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PART 1 GENERAL

1.1 SCOPE

A. Provide a complete copper and fiber communications cable plant distribution system as specified herein and as shown in the Documents.

B. WORK INCLUDED

The Vendor shall provide all necessary work order management, labor, materials, equipment, services, and other items required, whether specified or not, to furnish a complete and functional distribution facility. Among the items required are:

1. Outside Plant: 110 cross-connect block in MDF for incoming copper service (incoming cable by the Owner)
2. Single-mode fiber optic ribbon and Category 3 copper riser cables
3. 4-strand fiber for FA Fiber Optic Loop
4. Fiber optic enclosures for fiber optic cable
5. 110 cross-connect blocks for copper riser tie cables
6. Patch cables for Wi-Fi installation
7. Patch panels in the MDF/IDF Rooms for copper station cables
8. Patch panels for voice transition cross-connect cables
9. JP-36 termination blocks in MDF/IDF Room(s) for copper station cables
10. JP-36 cross-connect blocks for voice transition in universal voice format
11. 25-pr voice transition cross-connect cables
12. Category 6a unshielded twisted-pair station cables
13. Category 6a RJ45 568B inserts
14. Category 5e unshielded twisted-pair station cables
15. Category 5e RJ45 568B inserts
16. Outlet devices and faceplates
17. Labeling in MDF/IDF Room(s) and at station outlets
18. Terminations of riser backbone cables and station cables
19. Installation testing and reports
20. Connection to ground bar, grounding components
21. Equipment racks and vertical wire management
22. Telco ladder tray
23. Pull strings, firestopping, and associated products

C. Related Sections: The Vendor shall comply with the requirements and specifications contained in the RFQQ. The Vendor performing this work is required to work with Section 27 17 51 vendor to assure infrastructure is installed to meet Work Order scope requirements.

1.2 Regulatory Requirements

A. All work shall be performed in accordance with the latest revisions of all national, state, and local governing codes and standards, including:

1. ANSI American National Standards Institute
2. ASTM American Society for Testing and Materials
3. BICSI Building Industry Consulting Services International

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|-----|------|---|
| 4. | EIA | Electronic Industries Association |
| 5. | FCC | Federal Communications Commission |
| 6. | ICEA | Insulated Cable Engineers Association |
| 7. | IEEE | Institute of Electrical & Electronics Engineers |
| 8. | NEC | National Electrical Code |
| 9. | NECA | National Electrical Vendors Association |
| 10. | NEMA | National Electrical Manufacturers Association |
| 11. | NESC | National Electrical Safety Code |
| 12. | NETA | National Electrical Testing Association |
| 13. | NFPA | National Fire Protection Association |
| 14. | NIST | National Institute of Standards & Technology |
| 15. | OSHA | Occupational Safety and Health Administration |
| 16. | TIA | Telecommunications Industries Association |
| 17. | UL | Underwriters Laboratories, Inc. |

1.3 QUALITY ASSURANCE

A. Subcontractor Qualifications

1. Copper Cable Installation Requirements:

- a. Minimum Experience & Qualifications ... reference RFQQ 4.3.1
- b. Is a low-voltage contractor with demonstrated experience in the installation of structured cabling.
- c. Has demonstrated experience in the installation and testing of all cable plant components specified herein.
- d. Has Been Trained by the equipment manufacturers in the installation and testing of the proposed system. The technicians in the field shall demonstrate knowledge of material and installation on the product line. Only full-time permanent employees/staff of the company are approved to provide site supervision and testing.
- e. Employees directly involved with the supervision, installation, testing, and certification of the system shall be trained on the system. Training by employee type is required as shown below:
 - 1) Work order Managers/Supervisors/Work order Foremen: All (100%) shall provide proof of industry training for installation and testing.
 - 2) Test Technicians: All (100%) shall provide proof of industry training for installation and testing of equipment.
 - 3) Installation Technicians: All (100%) shall provide proof of industry training for installation.
 - 4) Personnel not directly responsible for installation, supervision, and testing of the system are not required to provide proof of industry training. (stockers, cleanup

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crews etc.) Otherwise, personnel not industry-trained shall not be allowed to perform work under this section.

5) The Vendor performing the work of this section shall employ a minimum of one staff Registered Communications Distribution Designer (RCDD), certified by and in current good standing with BICSI. The RCDD shall be a direct, full-time employee of the Vendor performing the work of this section (i.e., an RCDD consultant/subVendor to the Vendor performing the work of this section is not acceptable) and be available to visit site throughout the work order when work is ongoing. The Vendor performing the work of this section shall continue to employ this RCDD throughout the duration of the work order and submit documentation or a formal request for acceptance by the Owner if a different RCDD is proposed. Provide current copy of RCDD certificate at acceptance of bid.

6) Staff RCDD shall be available for site pre-installation walk-through and up to four (4) further reviews prior to completion of drywall during construction of infrastructure. RCDD shall coordinate with 27 17 51 Vendor to assure infrastructure installation is complete and coordinated for cable plant installation prior to drywall cover.

2. Fiber Optic Ribbon Cable Installation Vendor Requirements:

- a. Work in this section shall be performed by a full-time employee of section 27 17 52 vendor, with demonstrated experience in the installation of single-mode fiber optic cabling and fiber optic ribbon cabling and all components including fiber optic ribbon testing specified herein.
- b. The Fiber Optic ribbon cable Installation full-time employee shall have successfully completed no fewer than five (4) similar work orders (in terms of size and construction cost) with the same equipment under the low-voltage Vendor's current business name within the past three (3) years. Equivalent experience of Vendor's technical personnel may be substituted upon Owner's approval.
- c. The Fiber Optic ribbon cable Installation full-time employee shall be industry trained in the installation and testing of the proposed system. The technicians in the field shall demonstrate their experience and knowledge of the specifications specific fiber type for terminations, installation and testing. Only a fiber optic ribbon cable installation full-time employee of the low voltage Vendor shall be approved to provide site supervision and testing.
- d. The Fiber Optic Cable Installation full-time employee shall have and maintain current industry-recognized certification from major fiber optic manufacturers and organizations such as BICSI, Electronics Technician Association (ETA), Fiber Optic Association (FOA), etc., in particular associated with fiber optic ribbon cable systems.
- e. The Vendor performing the work of this section shall submit:
 - 1) A list of recently completed work orders of similar type and size with contact names and telephone numbers for each.
 - 2) A list of the test equipment by name and serial number proposed for use and evidence of recent calibration for each proposed device.

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- 3) A technical resume of optic fiber experience and optic fiber ribbon certifications for the low-voltage Vendor's Work order Manager, on-site installation supervisor, and technicians who will be assigned to this work order.
- 4) A list of technical product training, specific to this work order, attended by the low voltage Vendor's full-time fiber optic ribbon cable personnel who will install, terminate, pigtail splice, and test the fiber optic ribbon cabling system.
- 5) Current industry-recognized certification from major fiber optic manufacturers and organizations such as BICSI, Electronics Technician Association (ETA), Fiber Optic Association (FOA), etc., in particular associated with fiber optic ribbon cable systems shall be submitted for the Fiber Optic Cable insulation full-time employee (s).

3. Firestopping Installation Requirements: Reference RFQQ 5.3.2 "Safety Requirements"

- a. Vendor's employees whose duties include the application or field supervision of application of firestopping material shall be trained by the firestopping manufacturer.

B. Work order Testing

1. Provide report in hard copy of cable plant and equipment testing. Coordinate with Substantial Completion requirements of this section.

C. Warranties

Refer to RFQQ 5.5 "Warranties"

D. Work order Meetings/Walk-Throughs

1. Early in the construction time line, and before any shop drawings are produced, the Vendor shall schedule, through the Owners Representative, with UWIT a pre-construction meeting where installation issues including wire management, labeling, and other items will be clarified. The Lead or Forman who will be on site for the execution of the work order shall be at this walk-through.
2. Prior to commencing build out within the MDF and IDFs the Vendor shall coordinate, through the Owners Representative, a pre-installation conference with UW Technology and Section 27 17 52 Vendor to discuss issues including location of racks and wall fields, etc.
3. Prior to drywall cover and cable tray installation, the Vendor performing the work of this section shall through the Owners Representative coordinate a pre-installation walk-through with UWIT, ***all*** trades having work within or connected to the Main Distribution Frame Room (MDF) and/or Independent Distribution Frame Room (s) IDF (s).
4. Prior to commencement of installation work in the MDF/IDF's, the Vendor performing the work of this section shall arrange a site walk-through with Owner to "mark layout" of

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actual location of cable routing and termination equipment in the MDF Room and IDF rooms. Owner has the authority to make these modifications to the layout of the rooms with no additional cost to the Owner. The Vendor performing the work of this section's Foreman, who will be managing the cable installation, shall be present at the pre-installation walk-through.

