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APPENDIX III

UM STANDARDS FOR INFORMATION TECHNOLOGY SERVICES AND TELECOMMUNICATIONS INFRASTRUCTURE

University of Maryland

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UM CITS NETWORKING & TELECOMMUNICATIONS SERVICES
TELECOMMUNICATIONS WIRING STANDARD

PART I - GENERAL

1. SYSTEMS DESCRIPTION:

01. Telecommunications requirements at the University of Maryland continue to increase in variety and complexity. It is unlikely that this situation will change in the future. Voice, data and video requirements will vary over time, and will be different for each department and function of the University, but the trend will be towards more and faster communications capabilities. The lack of a modern cable plant has hampered progress in expanding data communications in particular.

02. This standard for telecommunications wiring is designed to meet the specific current needs of the University, and to permit growth and flexibility in the future. In addition to describing the twisted pair and/or fiber network required to deliver communications to the desktop, specifications are included for installation of a fiber optic cable backbone connecting buildings. Data requirements include the need for different levels of Ethernet from 100BASE-T to 1000BASE-FX over unshielded twisted copper pairs, and Fiber.

03. The standard is designed primarily for use in all new construction and major building renovation projects. The design addresses conduit use, equipment spaces and cable distribution systems. It is capable of providing support for a broad menu of telecommunications services from multiple vendors, and sufficiently flexible to grow and change as needs dictate. This design does not include operating hardware such as telephone systems, computers, networking hardware, terminal and file servers, and the like.

04. Both mandatory and desirable or advisory criteria are specified in this standard. Mandatory requirements are designated by the words "shall" and "must", while advisory criteria are designated by the words "should" and "may".

2. DEFINITIONS AND ABBREVIATIONS:

01. **Definitions:**

(a) **Main Distribution Frame (MDF) - aka MCC:** The main cross-connect distribution frame that terminates central office trunks and circuits, internal switching circuits/ lines and trunks that extend outside cable plant to each building distribution frame. In distributed systems there may be multiple MDF's, one located at each distributed node site. Our Primary Voice and Data MDF on this Campus is located on the 1st floor of Howard Hall. We have secondary Data MDFs at Nursing 1W120 and Pearl Street High Voltage Room, and 620 W. Lexington Street.

(b) **Building Distribution Frame (BDF) [aka Building Entrance]:** The first cross-connect distribution terminal within a building or structure that terminates outside plant (inter-building cable) and cross-connects to internal building cable (intra-building cable). On this campus, there is one in each building. Minimum room size shall be 240 square feet.

(c) **Intermediate Distribution Frame (IDF) [akaTela/Data Room]:** A room set aside for telecommunications distribution equipment, wire and cable distribution frames. There will be at least one IDF on each floor, except in small building where it is more practical to combine multiple floors into one IDF. The IDFs will be connected by a riser system, and the rooms will be stacked whenever possible. The IDF is the recognized location of the cross-connect between the backbone and horizontal facilities.

(d) **Horizontal Cross-Connect (HCC):** A cross-connect of horizontal cabling to other cabling (e.g., horizontal, backbone, and equipment)

(e) **Inter-building Cable, Outside Plant (OSP):** Cable plant that cross-connects the MDF with a BDF or two or more BDFs. OSP cable also refers to the cable used to connect the external Emergency Blue Telephones to the building BDF.

(f) **Intra-building Cable, Inside Plant:** Internal building cable that cross-connects the BDF to each IDF and extends to the final termination of the modular wall jack. Intra -building cable is designated in two manners; riser cable and station cable:

(g) **Riser Cable:** Intra-building cable that cross-connects the BDF to each IDF or cross-connects the MDF location to each applicable IDF at that location, or cross-connects two IDFs on the same floor.

(h) **Horizontal Wiring:** aka Horizontal Cable, or Station Cabling. Intra-building cable that cross-connects the modular station wall jack to the nearest IDF.

(i) **Hybrid Optical Fiber Cable:** An optical Fiber cable containing two or more fiber types (e.g., multimode, singlemode) under one jacket.

(j) **Patch Cord:** aka Patch Cables, Line Cords. Cables, such as modular cords, PC adapter cables, fiber jumpers, etc., that interconnects the modular station wall jack with an end user instrument.

(k) **Standard Communications Outlet:** The standard communications outlet provides access to the available communications media, initially twisted copper wire pairs. It will always contain at least two 4-pair green, plenum, Category-6 UTP data cables terminated on 8-pin modular RJ45 receptacles, and may also support two 62.5/125 multimode fibers with SC connectors. At certain locations a subset of this outlet may be installed, upon approval by UM CITS.

(l) **Permanent Link:** A transmission path between two points, not including terminal equipment, work area cables, patch cords, and equipment cables. Can be up to 90m in length for horizontal cabling.

(m) **Jack:** One 8-pin RJ-45 connector in a Communications outlet. For example, a Standard Communications Outlet contains two data jacks.

02. **Abbreviations:**

(a) **BICSI:** Building Industry Consulting Services International

(b) **UM CITS:** University of Maryland Baltimore Center for Information Technology Services

(c) **EIA/TIA:** Electronics Industries Association/Telecommunications Industry Association

(d) **FCC:** Federal Communications Commission

(e) **IEEE:** Institute of Electrical and Electronics Engineers

(f) **AFF:** Above finished floor

3. SUMMARY OF WORK:

01. **Work Included:**

(a) Furnish and install, including termination and testing of, Telecommunications UTP copper backbone cables between the BDF and the Campus MDF (Howard Hall 124) with at least 100 pair to service the building.

