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PART 1 - GENERAL

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END OF SECTION 000000

SECTION 027010 - BASIC COMMUNICATIONS REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings, Standard Contract Requirements, Special Provisions, and Division 27 specification sections apply to work on this section.

1.2 INDUSTRY AND UNIVERSITY STANDARDS

- A. The rules and standards of the following shall be considered as minimum requirements: ANSI/TIA-568 Standard, The Institute of Electrical and Electronics Engineers; the National Electrical Manufacturers Association; The Insulated Cable Engineers Association; National Bureau of Standards; National Fire Protection Association; Federal Aviation Administration; The Electrical Code of the City of Philadelphia, Occupational Safety and Health Administration, U.S. Environmental Protection Agency, U.S. Department of Transportation, and The National Electrical Code.
- B. The University uses the T568A pin/pair assignments for data station wiring and T568A pin/pair assignments for voice station wiring. The data wiring system is to be Category 6a compliant. In addition, specifications are provided for a separate video distribution system to be run in parallel and miscellaneous wiring to specific panels.
- C. The data wiring must be terminated to exact, high standards to ensure its ability to support the existing 10Base-T standard for 10 Mbs Ethernet over UTP and proposed open standards for gigabit Ethernet.

1.3 SAFETY

- A. During construction, the Contractor shall be responsible for providing all his employees with working conditions as prescribed in the "Safety and Health Regulations for Construction" of the Occupational Safety and Health Administration of the U.S. Department of Labor.
- B. The Designer, Owner Tenants, and the Owner shall not be held liable for any bodily injury or property damage resulting from the Contractor's operation.

1.4 SCOPE

- A. Mention herein, or indication on the drawings of articles, materials, operations or methods requires that the Contractor provide each item mentioned or indicated, of quality or subject to qualification noted; perform, according to conditions stated, each operation prescribed; and provide all labor, equipment and incidentals necessary for a complete and properly functioning installation of the communications work.
- B. All items of labor, materials, or equipment not mentioned or indicated in detail in the specifications or on drawings, but incidental to, or necessary for the complete installation and

proper operation of the work described herein or reasonably implied in connection therewith, shall be furnished as if called for in detail by the specifications and drawings.

1.5 SITE VISIT

- A. The Contractor is required to visit the entire site during the bidding period and thoroughly familiarize himself with the conditions, scope, and quantities of work involved.

1.6 DRAWINGS

- A. The drawings accompanying the specifications have been made to scale with the best knowledge of conditions, dimensions, and space requirements available at the time of preparation.
- B. The layout of wiring on the small-scale drawings shall not be considered absolute. The design shall be subject to such revisions as may be necessary to overcome obstructions. No changes shall be made in item locations, the method of wiring, or the placing of apparatus without written consent of the Designer.
- C. The Contractor shall examine the drawings and details for the placement of all outlets and equipment to properly coordinate them with relation to all other equipment.

1.7 SINGULAR NUMBER

- A. In all instances where an item, or part of the equipment is referred to in the singular number, the reference shall apply to as many items as are necessary to complete the work.

1.8 MATERIALS

- A. All materials used in the work shall be new, free of defects, the best of their respective kinds, and shall be installed by labor thoroughly skilled in the class of work anticipated by this Contract.
- B. All materials used shall be the latest version offered by the manufacturer.
- C. All materials used shall be as specified, without substitution.

1.9 SHOP DRAWINGS/SUBMITTALS

- A. Shop drawing submittal schedule shall be submitted within 10 days from the date of Notice to Proceed. All shop drawings shall be submitted within 40 days from the date of Notice to Proceed.
- B. Each shop drawing shall be clearly marked to indicate the specific items and accessories being submitted for review.
- C. Each shop drawing shall be stamped with Company Name and marked to identify the Contract title. Each drawing shall be dated and signed by the Contractor stating that he approves the submission as meeting the Contract requirements.