5. Prior to commencing installation of the copper and fiber optic cable, the Vendor performing the work of this section shall coordinate a pre-installation walkthrough through the Owners Representative with UWIT, the Vendors performing the work of this section and Section 27 17 51 The Vendor performing the work of this section installation lead shall attend to address build out within the IDFs and/or MDF including location of racks and wall fields.

1.4 Construction Schedule; RFQQ 5.6.1 "Construction Schedule"

- A. The overall building cable installation schedule shall be established such that the riser cables are installed first, starting with the MDF, then IDF's, followed by the building service locations and then the termination, testing, and labeling of cables.
- B. The following milestones shall also be referenced in the work order construction schedule. (At a minimum, include line items that relate to the work order as place holders.)
 1. Start/completion of continuity-of-service work
 2. Elevator inspection and other early building service commissioning dates
 3. Pre-install walkthrough for MDF/IDF's wall racks, floor rack and ladder build out
 4. Pre-install walkthrough for routing of electrical outlets on racks
 5. Mounting Outside Plant (OSP) punch down block for use by others
 6. Start and completion of early building service cable plant install and testing
 7. Completion of MDF and IDF Rooms - including all trades with work in the rooms and turnover of keys.
 8. Start of overall building cable plant, termination, testing with completion dates by MDF/IDF.

1.5 Materials, Equipment, and Product Substitutions

- A. The materials, equipment, and products specified herein have been extensively tested and vetted by the Owner. In many cases, multiple manufacturers or products are listed for common solutions.

1.6 Submittals

- A. The Vendor shall furnish the following in a single consolidated submittal:
 1. List of all foremen, all lead installers, and all copper cable testing technicians who will work on this work order. Include a summary of experience and training class certificates for each technician.
 2. Shop Drawings: The Vendor performing the work of this section shall submit shop drawings to show his intent during installation. Shop drawings shall be submitted at least forty-five (45) days before any cable installation and shall include at least the following:

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3. Sample labels for all cable label and termination label types including station outlet tapes (with printed sample).
4. Details of all IDF and MDF cable management wherever the Vendor performing the work of this section may suggest an alternate method from that shown in the Drawings.
5. Shop drawings shall indicate expected cable types and routing.
6. Provide complete manufacturer's product literature (not distributor's catalog sheets) for all products specified herein, referenced to the applicable paragraph in the Product Section.
7. Provide manufacturer's recommended installation methods including maximum cable pull tension and minimum bend radius of all cable.
8. Equipment Calibration and Certification:
 - a. The Vendor performing the work of this section shall provide this documentation a minimum of two weeks prior to performing any work to ensure that equipment meets the manufacturer's specifications. Dates provided shall be current through the construction schedule within a 12-month window.
 - b. Provide manufacturer's name and mode number for each piece of equipment used on this work order cross-referenced to serial number. Include documentation of recent calibration for each proposed device.
 - c. Provide manufacturer's certificate of compliance for fusion splicing equipment.
9. The Vendor prior to commencement of work under this section, shall submit (but not be limited to) for all, fiber ribbon, cable/testing technicians who will work on this work order for approval by University of Washington Information Technology (UWIT) through the Owners Representative.
 - a. A technical resume of optic fiber experience and optic fiber ribbon certifications for the low-voltage the Vendor performing the work of this section's Work order Manager, on-site installation supervisor, and technicians who will be assigned to this work order.
 - b. A list of technical product training, specific to this work order, attended by the low-voltage the Vendor performing the work of this section's full-time fiber optic ribbon cable personnel who will install, terminate, pigtail splice, and test the fiber optic ribbon cabling system.
 - c. The Fiber Optic Cable Installation full-time employee shall submit current industry-recognized certification from major fiber optic manufacturers and organizations such as BICSI, Electronics Technician Association (ETA), Fiber Optic Association (FOA), etc., in particular associated with fiber optic ribbon cable systems for approval by UWIT through the Owners Representative.

B. Prior to commencement of work under this section, the Vendor shall schedule a qualifying interview for installation full-time employee/field technician with UWIT to demonstrate their experience and knowledge of fiber optic ribbon cabling installation, termination, and testing.

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- C. If on-site full-time employee assignment changes occur, Certifications shall be submitted for the Fiber Optic ribbon cable installation replacement person and he/she shall be scheduled for his/her own interview with UWIT prior to any ribbon cable system performed by this person.

1.7 Product Substitutions

If substitutions to the recommended products are proposed, the Vendor shall submit complete manufacturer's product literature (not distributor's catalog sheets) demonstrating compatibility with other related products and provide samples for evaluation. No "custom" items (e.g., to meet unusual physical requirements of the installation site) shall be used except as specified in the Construction Documents or as reviewed and approved by Owner.

1.8 Substantial Completion Notice

- A. Refer to RFQQ 5.6.2 "Acceptance Criteria"
- B. All MDF, IDF Rooms and pathways must be complete to include hard copy of cable and equipment test results for each MDF, IDF Room and the service area it supports, prior to the Substantial Completion Notice.

1.9 Contract Closeout Refer to RFQQ 5.6 "UWIT Process Requirement"

END OF PART 1

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PART 2 PRODUCTS

2.1 CABLE PLANT AND TERMINATION DESIGN CRITERIA

A. Introduction

1. All materials constituting the voice and data transmission facility shall conform to the specifications herein.
 2. The installation standards for the cable plant system are described here in.
- B. All products shall be new and shall be brought to the job site in original manufacturer's packaging. Electrical components shall bear the Underwriter's Laboratories label. All communications cable shall bear the manufacturer's label in accordance with NEC 800 based on flammability testing as follows:

CM	General Purpose Communications Cable
CMR	Riser-rated Communications Cable
CMP	Plenum-rated Communications Cable

2.2 OUTSIDE PLANT

- A. Provide 110 cross-connect block and C-5 clips.
All other components N.I.C.

Required Products:
110 block: Systimax – 110AW2-300
C-5 clips: Systimax – C-5 Clips 110C-5

- B. Tunnel fiber

Required Product:
Outside Plant Fiber: 024EC4-14101D53

- C. Indoor/Outdoor Fiber for inter-building tie

Required Product:
Indoor/Outdoor Fiber: Corning 024ECF-14101-20

- D. Tunnel copper
Refer to Work Order SOW

- E. Cable for inter-building tie

SealPic-FSF 24-gauge cable

Required Product:
Superior Essex – 09-097-02 (25pair)

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Superior Essex – 09-100-02 (50 pair)
Superior Essex – 09-104-02 (100 pair)

F. Copper Cable Protection Blocks and Protector Modules; The labor and Material for these items will be by the Owner. The products are included here for work order coordination purposes only.

1. Protection Blocks

Required Products:

100 pr Circa - 1880ECA1-1 00G
200 pr Circa -1880ECA1/NCS-200

2. Protector Modules

Required Product:

Circa – 4B1S-300

2.3 MDF/IDF BUILD OUT

A. Equipment Mounting Hardware

1. Equipment racks shall be:

Floor mountable.

Constructed of painted or anodized aluminum.

Manufactured to support standard 19-inch mounting.

84 inches high.

Supplied with all mounting and assembly hardware.

Double-sided drilled and tapped to accept 12-24 screws.

And have EIA/TIA hole pattern (5/8-5/8-1/2-inch).

Required Product:

B-Line – SB-556-084-XU (7' racks)

B-Line – SB-556-075-XU (6' racks – use only where 7' racks will not fit, requires UWIT approval for use of 6' rack)

2. Top-of-Rack Horizontal Wire Management Brackets (Water Fall) shall be:

3.5 inches deep x 3.5 inches high.

Constructed of painted or anodized aluminum.

Provided one per rack.

Required Product:

CPI – 12183-719.

3. Vertical Wire-Management Brackets shall be:

84 inches high x 6 inches wide x 12 inches deep

Provided with four mountable spools per bracket

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And provide for cable routing on front and back of rack

Required Products:

Corning – CDF-IBU-7-6; CDF-HUB-05. (7' Racks)

Corning – CDF-IBU-6-6; CDF-HUB-05. (6' Racks)

4. Copper Horizontal Wire Management Brackets shall be:

[1.75 or 3.5] inches high.

Constructed of painted or anodized aluminum.

And have six distribution rings.

Required Products:

For 1RU – Ortronics – OR-60400131-1U

For 2RU – Hubbell – HC219 ME6N-2U.

5. Fiber Optic Horizontal Wire Management Brackets

Required Products:

For 1RU – Corning - CJP-01U

For 2RU – Corning - CJP-02U

6. Ladder Rack Cable Runway shall be:

Black.

Constructed of 0.065" thick steel

And utilize stringers to support rungs

And have rungs welded to stringers at 9-inch spacing on center.