(b) Furnish and install, including termination and testing of, Telecommunications Fiber Optic Backbone cabling between the BDF and Campus MDF (Howard Hall, Nursing, or Pearl) with a minimum of 24 single mode and 12 multi mode fibers to service the building.

(c) Furnish and install, including termination and testing of, 25 pair Telecommunications UTP copper riser cables between the BDF and each IDF.

(d) Furnish and install, including termination and testing of, 12 single mode and 6 multi mode Telecommunications Fiber Optic riser cabling between the BDF and each IDF with a minimum of 12 multimode and 12 single mode fibers to service each IDF.

(e) Furnish and install, including termination and testing of, UTP Workstation cables (Horizontal Cabling) between the Communications outlet locations and the respective serving IDF.

(f) Furnish and install grounding of Telecommunications equipment racks in the IDF and BDF to the telecomm grounding system.

(g) Furnish and install rack- and wall mounted termination blocks in the IDF and BDF.

(h) Furnish and install rack-mounted fiber panels in the IDF, BDF, and Campus MDF.

(i) Furnish and install testing of connectors, outlets, jacks, faceplates, etc, required to terminate optical fiber and workstation (horizontal) cables.

(j) Furnish and install center-hung type cable tray to support horizontal cabling distribution.

(k) Furnish and install ladder type cable tray in the IDF and BDF. Floor layout and elevation drawings shall be provided as part of the work, and approved by UM CITS before installation.

(l) Provide labeling and documentation for all cables, faceplates, patch panels, racks and termination blocks, riser conduits, cable trays, and grounding system installed under this work. This includes maps of all outlet locations with final telecommunications outlet ID number.

(m) Furnish and install wire management components, J-Hooks, and miscellaneous 'nuts and bolts' type components to provide a complete and working Cat 6 cable system.

(n) Prepare and submit of Shop Drawings, termination schedules, test results, as-built drawings, and component documentation as described within these specifications.

(o) Furnish and install firestopping of floor and rated wall penetrations specifically provided for the distribution of telecommunication cables. Required floor and wall ratings are to be maintained.

(p) Furnish and install grounding and bonding of cable tray as shown on the telecommunications riser drawings.

(q) Provide UTP and Optical Fiber Patch Cords as specified by the project.

02. **Work Specified Elsewhere:**

(a) Installation of conduits, pull boxes, plywood backboards, and floor boxes (provided under Electrical work).

(b) Installation of workstations, terminals, telephones, and similar equipment (installed by Owner and their representatives).

(c) Cutting and patching, and painting of walls, unless damaged performing the work described herein.

4. CODES, REGULATIONS, AND STANDARDS:

01. The installation shall comply fully with all government authorities, laws and ordinances, regulations and codes applicable to the installation.

02. Should any change in plans or specifications be required to comply with governmental regulations, the Contractor shall notify the Owner at the time of submitting the Shop Drawings.

03. Local Electrical and building codes may differ with national codes. Follow the most stringent code or recommendations. Where there are instances of ambiguity refer to the Owner/Engineer for interpretation.

04. All equipment shall be equal to or exceed the minimum requirements of NEMA, IEEE, ASME, ANSI, and Underwriters' Laboratories.

05. Telecommunications distribution, installation, administration, and testing must comply with the latest version of applicable Federal, State and local laws, codes, ordinances, regulations, and standards, especially the latest version of ANSI/TIA/EIA-568 – C Series Telecomm Building Cabling Standard EIA/TIA – 569 – B – 2004 Pathways & Spaces, ANSIJ/STD 607 – A – 2002 Grounding & Bonding, ANSI/NECA/BICSI 568 Electrical Installation, ANSI/TIA/EIA – A – 2004 Customer Owned OSP, TIA TSB – 162 Wireless. Other standards for materials, equipment and installation practices include ADA, ANSI, ASTM, BICSI, EPA, FCC, IEEE, NEC, NECA, NEMA, NFPA, OSHA, REA, and UL.

5. CERTIFICATION AND WARRANTY:

01. Where a manufacturer's warranty is longer than one year, the Contractor shall offer the extended warranty. The Contractor shall, upon notification of any defective items, repair or replace such items within 24 hours without cost to the Owner and the satisfaction of the Owner's representative.

02. Furnish a manufacturer's "Permanent Link" performance warranty for all horizontal communications wiring for a minimum period of fifteen years from the date of acceptance of the work. Where a manufacturer's warranty is longer than fifteen years, the Contactor shall offer the longer warranty. The Permanent Link Performance Warranty shall be issued and signed by the component manufacturer and shall list the University of Maryland as the holder of the warranty. The Permanent Link Performance Warranty shall cover all labor and material for all "Link" components.

PART II - PRODUCTS

1. GENERAL:

01. Part numbers are for reference, please verify with Manufacturer.

2. CABLE MEDIA:

01. **4 Pair Cable:**

(a) **Data Cable – CMP:**

(1) 4 pair unshielded twisted pair (22-24AWG), solid copper conductors, 100 ohms nominal impedance +/- 15%, minimum bandwidth 500 MHz, green CMP Plenum jacket complying with EIA/TIA 568 Category 6 performance specifications.

(2) **Manufacturer:** CommScope, BerkTek, Belden, Mohawk/CDT

(b) **Data/Voice Cable – OSP (for use with external Emergency Phones, etc.)**

(1) 4 pair unshielded twisted pair (22-24AWG), solid copper conductors, 100 ohms nominal impedance +/- 15%, minimum bandwidth 500 MHz, green

CMP Plenum jacket complying with EIA/TIA 568 Category 5e performance specifications.