- D. It is the Contractor's responsibility that the quantities, dimensions, installation methods, graphs, charts, and other technical data on the shop drawings are correct and fulfill the contract requirements.
- E. Shop drawing review shall not relieve the Contractor from complying with the contract drawings and specification.
- F. Contractor shall not install any work governed by a shop drawing until the shop drawing receives final review.
- G. When a substitution is proposed, the contractor shall submit shop drawings of both the specified and proposed items. He shall include a typewritten technical analysis outlining the qualities of proposed items versus the specified item. Samples of both items shall be submitted when requested. If the analysis fails to substantiate the proposed substitution or the sample proves inferior, no further consideration will be given and the specified item shall be provided.
- H. Submit five copies of the following shop drawings for review:
 - 1. Station Cable.
 - 2. Wiring Devices.
 - 3. Riser Cable.
 - 4. Others as requested.
 - 5. Testing Equipment.
 - 6. Schedule.
 - 7. Others as specified elsewhere.
 - 8. Any item that does not have a specified manufacturer and/or part number.

1.10 PROTECTION OF WORK

- A. The Contractor shall effectively protect, at his expense any of his work, materials and equipment, that are liable to damage during the period of construction. Conduit and openings as well as all associated equipment shall be properly covered and protected. The Contractor shall be held responsible for all damage done to his work, the Owner's property and injuries to the public until the work is fully and finally accepted by the Owner.
- B. Provide and maintain temporary barricades, drop cloths, partitions, and dust and noise barriers. Items shall be adequate to prevent the spread of noise, dust and dirt to adjacent areas and surfaces and to provide protection to the public and tenants.

1.11 TESTS

- A. The Contractor shall supply all labor, materials, instruments and miscellaneous equipment for any examination of work or tests as required. All equipment and wire shall be satisfactorily tested and operated before placing in service. All test results shall be recorded and submitted to the Designer.
- B. The University may observe any inspections or tests.

1.12 UL LABEL

- A. All equipment for which label service is available shall bear the label of the Underwriters' Laboratories, Inc. or other recognized testing laboratory.

1.13 SERVICE INTERRUPTIONS

- A. The Contractor shall notify the Designer of the intent to perform any work which requires service interruption and shall proceed with such work only after receiving a time schedule approved by the Designer. The Designer shall have the right to cancel or delay the time of any service interruption. The Contractor shall provide personnel and equipment to assist in the proper coordination of service interruptions. The Contractor shall not leave the job site until resumption of normal service is satisfactory to the Designer.
- B. Shutdown times must be minimized where entire building or sections of buildings are to be shut down. The Owner will perform coordination of all service interruptions.
- C. Contractor shall perform all work involving service interruptions at times designated by the Owner or at night and/or Saturday or Sunday. The Owner will make no allowances for overtime labor costs.
- D. Where Contractor interrupts any communications or other service due to damaging equipment or cable through his negligence, he shall be required to repair or replace the equipment or cable immediately, working continuously to restore service until satisfactory to the Owner. Repair, replacement or both shall be at the discretion of the Designer and at the expense of the Contractor.
- E. Contractor shall note that the facility shall be occupied and in use during the construction period. Contractor shall not disturb continuity of service to any area without the written approval and agreement as to time and duration of such interruption. Contractor shall perform any of this work at anytime without extra cost to Owner.

1.14 COORDINATION DRAWINGS

- A. Prepare coordination drawings to a scale of 1/16"=1'-0" or larger; detailing major elements, components, and systems of communications equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the Owner, including (but not limited to) the following:
 - 1. Indicate the proposed locations of major raceway systems, equipment, and materials.
 - 2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

1.15 FINAL ACCEPTANCE

- A. When the job is complete, the Contractor shall request a final inspection. The Contractor shall accompany the Designer throughout the inspection.
- B. The Contractor shall demonstrate the function of any equipment and system as requested. In the event that any equipment or system does not function correctly, the Contractor shall perform any tests and provide test equipment required to ascertain the cause.
- C. The Designer will inspect each closet group as a whole.
- D. The Designer will prepare a punchlist of unacceptable items and present it to the Contractor. Re inspection will be done as soon as all items have been corrected.

1.16 RECORD DOCUMENTS

- A. Prepare record documents showing as-built conditions. Indicate installed conditions for:
 - 1. Major cable systems, size and location.
 - 2. Approved substitutions, Contract Modifications, and actual materials installed.

1.17 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

1.18 COMMUNICATIONS INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of communications systems, materials, and equipment. Comply with the following requirements:
 - 1. Coordinate communications equipment and materials installation with other building components.
 - 2. Verify all dimensions by field measurements.
 - 3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for communications installations.
 - 4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 - 5. Sequence, coordinate, and integrate installations of communications materials and equipment for efficient flow of the work.
 - 6. Refer to approved shop drawings for exact location for rough-in of communications devices.
 - 7. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
 - 8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.