Required Products:

CPI – 10250-718

CPI – 10250-712 (where called out to be 12")

7. Ladder Rack Cable Runway Connecting Hardware shall be:

Black.

Constructed of steel.

UL listed.

provided with all connecting hardware (screws, bolts, washers etc.)

Required Products: CPI

Mounting plate – 10595-718 & 10595-712

Elevation Kit – 10506-702

J-bolt Kit – 11303-000

Triangle bracket – 11746-718 & 11746-712

Wall angle kit 11421-718 & 11421-712

Junction splice kit – 16302-701

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Butt Splice Kit – 11301-701
Protective end caps – 10642-001
Ground Terminal Blocks – 08009-001
Rack anchor kits-concrete – 40604-003
Rack anchor kits-wood – 40604-001

8. Ladder Rack Cable Runway Radius Drop Plates shall be:

Black.
Constructed of painted or anodized aluminum
Provided with three mountable guides.

Recommended Products (match to size of tray):
CPI – 12100-718
CPI – 12100-712
CPI – 12101-702.

B. MDF/IDF TERMINATION HARDWARE

1. Patch Panels/Patch Blocks ... to be provided for the type of cable used for the work order and shall:

- a. Patch panels shall:

Be rack-mountable in standard EIA 19" equipment racks.
Have cable support and strain relief.
Ensure minimum bend radius requirements are satisfied.
Include integral labeling means.
Labels shall be white with black lettering and backed with adhesive.
Be 24 and 48 port Category 6A (Category 5E where approved).
Be IDC tp RJ45 568B termination style.
Have integral wire-management rings on front.

Required Products:

Patch Panel: Systimax – M2000-24
Systimax – M2000-48

Support Bracket: Systimax 1100C1-35-19
Cat6A jacks: Systimax MGS600-123 (yellow)

Systimax – 24 port PM-PS-24 760 205 260
Systimax – 48 port PM-PS-48 760 205 278

- b. Patch blocks shall:

Be mounted on standoff can.
Be provided with wire management rings.
Include integral labeling means.
Labels shall be white with black lettering and backed with adhesive.
Be 24 port Category 6A (Category 5E where approved)
Be 36 port Category 6A (Match with Rino bracket below if 36 port is used)
Be IDC to RJ45 568B termination style.

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Wall Adapter = Systimax 1100C1-35-19
Patch Panel = Systimax M2000-24 (1U)
Mounting Bracket, Data Jack = Rhino GBAR-UW-24

Or approved equal

Products:

Cat5E Patch Blocks - Siemons – S110AB5-300JP (36 port)
Stand-off Cans – Rhino Mfg. Inc. -- RMNT-0010 (300 pr)
Rhino Mfg. Inc. -- RMNT-0009 (100 pr)
Wire Management Rings – Siemon – S146 (6”) & S145 (3”)

c. Fiber Optic Station Cabling Patch Panels

Provide to match the requirements listed in fiber optic section.

2.4 PATCH CABLES

A. Patch Cords for Data

Patch cords for both station end and MDF/IDF horizontal data cross-connect shall be Owner Furnished and Owner installed. (OFOI)

B. Patch Cords for Wi-Fi Applications

1. Patch Cords at the Wi-Fi Access Point (WAP).

- a. WAPs are furnished by Owner furnished, Contractor installed (OFCI). The furnished WAPs come with 3 1/2” long patch cords, one of which is a Cat 5e and one a Cat 6. Under no circumstance may the Cat 5e patch cord be used. The 6A patch cable may be used where the WAP is mounted directly to a 4”x4” box such as at hard lid ceiling applications.
- b. At all locations other than the applications referenced in a. the patch cord at the WAPs shall be Cat 6A and shall be Contractor furnished and Contractor installed. (CFCI).

Required Products:

Patch cables shall be by the same manufacture and the same product number as the station cable called out in this specification under; 2.5 STATIONS, A Copper Cables, 1. Cooper cables for station outlets.

2. Horizontal Wi-Fi cross-connect patch cords shall be Cat6a and be provided for 100% of the patch panel terminations and be of adequate length to ensure proper cable bending radius.

Required Products:

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Patch cables shall be by the same manufacture and product number as the station cable called out in this specification under; 2.5 STATIONS, A Copper Cables, 1. Cooper cables for station outlets.

2.5 RISERS

A. Copper and Fiber Cables

The following paragraphs describe the products used for intra-building riser cabling between the MDF Room(s) and the IDF Rooms.

3. Copper Cable

a. Category 3 cable criteria:

Rating listed for installed space
Shielded twisted pair, ARMM
Color coded.
Pair count per sheath of 100, 200, or 300 as shown on Drawings.

Products:

Superior Essex – 100PR 02-104-03
Superior Essex -- 200PR 02-108-03
Superior Essex -- 300PR 02-110-03
Or approved equal

b. Category 3 horizontal tie cable criteria:

Listed CMP
Provided with parallel ground conductor
Color coded
Pair count per sheath of 100, 200, or 300 as shown on Drawings.

Products:

Superior Essex – 100PR 02-104-03
Superior Essex – 200PR 02-108-03
Superior Essex – 300PR 02-110-03
Systemax -- 2010-100PR
Or approved equal

c. Copper riser voice transition tie cables (wall to rack)

To extend copper riser or tie cables from 110 cross-connect blocks on wall to patch panel on rack.
Minimum of 50 feet (actual length of cable determined during installation)
25 pairs, Category 3.

Products:

Systemax – 1010A GY 25/24 R1000
Or approved equal

4. Fiber Optic Cable

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Method # 1 Field terminate ribbon fiber – Corning 0XXED8-1401-20 (where XX =24 strand SM plenum for standard installation; XX = 12 or 48 where required per the Work order requirements) with LC terminations.

Method # 2 Pre-terminate ribbon fiber – Corning N909024 RD8AA4 XXXF with LC Terminations.

Method # 3 Corning 024E88-33131-29 with SC Terminations.

B. Single-mode fiber optic cable criteria:

Sufficiently free of surface imperfections and occlusions to meet optical, mechanical, and environmental requirements of this specification

Have been subjected to minimum tensile proof test by fiber manufacturer equivalent to 100-kpsi

Have transmission windows of 1310 nm and 1550 nm

Suitable for installation in free air, in building risers, in conduit in cable tray and in innerduct

Dielectric materials (no conductive materials)

Have jacket material of FEP or equivalent as required for cable rating

Have a cable rating of OFNP.

Have ARAMID Yarn strength member.

Required Products:

Ribbon Fiber Termination Kit [ribbon cable tubing kit] – Corning – 15-211-14
Fiber Optic Cable Tags – LEM Products, Inc. – LFO-100; PANDUIT PST-FO

C. Connectors/Termination Hardware (for riser and voice transition cabling)

1. For Riser Cabling: The following paragraphs describe the products used to terminate the copper riser cabling within the building. Products shall be located in MDF/IDF Rooms as directed by Owner during pre-installation walk-through.

- a. 110 cross connect blocks shall be supplied for/as cross-connects from building riser backbone cables from the MDF to the IDF.

The blocks used in the MDF and IDF Rooms for copper riser cable terminations shall be 300- pair 110-type wiring blocks.

110 cross-connect block criteria:

110-style high-density cross-connect blocks.
300-pair blocks with legs.

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Shall be capable of terminating one 25-pair binder group of Backbone Copper Cable on each horizontal row of the block.

Shall be capable of terminating one 25-pair binder group of Backbone Copper Cable on each horizontal row of the block.

Shall be able to terminate 24 AWG plastic-insulated, solid and stranded copper conductors.

Provide direct connection between riser voice transition and/or backbone cable and jumper wires.

Shall be designed to maintain cable pair twists as closely as possible to point of mechanical termination.

Shall be mountable on stand-off cans.

Product:
Systimax – 110AW2-300
Or approved equal

b. Stand-off cans

Product:
Rhino Mfg. Inc. -- RMNT-0010 (300 pr)
Rhino Mfg. Inc. -- RMNT-0009 (100 pr)
Or approved equal

c. 110 cross-connect block wire management shall be

Product:
Systimax – 110A3
Or approved equal

d. Connector clips

Copper riser backbone cable blocks shall be provided with 4-pair and 5-pair connector clips, IDC style displacement. Each 25-pair row on 110 block shall be provided with (5) 4-pair clips and (1) 5-pair clip.

Product is required to be same Mfg. as blocks used:
Systimax – C-4 clips 110C-4
Systimax – C-5 Clips 110C-5
Or approved equal

e. 110 block labels shall be:

Provided with each 110 block.

Provided with clear plastic protective cover for attachment to 110 block

Affixed to each row on the 110 block.

White with dark black lettering.

