SECTION 27 15 00 – COMMUNICATIONS CABLE PLANT

PART 1 - GENERAL

1.1 GENERAL

A. Scope

1. Provide a complete voice, data, and multimedia communications cable plant distribution system as specified here in and as shown in the Contract Documents.

B. Work Included

1. The Contractor shall provide all necessary project 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
   a. Outside Plant cabling
   b. Category 3 shielded twisted-pair vertical riser cables
   c. Optical fiber vertical riser cables
   d. Multimedia riser cable
   e. Voice cross-connect blocks in the MDF and IDF Rooms for riser and station cable
   f. Optical fiber termination patch panels, sockets, and related components
   g. Data patch panels in the MDF and IDF Rooms for station cabling
   h. Category 5e unshielded twisted-pair station cable and termination hardware
   i. Multimedia station cable and termination hardware
   j. Terminated station drop cable bundles
   k. Outlet devices and faceplates
   l. Labeling in MDF Room, IDF Room(s), and at station locations
   m. Installation test data
   n. Connection to ground bar
   o. Equipment cabinets and racks

   [**A&E: Modify the list above per specific Project scope.**]

C. Related Sections

1. If not addressed in this section or the Contract Documents, the Contractor shall comply with the requirements and specifications contained in Division 01 and Division 26. Refer to Division 01 for meeting attendance and submittal requirements.

1.2 QUALITY ASSURANCE

A. Contractor Qualifications

1. Work in this section shall be performed by a low-voltage Contractor with demonstrated experience in the installation of inside and outside plant cabling.
2. The Contractor shall have demonstrated experience in the installation and testing of all cable plant components specified herein.
3. The Contractor shall have installed cable plant in buildings similar in size and scope to this project.

B. Warranty

1. Refer to Division 01.

C. Regulatory Requirements

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

Uniform Building Code (UBC)	International Conference of Building Officials (ICBO) 12505 Bellevue-Redmond Road, Bellevue, WA 98005
Seattle Building Code and the Seattle Electrical Code (SEC)	City of Seattle, Department of Construction and Land Use 400 Seattle Municipal Building, Seattle, WA 98104-1884 (SEC is based on the UBC.)
NEC	National Electrical Code
NFPA 75	Protection of Electronic Computer and Data Processing Equipment
NFPA 78	Lightning Protection Code
NFPA 101	Life Safety Code
FCC Part 68	Connection of Terminal Equipment to Telephone Network
FCC Part 76	With special attention to Section 611 CFR Title 47, Radiation Leakage Standards for Cable TV

D. Other References

1. All work shall be performed in accordance with the latest revisions of all ANSI/TIA/EIA, BICSI, and Computing & Communications standards. Whichever is strictest shall take precedence.

RS-455	Standard Test Procedures for Fiber Optic Cables
NCTA	Recommended Practices for CATV Measurement

1.3 MATERIALS, EQUIPMENT, AND PRODUCT SUBSTITUTIONS

A. Refer to Section 01600; Materials, Equipment, and Product Substitutions.

1.4 SUBMITTALS

A. Refer to Section 01300; Submittals.

B. Provide complete manufacturer's product literature (not distributor's catalog sheets) for all products specified here in, referenced to the applicable paragraph in the Product Section. Provide manufacturer’s recommended installation methods including maximum cable pull tension and minimum bend radius of all cable. If substitutions to the recommended products are proposed, the Contractor shall submit complete manufacturer’s product literature (not distributor’s catalog sheets) demonstrating compatibility with other related products and provide samples for evaluation two weeks prior to the bid date. 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’s Representative.

1.5 CONSTRUCTION SCHEDULE

A. Refer to Division 01, Construction Schedule

[**A&E: Coordinate the schedule milestones outlined below with C&C.**]

B. In addition to the requirements in the above referenced section, the following milestones shall be referenced in the project construction schedule

1. start/completion of continuity-of-service work
2. start of cable installation
3. start of installation testing and successive testing milestones
4. start of final inspection process
5. riser Rooms re-keyed and turned over to Owner personnel for equipment installation
6. multimedia system milestones

[**A&E: shall customize the construction phasing approach described below.**]

C. Pre-installation walk-through

1. Upon award of contract and after product submittals have been approved, the Contractor shall arrange a site survey with Owner's Representative to "marking layout" for actual location of termination equipment in the MDF and IDF Rooms. Owner has the authority to make minor modifications to the layout of these Rooms when additional cost to the Owner is not incurred.