(2) **Manufacturer:** CommScope, BerkTek, General Cable, Superior Essex

02. **25 Pair Binder Cable:**

(a) **Inter-Building Cable (OSP):**

(1) 25 twisted pair per binder – 24 AWG, solid copper conductors, 100 ohms nominal impedance +/- 20%, OSP jacket, complying with EIA/TIA 568 Category 3 performance specifications. North of Howard Hall, the OSP cable shall be gel-filled. South of Howard Hall, the OSP cable may be air core.

(b) **Intra-Building Cable - Riser and/or Tie (CMR or CMP):**

(1) 25 twisted pair per binder – 24 AWG, solid copper conductors, 100 ohms nominal impedance +/- 20%, plenum jacket (if necessary), complying with EIA/TIA 568; category 5e or 6 performance specifications.

03. **Optical Fiber:**

(a) **Inter-Building Cable (OFNP):**

(1) Shall be a hybrid fiber cable containing both multimode and singlemode under a single plenum jacket, unless otherwise noted. UM recommends using armored fiber. As an option, when using fiber without an armor jacket, the unarmored fiber must be installed in a protective corrugated flexible raceway “Inner-Duct”.

Multimode - 62.5/125 µm tight buffer construction with aramid yarn strength member (ie Kevlar™), plenum jacket, indoor/outdoor rated (-40°C to +85°C). 900µm buffer diameter, numerical aperture .29 +/- .02, minimum bandwidth of 200 MHz at 850 nm, 500 MHz at 1300 nm, maximum attenuation 3.5 dB/km at 850 nm and 1.5 dB/km at 1300 nm.

Singlemode - 9/125 µm tight buffer construction with aramid yarn strength member (ie Kevlar™), indoor/outdoor rated (-40°C to +85°C). 8-9 µm Core diameter, and 125µm Cladding diameter, maximum attenuation 1.0 dB/km at 1310 nm and 1.0 dB/km at 1550 nm.

(2) **Manufacturer:** OCC
Part Numbers: DX Series Unarmored plenum cable, 24MM/24SM, part number of DX048KZGS90P, or DX Series Armored plenum cable, 24MM/24SM, part number of DX048KZGS90PI6

(b) **Intra-Building Cable – Riser and/or Tie (OFNR or OFNP):**

(1) Shall be a hybrid fiber cable containing both multimode and singlemode under a single plenum (if necessary) jacket, unless otherwise noted.

Multimode - 62.5/125 µm tight buffer construction with aramid yarn strength member (ie Kevlar™), orange jacket, indoor rated (-20°C to +65°C). 900µm buffer diameter, numerical aperture .20 +/- .02, minimum bandwidth of 200 MHz at 850 nm, 500 MHz at 1300 nm, maximum attenuation 3.5 dB/km at 850 nm and 1.5 dB/km at 1300 nm.

Singlemode - 9/125 µm tight buffer construction with aramid yarn strength member (ie Kevlar™), indoor rated (-20°C to +65°C). 8-9 µm Core diameter, and 125µm Cladding diameter, maximum attenuation 1.0 dB/km at 1310 nm and 1.0 dB/km at 1550 nm.

(2) **Manufacturer:** OCC, Lucent/Avaya, Siecor/Corning
Part Number: OCC, DX Series (ie 12 MM / 6 SM would have a Part Number of DX018-070D-12W3EB/1UC-6S1MC/1MD/900-R)
Lucent/Avaya Accumax Series (ie LGCC-06/12D-S/LRX)
Siecor MIC (ie 018X81-A7132-24)

04. **Patch Cords - UTP:**

(a) 4 pair unshielded twisted pair (22-24AWG), stranded copper conductors, 100 ohms nominal impedance +/- 15%, green (other colors may be requested) jacket. Must be 100% factory transmission tested in a Category 6 channel.

(b) **Manufacturer:** The Siemon Company, Ortronics
Part Number: Siemon – MC6-8-T-(XX)-(07) (XX = length)
Ortronics Clarity – OR-MC60X-05 (X = length)

05. **Patch Cords - Optical Fiber:**

(a) **Multimode:**

(1) 62.5/125 µm, zipcord cable patch cord, with an orange jacket. Supports all bandwidths, dual-window, and low-loss. Comply with the Bellcore FDDI, TIA/EIA-568, and ICEA Standards.

(2) **Manufacturer:** Lucent/Avaya, Siecor/Corning or equivalent
Part Number: Lucent/Avaya (ie LL2SC-SC0-XX (X = length))
Siecor (ie 9191-02K5141-XXX-M (X = length))

(b) **Singlemode:**

(1) Duplex SC to Duplex SC, 8-9/125 µm, zipcord cable patch cord, with a yellow jacket. Supports all bandwidths, dual-window, and low-loss. Comply with the TIA/EIA-568 and ICEA Standards.

(2) **Manufacturer:** Siecor/Corning or equivalent
Part Number: Siecor (ie 9191-02R5131-XXX-M (X = length))

3. TERMINATION HARDWARE:

01. **Termination Blocks:**

(a) **Voice (UTP):** Category 5e S66M150 (for installations that do not want VoIP)

(1) Complies with EIA/TIA 568 Category 5e performance specifications. Complete with standoff brackets installed on 183 type blue backboards.