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Product is required to be the same Mfg. as blocks used:
Systemax – Clear cover 1884T1-50
Systemax -- White labels 110WA2-4500L
Or approved equal

2. For Voice Transition Cabling:

The following describe the products used to terminate the copper voice transition cabling within the building MDF or IDF's where patch panels are provided. Products shall be located in the MDF Room as directed by Owner during pre-installation walk-through.

- a. In the MDF the 110 riser cross connect blocks shall also be used for/as a voice transition cross-connect from the rack-mounted patch panel to the MDF wall field riser block. The voice transition cable shall overlay the riser cables utilizing connector clips. The Vendor performing the work of this section shall be responsible for the cross-connect voice transition cable termination at voice transition patch panel and 110 riser block in MDF.

Copper voice transition patch panel criteria:

48-port
Include RJ-45 to IDC connectors
Terminated 4-pair per port
Rack-mountable
4 RU's high
Integral wire-management bracket
Include white adhesive labels with dark black lettering

Required Products:

Systemax – PM-PS-48 760 205 278

- b. JP36 Blocks shall be used to terminate the copper voice transition cabling within the building IDF's where racks are not installed. Products shall be located in the IDF Rooms as directed by the Purchaser during pre-installation walk-through.

In the IDF JP36 blocks shall be used for/a s a voice transition cross-connect from the wall-mounted station cable JP36 patch block on the IDF wall field. Is required to cross-connect between the station patch blocks and the voice transition block. No cable is required to cross-connect between the voice transition block and the IDF riser 110 block.

Copper voice transition patch block criteria:

36-port
Include RJ-45 to IDC connectors
Terminate 4-pair per port
Wall-mountable
Include white adhesive labels with dark black lettering
Be mounted on stand-off cans
Be provided with wire-management rings

Required Products:

Siemens – S110AB5-300JP 36-port, T568A/B with permanent legs
Siemens – S145 [3" wire management rings]

- c. Stand-off cans

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Product:
Rhino Mfg. Inc. -- RMNT-0010 (300 pr)
Rhino Mfg. Inc. -- RMNT-0009 (100 pr)
Or approved equal

3. Fiber Optic Termination Hardware

a. Rack-Mounted fiber optic distribution cabinet criteria:

An enclosed assembly
Incorporate hinged or retractable cover
Rack-mountable
Provide-strain relief for incoming cables
Incorporate radius control mechanisms
Include provisions for permanent labeling
Incorporate splice shelf for fusion-spliced pigtail assemblies
Incorporate splice organizer to manage pigtail assemblies and incoming fiber
Incorporate LC coupler panels for single-mode couplers

Required Products: Pretium Connector Housing
144 strand Corning PCH-04U*
72 strand Corning PCH-01U
(*288 strand configuration requires (2) 144 strand units).

b. Wall-field mounted fiber optic distribution cabinet criteria:

An enclosed assembly
Incorporate hinged or retractable cover
Wall-mountable
Provide strain relief for incoming cables
Incorporate radius control mechanisms
Include provisions for permanent labeling
Incorporate splice shelf for fusion-spliced pigtail assemblies
Incorporate splice organizer to manage pigtail assemblies and incoming fiber
Incorporate LC coupler panels for single-mode couplers

Required Product:
Corning – 24 strand WIC-02P
Corning – WIC-2-DOOR

c. Fiber optic splice trays shall be incorporated with each distribution cabinet.

Required Products:
Corning – M67-110 (with PCH-04U and WIC-02P)
Corning – PC1-SPLC-04R (with PCH-01U).

d. Fiber optic coupler panels with integrated pigtail assembly shall be provided with each distribution cabinet.

Required Product:
Corning – CCH-CP24-A9-P03RJ

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- e. Fusion Splice Protection (heat shrink tubing) for Ribbon fiber and distribution shall be provided.

Required Product:
 Corning – 2806031-012

- f. Brackets for fiber optic distribution cabinet shall be provided.

Required Products:
 Corning PCH-GOV-SPLC for distribution cabinet
 Corning CDF-RJ12-BKT for rack at distribution cabinet

2.5 STATIONS

A. Optical Fiber/Copper Hybrid Cables

- 1. Hybrid cable for outdoor and light pole mounted wireless access point outlets suitable for installation in an indoor environment.

Two strand OS2 single-mode cables with two 16 AWG stranded conductors in a common overall jacket.

Required Products:

CommScope Part # PFC-S02L16F
 Or approved equal

B. Copper Cables

- 1. Copper cable for station outlets

The twisted-pair cable for standard outlets criteria:

Suitable for installation in environment defined

Twisted 4-pair

Have insulated solid annealed copper pairs, 24 AWG

Category 6a [(standard/Wi-Fi outlets), **Category 5e (standard outlets where approved)**]

Have jacket type **[PVC] [FEP or equivalent]** as required for cable rating

Have an NEC Article 800 cable rating type **[CMP] [CMR]**, UL listed

Jacket Color: White or gray

Required Products:

	Mohawk	Systimax	CommScope	Belden
CMR(6a)	x	1091B	CS44R	x
CMP(6a)	x	2091B	CS44P	x
CMR(5e)	M55987	1061	CS27R	1212
CMO(5e)	M55986	2061	CS27P	1213

Or approved equal.

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2. Copper Cable for Exterior Wide Area Emergency Broadcast Phone Units

Phone Product:

	Mohawk	Systemax	Commscope
Outdoor (6a)	LT57976	1592A BK4/24 R1000	
Outdoor (5e)	x	x	15NF4, AWG 4-pair

or equivalent 24 AWG, 4-pair UTP gel-filled, PW jacket by Systemax, Uniprise, or ADC
 Or approved equal.

Emergency Broadcast Product:

Talk A Phone 6303 – 3 Conductor cable.
 22 gauge solid copper/tin
 3 conductors: one twisted pair with mylar shield and drain wire and overall jacket.
 3/16" (4.8mm) O.D. available in lengths up to 2000 ft (610m) spool
 UL Type Class 2
 Or approved equal

3. Copper Cable in Semi-Protected Pathway (gravel under slab)

Required Product:

	Mohawk	Systemax	Commscope
Outdoor (6a)	LT57976	1592A BK4/24 R1000	x
Outdoor (5e)	M58926	x	15NF4, AWG 4-pair

or equivalent by Systemax, Uniprise, or ADC, 24 AWG, 4 pair UTP cable with CMX and CMR outdoor ratings

B. Connectors and Termination Hardware for Station Outlet Cabling

Standard modular copper, fiber, and multimedia outlet devices that shall be used in all new construction and remodeled installations. Typical configurations combine a modular information insert with or without a mounting frame and a faceplate.

1. Station Outlets

The Vendor performing the work of this section is required to provide faceplates, bezels, adapters, inserts, and mounting brackets to support station outlet installation including floor boxes, podium boxes, surface-mounted raceway and modular furniture outlets.

a. Station Copper Inserts criteria:

Meet or exceed performance requirements for Category 5e
 Yellow

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RJ45 568B
Non-keyed
Insulation displacement type contact
Maintain cable's pair twist as close as possible to point of mechanical termination

Required Product:

Systemax – MGS600-123 (6a) yellow
Systemax – MPS100E-112 (5e)

b. Standard Faceplate criteria:

Double-gang
Accommodate a minimum of [8] [XXX] modular inserts and connectors
[Constructed of high-impact plastic] [Stainless steel]
Incorporate recessed designation strips at top and bottom of frame secured with clear plastic cover
Color: [electric ivory -246] [white] [gray] [match other trades]

Required Products:

Plastic - Systemax – M28L-246
Stainless Steel – Uniprise – UNF-MFM-DG8P-L-ST
Stainless Steel – Semtron – 2FM-(8)0E-LUC

c. Wall Mount Phone Faceplate and Adapters criteria:

Provide standard insert MPS100E-112

Required Products:

Plastic - CommScope – M10LW-148.
Stainless – CommScope – M10LW-Stainless

d. Station Poke Through Faceplates and Adapters

Required Products:

WireMold
Hubbell (shared)
Hubbell (dedicated)

e. Station Flush Floor Box Faceplates and Adapters

Required Products:

Walker
Hubbell HBLLT309SGY

f. Station Podium Box Faceplate and Adapters; Co-located Medium Box for Power and Communications with a Large Box for Audiovisual

Required Product:

Hubbell HBLLT309SGY

g. Wireless Access Point Faceplate and Adapters

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1) Wireless access point outlets located in ceiling at a maximum of 12 feet shall be provided with standard box and faceplate – install flush with and below ceiling.

Required Products:
Faceplate – Systimax M28L-246

2) Wireless access point outlets located in wall at a maximum of 10 feet but not lower than 8 feet shall be provided with standard box and faceplate.

Required Product:
Systimax M28L-246

3) Wireless outlets in an auditorium seating step riser shall be provided with standard box, faceplates, and clear plastic cover (plastic cover provided and installed by UWIT).