D. Partial Completion Notification

1. The cable plant Contractor shall complete portions of his work early enough that Owner has adequate time to install equipment and related functions prior to substantial completion. Owner shall have complete access to the Router Room, MDF Room, and all work shall be complete therein, at least five (5) weeks prior to substantial completion. All riser cable installation, termination, and testing shall be complete prior to Owner access to the MDF. Owner shall have access to all IDF Rooms (for purposes of mounting equipment and related functions) at least two (2) weeks prior to substantial completion of the area served by that IDF. All associated work for a functioning system for the area served by that IDF shall be completed at this time.
2. The installation schedule shall be established and followed such that the Router and MDF Rooms are completed first, prior to completion of any IDF.

1.6 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

A. Refer to Division 01, Section 01 50 00.

1.7 INSPECTION AND SUBSTANTIAL COMPLETION

A. Refer to Division 01, Section 01 77 00: Contract Closeout.

1.8 CONTRACT CLOSEOUT

A. Refer to Division 01, Section 01 77 00: Contract Closeout.

PART 2 - PRODUCTS

2.1 INTRODUCTION

A. All materials constituting the voice, data, and multimedia transmission facility shall conform to the specifications herein.

B. The products included in each specification have been extensively evaluated by the University of Washington and constitute items of demonstrated functionality and compatibility.

C. 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
CATV	General Purpose Coaxial Cable
CATVR	Riser-rated Coaxial Cable
CATVP	Plenum-rated Coaxial Cable

2.2 OUTSIDE PLANT

A. Cable

1. The following paragraphs describe the products used for inter-building cabling between the Router Room and remotely located MDF Rooms.

B. Voice

1. Outside plant feeder voice cable shall be (at a minimum Cat 3) AWG26 twisted-pair cable. Core shall be solid polyolefin with filled core. Outer protection shall be unsoldered. Pair counts as noted on contract drawings. Cable splicing method shall be with multi-splicing modules using IDC displacement.

C. Aerial Cable
[**A&E: Specify as required by project in coordination with C&C.**]

D. Buried Cable
[**A&E: Specify as required by project in coordination with C&C.**]

1. In addition, sheath shall be PIC filled.
2. Data
   a. Singlemode fiber optic cable
      1) Required Products:
         OFS Allwave fiber optic cable #ADNX-012-BXD
         OFS Allwave fiber optic cable #ADNX-024-BXD
         OFS Allwave fiber optic cable #ADNX-048-BXD
         OFS Allwave fiber optic cable #ADNX-072-BXD

OFS Allwave fiber optic cable #ADNX-096-BXD

b. Multimode fiber optic cable, 62.5/125 micron, 12 strand, high-pack core, LXE metallic sheath.

[**A&E: Limited application to be coordinated with C&C.**]

1) Required Product: OFS #3DNX-012-HXM

c. Aerial Cable

[**A&E: Specify as required by project in coordination with C&C.**]

d. Buried Cable

[**A&E: Specify as required by project in coordination with C&C.**]

3. Multimedia

a. Fiber optic cable

1) Required Products: Refer to section 2.1.1.2.1 in this document.

b. Coaxial cable

[**A&E: Limited application to be coordinated with C&C.**]

1) Where existing Multimedia outside plant is coaxial cable, it may be necessary to extend outside plant using coaxial cable. Coaxial cable shall be jacketed, .540-inch cable suitable for installation in buried conduit. The cable shall be engineered and tested to support frequencies ranging between 5-1000 MHz.

2) Required Product: CommScope QR-540JCA

E. Connectors/Hardware

1. The following paragraphs describe the connectors and hardware used to terminate the cable from the voice, data, and multimedia service providers, and the outside plant cable between the Router Room and the remote MDF Rooms.