1.19 SELECTIVE DEMOLITION

- A. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
- B. Locate, identify, and protect communications services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas under the guidance of the University.
- C. Communications services include but not limited to data and voice.
- D. When demolition permanently interrupts service to areas outside the demolition limits, provide new service to the area.
- E. All material not to be salvaged shall become the property of the contractor and shall be removed from the site for legal disposal off University property. Materials determined to be salvageable by the Designer shall become property of the Designer and delivered to a location on Owner property as directed.
- F. All raceway and wire made obsolete by this work shall be removed to its source.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION 027010

SECTION 027121 - STATION CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings, Standard Contract Requirements, Special Provisions, and Division 27 specification sections apply to work of this Section.

PART 2 - PRODUCTS

2.1 CABLES

- A. Provide unshielded twisted pair cable as scheduled below.
1. Cable: Category 6A, manufacturer: Berk-Tek, product line: LM-RDT Cat 6A UTP CMP Cable, manufacturer part numbers as listed below:

Use	Jacket Color	Plenum
Berk-Tek LM-RDT Data Cable	White	11141651
Miscellaneous Cable	Violet	11142238

2.2 LABELS

- A. Label Type "A": Provide machine-printed, self-laminating cable labels to identify all station cables. Provide products by either one of the following manufacturers or similar label-printing machine product line as scheduled below. Use labels, which will accept a minimum of 13 characters per line. The labels used must be able to stay intact and legible when the cable is not straight.
1. "Brady" Bradymaker XC Plus Printer.
 2. "Thomas & Betts" Programmable Alpha-Numeric Wire Marker Printer" (Cat. No. WD-25P).

PART 3 - EXECUTION

3.1 CABLE SHALL BE INSTALLED IN PATHWAY

- A. Cables will be pulled through soffits, virtual pathways, and surface-mounted conduit as detailed elsewhere in the construction documents.
- B. Where pathway is not provided, install support devices for the cables. Use the following types:
1. 6000 lb test messenger strand.
 2. Cable runway (B-line Systems, Inc. or similar product line).
 3. CAT 5 Rated cable supports.

3.2 INSTALLATION OF STATION CABLES

- A. Pull cables simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound or lubricant, where necessary.
- B. Use pulling means including, fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceways. Do not use rope hitches for pulling attachment to wire or cable.
- C. No splices are permitted.
- D. Provide adequate length of cables within device boxes and train the conductors to terminal points with no excess. Make terminations so there is no bare conductor at the terminal.
- E. When station cables are to be supported by a strand, they must be attached and secured with a ty-
rap to the strand every 12 inches in horizontal locations and every 18 inches in vertical locations.
- F. All cable sheaths must be protected from sharp metal edges. Where the cable passes over a sharp
edge, the sharp edge should be eliminated or a bushing or grommet must be installed to protect
the cable.
- G. Install station cabling as listed to the locations specified on the drawings:
 - 1. Standard Double Gang Locations: Two data cables and two voice cables to each device
box as indicated on the construction documents .
 - 2. High Density Double Gang Locations: Four data cables and four voice cables to each
device box as indicated on the construction documents .
 - 3. Single Gang Wall phone Locations: One voice cable to each device box as indicated on the
construction documents by .
- H. Closet Zones:
 - 1. Pull station cables to the following communications rooms.
 - 2. The following locations are to be pulled to :
 - a. Standard Double Gang Locations.
 - b. ACD Double Gang Locations.
 - c. Single Gang Wallphone/Payphone Locations.
 - 3. The following locations are to be pulled to :
 - a. All stations on the third floor west of column line 8.
 - b. All stations on the fourth floor west of column line 8.
 - c. All stations on the fifth floor west of column line 8.
 - d. All stations on the sixth floor west of column line 8.

3.3 LABELING

- A. All station cables shall be labeled at both ends.
- B. Printing on the label must be parallel with the cable.

- C. Printing on the label must not be smeared while the label is installed.
- D. Data cables shall be labeled with label type "A". The label is to be printed with the following items in order:

- 1. Building code:

Building	Code

- 2. Room number followed by a dash.
- 3. Faceplate location followed by a dash. Location of each faceplate in a room, even if the room has only one faceplate. Faceplate order is clockwise around the room starting from the door.
- 4. Cable type:
 - a. U for unshielded twisted pair data cable.
- 5. Cable number. The number for the cable of that type pulled to the faceplate. i.e., the first UTP cable pulled to the faceplate would have a cable number of 1. The second UTP cable would have a cable number of 2.