Required Products:
Systimax – M28L-246;
Oberon 1021-00

h. Station Surface-mounted Raceway Faceplates and Adapters

RJ45 inserts shall match requirements above for station outlets.

Faceplates, activation plates, device plates, and couplers shall be furnished and installed to match the specifications of the surface-mount raceway.

1) Wiremold Faceplates and Adapters

Required Products:
Raceway adapter – Wiremold CM-ARA
2-port bezel – Wiremold CM2-U2ATT
Blank insert – Wiremold 5507B.

2) Panduit Faceplates and Adapters

Required Products:
Single-gang faceplate – Panduit – CPGIW
Device bracket – Panduit – T70DB-X

i. CAAMS Communications Outlets (reference the Work Order scope of work for locations)

Required Products:
ENET: 6" x 6" x 4" box/16-gauge steel/screw cover
2-port biscuit jack-system M102SMB-A-246
VOICE: CommScope – M10LW-148

j. Irrigation Control Box Outlet

Required Products:
6" x 6" x 4" box/16-gauge steel/screw cover (The Vendor performing the work of this section)

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2-port biscuit jack-system M102SMB-B-246

k. Two-way Communications Annunciator Control Panel Box Outlet

Required Products:

6" x 6" x 4" box/16-gauge steel/screw cover (The Vendor performing the work of this section)

2-port biscuit jack-system M102SMB-B-246

l. Laundry Room Controller (H&FS) Box Outlet

Required Products:

6" x 6" x 4" box/16-gauge steel/screw cover (The Vendor performing the work of this section)

2-port biscuit jack-system M102SMB-B-246

m. Fire Alarm FIBER Loop

- 1) 12" x 12" x 8" Hinged Lockable Cover box located adjacent The Main Fire Alarm Control Panel.

Required Product:

Milbank Part # 12126-LC1

- 2) Mounted inside MILBANK Box:

Required Product:

4-port Wall Panel – Leviton 41089-4WP

Coupler – Leviton 41084-SWZ

ST Fast Cure Connector Leviton SM-49990-SST

- 3) Fiber Connections between MILBANK Box and Main Fire Control Panel location:

ST-ST Jumper (SM) 3 meter length: Leviton UPDST-S03

- 4) The following is to be provided between the MDF and the Milbank box, located near the Mail Fire Alarm Control Panel.

Required Product:

4-strand SM Indoor Plenum Fiber – OCC #DX004SSLX9YP-SPCLBL

- 5) For Rack Mounted application Provide the following:

Required Products:

Premium Connector Housing – Corning PCH-01U

ST Coupler Panel – Corning CCH-CP12-19T

n. Other Building Access Systems (BAS) Milbank Box Locations

Where other BAS are required coordinate with Purchaser's Order for specific products and details required and outlet schedule information. (Typical BAS would require that the faceplate to be within the Milbank box, DDC Master Control, Power Metering Main Unit, and Lighting Relay Control.

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o. Modular Furniture Faceplate and Adapters

The typical jack for this application is Systimax – M28L-246 Jack. Refer to the Drawings for the type of Power Furniture and the compatibility of Jacks and face plates with UWIT standards.

p. Power Poles

Refer to the Drawings for the type of Power Poles and insure the compatibility with Owner standard boxes and face plates.

2.6 ASSOCIATED PRODUCTS

A. Innerduct shall be:

Flexible nonmetallic
Corrugated
Suitable to the environment installed in
Flame-retardant plenum rated where applies
Riser Rated where applies
Color - Orange for Riser and General Purpose
Color – White for Plenum Rated
Minimum of 1" Diameter

Recommended Products:

ENDOT – CMR IRI XXX 24 17 02
ENDOT – CMP IPR XXX 24 17 07
ENDOT – CM ICE XXX 32 17 02 (Outside Plant Only)
(XXX = Diameter ... 1" = 100, 125 = 1 ¼", 150 = 1 ½", 200 =
or approved equal

B. Cable Lubricants:

Shall be non-injurious to cable jacket and other materials used
Shall not harden or become adhesive with age

Products:

Dyna-Blue American Polywater (copper cable)
Ideal Optic Lube (fiber cable)
Or approved equal

C. Firestopping:

Coordinate with section RFQQ 5.3.2 "Safety Requirements". Fire stopping can be a combination of "manufacture sleeves, muffins, caulk/putty foam or other approved methods.

During the final review and inspection period, following the Owner inspection of cable installed and tested acceptable, but prior to substantial completion, all sleeves passing through floors, roofs,

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and exterior walls shall be filled with approved fire-stop material in accordance with NEC 300-21. All firewall penetrations shall likewise be filled with suitable fire-stop material. Unused sleeves shall be capped or grouted.

Recommended Manufacturers:

STI,
T&B,
3M.

Or approved equal

D. Pull Strings:

Shall be a minimum of 3/32-inch diameter
Shall be minimum of 200-pound strength
Shall be Polyethylene line

END OF PART 2

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PART 3 EXECUTION

3.1 PRODUCT INSPECTIONS

A. Pre-installation Walk-through

Prior to commencement of cable installation, the Vendor performing the work of this section shall arrange a site walk-through with Owner to "mark layout" for actual location of termination equipment in the MDF and IDF Rooms. Owner has the authority to make modifications to the layout of these Rooms with no additional cost to the Owner. The Vendor performing the work of this section's Foreman, who will be managing the cable installation, shall be present at the pre-installation walk-through.

B. Owner Review

1. All products shall be inspected prior to installation to verify that they are of proper gauge, contain the correct number of pairs, and otherwise meet the specifications. Any physical damage to products is unacceptable. Uniform jacket thickness, tightness, or buckling should be checked. All outlet devices, cross-connect blocks, and other components shall also be inspected prior to installation.
2. Within one (1) week, or agreed upon time frame, of inspection, the Vendor performing the work of this section shall submit a statement certifying that all cable and components met specifications or were replaced.

3.2 SERVICE INTERRUPTIONS

A. General Requirements

1. The Vendor shall be responsible for identifying any possible service interruptions. Coordination with Owner shall be required to develop a plan.
2. The Vendor shall schedule a pre-demolition walkthrough with Owner's Representative prior to commencing any work.
3. The Vendor shall maintain continuity of existing service in the construction area and for building occupants not otherwise affected by the work order throughout the demolition and construction phases, unless prior arrangements have been negotiated.
4. The Vendor shall notify the Owner's Representative of all copper, fiber optic, and coaxial communications cables (which are serving occupied areas) that must be relocated. The Vendor performing the work of this section shall be responsible for relocating existing cables that are to remain in service after consultation with Owner.
5. The Vendor shall prevent interruption of service by identifying and providing temporary supports and protection of all existing communications cables, cross-connect blocks, and equipment throughout demolition and construction. Coordinate requirements for continuity with the Owners Representative to obtain UWIT approval prior to final solution.

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6. Upon disruption of service, the Vendor performing the work of this section shall notify the Owner's Representative immediately.

B. Construction Services

1. Decommissioning of Construction Trailers and Temporary Offices

The Vendor shall remove communication cable and termination equipment serving construction trailers and temporary offices installed for the purpose of supporting this work order. The Vendor performing the work of this section shall coordinate decommissioning with Owner prior to performing this work. Two (2) weeks' notice is required. This time is designated for the Owner to remove equipment and termination blocks prior to any demobilization work performed by the Vendor.

3.3 CABLE INSTALLATION

A. General Installation Requirements

1. The Vendor shall ensure that communications cable is installed with care, using techniques that prevent kinking, sharp bends, scraping, cutting, or deforming the jacket, or other damage. Installation shall be subject to periodic inspections by the Owner. The Vendor performing the work of this section shall replace unacceptable or damaged cable at no additional expense to the University.
2. Furnish all required installation tools to facilitate cable pulling without damage to cable jacket.
3. Pull all cable by hand unless installation conditions require mechanical assistance.
4. Install cable in conduit or metal raceway system (cable tray or equivalent) in public areas and as designated on plans.
5. Station cable in MDF/IDF shall be routed and supported utilizing "D-type" mounting rings and overhead cable tray.
6. Backbone in the MDF/IDF shall be routed and supported utilizing overhead cable tray and D-rings.
7. Cabling shall be neatly laced, dressed, and supported.
8. Repair damage to interior spaces caused by installation of cable, raceway, or other hardware. Repairs or replacements must match preexisting color and finish of walls, floors, and ceilings.

B. Splices

1. Copper cables shall be installed splice-free.
2. Optical fiber cable shall not be spliced except when specified. Fiber terminations shall utilize fusion-spliced pigtails.

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C. Patch Cable

Patch Cables for Data & Wi-Fi shall be installed per Owner/Contractor furnish and install designations called out in Part 2, Section 2.4 PATCH CABLES of this specification.