(2) **Manufacturer:** Siemon, AllenTel
Part Number: Category 5e S66M1-50 wall mounted, S89B standoff brackets,

(3) AllenTel 183B1 blue backboards or approved equivalent

(b) **Voice (UTP):** Indoor Building Entrance Terminal and Solid State Digital Surge Protection Modules (for installation in BDF OSP Inter building Copper and patch panel)

(1) **Manufacturer:** Circa or approved equivalent

(2) **Part Number:** Circa 1880 ENA1/NSC – 100, 100P P Circa 4BIS-300 Solid State Protection

(c) **Data & Voice (UTP):**

(1) Rack mounted (19 inch) Category 6, modular 48 port patch panels. Standard density preferred complying with EIA/TIA 568-C Category 6 performance.

(2) **Manufacturer:** The Siemon Company, Ortronics
Part Number: Siemon – HD6-48, High Density or Ortronics Clarity – OR-PHD66U48, High Density

(d) **Data (Fiber):**

(1) Rack-mounted (19 inch) optical fiber patch panel with hinged front door, mounting guides, and designation panels. Populate panels complete with coupler panels and SC couplers.

(2) **Manufacturer:** Siecor/Corning or approved equivalent
Part Number: CCH rack mounted units, CCH-CP12-59, singlemode panels, or CCH-CP12-91, multimode panels

02. **Modular Connectors/Outlets:**

(a) **Data (UTP Workstation Outlet):**

(1) 8 pin modular outlet, non-keyed, angled front complying with EIA/TIA 568-C Category 6 performance. Outlet wired standards compliant 568B pinning. Outlets must be white.

(2) **Manufacturer:** The Siemon Company, Ortronics
Part Number: Siemon CT Series CT-C6-C6-02 or Ortronics Clarity 6 TracJack OR-TJ645

(b) **Data (Wallphone Outlet):**

(1) 8 pin modular outlet, non-keyed, angled front complying with EIA/TIA 568-C Category 6 performance. Outlet wired standards compliant 568B pinning. Outlets must be white.

(2) **Manufacturer:** Ortronics
Part Number: Ortronics Clarity 6 TracJack OR-TJ645

(c) **Data (Fiber Workstation Outlet):**

(1) Duplex SC couplers, angled front complying with EIA/TIA 568-C performance specifications. Outlets must be white.

(2) **Manufacturer:** The Siemon Company, Ortronics
Part Number: Siemon CT Series (CT-SC-4-02) or Ortronics OR-63700016

(d) **Faceplates:**

(1) **Work Station Outlet:** Stainless Steel, singlegang, 4 port Siemon or 6 port Ortronics
Manufacturer: The Siemon Company, Ortronics
Part Number: Siemon CT Series (CT4-FP-SS-L) or Ortronics Or-40300457

(2) **Wallphone Outlet:** Stainless Steel, single gang, 1 port, Ortronics
Manufacturer: Ortronics
Part Number: Ortronics OR-403STJ1WP

(e) **Blank Inserts:**

(1) White, flat inserts for faceplates
Manufacturer: The Siemon Company, Ortronics
Part Number: Siemon CT Series CT-BLNK-02 or Ortronics Or-42100002

03. **Optical Fiber Connectors:**

(a) **Multimode:**

(1) SC connector, composite ferrule, 62.5/125 µm, minimum insertion loss 0.3 dB, FOTP-171 complying with EIA/TIA 568 performance specifications and TIA/EIA 604-3.

(2) **Manufacturer:** Siecor/Corning or approved equivalent
Part Number: Unicam (95-000-40)

(b) **Singlemode:**

(1) SC connector, ceramic ferrule, 8-9/125 µm, minimum insertion loss 0.4 dB, FOTP-171 complying with EIA/TIA 568 performance specifications and TIA/EIA 604-4.

(2) **Manufacturer:** Siecor/Corning or approved equivalent.
Part Number: Unicam (95-200-41)

4. EQUIPMENT RACKING:

01. Equipment Racks:

(a) Standard rack, lightweight aluminum construction, bolted assembly, 19 inch width, Black coated. Mounting channels are EIA-310-D compliant. Includes assembly hardware, and 50 each #12-24 mounting screws.

(b) **Manufacturer:** CPI or approved equivalent
Part Number: 55053-703

(c) 4-post server rack , black coated, 19 inch width, approximate 30 inch depth.

(d) **Manufacturer:** CPI or approved equivalent
Part Number: 15053-703

02. Wire Management Hardware:

(a) **Rack Mount:**

(1) **Horizontal:**

(a) Shall be 1 RU or Rack Unit high.

(b) Manufacturer: Ortronics or UM CITS approved equivalent
Part Number: OR-808004759

(2) **Vertical:**

(a) Double-sided vertical trough with lockable cabling latches, protective edge guards and pass through ports and can be used to bay two racks together. Includes
assembly hardware.

(b) **Manufacturer:** CPI or UM CITS approved equivalent
Part Number: 11729-703

(b) **Wall Mount:**

(1) **D-Rings:**

(a) Metal, closed, rolled steel edges, large size (minimum 5 inch width x 3.25 inch height).

(b) **Manufacturer:** CPI or equivalent
Part Number: 10943-000

(2) **White backboards with spools:**

(a) Single or double height white backboards with B20 distribution posts (mushroom spools).