- E. Voice cables shall be labeled with label type "A". The label is to be printed with the following items in order:

- 1. Room number followed by a dash.
- 2. Cable Number:
 - a. Number of each voice cable in a room, even if the room has only one voice cable. Faceplate order is clockwise around the room starting from the door, and cable order is from top down on the faceplate.

- F. LAN cables shall be labeled with label type "A". The label is to be the same as a data cable label with LAN as the building code.

3.4 FIELD INSPECTION

- A. All cables are to be inspected prior to installation for defects.
- B. All cables and cable jackets are to be inspected after installation for defects.
- C. All cables are to be checked for continuity.

END OF SECTION 027121

SECTION 027122 - RISER AND FEED CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings, Standard Contract Requirements, Special Provisions, and Division 27 specification sections apply to work of this Section.

PART 2 - PRODUCTS

2.1 CABLES

- A. Provide twisted pair cable as scheduled below.

- 1. Voice Cable: 24 gauge, manufacturer: General Cable Corporation, manufacturer part numbers as listed below.

Cable Size	Plenum	ARMM	BKMA
100 pair	7056641	7507601	6937064
200 pair	7056666	7507619	6964803

- 2. Voice Cable: 24 gauge, manufacturer: Essex Cable, manufacturer part numbers equal to those listed for General Cable.

- B. Provide fiber optic cable as scheduled below.

- 1. Data Cable: Armored Indoor/Outdoor, Premise Distribution, Tight Buffer, Plenum, Manufacturer: Berk-Tek part numbers, or equivalent, as listed below.

Cable Size	OS2 Single Mode
06 strand	PDPK006AB0707
24 strand	PDPK024AB0707
48 strand	PDPK048AB0707

- 2. Data Cable: Adventum Indoor/Outdoor Plenum Loose Tube w/Armor-Tek, manufacturer: Berk-Tek part numbers, or equivalent, as listed below.

Cable Size	OS2 Single Mode
24 strand	LTPK12B0224AB0403
48 strand	LTPK12B048AB0403
144 strand	LTPK12B144AB0403

- 3. Data Cable: Indoor/Outdoor Riser Ribbon Cable with Armor-Tek, manufacturer: Berk-Tek part numbers, or equivalent, as listed below.

Cable Size	OS2 Single Mode
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24 strand	RDRK12B024-I/O(BLA)-M4-AB0403
48 strand	RDRK12B048-I/O(BLA)-M4-AB0403
144 strand	RDRK12B144-I/O(BLA)-M4-AB0403

4. Data Cable: Ultra Ribbon, Interlocking Armored Gel-Free Riser Indoor/Outdoor Cable, manufacturer: Corning part numbers, or equivalent, as listed below.

Cable Size	OS2 Single Mode
432 strand	432ZVF-14101DA1

2.2 FIBER TERMINATIONS

- A. Siemon SC Connector
1. Epoxy/polish: FC1-SC-SM-B06
 2. Fusion: FC-F-SCU-29BL
- B. Ribbonized Pigtailed
1. LVS12-SCUARBB1A

2.3 LABELS

- A. Label Type "A": Provide machine-printed, self-laminating cable labels printed from equipment as scheduled below. Provide products by either one of the following manufacturers or similar label-printing machine product line as scheduled below. Use labels which will accept a minimum of 13 characters per line. The labels used must be able to stay intact and legible when the cable is not straight.
1. "Brady" Bradymaker XC Plus Printer.
 2. "Thomas & Betts" Programmable Alpha-Numeric Wire Marker Printer" (Cat. No. WD-25P).
- B. Label Type "B": Provide labels printed from equipment as scheduled below. Labels are to be black characters on white background, 12 mm wide tape, and self-adhesive.
1. Kroy Printer Duratype 210 Electric Labeling System.
 2. Brother P-touch III Electronic Labeling System

2.4 ADDITIONAL MATERIAL

- A. Provide galvanized cable racking for use in manholes. Industry standard.
- B. Provide ENT as scheduled below:
1. Innerduct, 3/4 inch diameter, non-rated.
 2. Innerduct, 3/4 inch diameter, riser rated.
 3. Innerduct, 3/4 inch diameter, plenum rated.
 4. Innerduct, 1 inch diameter, non-rated.
 5. Innerduct, 1 inch diameter, riser rated.