D. Routing

1. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance purpose (e.g., access boxes, ventilation mixing boxes, access hatches to air filters, switch or electrical outlets, electrical panels, fire alarm equipment, clock systems, and lighting fixtures).
2. The installation of cable around movable devices, instruments, sub-panels, etc., shall be provided with a fixed standard outlet adjacent to device. Final connectivity shall only be provided through patch cable.

E. Pull Lines

A 3/32-inch diameter, 200-pound (minimum) strength polyethylene pull line shall be installed in all communication system conduit, both empty and with cable. This provides a pull line available for the next cable installation. Each end of the pull line shall be secured. Secure pull line to conduit end and box end.

F. Cable Bend Radius and Pull Tension

1. During pulling operation, adequate number of workers shall be present to allow cable observation at all points of raceway entry and exit, as well as to feed cable and operate pulling machinery.
2. Pull cables in accordance with cable manufacturer's recommendations and ANSI/IEEE C2 Standards.
3. Recommended pulling tensions and bending radii shall not be exceeded.
4. Where mechanical assistance is used, ensure that maximum tensile load for cable is not exceeded. This may be in the form of continuous monitoring of pulling tension, use of "break-away" or other approved method.

G. Cable Support

1. All cable shall be supported every 4 feet vertically and horizontally within MDF and IDF Rooms.
2. Separately supported "D-rings" shall be used to support cable vertically and horizontally by means of D-rings screwed to the backboard. Installation of these supports shall be done with care, so as not to cause crushing or distortion of the cable or result in tighter radius bends than the minimum radius permitted for each type of cable. Cable not dressed in a neat fashion or installed with excessive slack shall be rejected.

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3. Station cables shall be organized neatly by system (copper/fiber). Zip ties are not acceptable. Provide temporary Velcro hook-and-loop straps during installation. Remove straps when installation is complete.

H. Cable Removal

1. All communications cable that has been decommissioned, slated for demolition, or otherwise found abandoned shall be removed from ceiling spaces, conduit, cable tray, and other raceway within the construction area.
2. Provide demolition of cable complete from point of origin (MDF, IDFs) to outlet.

I. Conduit/Sleeve Usage/Fill

1. All communications conduits and sleeves shall be grounded, dedicated, meet NEC fill requirements, meet bend radius, supplied with pull lines, and labeled.
2. The Vendor performing the work of this section shall not attach any devices, raceway, or other building systems to communications conduits.
3. If raceway has been installed in 3 x 3 cluster patterns or greater, do not install cable. Any cable pulled in the conduits located on the perimeter ring blocks access to the interiorly located conduit. Identify and report locations to Engineer/UWIT prior to installation.
4. Innerduct is to be installed only where fiber optic cable is exposed and shall not be installed through conduits.
5. Innerduct must be installed with UL listing visible to Authority Having Jurisdiction.
6. Communications conduit shall not be filled beyond 40% capacity. Refer to NEC for conduit capacity for various trade sizes of conduit.

7. Grounding

- a. All communications cable shall be installed in grounded metal conduit.
- b. A grounding riser shall be established for all communications cabling devices and supports. Refer to Section 27 17 51 for grounding requirements and coordination with trades.
- c. Riser cable shields in MDF and in each IDF shall be connected to telecommunications ground bus bar.

8. Dedicated Use

Communications cable shall not share conduit sleeves with electrical power wiring, department system wiring, or any other building system.

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9. Cable Lubricants

Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit. After installation, exposed cable and other surfaces shall be cleaned free of lubricant residue.

J. Cable Tray Usage/Fill

1. All communications cable tray shall be grounded, dedicated, meet NEC fill requirements, and meet bend radius.
2. The Vendor shall not attach any devices, raceway, or other building systems to sides or bottom of cable tray.
3. Communications cable shall be installed in cable tray as indicated in the Drawings. Cable tray fill shall not exceed 50% of total tray cross-sectional area per NEC.
4. At transitions Install cable so that entry to and exit from tray is supported by drop-out plates or other listed devices installed to ensure cable is not stressed at the point at which it enters or exits the tray.

K. Cable-Dressing

1. Wherever cable tray is exposed in hallways, whether completely visible or partially concealed, extra care shall be taken to neatly dress all cable between the conduit and the tray. Do not secure cable in bundles while inside the tray. Cable shall remain loose, not bound, but neatly managed in tray.
2. Zip ties shall not be used to secure cable, even temporarily.
3. Provide velcro straps to secure cables in vertical cable management adjacent to racks only.

L. Fire-stopping: Coordinate with RFQQ 5.3.2 "Safety Requirements"

1. During the final review and inspection period, following the Owner inspection of cable installed and tested acceptable, but prior to substantial completion, all sleeves passing through floors, roofs, and exterior walls shall be filled with approved fire-stop material in accordance with NEC. All firewall penetrations shall likewise be filled with suitable fire-stop material. Unused sleeves shall be capped or grouted.
2. Fire-stopping shall be coordinated with all trades to assure a common fire-stopping system is deployed.
3. In situations where cable tray, conduit, or sleeves extend outside the construction area into occupied portions of the building or through fire-rated construction, they shall be capped or fire-stopped throughout the course of construction.
4. The ancillary space around all sleeves passing through fire-rated construction shall be sealed with approved fire-stop material in accordance with NEC 300-21. Unused sleeves shall be sealed with approved fire-stop material. UL-listed, fire-rated conduit

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caps may be used to seal unused sleeves and conduit except where conduits have grounding bushings.

5. Where conduits extend through walls to the exterior of buildings, conduits shall be sealed with weatherproof material or capped. Unused conduits in outside cable plant pull vaults or duct banks shall be capped.
6. Regardless of building code requirements, all sleeves and conduit entering or exiting an MDF or IDF shall be fire-stopped or be a manufactured fire-rated assembly for both horizontal and vertical interconnections.

3.4 MDF/IDF CABLE PLANT INSTALLATION

A. Cable Sleeve Usage and Cable Routing

1. Exact conduit/sleeve usage, cable routing and backboard layout shall be coordinated with Owner during pre-installation walk-through.
2. Coordinate Construction Schedule to assure outside plant cable (by Owner) is installed in MDF prior to any riser or station cable routing in MDF.
3. Copper riser cable, optical fiber riser cable, and coaxial riser cable shall be routed inside the MDF and IDF Rooms as three distinct and separate cable bundles.
3. Install cable in the MDF and the IDF per the Drawings. Allocation of riser sleeves shall be as indicated on the riser diagram. Unless otherwise noted in the contract drawings, each sleeve shall be filled to maximum fill allowed by the NEC before adjacent sleeve is used. For existing conditions, use partially filled sleeves before using adjacent unused sleeves.
4. Station cables shall be installed in conduits and sleeves as directed by UWIT during pre-installation walk-through.
5. Cable shall be routed as close as possible to the ceiling, floor, or corners to ensure that adequate wall or backboard space is available for future equipment and for cable termination.
6. Cable shall be routed over a path that will offer no obstruction to future installation of equipment on backboards, or other cables. Avoid crossing areas horizontally just above or below riser sleeve or cable tray penetrations.

B. Cable Terminations

1. The exact position of copper, fiber, and coaxial riser termination locations shall be based on the pre-installation walk-through with the Owner prior to rough-in of the cable plant. Refer to Section 3.1 pre-installation walk-through for requirements.
2. Copper Riser Cables shall be installed from the riser field termination block(s) in the MDF to the termination block(s) in each IDF. Refer to the riser diagram for pair counts and cable counts.

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- a. Copper riser pairs shall terminate to 300-pair 110 blocks mounted to stand-off cans. All pairs shall be terminated with a combination of 4-pair and 5-pair 110 connectors.
 - b. 110 blocks shall be organized into fields designated as riser and riser voice transition cross-connect. Additionally, fields shall be further subdivided by floor where multiple floors are served by the same riser room.
3. For rack-mounted universal design format, copper riser pairs shall be cross-connected to rack-mounted patch panels utilizing separate riser-tie wall-mounted 110 blocks, with 5-pair 110 connectors, and 25-pair cables. Cables shall be terminated 4 pair (8 conductor) per outlet on patch panel. Verify the format with Owner prior to installation.
 4. For wall-field universal design format, a JP-36 voice transition block is provided by the Vendor performing the work of this section, but the copper riser pairs are cross-connected by others.
 5. Individual Optical Fiber Riser Cables shall be installed from the termination point in the MDF to the patch panel in each IDF. Refer to the Drawings for strand counts and cable type. Cable shall be protected by innerduct whenever cable is not in conduit (more typically in cable tray or routing in communication rooms). Provide service loop consisting of 15 feet of slack (coiled to manufacturer's recommendation) in the MDF and at each IDF termination point (exact location to be determined on pre-installation site walkthrough). At all points, innerduct rating shall be visible for Authority Having Jurisdiction inspection.
 6. Fiber optic cables shall be terminated in rack-mounted optical fiber patch panels using pigtail terminations. The patch panels shall be organized in the MDF by floor and by IDF as specifically shown in the Drawings on the rack elevation detail and as discussed during the pre-installation walkthrough.