2. Voice

a. Network Protectors

[**A&E: Confirm pair count of NP and mounting configuration.**]

3. All twisted-pair outside plant cable entering the building shall be protected with the following:

a. Router Room - Required Product: Provide Avaya 4C3S solid-state, plug-in protector units used in conjunction with Lucent XLBET single-sided, wall-mounted frame along with associated Lucent components to complete build-out of frame.

b. MDF - Required Product: Wall mounted NP: Avaya 489ACA1-100

c. Splice Module

[**A&E: Include splice module if necessary, coordinate product selection with C&C.**]

4. Data

a. Fiber optic cable distribution shelf

1) Required Product:

<u>Rack Mount</u>
Avaya #700 007 289 [**72/144 capacity**]
Avaya #700 007 255 [**24 capacity combo termination/splice**]

<u>Wall Mount</u>
[**A&E: limited application to be coordinated with C&C**]
Avaya #106 896 947 [**12/24 capacity**]

b. Splice shelf

1) Used with fusion-spliced, pre-terminated pigtails.
2) Required Product:
Avaya #700 007 230 [**72 capacity**]
Avaya #700 007 222 [**144 capacity**]

c. Splice Organizer
1) Required Product:
Avaya #105 339 899 [**24 capacity**]

d. Splice Case
1) Required product:

[**A&E: limited application to be coordinated with C&C**]

e. SC coupler panel
1) Required Product:
<u>Rack Mount</u>
Avaya #106 970 981 [**8 capacity**]

[**A&E: limited application to be coordinated with C&C**]

Avaya #700 011 398 [**6 capacity**]
<u>Wall Mount</u>

[**A&E: limited application to be coordinated with C&C**]

Avaya #106 371 800 [**6 capacity**]

f. SC singlemode/multimode couplers
1) Required Product: SC UPC (sm/mm): Avaya #700 004 807; SC APC (sm): Corning #TER-549

g. Singlemode SC fiber optic connector
1) For direct termination
2) Required Product:
Avaya #700 006 976 [**SC UPC**]
Corning #95-211-08 BP3G [**SC APC**]

h. Multimode SC fiber optic connector

[**A&E: Limited application to be coordinated with C&C.**]

1) Required Product: Avaya #700 007 024

i. Flat polish SC fiber pigtails
1) Required Product:

[**A&E: Use appropriate length pigtail for specific application. Typical 5-foot pigtail listed below.**]

Avaya #700 011 083 [**5' Simplex 8.3/125 micron sm SC UPC**]

j. Angle polish SC fiber pigtails
1) Required Product:

[**A&E: Use appropriate length pigtail for specific application. Typical 5-foot pigtail listed below.**]

Corning #0065-01R4131-005-F [**5' Simplex 8.3/125 micron sm SC APC**]

5. Multimedia
a. Fiber Optic: Refer to section 2.1.2.2.1 in this document.
b. Coaxial: Where existing plant is over coaxial cable and is extended, provide the following products.
1) Pin-type Connector

[**A&E: Select most current model number of connector.**]

2) Provide pin-type, threaded (5/8"), connectors designed to mate with the various passive and active devices on the Riser and Backbone portion of the

cable system (.540). The connectors shall be sized with a .540-inch seizing mechanism for .540 coax.

3) Recommended Product:
Gilbert GRS-540-xxxx-xx
Jerrold xxx
Regal xxx

c. Amplifiers
1) Minimum bandwidth 870 MHz.
2) Recommended Product: ACI #MFT8/40PCS419-1

d. Equalizers
1) Required Products (provide both):
CEQ870/3-6-9-12 as designed
EQDA-870/3-6-9-12 as designed

e. Attenuators
1) Required Product: SXP3T, 6T, 9T, 12T, 14T, 20T as designed

f. Taps

[**A&E: Select most current model number of connector.**]

1) The bandwidth shall be 5-1000 MHz; the insertion loss will vary with isolation value but shall be comparable to Regal Technologies Ltd. Rxx10 series directional couplers. These units shall employ pedestal/strand mounts (to cable tray), corrosion-resistant housings, weatherproof seals, modular design for swapping of tap assembly without the removal of the housing from the cable, and clearly labeled tap value.
2) Recommended Product: Regal Rxx10 series