- 6. Innerduct, 1 inch diameter, plenum rated.
- 7. Innerduct, 1 1/4 inch diameter, non-rated.
- 8. Innerduct, 1 1/4 inch diameter, riser rated.
- 9. Innerduct, 1 1/4 inch diameter, plenum rated.

PART 3 - EXECUTION

3.1 CABLE SHALL BE INSTALLED IN PATHWAY

- A. Cables will be pulled through soffits, virtual pathways, conduit, cable trays, and surface-mounted conduit as detailed elsewhere in the construction documents.
- B. Where pathway is not provided, install support devices for the cables. Use the following types:
 - 1. 6000 lb test messenger strand.
 - 2. Cable runway (B-line Systems, Inc. or similar product line).
- C. In manholes, cable racking is to be installed so that the cables can be dressed around the manhole, and splice cases can be supported.

Manhole:	Wall (s)
MH M26	

- D. When voice cables exit a conduit, “shoes” are to be installed to prevent the cable from kinking.

3.2 INSTALLATION OF INNERDUCT

- A. Pull innerduct simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound or lubricant, where necessary.
- B. Install innerducts as listed in the following schedule.

From:	To:	Type	Quantity

3.3 INSTALLATION OF RISER CABLES

- A. Pull conductors simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound or lubricant, where necessary.
- B. Use pulling means including, fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceways. Do not use rope hitches for pulling attachment to wire or cable.
- C. No splices are permitted.
- D. Provide adequate length of cables within communications rooms and train the conductors to termination hardware. Make terminations so there is no bare conductor at the terminal.

- E. Avoid routing the cables in a manner the compromises their integrity. Maintain bend radii as specified in documentation specified in Section 27010.1 paragraph 1.2.A.
- F. Data cables are to be pulled inside innerducts.
- G. Install riser cabling as listed to the listed locations.
 - 1. Voice Cables as listed in the following schedules with size and cable count (H denotes House cable and LH denotes Local House cable).

From:	To:	Size (in pairs):	Type:	Cable Count:
IST 0011	MH M37	1200	BKMA	1 - 1200

- 2. Data cables as listed in the following schedule with run numbers.

From:	To:	Strands:	Type:	Cable Identifier
IST 0011	MH M37	144	Single-Mode	SS 301

3.4 LABELING

- A. All riser cables shall be labeled at both ends.
 - 1. Voice cables are to be labeled with label type "B" fastened with the self-adhesive and a ty-rap at each end. The label is to be printed with the house/local house cable count and the location of the other end of the cable.
 - 2. Data cables are to be labeled with label type "A". The label is to be printed with the run number and the location of the other end of the cable.
- B. Voice cables shall be labeled at each end according to the cable count numbers on the schedule in 3.03.E.1.
- C. Data cables shall be labeled at each end according to the run number on the schedule in 3.03.E.2:

3.5 FIELD INSPECTION

- A. All cables are to be inspected prior to installation for defects.
- B. All cables and cable jackets are to be inspected after installation for defects.
- C. All cables are to be checked for continuity.

END OF SECTION 027122

SECTION 027143 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings, Standard Contract Requirements, Special Provisions, and Divisions 1 and 27 specification sections apply to work on this section.

1.2 SEQUENCE AND SCHEDULING

- A. Schedule installation finish plates after the surface upon which they are installed has received final finish.

1.3 STANDARDS

- A. The data wiring must be terminated to exact, high standards to ensure its ability to support the existing 10Base-T standard for 10 Mbs Ethernet over UTP, and proposed open standards for gigabit Ethernet.
- B. It is expected that the wiring contractor will have training sessions for their technicians on Simon's ZMAX or UltraMAX series, Berktek cable, and Comm-Scope cable.

PART 2 - PRODUCTS

2.1 WIRING DEVICES

- A. Provide wiring devices as scheduled below.
 - 1. Data Outlets, Single Jack: T568A, manufacturer: The Siemon Company, manufacturer part number U6A-H02NS UltraMAX Cat 6a.
 - 2. Wallphone Faceplate, Single jack: 3 pair, USOC, manufacturer: Suttle Apparatus, manufacturer part number SE-630AD6.