3.5 STATION CABLE PLANT INSTALLATION

A. Cable Routing

1. Cabling shall be run in raceways as designated on floor plans and outlet schedule.
2. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance purpose (e.g., access boxes, ventilation mixing boxes, access hatches to air filters, switch or electrical outlets, electrical panels, fire alarm equipment, clock systems, and lighting fixtures).
3. To reduce effects of EMI, the following minimum separation distances shall be adhered to:
 - 5" from power lines of 2 kVA.
 - 18" from high-voltage lighting (including fluorescent).
 - 39" from power lines of 5 kVA or greater.
 - 39" from transformers and motors.

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4. Station copper and station fiber cables shall be home run to IDF or MDF from station outlet.
5. Station fiber for the Seattle campus Fire Alarm Loop shall homerun in continuous conduit from the outlet device adjacent to the main Fire Alarm panel to the MDF. Use of pull boxes or cable tray must be approved by the owner.
6. Maximum station cable length shall not exceed 295 ft (90 meters) measured from termination in IDF or MDF to station outlet, including slack required for installation and termination. The Vendor performing the work of this section is responsible for installing station cable to avoid unnecessarily long runs. Coordinate with 27 17 51 Vendor to assure pathways are adequately installed.
7. Any area that cannot be reached within the above constraints shall be identified and reported to Engineer/UWIT prior to installation.

B. Cable Terminations at MDF/IDFs

1. The exact position of copper station termination hardware shall be based on a pre-installation walk-through with the Owner prior to rough-in. Refer to Section 3.1 for pre-installation walk-through requirements.
2. Station copper cable shall terminate to rack-mounted patch panels and/or wall-mounted JP36 blocks. Additionally, furnish and install dedicated patch panel(s) and/or patch blocks for wireless access point copper cables.
3. Cables shall have pair twists preserved per the manufactures installation requirements.
4. Cable jacket shall be continuous to within 1/2" of termination.
5. Terminate cables using 568B wiring standard.

C. Cable Termination Sequence – Copper Patch Panel/Patch Block

1. For rack-mounted patch panels, station copper cables shall terminate in sequential order from top left port to bottom right port.
2. For rack-mounted patch panels, wireless access point copper cables shall terminate in sequential order on dedicated patch panel from top left port to bottom right port.
3. For wall-field patch blocks, station copper cables shall terminate in sequential order on JP36 blocks from top left to bottom right port, alternating top/bottom across each 12-port termination row.
4. For wall-field patch blocks, wireless access point copper cables shall terminate in sequential order on dedicated JP36 blocks from top left to bottom right port, alternating top/bottom across each 12-port termination

D. Cable Termination at Outlet Device

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Specifier – Check with Owner if standard bundle is to be two or three cables .. (this may vary depending on if phone service is to be converged or not and departmental requirements).

1. The standard communications outlet consists of two (2) cables of unsheathed twisted 4-pair Category 6a (5e where approved). See outlet schedule to confirm the number of cables at each location. Unless noted otherwise, this cable bundle shall be installed from each outlet location to the MDF and/or IDF designated in the Outlet Schedule.
 2. At the outlet location, approximately 6-9 inches of slack cable shall remain to facilitate servicing after the installation.
 3. Cables shall have pair twists preserved to point of termination.
 4. Cable jacket shall be continuous to within the distance of termination per manufactures installation requirements.
 5. Terminate cables using 568B wiring standard.
 6. All cable installed to floor boxes shall be terminated at floor box in specified faceplate. It is not acceptable to extend station cable out of a floor box. Refer to Outlet Schedule.
- E. Surface Mounted Raceway (SMR)
1. Applications in SMR require a device plate and jack insert frame. In installations within divided SMR, the communication system outlet shall be offset from the power receptacle faceplate by 2 inches. Refer to additional assembly details in the Drawings for SMR mounting configurations.
 2. Cable shall be placed into open SMR, not pulled. Care shall be exercised when installing the SMR cover so as not to pinch or otherwise damage cable.
 3. Communications cable shall be routed in the top half of divided SMR. Manufacturer's listed divider shall be used to separate power wiring from communications cabling.
 4. Communications cable must be pulled per the manufactures cabling instructions however under no circumstances shall cable be pulled around 90 degree corners in SMR.
 5. The Vendor performing the work of this section shall furnish and install all required faceplates, device plates, and activation components required for complete and secured installation.
- F. Furniture Outlets

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The Vendor performing the work of this section shall terminate system furniture outlets after the completion of the furniture installation. Refer to the Drawings for details of this activation.

G. Specific Service Location Requirements:

1. Stacked/Through Box Installation
2. Installation of Owner furnished Elevator Phone
3. Installation of Owner furnished 911 Telephone with or without light.
4. Installation of Owner furnished Outdoor Weatherproof Phone.

H. Building Automation Systems Outlets:

Provide cables and terminations per outlet schedule.

1. Fire Alarm System
2. Voice Rescue Assistance vs. Area of Refuge Panel
3. Elevator (See section 3.5.G.2 "Specific Service Location Requirements".)
4. Monitoring [ADT/Sonitrol]
5. DDC Control for HVAC
6. Lighting Relay Control Panel
7. Power Panel Meter
8. Utility Meter
9. Irrigation Control
10. CAAMS
11. Car Charging Vehicle Locations
12. UCAR Locations

I. Payment Systems

1. Husky Card System
2. Point of Sales Locations
3. ATM's

3.6 LABELING REQUIREMENTS

A. General

All cable and terminating devices shall be labeled.
Label with adhesive tags.
Insert white adhesive labels behind a clear protective cover.
Fiber cable labels shall be attached to cable via loose tie wraps.
All labels shall be white (except for fiber optic cable label).
Labeling shall be by mechanical means in black ink.
Labeling for Fire Alarm station fiber cable/panels shall be by mechanical means in red ink.
Fiber cable labels may be handwritten in black ink, using capital lettering, best penmanship.
Hand-lettered designations are not allowed (except on fiber cable).

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- B. Vertical Riser Cable Labels shall be placed at the following locations:

Riser blocks, fiber enclosures, and patch panels in the MDF and each IDF.

Six inches above the floor penetration (sleeve or conduit) in each MDF and IDF.

For optical fiber, labels shall be placed 6 inches before the service loops, 6 inches after the service loops, and 6 inches below the sleeve opening at the ceiling or from the wall.

- C. Fiber Optic Labeling MDF/IDF

Riser Cable Label Format

Fiber optic cables shall have the following labeling format:

Building Facnum – Building Facnum – SM – 24

Room – Room [MDF room number if first; IDF room number is second]

Ribbon

Example: Building – Molecular Engineering

6105-6105-SM-24

G37-132

Ribbon

- D. Fiber optic rack-mounted enclosures shall have the following labeling format:

A
X-Y

Building Facnum
Room Number

where "A" is the rack row (typically only one);

where "X" is the rack number (rack for riser cable abuts wall is #1);

where "Y" is the fiber enclosure number (#2 in MDF; #1 in IDF).

Example: Building – Molecular Engineering (Facnum = 6105)
At MDF G37

A
1-2

6105
G37

6105-6105-SM-24
G37-132

6105-6105-SM-24 etc.
G37-232 etc.

At IDF 132

At IDF:

A
1-1

6105
132

6105-6105-SM-24
G37-132

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- E. Fiber optic wall-mounted enclosures shall meet all standards as listed for IDF's excluding rack and row number BUT including the following:

TOP CENTERED

Building Facnum-Building Facnum-SM-24
Room-Room (MDF room number is first; IDF room number is second)

LOWER RIGHTHAND CORNER

Building Facnum-Room Number
Wall Panel Number

Example: Building – Molecular Engineering (Facnum = 6105)
6105-6105-SM-24
G37-132

6105 132
WP1

- F. Copper Riser Cable Label Format (MDF/IDF)

1. Voice riser 300 pair 110 block label format Example:

VP1V1 VP1V2 VP1V3 VP1V4 VP1V5 VP1V6
VP1V7 VP1V8 VP1V9 VP1V10 VP1V11 VP1V12
Etc.

where VP1 stands for the first Voice Transition Panel
and VP2 stands for the second Voice Transition Panel;
where V1 is the first 4-pr on the 110 block, etc..

2. Voice transition patch panel label format Example:

VP1V1 VP1V2 VP1V3 etc. VP1V24

where VP1 is Voice Transition Panel #1 and V1 is port 1.

