The Contractor shall install the SCS supplier’s approved SC style couplers in all patch bays that meet or exceed the following specifications:
   (a) Operating Temperature: -40º to 140ºF (-40º to 60ºC)
   (b) Average Loss: 0.3 dB

(7) Fiber optic connectors shall be consistent with the SCS supplier’s package. Connector specifications shall be as follows:
   (a) attenuation < 0.2 dB @ 1300 nm typical
   (b) reflection < -25 dB typical
   (c) connector durability < 0.2 dB change after 500 matings
   (d) ferrule zirconia ceramic
   (e) housing nickel plated zinc
   (f) boot Estane

B. Manufacturer: Structured Cable System Supplier.

2.10 CABLE TAGS AND LABELS

A. Materials: Metal or heavy plastic identification tags with cable type and number, copper pair or optic number assignments, and destination shall be provided on both ends of all cables (except station cables) and all splice cases. All cables shall be clearly labeled with cable number (campus to determine scheme) and size at each end of the cable, when it enters or leaves a conduit and at 30-foot intervals when run in accessible areas such as tunnels, manholes, ceilings, etc.

B. Manufacturer: 3-M, Panduit, or approved equivalent.

2.11 COMMUNICATIONS BACKBOARDS

A. The Contractor shall provide 3/4" A/C void-free plywood as noted on drawings. The backboard shall be sized as noted on the contract drawings and shall be a minimum of 4' by 8'. Plywood shall be extended from 2" A.F.F. to 8'-2" A.F.F. and wall-to-wall unless noted otherwise by the University.
B. Plywood shall be fire retardant or treated with fire-retardant sealant or covered with a fire-retardant paint. This requirement is campus and local fire code specific.

2.12 STATION OUTLETS

A. Outlet Boxes

(1) Outlet boxes shall be galvanized steel. Boxes installed in any exterior location where exposed to rain or moisture laden atmosphere shall be cast screw hub type with gasketed weatherproof covers. Boxes for vapor proof or explosion proof applications shall be designed specifically for such use.

(2) Interior outlet location fasteners for fished walls location shall be single gang and applied to surfaces using screws appropriate for the surface (drywall, etc).

(3) Outlet boxes, where required, shall be large enough to accommodate the required number and sizes of conduits, wires, splices, and devices but shall not be smaller than a 4 11/16" square box. No extension boxes will be accepted.

(4) All wall boxes shall be flush mounted, and all floor boxes shall be recessed. All boxes shall be equipped with single gang rings unless otherwise specified.

(5) Manufacturers: Appleton, Erico, Raco, Steel City or equal.

B. Voice/Data Outlets

(1) The standard voice or data outlets shall consist of Category rated four-pair cables, each terminated on a separate Category rated RJ45 8-position jack following EIA/TIA 568B wiring standards. Outlet ports colors shall be campus stand colors. Color to be provided by campus.

(2) Jacks shall be mounted in mounting frames and unused spaces will be filled with dust cover/blank.

(3) Manufacturer: SCS supplier’s standard

C. Fiber Outlets

(1) Not required.

D. Video Outlets

(1) The video jacks shall consist of one Category rated RJ45 8-position jack following EIA/TIA 568B wiring standards.

(2) The CATV drop “F” connector for riser connection shall be equipped with a self-terminating 75 ohm resistor configured to terminate the riser run for MDF,BDF and IDF connections.

(3) Manufacturer: SCS supplier’s standard
E. Wall Phone Outlets

1. Wall phone outlets shall consist of one (1) Category rated four-pair cable terminated on an RJ45 8-position jack following EIA/TIA 568B wiring standards.

2. All wall phone outlets shall be placed at 44 inches above the finished floor unless otherwise noted to make the maximum height to the top of the telephone 48 inches above the finished floor.

3. Wall phone outlets shall be equipped with a duplex mud-ring around the standard dual gang outlet box.

4. Wall phone outlets shall consist of a stainless steel duplex faceplate equipped with a single 630B.

5. Manufacturer: SCS Supplier’s Standard.

F. Floor-Mount Voice/Data/Power Outlets

1. The floor mount outlet shall be a joint power/signal outlet. Box and its installation shall provide for future electrical power to be provided by others.