2.2 DEVICE PLATES

- A. Provide a device plate for each faceplate location.
 - 1. Single Gang Faceplate: manufacturer: The Siemon Company, manufacturer part number 10GMX-FPS02-02.
 - 2. Double Gang Faceplate: manufacturer: The Siemon Company, manufacturer part number 10GMX-FPS04-02.
 - 3. Walkerbox Faceplate Adapter.
- B. Provide blank coupler in unused faceplate openings.
 - 1. Blank Coupler: place holder, manufacturer: The Siemon Company, manufacturer part number MX-BL-02.

2.3 LABELS

- A. Label Type "C": Provide labels printed from equipment as scheduled below. Labels are to be black characters on white background, and 9 mm wide tape.
1. Kroy Printer Duratype 210 Electric Labeling System.
 2. Brother P-touch III Electronic Labeling System.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRING DEVICES AND ACCESSORIES

- A. Device plates shall be installed on a device box.
- B. Coordinate with other Work, including painting, electrical boxes, and cable installations, as necessary to interface installation of device plates with other Work.
- C. Install wiring devices only in electrical boxes which are clean; free from building materials, dirt, and debris.
- D. Install wiring devices and accessories after wiring work is completed.
- E. In areas of new construction, install device plate after painting or final finish work is completed.

3.2 TERMINATION OF STATION CABLES

- A. Install wiring devices as listed to the listed locations.
1. Standard Double Gang Locations: One data coupler, one voice coupler, one double gang faceplate, and two blank couplers to each device box as indicated on the construction documents by [REDACTED].
 2. High Density Standard Double Gang Locations: Two data couplers, two voice couplers, and one double gang faceplate to each device box as indicated on the construction documents by [REDACTED].
 3. Single Gang Wall phone/Payphone Locations: One wall phone faceplate to each device box as indicated on the construction documents by [REDACTED].
- B. Punch-down color-code sequences are given on the diagrams labeled "Physical and Logical Wiring Detail for Communications Outlet."
1. On the coupler, the order of termination for each jack is as follows from blue post to brown post:
 - a. White/Blue.
 - b. Blue/White.
 - c. White/Orange.
 - d. Orange/White.
 - e. White/Green.
 - f. Green/White.
 - g. White/Brown.

h. Brown/White.

C. Plastic icons shall be installed in the following manner at all locations:

1. Data couplers shall have ivory computer icons installed at all positions.
2. Voice couplers shall have ivory phone icons installed at all positions.
3. All remaining icons are to be turned over to the University.

3.3 LABELING

- A. The wiring must be labeled such that no documentation other than the physical labeling of the installed components is necessary to support the installed wiring system.
- B. All faceplates shall be labeled with label type "C". The label is to be printed with the cable label of the cable(s) terminated on the coupler adjacent to the label position.
- C. The printed label is to be inserted behind the plastic cover slip provided with the device plate.
- D. For label positions adjacent to blank couplers, insert the blank paper slip provided with the device plate behind the plastic cover slip.

3.4 FIELD INSPECTION

- A. All devices are to be inspected prior to installation for defects.
- B. All devices and accessories are to be inspected after installation for defects.

END OF SECTION 027143

SECTION 027470 - TERMINATION PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings, Standard Contract Requirements, Special Provisions, and Divisions 1 and 27 specification sections apply to work on this section.

PART 2 - PRODUCTS

2.1 COPPER TERMINATION HARDWARE AND MATERIALS

- A. Provide termination hardware and materials as scheduled below.
 1. 19 Inch Floor Mount Equipment Rack, steel, Manufacturer: The Siemon Company, manufacturer part number RS-07-S.
 2. D-ring: 8 inch, manufacturer: The Siemon Company, manufacturer part number S146.
 3. Siemon UP6A-A1-24K-RS: Copper, Patch Panel, UltraMAX, with Jacks, UTP, Category 6A, 24 Port, Angled, 1U, Black, Detached Wire Manager
 4. Siemon UP6A-A2-48K-RS: Copper, Patch Panel, UltraMAX, with Jacks, UTP, Category 6A, 48 Port, Angled, 2U, Black, Detached Wire Manager
 5. Siemon UP6A-F1-24K-RS: Copper, Patch Panel, UltraMAX, with Jacks, UTP, Category 6A, 24 Port, Flat, 1U, Black, Detached Wire Manager
 6. Siemon UP6A-F2-48K-RS: Copper, Patch Panel, UltraMAX, with Jacks, UTP, Category 6A, 48 Port, Flat, 2U, Black, Detached Wire Manager