- G. Copper Station Cable Labels

All station cables shall be labeled per the Drawings. Cable shall be labeled on both ends at the Faceplate Outlet Device and in the MDF/IDF Rooms.

Patch panel port label format: Ports are numbered in sequential order from left to right starting on the top row 1-24 and the bottom row 25-48.

Example:

Using sample Room 242 with outlet device faceplate .03 having three jacks – the top row of the patch port panel would look as follows at ports number 1, 2, 3:

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242.03-01 242.03-03
242.03-02

289.01-46 289.01-48
289.01-47

Using sample Room 289 with outlet device faceplate .01 also having three jacks – the bottom row of the same patch port panel would look as above at ports 46, 47, 48.

H. Copper WiFi Cable Labels at Patch Panel

All WiFi cables shall be labeled per the Drawings. Cable shall be labeled on both ends at the Faceplate Outlet Device and in the MDF/IDF Rooms.

Patch panel port label format: Ports are numbered in sequential order from left to right starting on the top row 1-24 and the bottom row 25-48.

1. Each wireless AP must have a unique name. The name shall be labeled on the patch panel in the format CCC.RRRR.Apyy.zz where:

CCC is the official building code, in all capital letters (e.g., SAV for Savery Hall and UMSS for the SS wing of UWMC). This code shall be provided by UW-IT on the Wi-Fi Information Form;

RRRR is the room number that the AP is located in, corresponding to the room or corridor number shown on the CAD drawings (and building signs);

yy is a two digit incrementing integer for each device within a room, beginning with 01;

zz is the patch panel port.

Sample AP names as listed on the patch panel include:

- a. HMC.12EH-04.1.AP01.01; HUB.203.AP01.08; HUB.203.AP02.09;
HUB.B100G.AP01.03; HUB.B100G.AP02.04; MLR.122H.AP01.22;
HSJ.J100S.AP01.04; WCH3.100B.AP01.02.

G. Station Cable Termination Labels at Outlet Device

1. All faceplate identification shall be consistent with the numbers on the Outlet Schedule. Document grid numbers are unacceptable. Owner-assigned room numbers shall be used. Verify that floor plans show Owner-assigned room numbers; no conversion outlet schedules will be accepted.
2. Standard wall-mounted outlets shall be labeled sequentially clockwise around the room from the door (skipping wireless outlets). Floor-mounted outlets shall be labeled after wall outlets, and ceiling-mounted outlets will be labeled last.
3. Wireless outlets shall be labeled sequentially, clockwise around the room from the door, beginning with Room #.

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4. CATV outlets shall be labeled in sequence with the data outlets, clockwise around the room from the door, beginning Room#. Where the CATV device has been combined in the same box as the Cat6a (Cat5e where required) device, number with the data outlet. See Outlet Schedule
5. All faceplates shall be labeled. The mechanical labels shall be legible, permanent, and securely attached to the respective faceplate. Position the room and outlet identifier at the top center of the faceplate.
6. As specified in the Construction Documents, all plastic faceplates shall be provided with a mechanical label in black ink securely attached to the faceplate indicating that location's ID number. The Contractor performing the work of this section shall provide blank faceplates on all device boxes and SMR sections that do not get served with station cable. This includes replacing pre-punched section of SMR (Isoduct) with new blank section. Blank faceplates shall be labeled "comm." with same material as other outlet labels.

H. Faceplate outlet device label format

1. Faceplate outlet devices are numbered in sequential order using the Room # and a faceplate number. The example below uses room number 267 and faceplate number .01.
2. Patch panels in riser room rack are numbered in sequential order by patch panel slot and Pre-installation walkthrough section 1.3D of this specification). The patch panel ports are numbered 1-48. Outlet device jacks are terminated sequentially first on patch panel #1, ports 1-48, then on patch panel #2, ports 1-48, etc.

Example:

2/3-25	2/3-26	2/3-27	2/3-28
267.01			

IDF 132

2/3-29	2/3-30	2/3-31	2/3-31
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where center tag directly above jacks indicates Room #.Faceplate #;

where center tag directly below jacks indicates MDF or IDF room number when either a floor has more than one MDF/IDF or when more than one floor goes to the same MDF/IDF;

where label locations on topmost and bottom most row on faceplate indicate Rack # (in this example Rack 2) / Patch Panel # (in this example Patch Panel 3) - Patch Panel Port # (in this case #25 through #31).

3.7 TESTING

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A. General Testing Requirements

1. Work Planning

- a. Before requesting a final inspection, the Vendor performing the work of this section shall perform a series of end-to-end installation performance tests. The Vendor performing the work of this section shall submit to the Owner's Representative for approval by UWIT a proposal describing the test procedures, test result forms, and timetable. Owner shall be notified 2 weeks prior to any testing so that the testing may be witnessed.
- b. Acceptance of the simple test procedures discussed below is predicated on the Vendor performing the work of this section's use of the recommended products (including, but not limited to, twisted-pair, fiber, and outlet devices specified in the Products section), and adherence to the inspection requirements and practices set forth.
- c. The Vendor performing the work of this section shall test:

All riser cable from MDF termination points to IDF termination points
All station cable from MDF/IDF termination points to outlet device

B. Riser Cable Testing

1. Optical Fiber Cable Testing Requirements

- a. After installation the Vendor performing the work of this section shall test each fiber strand using an Optical Time Domain Reflectometer (OTDR) to ensure that it meets the manufacturer's specifications.
- b. The procedure for testing optical fiber cables requires a power meter and a light source with the capability to record test data on a CD in non-proprietary standard format. A hard copy of the summary test results on CD shall be provided to the Owner including link loss and a reference reading. The power meter and the light source shall have the proper interface (patch cord) to test LC connector terminations.
- c. Each optical fiber strand shall be tested using the same patch cord for each port to keep readings consistent.
- d. All OTDR tests shall be performed using the same 100-foot launch cable.
- e. After installation, the Vendor performing the work of this section shall also test each fiber strand utilizing a power meter at both 1310 nm and 1550 nm wavelengths to include:

Continuity

Length (calculated from difference between footage markers on cable.

Total segment (end-to-end) loss (dB) at each end.

Bi-directional testing.

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Acceptable connector loss shall not exceed 0.4 dB.
If loss is greater than 0.4 dB, check connector for proper buffing or contaminants before retesting.
If the source of high loss is the LC-to-LC interface and it cannot be corrected, verify that the fault does not lie with the pigtail assembly.
If the source of high loss is the LC-to-LC interface and it cannot be corrected, verify that the fault does not lie with the pigtail assembly
When loss is greater than 0.75 dB, replace the pigtail assembly

If any fractures, no matter how small, are detected during examination of the fiber in the LC, the pigtail assembly shall be replaced.

2. Twisted-pair Copper Riser

- a. A visual inspection shall be made to ensure that the cables have been terminated on the punch-down blocks in proper color code order. An end-to-end continuity test is to be made for each pair to ensure wire continuity and correct tip and ring polarity. Riser cable shall be tested from the MDF frame punch-down blocks to each IDF punch-down block.
- b. Vertical and horizontal riser cables shall be tested to ensure that they meet the current requirements of EIA/TIA-568-A cabling standard for the category of cable being installed (i.e., Category 3 cable shall meet Category 3 parameters). Documentation shall include cable ID, pair ID, results of testing, and as-built information.

C. Station UTP Copper Cable Testing Requirements

1. All testing shall be done using the permanent link parameters.
2. All pairs shall test "pass" and meet appropriate performance parameters. Open, split, mis-terminated pairs, deviations from the manufacturer's installation specifications, defective connections, and bad installation practices shall not be accepted and shall be corrected. Test all station cables.
3. Test results shall meet or exceed the performance test requirements as specified in the current ANSI/TIA/EIA specifications.

D. Copper and Fiber Optic Test Records

1. Required Submission to Owner
 - a. Provide one (1) hard copy of summary (one line per jack) test results to UWIT as each MDF/IDF room is completed. Save electronically complete documentation of all tests. Documentation shall include outlet number and results of performance testing done with the cable analyzer. Analyzer documentation of testing shall consist of test result recorded in a ".txt" or ".csv" file onto a CD in each MDF or IDF. Test results shall be submitted and approved prior to substantial completion and final payment approval.
 - b. Test records for cable shall be maintained using an organized format. The forms for twisted-pair and optical fiber cable shall record MDF/IDF Room number, riser

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pair/strand number or outlet ID, outcome of test, re-test results after problem resolution, and signature of the technician completing the tests. Test results shall be submitted in electronic format.

2. Defects Identified through Testing

- a. When errors are found, the source of each error shall be determined and corrected and the cable retested.
- b. All defective components shall be replaced and retested following the procedure described above.
- c. A list shall be submitted for University approval of any defective components that the Vendor performing the work of this section is unable to correct with a detailed explanation and alternative proposals.

END OF PART 3