2. The communications portion of the outlet shall be equipped with a NEMA standard duplex faceplate cutout and RJ45 jacks.

3. The outlets shall be SCS Supplier Standard with Category rated jacks.

G. Floor-Mount Furniture Feeds

1. The voice/data furniture outlet shall consist of three Category rated four-pair cables, each terminated on a separate RJ45 8-position jack following EIA/TIA 568B wiring standards. One outlet will be electrical ivory, one electrical gray, and one electrical orange. Box and its installation shall provide for future electrical power to be provided by others.

2. The furniture shall be served from the ceiling (using a pole) or through a joint power/signal poke-through floor outlet as defined in the electrical section. The Contractor shall provide and install all fittings and flex conduit necessary to form an unbroken link from the floor monument into the communications raceway of the modular furniture.

3. Category rated station cable shall be placed from the IDF, through the riser sleeves, through the cable tray system into the conduit, poles, etc. into the outlet location at the furniture.

4. No more than six stations (6 cables) shall be served through a single poke-through fitting.

5. The outlets shall be SCS supplier’s Standard equipment with Category rated jacks.
2.13 **FACEPLATES**

A. Plates will be supplied for every information outlet (voice, data, and data with video where specified). Faceplates shall be beige.

B. Plates for information outlets (voice, data and network) shall be for single gang rings; standard electrical duplex receptacle type (flush for wall, recessed for floor); punched double duplex unless otherwise specified in the specifications or drawings.

C. Unused spaces shall be filled with blank panels.

2.14 **COPPER CABLE TERMINATION BLOCKS-STATION CABLE**

A. **Materials**

   (1) All copper cable terminations shall be made on 110 modular terminals (300 pair size unless otherwise specifically noted).

   (2) All blocks shall be equipped with color coded identification strips following the convention listed below. Color code to be confirm upon award of contract.

      (a) Green - to dedicated MDF pairs
      (b) Blue - to voice/data stations
      (c) Yellow – to dedicated video stations
      (d) Orange – to dedicated data stations
      (e) White - riser

   (3) All block assemblies (each 300 pair terminal) shall include wire retention clips and 188B2 jumper backboards mounted as shown in the construction drawings (minimum one 188B2 for vertical and horizontal positions).

   (4) The proper size retaining clips shall be used for all cable terminations (e.g., four-pair for stations (5-C4’s and 1-C5) and five-pair for riser, interbuilding, and entrance).

B. **Manufacturer**: SCS Supplier’s standard.

2.15 **MDF, BDF AND IDF EQUIPMENT RACKS**

A. **Materials**

   (1) The MDF, BDF and each IDF shall be equipped with a 7’ high, 19” wide equipment rack for fiber optic terminations and data equipment.

   (2) The frame shall be a bolted aluminum construction and shall meet EIA Standard RS-310-C for equipment support frames. Seismic cross bracing shall be provided. (Seismic Zone 4)
(3) Floor-mounted frames shall have a self-supporting base designed to be anchored to the floor. (Seismic Zone 4)

(4) Frames shall be factory painted when applicable.

B. Manufacturers: Chatsworth, Homaco or SCS Supplier’s Standard.

2.16 PULL BOXES

A. Materials:

(1) All pull boxes and cabinets shall be galvanized steel.

(2) No extension boxes will be accepted.

(3) Surface-Mounted Entrance Cabinets: Cabinets mounted on an outside wall of a building shall be equipped with a ¾ inch plywood backboard, gaskets or equipment required to maintain a weatherproof enclosure, and a door latch that can be locked.

B. Manufacturer: Christy Concrete Products, Brooks, or equal.

2.17 WIRE MANAGEMENT

A. Materials

(1) All equipment and fiber optic panel frame racks shall be equipped with vertical and horizontal wire management organizers as outlined in the design documents.

(2) All wire managers shall be heavy duty painted metal units designed specifically to connect to equipment frames.