2.2 FIBER TERMINATION HARDWARE AND MATERIALS

- A. Provide termination hardware and materials as scheduled below.
 1. Siemon LVE-1U-MD-P01A: Fiber, Enclosure, LightVerse Pro, Rack Mount, 1U, Sliding Access, 4 Openings, Black
 2. Siemon LVE-2U-MD-P01A: Fiber, Enclosure, LightVerse Pro, Rack Mount, 2U, Sliding Access, 8 Openings, Black
 3. Siemon LVE-4U-MD-P01A: Fiber, Enclosure, LightVerse Pro, Rack Mount, 4U, Sliding Access, 16 Openings, Black
 4. Siemon LVA12-SCQ-BM-A: Fiber, Adapter Plate, LightVerse, 12 Fiber, SC, Flat, Aqua Adapter, Black Housing, Phos Bronze Sleeve

PART 3 - EXECUTION

3.1 TERMINATION OF STATION CABLES

- A. Voice and Data Station Cables:
 1. All data UTP cables must be terminated on patch panels listed above in section 2.1.
 - a. White/Blue.

- b. Blue/White.
- c. White/Orange.
- d. Orange/White.
- e. White/Green.
- f. Green/White.
- g. White/Brown.
- h. Brown/White.
- i. LABELING

B. General:

- 1. The data wiring must be labeled such that no documentation other than the physical labeling of the installed components is necessary to support the installed wiring system.
- 2. All termination points must be labeled, as shown in the diagrams and examples on the following pages.

3.2 FIELD INSPECTION

- A. All devices are to be inspected prior to installation for defects.
- B. All devices and accessories are to be inspected after installation for defects.

END OF SECTION 027470

SECTION 027950 - TESTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings, Standard Contract Requirements, Special Provisions, and Divisions 1 and 27 specification sections apply to work on this section.

1.2 STANDARDS

- A. The University requires the contractor to test the installed system to make sure it complies with all requirements in this RFQ. All station and riser cables must be correctly wired and pass testing.
- B. Test results must be submitted for all station and riser cables.
- C. The contractor must sign and date all test results, signifying that the test was conducted according to the contractor's procedures and that the results are as stated. Any problems detected by the tests will be corrected before work proceeds to the next stage of the project.
- D. Station cabling test results are to be turn over to the University at the completion of each closet grouping. The testing needs to be completed prior to the scheduled turn over date.
- E. University standards for fiber are $.4 \pm .2$ dB per mated pair of ST connectors and 3.75 dB per 1,000 meters.

1.3 SUBMITTALS - TEST RESULTS

- A. Test results are to be submitted on 8 1/2 x 11 inch, 3 hole paper from a computer printer. 3 Ring binders are to be provided to the University at the turn-over of the first set of closets. One binder set will be used for data test results and one binder set will be used for voice test results. Size the binders and provide the quantities of binders needed accordingly.
- B. Station Cable Tests:
 - 1. Data Station Cabling:
 - a. The format for submitted test results is to be the printed saved test file after being downloaded to a computer, and the electric file from the tester.
 - b. Required results for each cable to be submitted are:
 - 1) Attenuation.
 - 2) Near End Crosstalk (NEXT) Loss.
 - 3) Equal Level Far-End Crosstalk (ELFEXT).
 - 4) Power Sum Equal Level Far-End Crosstalk (PSELFEXT).
 - 5) Return Loss.
 - 6) Propagation Delay (ANSI/TIA/EIA-568-A-1).
 - 7) Delay Skew (ANSI/TIA/EIA-568-A-1).

- 8) Longitudinal Conversion Loss (LCL).
- 9) Longitudinal Transfer Conversion Loss (LCTL).
- 10) Attenuation to Crosstalk Ratio (ACR).
- 11) Power Sum Attenuation to Crosstalk Ratio (PSACR).
- 12) Transfer Impedance.

2. Voice Station Cabling:

- a. The format for submitted test results is to be the printed saved test file after being downloaded to a computer.
- b. Required results for each cable to be submitted are:
 - 1) Line Map.
 - 2) Length.

3. Miscellaneous Station Cabling:

- a. The format for submitted test results is to be the printed saved test file after being downloaded to a computer.
- b. Required results for each cable to be submitted are:
 - 1) Line Map.
 - 2) Length.