2.3 RISERS

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

B. Cable

1. Voice
a. Category 3 (Riser-rated)
1) Voice Riser Cable. The Category 3 shielded twisted-pair cable for voice shall meet or exceed the transmission specifications for category 3 cable and be color-coded.
2) Pair count per sheath shall be at least 100 pair but shall not exceed 300 pair.
3) Recommended Products:
Avaya ARMM 100 pair (COMCODE 107 527 129)
Avaya ARMM 200 pair (COMCODE 107 527 285)
Avaya ARMM 300 pair (COMCODE 107 527 293)

b. Horizontal riser cable (plenum rated)
1) Recommended Product: Avaya 2010B (COMCODE 107 766 057)

2. Data
a. Singlemode and multimode optical fiber riser cable shall meet or exceed the specifications of the manufacturers referenced in the recommended product.
b. MDF-MDF ties

c. Use singlemode cable where horizontal tie cable is needed to connect MDF to MDF within same building.

[**A&E: Limited application to be coordinated with C&C.**]

1) Required Products:
CM rated: Avaya LGBC-xxxD-SRX
CMP rated: Avaya LGBC-xxxD-SPX

d. Vertical Riser

[**A&E: Verify with C&C whether singlemode or multimode is to be used to connect IDFs to MDF.**]

1) Required Product:
3M Volition multimode fiber optic cable VOL-B624P1 [**24-strand plenum**]
3M Volition singlemode fiber optic cable VOL-B924P1 [**24-strand plenum**]

e. IDF to Station

[**A&E: Limited application to be coordinated with C&C.**]

1) Required Product:
3M Volition multimode fiber optic cable VOL-H64P1 [**4-strand plenum**]
3M Volition singlemode fiber optic cable VOL-H94P1 [**4-strand plenum**]

3. Multimedia

a. CATV

b. The cables shall be riser-rated CATV RG-11, 75-Ohm, foamed dielectric coaxial cables, bonded foil and at least 60% braid shielding. This cable shall be engineered and tested to support frequencies ranging between 5-1000 MHz. The nominal attenuation shall not exceed 2.9 dB per 100 feet @ 500 MHz.

[A&E: Use most current product numbers.]

1) Recommended Product: CommScope F1160BVR Series (RG-11)

c. Video/Audio

d. Fiber optic cable

1) Required Products: Refer to Section 2.2.1.2 within this document.

C. Connectors/Hardware

1. The following paragraphs describe the products used to terminate the cabling within the building.

2. Voice

a. Network Protectors

1) All twisted-pair outside plant cable entering the MDF from the Router Room shall be protected with the following:

2) Required Products:
Lucent 489ACA1-100 Building Entrance Protection Device
Lucent 4C3S solid-state
(plug-in protector units shall be used in conjunction with the 489-type unit)

b. The blocks used in the MDF and IDF Rooms for voice riser and voice station drop cable terminations shall be 300-pair Lucent Technologies 110-type wiring blocks.

1) Required Product: Avaya 110 AW2-300 (COMCODE 107 059 917)

c. 5-pair clips

1) Voice riser cable blocks shall be provided with 5-pair connector clips.

2) Required Product: Avaya 110C-5 (COMCODE 103 801 254)

d. 4-pair clips

1) Voice station cable blocks shall be provided with 4-pair connector clips.
2) Required Product: Avaya 110C-4 (COMCODE 103 801 247)

e. The jumper wire routing guides used directly above the riser and station blocks shall be the Lucent Technologies trough design.
1) Required Product: Avaya 188B2 (COMCODE 104 405 113)

f. Labels
1) Standard colored label strips shall be affixed to each row of the wiring block that indicated its use as follows:
Green Voice Riser
Blue Voice Station Drop
2) Required Products:
Avaya 110GA2-4500L, Green (COMCODE 106 657 109)
Avaya 110BB2-4500L, Blue (COMCODE 106 657 174)

3. Data
a. MDF end of cable from Router Room
1) Fiber optic cable distribution shelf
Required Product: Refer to Section 2.1.2.2.1 within this document.
2) Splice shelf
Required Product: Refer to Section 2.1.2.2.2 within this document.
3) Splice Organizer
Required Product: Refer to Section 2.1.2.2.3 within this document.
4) Splice Case
Required Product: Refer to Section 2.1.2.2.4 within this document.
5) SC coupler panel
Required Product: Refer to Section 2.1.2.2.5 within this document.
6) SC singlemode/multimode couplers
Required Product: Refer to Section 2.1.2.2.6 within this document.
7) Singlemode SC fiber optic connector
Required Product: Refer to Section 2.1.2.2.7 within this document.
8) Multimode SC fiber optic connector
Required Product: Refer to Section 2.1.2.2.8 within this document.
9) Flat polish SC fiber pigtails
Required Products: Refer to Section 2.1.2.2.9 within this document.
10) Angle polish SC fiber pigtails
Required Products: Refer to Section 2.1.2.2.10 within this document.