(3) All wire managers shall be secured to the frames and shall provide a clear and unobstructed pathway in which to route the cables.

B. Vertical Wire Managers

(1) Vertical wire managers shall be between three and six inches wide and shall have a minimum of seven evenly spaced wire rings designed to maintain jumper, patch, or cross-connect wire in place.

(2) These organizers shall be designed to extend past the frame to allow placement of equipment in any position within the rack. When mounted between equipment frames, they shall be designed to direct cables into either frame and shall be securely mounted to both units.

(3) Manufacturers: SCS Supplier’s Standard, level of quality consistent with Chatsworth 11374 style, Homaco VCB-93-6UH or VO-84-T6, or approved equivalent.

C. Horizontal (Top of Frame) Wire Managers
(1) The horizontal wire managers shall be a minimum of six inches wide and shall have a lip or fence no less than six inches deep. In any location designed to support over 150 stations, the minimum size shall be nine inches wide.

(2) Manufacturers: Homaco TR runway with fence and pan or approved equivalent.

D. Horizontal (Mounted in The Frame Between Equipment) Wire Managers

(1) The in-frame horizontal managers shall range from one to two rack units in size and shall extend from side rail to side rail. These units shall be equipped with a minimum of four horizontal supporting rings and a minimum of eight smaller retaining rings top and bottom to route cables directly into equipment ports. The horizontal retaining rings shall be a minimum of 3” by 3”.

(2) Each frame shall be equipped with three units mounted as directed by the University.

(3) Manufacturers: SCS supplier’s Standard, level of quality consistent with Ortronics OR808004410, Homaco FCM-19-2SRC or FCM-19-2XL with 310-19E strip, or approved equivalent.

E. Copper and Fiber Optic Distribution Centers

1. General: Fiber Optic Distribution Centers shall be self-contained, wall or rack mountable units suitable for the termination, splicing, and distribution of fiber optic cables. Each unit shall consist of a cabinet and a suitable number of splice trays and connectors to terminate the specified number of fiber strands.

2. Cabinet Construction: The cabinet shall consist of a factory painted steel casing and contain the necessary hardware to allow wall or rack mounting.

3. Splice Trays: Distribution centers shall contain splice trays to allow fusion splicing of the specified number of fiber strands.

4. Acceptable Products: Equivalent to Siecor type "WDC" as detailed on the drawings.

2.18 DATA NETWORK PATCH PANELS

A. Materials: The Category rated patch panels for 19 inch rack mounting, EIA-TIA568B, will be Category PowerSum Modular Jack Panels or SCS Supplier approved equivalent. (Capacity as shown in drawings).

B. Manufacturer: SCS Supplier approved equivalent.

2.19 PROTECTOR PANELS

A. Materials: Interbuilding and entrance cable protection will be Corning Type S110, Circa 1880 or equivalent with protector panels in all locations except Siemens Hall, including entrance cable protection modules with gas tube protector units with heat coils. Unit shall be for indoor use, 5-pin gold protection block type, stub input (length as necessary
for cable entrance and telecommunication room construction), exposed 110 termination field output, wall-mounted, stackable up to 600 pair, and shall be UL listed.

All protector panel base panels not associated with buildings served by “standalone telecommunication cabinets” shall be provided in increments of 100 pair termination base units and populated with protector modules consistent with the pair count of the high count OSP copper cable being terminated at each building. At buildings serviced by “standalone telecommunication cabinets”, protector panel base units and protection modules shall be sized to the quantity of high count OSP copper cable being terminated at each building and mounted onto the back panel cabinet design.

Due to the significant plant currently installed at Siemens Hall, which is the main voice switch location it shall be provided with multiple 300 Series Porta 25 pair protection panels (to match existing) with gas tube protection modules sized to receive all incoming OSP copper cabling. Each panels shall be populated completely with protection modules.