(b) **Manufacturer:** AllenTel or equivalent
Part Number: 187D1 (single) or 187B1 (double)

(3) **Blue backboards:**

(a) Full height blue backboards for mounting of 66 Blocks

(b) **Manufacturer:** AllenTel or equivalent
Part Number: GB183B1

5. DISTRIBUTION:

01. **Ladder Rack:**

(a) **Ladder Rack for IDF /BDF:**

(1) Open rung cable runway (12 inch wide) with runway radius drop outs, 8 inch cable retaining post and end cap, complete with heavy-duty butt-splice hardware, junction splice hardware, end feet hardware, protective end caps, 5/8 inch ceiling support hardware and any other hardware to complete a Cat 6 installation. Constructed of steel tubing with 12-inch rung spacing, black coated.

(2) **Manufacturer:** CPI or UM CITS approved equivalent
Part Number: 10250-712 (12" wide ladder rack)

(b) **Cable Tray:**

(1) Aluminum, center spine tray for horizontal cables with a bottom-rung design. Size and design in accordance with TIA/EIA-569 – B Pathways & Spaces.

(2) **Manufacturer:** Wiremold Spec-Mate or equivalent
Part Number: CA 04 09 18 (Part # for a 10' long section of tray with 1 inch wide rungs (4 inches high) spaced 9 inches apart and an overall tray width of 18 inches)

(c) **Fasteners:**

(1) Plenum-rated cable hanger, should have a wide base to provide support for Category 6 cable and fiber optic cable. Size in accordance with TIA/EIA-569 – B Pathways & Spaces.

(2) **Manufacturer:** Hilti, Erico or approved equivalent
Part Number: Hilti X-ECH or Erico Cable Cat CAT32

(d) **Corrugated flexible raceway (aka Innerduct):**

(1) **Indoor:**

(a) Flexible non-metallic corrugated plenum innerduct with a pre-installed pull line. Riser rated may be used in riser applications only. Size in accordance with TIA/EIA-569 – B Pathways & Spaces.

(b) **Manufacturer:** Pyramid or equivalent
Part Number: PLM100T (for 1 inch)

(2) **Outdoor:**

(a) Orange Flexible non-metallic corrugated plenum (or outdoor where possible) innerduct with a pre-installed pull line. Size in accordance with TIA/EIA-569 – B Pathways & Spaces.

6. ADMINISTRATION:

01. **Labels:**

(a) The communications workstation outlet faceplate shall be labeled with a pre-printed or machine printed, smudge resistant appropriately sized to fit, white label with black print.

(b) **Manufacturer:** "Brother P-Touch III", "Panduit LS-5 inch or equivalent

02. **Icons:**

(a) The communications workstation outlet shall have each data jack marked with a green icon, and each fiber jack marked with a red icon.

(b) **Manufacturer:** Siemon, Ortronics

PART III - EXECUTION

1. UNIVERSITY GENERAL PRACTICES:

01. **Standard Communications Outlet:**

(a) The Standard Communications Outlet for wall-mounted installation shall consist of a flush mounted two-gang wall box (4 inches sq. x 2 1/2 inches deep), with the following receptacle configuration: two 4 pair green, plenum, Category 6 UTP data cables terminated on 8 position, 8 conductor RJ45 receptacles, in a single gang stainless steel faceplate. These jacks shall be wired according to the 568B pinout. This outlet may also support two 62.5/125 multimode fibers with SC connectors. At certain locations a subset of this outlet may be installed, upon approval by UM CITS.

(1) The “Siemon CT” communications outlet shall be mounted in vertical position with the data-1 and data-2 jacks at the top. The blank will be mounted below.

(2) The “Ortronics Tracjack” shall be mounted in a vertical position with the data-1 jack in the top left and the data-2 jack next to it. The blanks will be mounted below.

(b) A standard wall phone outlet for wall-mounted installation shall consist of a flush mounted single-gang wall box (2 inch x 4 inch x 2 1/2 inches deep), with one separately sheathed Category 6 UTP green plenum data cable with a stainless steel faceplate.

(b) See Paragraph 7 for Standard Communications Symbols and Definitions.

02. **Distribution Requirements:**

(a) **Faculty and Administrative Office Spaces:**

(1) Each multiple occupant office shall be equipped with a minimum of one standard communications outlet per desk or workstation. There shall be a minimum of two standard communications outlets per private (i.e. single occupancy) office, located on opposite walls.

(b) **Secretarial/Receptionist Areas:**

(1) Each secretarial or reception area shall be equipped with one standard communications outlet per desk or workstation.

(c) **Classrooms and Lecture Rooms:**

(1) Each classroom and lecture room will be equipped with a minimum of one standard communications outlet located at one side of the teaching wall or chalkboard. If there is a podium in the room, it should get a floor box with power, voice, data, and AV cable. Wireless communication shall be included in these locations with the installation of communication outlets in the ceiling.

(d) **Seminar Rooms:**

(1) Each seminar room will be equipped with a minimum of one standard communications outlet. If there is a podium in the room, it should get a floor box with power, voice, data, and AV cable. Wireless communication shall be included in these locations with the installation of communication outlets in the ceiling.

(e) **Conference Rooms, Workrooms, Laboratories, etc.:**

(1) Each such room shall be equipped with a minimum of one standard communications outlet. If there is a chalkboard or teaching station in the room, the outlet shall be in close proximity to that location. If there is a

podium in the room, it should get a floor box with power, voice, data, and AV cable. Wireless communication shall be included in these locations with the installation of communication outlets in the ceiling.

02. **Horizontal Cabling:**

(a) The following requirements pertain to the horizontal or station wire itself.