C. Riser Cable Tests:

1. Data Riser Cabling:

- a. Loose Tube Fiber Cable:
 - 1) The format for submitted test results is to be a printed page displaying the following format:

LOOSE TUBE FIBER CABLE TEST LOG

Building: _____
 Termination Locations: _____ to _____
 Run Number: ____ Length: ____

Color	Date	Time	Tested by	dB loss	P/F
-------	------	------	-----------	---------	-----

- 2. Submit a test log per cable with each log having an entry per fiber.

D. Ribbon Fiber:

- 1. If the ribbon is terminated at both ends with no splice, follow the procedure for loose tube fiber cable.
- 2. If the ribbon is spliced, the format for submitted test results is to be the printed test file after being downloaded to a computer or printed out from the tester. Required results for each individual fiber to be submitted are:
 - a. Length.

- b. db loss.
 - c. Signature at splice.
- 3. Voice Riser Cabling:
 - a. The format for submitted test results is to be a printed page displaying the following format and table sized for the cable:

VOICE HOUSE/TIE CABLE TEST LOG

Building: _____
 Termination Locations: _____ to _____
 Cable Type: ____-pr

Binder Group	Date	Time	Tested by	P/F	Corrected
--------------	------	------	-----------	-----	-----------

- b. Required results for each cable to be submitted are defects by binder group. Even if a cable has no defects, a test log is to be submitted.

PART 2 - PRODUCTS

2.1 CAT 6a TESTERS

- A. Use commercially available hand-held testers that certify wires for conformance with ANSI/TIA-568-B.2 compliance with the Siemon’s UltraMAX Cat 6a Warranty and have the capability of downloading the test results to a computer for printing. Siemon approved manufacturers of copper testing devices include Fluke, AEM, Trend Networks, Softing & VIAVI.

2.2 FIBER TESTERS

- A. Loose Tube Fiber Cable: Use commercially available hand-held testers that certify fiber optic cable for conformance with EIA/TIA-568 tests and have the capability of downloading the test results to a computer for printing.
- B. Ribbon Fiber Cable: Use commercially available Optical Time Domain Reflector testers that certify fiber optic cable for conformance with EIA/TIA-568 tests and have the capability of downloading the test results to a computer for printing.

2.3 VOICE RISER TESTERS

- A. Voice riser testers need to be able to provide the testing team with results needed to diagnose the cable in question. An example of a 25 pair tester is the Siemon MT-5000 Multitest tester.

PART 3 - EXECUTION

3.1 STATION CABLES

A. Data Station Cables:

1. Test data station cabling using the CAT 6a tester according to manufacturer's instructions.
2. All troubles are to be checked at termination points and corrected.

B. Voice Station Cables:

1. Test voice station cabling using the CAT 5 tester according to manufacturer's instructions.
2. All voice station cables must be tested for:
 - a. Opens.
 - b. Shunts (Shorts).
 - c. Grounds.
 - d. Crosses.
 - e. Reversals.
 - f. Transpositions.
3. All troubles are to be checked at termination points and corrected.

C. Miscellaneous Cables:

1. Test miscellaneous station cabling using the CAT 5e or CAT 6a tester according to manufacturer's instructions.
2. All troubles are to be checked at termination points and corrected.

3.2 RISER CABLES

A. Data Riser Cables:

1. LGBC:
 - a. Test the fiber cabling using the tester according to manufacturer's instructions.
 - b. Test end to end db loss.

B. Voice Riser Cables:

1. Test the voice riser cabling using the tester according to manufacturer's instructions.
2. All voice riser cables must be tested for:
 - a. Opens.
 - b. Shunts (Shorts).
 - c. Grounds.
 - d. Crosses.
 - e. Reversals.
 - f. Transpositions.
3. All troubles are to be checked at termination points and corrected.
4. Trouble pairs that cannot be corrected in a section of cable must be noted on the Voice House/Tie Cable Test Log for that cable as to the binder group, color, and cable pair number. Any house/tie cable that contains trouble pairs in excess of 2% (2 pairs per 100

pairs of cable count) shall be removed and replaced with a new cable at the contractor's expense.

3.3 FIELD INSPECTION

- A. All devices are to be inspected prior to installation for defects.
- B. All devices and accessories are to be inspected after installation for defects.
- C. The University may observe any inspections or tests. All printouts of test results will be required for data and voice cabling. Requirements for logs appear below. Forms to be used appear at the end of this chapter.

END OF SECTION 027950