2.20 STAND-ALONE TELECOMMUNICATION CABINETS

A. Materials:

(1) This section defines the telecommunications, electrical and mechanical characteristics and requirements for scaleable electronic equipment support system enclosure for telecommunication cabinet installation, in lieu of fully developed telecommunication spaces. The unit shall include EIA-310 standard rack mount rails. The systems shall be factory assembled NEMA 4 enclosure (NEMA 12 for units at the Farm Complex), ready for the installation of customer supplied electronic equipment. Units provided at the Farm Complex and Nettleton Field shall have cooling packages capable of operating in a 120-degree ambient temperature environment. These units shall include an uninterruptable power supply, 120v A/C/ power strip with 6 outlets, fiber optic patch panel capable of receiving multimode fiber and single mode fiber, standard 100 block termination field capable of receiving a 50 pair copper cable from building risers or the outside plant, rack units for campus supplied switching equipment, and ventilation fan unit. The unit will be capable of receiving and terminating up to 50 station cables (voice or data).

(2) Units including integrated cooling equipment shall include a 9’/2.7m input power cord. Power supply shall be single-phase 2-wire plus ground from a 15A dedicated circuit. Systems provided with UPS option shall require separate dedicated circuits for the UPS and the cooling unit. The heat rejection fan systems shall be supplied from a 120VAC, 15A, 60Hz circuit. The electrical connection shall be field supplied and installed. The telecommunication cabinet shall be installed with a minimum of 2 feet clearance about the front and top and 8 inches in the rear.

(3) The enclosure frame shall be constructed of heavy-duty 12-gauge steel and equipped with leveling feet rated for 1000 lb. A compression-type grounding lug (1/0 AWG/35mm² wire max) shall be provided on the frame bottom and shall be removable for relocation to the top of the frame as required. Frame components shall be finished in powder-coat black and factory rivet-assembled. Cable access cutouts shall be located in the top, bottom and rear plates for customer cable
entry; cover plates shall be provided as sealing and cooling options require. Usable mounting space shall be 19” rack-mount, 22RU and approximately 30” in depth.

(4) All mounting rails shall be constructed of heavy-duty 12-gauge steel. The mounting rails shall support the EIA-310 Standard hole mounting pattern, be factory installed and individually field-adjustable to allow for flexibility of mounting depth. The mounting rails shall include top-to-bottom RU positioning indicators at one RU increments, and be finished in powder-coat black.

(5) The unit doors shall be of 16-gauge sheet metal construction with air circulation vents at the top and bottom portions of the door. All doors shall be removable and field-reversible for left- or right-hand opening with two-point (22U) latch with key lock. Sheet metal Door shall be of sheet metal construction with air circulation vents only at the door top and bottom with a fixed air-intake plate and no air circulation vents. Side panels shall be of 20-gauge sheet metal construction, be removable from the outside of the enclosure. Construction shall prevent the removal of the side panels without unlocking the enclosure.

(6) The power strip shall be field-installed (6-outlet) in a vertical frame member. 6 Outlet / 15 Amp 120 VAC/60 Hz includes six 5-15R receptacles, 5-15P plug connection, circuit breaker, and TVSS protection and is 12”/0.3m long with a 6’/1.8m power cord (field-installed).

(7) Vertical and horizontal cable ring shall provide a means of internal cable management. Cable rings shall support a 2”/5.1cm-diameter cable bundle, and be field-installed on the rack mounting rails.

(8) Lifting lug options shall be a quantity of 4 ship loose, field installed eyebolts (1”/2.5cm diameter) used for enclosure relocation.

(9) The enclosures shall be provided with a fan cooling to provide enhanced primary cooling for rack/enclosure systems. This shall be a one or two system in either “low noise” or “high ambient” condition. Fan(s) shall be factory installed. Fan(s) are installed in top plate cutouts and can be field relocated to rear access holes. A fan filter shall provide basic air intake filtration.

(10) The telecommunication cabinet enclosure and all components shall be warranted against defects in materials and workmanship for two (2) year parts from date of shipment. Extended warranty of up to 3 years shall be offered by the supplier and selected at the Campus’ option.