(1) Station wire runs from the station outlet to the cross-connect point in the IDF (aka the horizontal link) shall be no longer than 90 meters (295 feet) of cable distance including 10 feet of slack in the IDF and 1 foot of slack at the outlet.

(2) Horizontal cabling shall be installed in a Star topology.

(3) Station wire shall be constructed of 24 AWG thermo-plastic insulated solid copper conductors formed into four individually twisted pairs and enclosed by a thermoplastic jacket. All horizontal cable shall be rated type CMP per Section 800 of the National Electric Code, except for those cables installed in Bressler Building, Howard Hall, the Medical School Teaching Facility and future laboratory facilities which may be NEC rated type CM where permitted by code. If there is any uncertainty about which type to use, then always use CMP type.

(4) Splicing shall not be allowed in station wiring.

(5) Transition points or Consolidation points between the outlet and the IDF are not allowed.

(6) The diameter of each four-pair cable shall be less than 6.35 mm (0.25 in).

(7) Unshielded media is subject to crosstalk and electrical interference. During installation, care shall be taken to avoid environments that may expose the media to higher levels of electromagnetic interference from such sources as:

(a) Fluorescent lighting
(b) Power cables
(c) HVAC equipment
(d) Commercial radio frequency transmissions
(e) Electric motors
(f) Dynamometers
(g) Resistance welding equipment

(8) Guidelines for maintaining separation between unshielded twisted pair cable and interference sources are:

(a) Maintain at least a 305 mm (12 inches) separation from fluorescent or neon lighting fixtures.

(b) Maintain at least a 1-meter (3.3 feet) separation from transformers, motors or other sources of electromagnetic fields.

(c) Maintain separation from unshielded power cables for voltages up to 480 volts:

(1)	Less than 2 kva:	127 mm (5 inches)
(2)	2 to 5 kva:	305 mm (12 inches)
(3)	More than 5 kva:	915 mm (36 inches)

(9) Under-cabinet fluorescent fixtures installed in modular furniture or on walls can cause interference depending upon the proximity of the communications equipment to the fluorescent ballast.

3. VERTICAL DISTRIBUTION:

01. IDF and BDF:

(a) A Building Distribution Frame and Intermediate Distribution Frame (BDF/IDF) is an area within a building set aside for the exclusive purpose of housing equipment associated with the telecommunications wiring system. Each BDF/IDF house's an increasing variety of communications equipment, hardware, cable, etc.

(b) BDF/IDF's must be designed to accommodate the following: riser cables from the riser system, telecomm grounding system, cables to interconnect IDF's when there is more than one room per floor, Category 6 data cable and fiber optic patch panels, data communications hardware, wire and equipment racks, station wiring, electrical outlets, blue mounting boards for voice fields and white mounting boards for cross-connect fields, "66" type terminating blocks for the voice cable.

(c) Prior to the installation of any equipment in the BDF and any of the IDFs, the Contractor shall provide floor layout drawings and elevation layout drawings for the BDF and each of the IDFs. These drawings must be pre-approved by UM CITS before any work is started in these rooms. These drawings must show the proposed locations of all blue backboards for voice, "66 type" terminating blocks, distribution panels, wire and equipment racks, security boxes, control boxes, electrical outlets, power supplies, and anything else required for all communications systems which are part of this specification.

(d) The following should be used as a general guideline for designing BDF/IDFs that house the riser systems:

(1) IDFs must be located so that station wire runs from the station outlet to the cross-connect point in the IDF be no longer than 90 meters (295 feet) of cable distance.

(2) BDF/IDFs must be single purpose spaces and cannot be shared by other utilities, janitorial storage, etc.

(3) A minimum of one IDF per floor is required. IDFs shall be designed such that station outlets are served by the IDF located on the same floor. In some cases, where buildings are small, and the amount of jacks on the floor is low, consolidating 2 or 3 floors of cabling into one IDF may be considered.

(4) The placement of IDFs adjacent to building columns and exterior walls may greatly restrict flexibility with regard to the layout of a raceway system and subsequent routing of cables.

(5) BDF/IDFs should be designed so they are stacked one above the other.

(6) A minimum of three 4 inch riser conduits will connect the IDFs. These conduits must be threaded and capped at both ends. Conduit penetrating the ceiling should extend only far enough below the ceiling to permit installation of a bushing and cap. Conduit penetrating the floor should extend a minimum of 1 inch AFF, and a maximum of 3 inches AFF. All such conduits should be a maximum of 2 inches from the finished plywood wall.

(7) An AWG #6 solid ground wire will be installed in the vertical riser from the basement to the top floor for the telecomm grounding system. This ground shall be attached to the building's approved grounding point used for the building electrical service.

(8) A walk-in IDF of a minimum of 8 feet by 10 feet is preferred. A single 3 foot solid door shall be provided and mounted to swing outside the room. This space should be accessible from a corridor.

(9) Where a shallow IDF is the only available alternative, it shall not be less than 3 feet by 8 feet. This type room should be equipped with two 3 foot doors hinged to swing outside the room.

(10) All walls, ceilings and floors must be made non-porous with paint or sealant to minimize dust.

(11) The BDF/IDF walls shall be lined with 8 foot high, 3/4-inch fire treated plywood mounted 6 inches AFF. Anchors for plywood panels shall be sufficient to support equipment apparatus.

(12) Minimum ceiling height for BDF/IDF is 8 feet 6 inches. Dropped ceilings shall not be used within the BDF/IDF.