B.Manufacturer: Great Lakes, Rittal or SCS Supplier approved equivalent.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. All installation work shall be performed according to published industry guidelines, rules, and regulations. All Structured Cabling System products shall be installed according to the latest issue of the manufacturer’s standard procedures.
B. All pathways shall avoid electromagnetic interference (EMI). Cable that is distributed in partially-enclosed metallic pathways shall be routed with the following minimum clearances:

1. Four (4) feet from motors or transformers.
2. One (1) foot from conduit and cables used for electrical power and distribution.
3. Five (5) inches from fluorescent lighting.

C. Pathways shall cross perpendicular to fluorescent lighting and electrical power cables and conduit.

3.2 CONDUIT

A. All conduits shall be routed parallel and perpendicular to walls.

B. All conduits shall be installed in accordance with NEMA “Standard of Installation” and shall meet applicable local and national building and electrical codes or regulations.

C. New station cable conduit runs shall not exceed 100 feet (horizontal plus vertical distances) or contain more than two 90 degree bends without utilizing appropriately sized pull boxes.

D. No communications outlet boxes shall be “daisy-chained.” Where directed in the construction drawings each communications outlets to be interconnected via conduit, conduit shall be a separate 1¼-inch (minimum) conduit.

E. All outlet locations shall be connected to the building major pathway (cable tray) via 11/4-inch conduit (EMT) secured to the cable tray to a position secured at the top of the wall to fished to the new outlet location.

F. All conduit embedded in concrete, i.e. sleeves and conduit entering for exterior locations shall be rigid steel conduit with appropriate transitions to EMT or PVC.

G. In rooms with a drop or false ceiling, and communications outlets shall be served by conduit, the conduit shall stubbed six inches above the false ceiling, angled toward the cable tray or open access area, and shall be equipped with a compression fitting and plastic bushing. All stubs shall be marked “Comm.”

H. All conduits shall be equipped with approved water or barrier seal in building access points.

I. All conduits entering a building from outside shall be plugged with reusable stoppers to eliminate the entrance of water or gases into the entrance room.

J. All conduits leaving the entrance room for other portions of the building will be fire-stopped after the installation of cable.

3.3 CONDUIT SUPPORTS
A. Securely fasten all conduits to walls and support using clamps and clips designed for the purpose.

3.4 HANGERS AND CABLE TIES

A. In suspended ceiling and raised floor areas where walker duct, cable trays, or conduit are not available, station wiring shall be bundled with plastic cable ties at appropriate distances.

B. Tie wraps shall not be over tightened to the point of deforming or crimping the cable sheath.

C. Hangers, designed specifically for carrying Category 5e or greater cabling, shall be placed at a maximum spacing of 5 feet.

D. Hangers supporting the cable bundling shall be attached to the existing building structure and framework by means appropriate for that specific site condition.

E. Hangers must be installed to provide at least 3 inches of clear vertical space between the cable bundling and the ceiling tiles.

F. Hangers shall be spaced to prevent cables from sagging or buckling. Should cabling sag more than 12” inches between spans add additional fasteners and J-hooks to accommodate the cable.

3.5 RACEWAYS

A. All surface-mount raceways must be mechanically secured to the structure a minimum of every four feet.

B. Raceways must be routed at right angles to nearby structures or wall corners, and shall be neatly installed and trimmed to fit into and around other existing moldings or pathways such as the ceiling area.

C. All surface-mount raceways shall be placed vertically only in corners of rooms and horizontal raceway placed at baseboard height to extend the cable run to the actual outlet location.

D. Raceways shall be routed to avoid interferences, using standard sections and a minimum number of field-cut sections.

E. Raceways shall be routed to avoid interference with removal and installation of lighting fixtures and devices of other systems that require servicing or operation.

F. Sharp burrs or edges shall be removed from raceways.

G. Completed raceways shall have no cracks or openings at coupled sections.

H. Raceway supports:
3.6 LADDER RACKING

A. Ladder racking shall be placed so that fully loaded racking shall not obstruct or impede the operation of cable installation, lighting, air handling systems, and fire extinguishing systems.

3.7 INNERDUCT

A. When innerduct is installed in conduit to place a fiber optic cable into service the conduit will be filled to the maximum capacity of the duct with innerduct of the size indicated.

3.8 CABLE TRAY

A. Cable trays shall be installed in accordance with NEMA VE 1.

B. The Contractor will be responsible for placement of the cable tray in concert with other trades, allowing sufficient room for the cable installers to gain access to all portions of the tray system. Cable tray location shall be coordinated with open ceiling areas, access panel locations, and feeder conduit positions to provide an accessible cable pathway throughout the facility.

C. All metallic trays must be grounded and may be used as a ground conductor. Provide 2 AWG bare copper equipment grounding conductor through entire length of tray; bond to each component. Trays used as an equipment grounding conductor must be clearly marked.

D. Trays shall enter distribution rooms six inches into the room, then utilize a drop out to protect station cables from potential damage from the end of the tray.

E. Cable trays shall be placed a minimum of six (6) inches from any overhead light fixture and twelve (12) inches from any electrical ballast. A minimum of eight (8) inches of clearance above the tray shall be maintained at all times. All bends and T-joints in the tray shall be fully accessible from above (within 1 foot). Trays shall be mounted no higher than twelve (12) feet above the finished floor and shall not extend more than eight (8) feet over a fixed ceiling area.
F. A separate conduit sleeve (minimum of two inches) must be provided as a pathway through any wall or over any obstruction (such as a rated hallway) from the cable tray into any room having a communications outlet.

G. The Contractor shall fire stop around the tray and, after installation of the cables, within the tray using removable pillow-style products following manufacturers’ guidelines. Sound deadening material shall be provided and installed after installation of cable.

H. In rooms without a drop ceiling (open to the structure), the cable shall be mounted as high as possible to provide the greatest clearance above the finished floor, but within the limits in 3.8.B above.

3.9 SPLICE CASES-INDOOR COPPER

A. Splice cases shall be installed in accordance with manufactures instructions and shall be placed in telecommunication rooms so as to not adversely impact the future use of space in the rooms and/or on telecommunication room backboards.

3.10 FIBER OPTIC TERMINAL PANELS

A. Final location of frames shall be coordinated with the Trustees/University.

B. Rack-mounted fiber panels shall be mounted as shown in the construction drawings.

C. All cables mounted into fiber optic panels shall be installed and secured as defined by the manufacturer using the tools, materials, and techniques outlined by the manufacturer.

3.11 CABLE TAGS AND LABELING

A. The Contractor shall legibly label all voice and data outlets, cable, blocks, frames, and patch panels per campus-specific directions and as defined herein. Outlet faceplates shall be labeled on both sides.

B. The Contractor shall employ a cable labeling and tagging scheme that meets ANSI-606 specifications.

C. Construction labels shall be installed on all cables as they are pulled. These labels shall contain the same information as the finished labels. Typed labels on self-sealing tape shall be used. Each cable shall have a unique number that shall be related to the appropriate faceplate number and jack letter.

D. A label shall be installed on each conduit attached to a communications wall box and shall be affixed to the end of the conduit near the cable tray. The label shall have a unique number related to the appropriate faceplate number and jack letter.

E. Labels shall be installed on all station cables within two (2) inches of the end of the outer jacket material within the back box and at the blocks/patch panel. Typed labels on self-sealing tape, with a plastic overlay, shall be used. Each cable shall have a unique number that shall be related to the appropriate faceplate number and jack letter.

F. Labels shall be installed on all patch panels, blocks, and both the inside and outside of all faceplates. A uniquely numbered label for each faceplate and a unique letter for each
jack shall be supplied and installed. The labels shall be machine printed (not embossed) on vinyl tape using a Brothers label maker or equivalent. The labels shall have protective overlays.

G. Labels shall be numbered according to a scheme developed in consultation with the University.

H. Ground Bars

(1) The master ground bar shall be labeled as such.

(2) Each subsidiary ground bar shall be labeled as such and have a unique identifier.

(3) All ground bars shall have a warning label that states, “If this connector or cable is loose or shall be removed, please call the Telecommunications Manager.” All ground bars will be connected to the building ground with continuous 0” AWG wire.