(13) All BDF/IDF shall be equipped with a minimum of four dedicated non-switched NEMA L6-30 receptacles. These must be connected to emergency power sources. In addition there shall be at least one “convenience” outlet installed in the room which does not have to be on emergency power.

(14) All BDF/IDF shall be equipped with Quad NEMA 5-20 Emergency Power Receptacles mounted in the center of each wall at a height of 18 inches

AFF, 96 inches AFF, or on the equipment rack whichever is deemed suitable for the specific project by UM CITS. These should be shown on floor layout and elevation drawings.

(15) The cross-connect hardware should be connected to the telecomm grounding system installed in the vertical riser from the basement to the top floor.

(16) A minimum of one fluorescent light fixture will be required. It shall be located to provide adequate lighting providing a minimum of at least 50-foot candles, measured at 3 feet AFF, with a standard wall switch located near the door. For EMI protection, mount lights no closer than 12 inches from cable sleeves, cable trays, and patch panels**.**

(17) Plumbing lines (water, soil or steam) may not pass through the BDF or IDF. Integrity of fire separations shall be maintained in all cases. Rest rooms or janitor closets may not be placed above BDF or IDF's.

(18) Sleeves or conduit entering these spaces from telephone outlets shall penetrate the IDF walls at a height above the plywood panels and extend only far enough to install bushings.

(19) For BDF/IDF environmental requirements see Section 3 MD: Part I General Requirements and Section 3 MD Part III HVAC System Design of these Design Standards.

(20) Each IDF and BDF must contain at least 1 standard equipment rack and 1 4-post server rack.

02. **Riser Cable:**

(a) **General:**

(1) All vertical riser cable shall be rated type CMR per Section 800 of the National Electric Code. Horizontal riser (aka Tie Cable) shall be rated type CMP or type ARMM per Section 800 of the NEC, except that cable installed in Bressler Building, Howard Hall, the Medical School Teaching Facility and future laboratory facilities may be NEC rated CMR where permitted by code.

(2) Any riser cable that enters an air plenum area must be plenum rated ("NEC" type CMP) or may be enclosed in metal conduit.

(3) Each BDF/IDF shall be served by a copper riser cable and a "Data" riser fiber cable in separate sheaths.

(4) Riser cable sheaths shall be grounded only at the BDF. Riser cable sheaths entering and leaving each IDF will be bonded together, voice to voice and data to data, using industry standard bonding techniques.

(5) All riser cables shall be routed in such a way as to not interfere with the operation or maintenance of any device along its path, including electrical wiring, fluorescent lighting fixtures, transformers, etc. All riser cables paths shall be routed into corners when going vertical through a IDF. All riser cable paths should be shown on elevation drawings. All riser cable shall be fastened to a center hung cable tray at a minimum of 3 foot intervals. Riser must not be supported by any other utility raceway, electrical or mechanical apparatus.

(b) **Copper:**

(1) Pair twists of any pair shall not be exactly the same as any other pair within the same 25-pair cable. The pair twists lengths shall be selected by the manufacturer to ensure compliance with the crosstalk requirements of this standard, but shall not be less than two twists per foot.

(2) All pairs and groups of pairs shall be color-coded using standard REA color-coding. Color code integrity shall be maintained whenever cables are spliced.

(3) Transmission requirements of riser cable shall be the same as those for station wire with respect to resistance, resistance unbalance in a pair, mutual capacitance of a pair, and capacitance unbalance to ground. Other requirements are as listed in the cable specifications section.

(c) **Fiber:**

(1) There shall be a minimum of 12 Multi-mode Fibers and 6 Single-Mode Fibers from the BDF to each IDF on every floor.

(2) All fiber must be manufacturer certified as to bandwidth.

(3) The outer jacket of the fiber optic cables shall be color coded orange and print marked with the words "Fiber Optic Cable" no more than one 1m. (3.28 feet) apart. The fiber optic cable shall be distinguishable from the existing electrical cables presently installed.

(4) Each and every fiber in the cable shall be color coded or numerically identified so as to properly identify dedicated fibers. This coding shall be documented in the final as built drawings submitted to the University upon completion of the installation.

(5) The cable shall be riser (type OFNR) or plenum (type OFNP) rated, as required.

(6) The University requires that all fibers be terminated directly into interconnection units that provide for fiber termination, protection, and cross connection. Use Siecor/Corning CCH rack mount units as stated in the Products section.

(7) A separate panel or panels shall be furnished and installed for each cable terminated in a building. Each panel shall be sized to include mounting positions for all strands in the cable it serves. A service loop of not less than 10 feet will be provided in each panel.

(8) Each fiber strand shall be mounted in the patch panel for its cable and identified on the panel with its color code or unique number.

(9) The cable shall be installed, terminated and tested according to TIA/EIA-568-B.3, unless otherwise noted in these specifications.

(10) When a large conduit (4 inches or greater) is to be used for optical fiber cable placed in innerduct, the whole conduit shall be sectioned with a minimum of three (3) innerducts. This is to be used for OSP Fibers as well.

4. FIRESTOPPING:

01. General:

(a) Firestopping shall be completed in accordance with codes.

(b) All intra-building riser penetration, conduit cores, wall and ceiling penetrations will be sealed with a fire retardant expandable urethane foam or other UL listed solution designed to meet the requirements of building and safety codes. The completed seal must have a rating equal to or greater than that of the wall or ceiling penetrated.