(4) Each ground cable shall be labeled with a unique identifier.

3.12 COMMUNICATIONS BACKBOARDS

A. Communication backboards shall be configured and installed as defined on the drawings.

B. Backboards shall be mounted vertically, starting 2” above the finished floor.

C. All backboards shall be securely mounted to wall structures or studs using fasteners designed for the surface. All fasteners shall be mounted flush with the backboard and located so as to not interfere with the placement of cable or equipment. Backboards shall be sanded smooth after being secured to the wall.

D. All plywood panels must be mounted in contact with one another, leaving no gaps between sheets.

E. All backboards shall be fire retardant or treated with fire-retardant sealant or covered with a fire-retardant paint.

3.13 STATION OUTLETS

A. Station outlets shall be mounted securely at work area locations.

B. Station outlets should not be “daisy-chained.”

C. Outlets shall be mounted as follows unless directed otherwise by the Construction Administrator:

   (1) Wall phone: 48 inches above the finished floor.

   (2) Standard voice/data outlet: 12 inches above the finished floor.

   (3) Wall-mounted video outlet: 78 inches above the finished floor.
(4) Counter top: 6 inches above the counter top.

D. Modular Furniture Telecommunications Outlets

(1) The Contractor shall provide and install all components and labor necessary to completely install, test, and document voice and data telecommunications outlets at each modular furniture workstation location.

(2) Category rated station cable shall be placed from the IDF, through the riser sleeves, through the cable tray system into the conduit, ceiling or floor poles, etc. into the furniture to be served.

(3) Where required in the construction drawings, the Contractor shall coordinate the telecommunications and electrical installation so that the modular furniture is served from the joint signal/power floor monuments or joint power pole in a consistent manner. The Contractor shall provide and install all fittings, flex conduit, adapter plates, and telecommunications cable and components necessary to install Category rated station cable from the consolidation point box, through the ceiling or floor monument or pole, into the furniture raceway, and to the final user outlet location (including jacks, adapters, and faceplates).

(4) The telecommunications installers shall coordinate with the electrical drawings for the number and location of user voice and data outlets.

(5) Labels shall be numbered according to a scheme developed in consultation with the University.

3.14 FACEPLATES

A. Media jacks shall be oriented and labeled in the faceplate in a manner consistent with the construction drawings. All faceplates shall be secured and clear of any dirt, smudges or other visual contamination.

3.15 COPPER CABLE TERMINATION BLOCKS

A. All 110 terminal blocks shall be clearly and neatly labeled with outlet (jack) or pair assignments.

B. All outlets shall be numbered sequentially in the closet using a numbering assignment agreed upon with the University.

C. All riser, tie, and data terminals shall be numbered using pre-printed identification strips. Numbering methodology shall be determined by the University unless otherwise noted.

D. All terminal locations shall be approved prior to installation.

E. All work on terminals shall be accomplished using tools and support hardware designed for the 110 system and following procedures identified by the manufacturer.

3.16 EQUIPMENT RACKS
A. Install as shown in the construction drawings, and wherever possible, and provide a minimum of 3’ 0” wide aisle way on the front and back side of new equipment racks. One end of the equipment rack shall be located so that there is 3’0” isle on one end or the other.

3.17 PULL BOXES AND CABINETS

A. Pull boxes shall be installed in easily accessible locations.

B. Pull boxes installed as part of a horizontal cabling pathway shall be installed immediately above suspended ceilings, where possible.

C. Pull boxes shall not be used for splicing cable.

D. Pull boxes shall be placed in conduit runs that exceed 100 feet (horizontal plus vertical distance) or which require more than two 90 degree bends. The pull boxes shall be located in straight sections of conduit and must not be used for a right angle bend. Installation shall allow cable to pass through from one conduit to another in a direct line.

E. Pull boxes must have a length at least 12 times the diameter of the largest conduit.

F. Surface-Mounted Entrance Cabinets: Cabinets mounted on an outside wall to serve a smaller building shall be at least 36” x 24” x 6” deep. Cabinets must provide full access from the front and access to an approved ground.

- END -