(c) Fire stops (area around sleeves, drilled "core" floor openings and cables) will be sealed or plugged with 8- to-1 ratio expandable urethane foam with a 1 inch thick topping of water plug cement or equivalent. Unused conduits will be plugged and capped for fireproofing as specified above. Other “NFPA” approved firestopping methods may be substituted upon approval from the UM EE, or UM Fire Marshall.

5. TESTING:

01. General:

(a) All UTP cables shall be tested in accordance with TIA/EIA-568-B.2 Standards.

(1) Data UTP shall be tested in a permanent link configuration.

(2) All test results shall be provided to UM CITS for approval.

(b) All Optical fiber cable testing shall at a minimum, quantify the attenuation range, optical loss, bandwidth, and misalignment.

(1) The Contractor shall test all fiber optic cable on the reel prior to installation to insure fiber strands are continuous (in perfect working order), that the fiber optic cable meets manufacturer's specifications and is free from any physical damage.

(2) The Contractor shall test all fiber optic cabling and equipment after installation to insure proper operation according to the specifications herein and on the drawings.

(3) For optical fiber installation between the BDF and one of the campus fiber hubs, Howard Hall, School of Nursing and Pearl St. Garage, all fibers shall be tested end-to-end, from both directions, and at the following bandwidths, 850 and 1300 nm for multi-mode fiber, and 1300 and 1550 nm for single mode fiber, using an optical time domain reflectometer (OTDR). The OTDR must have been certified within the immediate prior six-month period. The light source or OTDR must operate within the range of 850 +/- 30 nm or 1300 +/- 20 nm for multimode testing in accordance with ANSI/EIA/TIA-526-14. The light source or OTDR must operate within the range of 1310 +/- 10 nm or 1550 +/- 20 nm for single-mode testing in accordance with ANSI/EIA/TIA-526-7.

(4) The fibers shall also be tested one way using a Optical Loss Test Set (Power Meter) using the following wavelengths:

(a) 850 & 1300, and 1310 & 1550 for riser backbone
(b) 850 or 1300, and 1310 or 1550 for horizontal

(5) For optical fiber installation between the BDF and a IDF, the contractor shall provide two-way loss testing through the use of a power meter.

(6) All traces and results of testing shall be presented to UM CITS for approval.

(7) Protective covers shall be in place on all connectors when they are not in use to protect against dirt or dust. Any fiber found to be defective as a result of installation, physical inspection, or operational test shall be replaced at the contractor's expense.

6. ADMINISTRATION

01. General:

(a) Administration shall be in accordance with TIA/EIA-606-A, unless otherwise noted.

(b) Communications Outlet Labeling

(1) The contractor shall provide permanent labeling of outlet jacks, termination blocks, racks, etc. Each outlet will be labeled with one label only. Each termination point will have a unique label also.

(2) Each outlet shall have an identification code consisting of 5 digits (6 if "LL" is used instead of "B"). The first digit shall indicate the floor of the building where the closet serving the outlet is located. The letter "G" shall be used for the ground floor, "1" for the first floor, etc. The letter "B" shall

be used for basements, "S" for subbasement, “LL” for lower level, and "M" for mezzanine.

(3) The second digit shall be the closet identifier. The letter "N" shall be used to indicate the north closet, the letter "S" shall be used to indicate the south closet, the letter "E" shall be used to indicate the east closet, and the letter "W" shall be used to indicate the west closet. If there is only one closet per floor, we use the letter “N”.

(4) The last three digits shall denote the number of the outlet. Outlet numbers 1 through 9 shall be preceded with two zeros (e.g. 008). Outlet number 10 through 99 shall be preceded with one zero (e.g. 1N028).

(5) In the Telecommunications Room, data patch panels will be labeled with both the outlet # and the jack #. For instance for outlet # 1N028, the patch panel will read1N028-D1, and 1N028-D2.

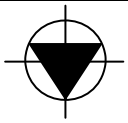
(6) The color code for Communication Outlet Icons is as follows:

(a)	Category 6 data jack	green
(b)	‘SC’ Fiber jack	red

c. **Optical Fiber:**

(1) An engraved tag indicating the source and destination shall be on the fiber cable, and on each interconnection unit.

7. STANDARD COMMUNICATIONS SYMBOLS AND DEFINITIONS:

		Standard Communications Outlet – (18” AFF UON), (2) Category 6 plenum cables (green jacket). 2” box with a single gang ring and (1) 1” conduit stub-up with pull wire toward cable tray or IDF room.
 w		Standard Wall Phone Outlet – (48” AFF UON), (1) Category 6 plenum cable (green jacket). 2” box with a single gang ring and (1) 3/4 inch conduit stub-up with pull wire toward cable tray or IDF room.
 4		Quad Data Outlet – (18” AFF UON), (4) Category 6 plenum cables (green jacket). 4” box with a single gang ring and (1) 1” conduit stub-up with pull wire toward cable tray or IDF room.
		Standard Floor Mount Communications Outlet – (2) Category 6 plenum cables (green jacket). Two (2) 1” conduits shall be installed to the floor box unless it is accessible from the ceiling of the floor below
		Standard Ceiling Mount Communications Outlet - (2) Category 6 plenum cables (green jacket).
		Standard Communications Outlet – (18” AFF UON), (2) Category 5e plenum cables (yellow jacket) and (2) Category 6 plenum cables (green jacket). 4” box with a doublegang ring and (2) 1” conduit stub-ups with pull wire toward cable tray or IDF room. Use for non-standard non-VOIP applications.

END OF SECTION IV: APPENDICES