b. MDF to IDF vertical cable system
1) The enclosures used in the MDF for termination of the optical fiber vertical riser cables shall provide termination panels for VF45 sockets. They shall be of sufficient size and capacity to terminate 200% of the combined fiber count of the vertical riser cable.
2) Required Products:
<u>Floor Mount Rack</u>
Cooper B-Line #SB-556-084-XU
[**Relay rack, brushed aluminum, self-supporting, customer premises style, 19" width, 84" height, universal hole pattern**]

[**A&E: Limited application to be coordinated with C&C.**]

<u>Wall Mount Rack</u>
Chatsworth Products Inc. #1196-1-7-18

[**Fixed wall mount equipment rack, 19" width, 38-1/2" height, 18" depth, universal hole pattern, black, supports up to 200 pounds**]

[A&E: Limited application to be coordinated with C&C.]

Vertical Cable Management
Corning #CDF-IBS-7
[**Customer distribution frame inter-bay storage with routing spools and storage bay**]

c. Patch panels (MDF)
   1) Required Product:
      3M (Volition) #VOL-0400S
      [**24-port rack mount patch panel, 2U, with cable management and slide kit**]
      3M (Volition) #VOL-0400EXP
      [**24-port expansion panel for VOL-0400 series patch panel**]
      3M (Volition) #VOL-0402S
      [**48-port rack mount patch panel, 3U, with cable management and slide kit**]

d. Patch panel (IDF)
   1) Required Product:
      3M (Volition) #VOL-0412
      [**Patch panel, wall-mount, 12 VF-45 ports, 24-fiber**]
      3M (Volition) #VOL-0414
      [**Patch panel, wall-mount, 24 VF-45 ports, 48-fiber**]

e. Fiber Termination Sockets (MDF/IDF)
   1) Required Product:
      Multimode
      3M (Volition) #VOL-0001
      [**socket base, white housing, socket fiber holder and boot (for 250 micron coated multimode fiber)**]
      Singlemode
      3M (Volition) #VOL-0002
      [**socket base, white housing, socket fiber holder and boot (for 250 micron coated singlemode fiber)**]

f. Termination Blocks
   1) Required Product:
      Data station patch panels shall be provided.
      Avaya 110AB-CAT5PS-JP36 (COMCODE 107 920 712)
      Data station wiring blocks shall be provided with 5-pair connector blocks.

g. Vertical cable management
   1) Provide surface-mount cable management brackets with notch for guide installation/removal without requiring threading through bracket. Brackets shall be
   2) 3-inch x 3-inch opening, minimum.
   3) Required Product: Ortronics OR-808004796

4. Multimedia
   a. CATV
      1) Connectors
         Recommended Product: Gilbert GAF-11-AHS/480
      2) CATV Taps/Splitters

[**A&E: Use most current product numbers.**]

The bandwidth shall be 5-1000 MHz; the insertion loss will vary with isolation value but shall be comparable to Regal Technologies Ltd.Rxx10 series directional couplers. These units shall employ pedestal/strand mounts (to cable tray), corrosion-resistant housings, weatherproof seals, modular design for swapping of tap assembly without the removal of the housing from the cable, and be clearly labeled with a tap value.

Recommended Product: Regal Rxx10 (tap/splitter value as dictated by design)

3) Amplifier
Minimum bandwidth 870 MHz
Recommended Product: ACI #MFT8/40PCS419-1

4) Equalizers
Required Products (provide both):
CEQ870/3-6-9-12 as designed
EQDA-870/3-6-9-12 as designed

5) Attenuators
Required Product: SXP3T, 6T, 9T, 12T, 14T, 20T as designed

2.4 STATIONS

A. The following paragraphs describe the cabling for voice, data, and multimedia station outlets.

B. Cable

1. Voice and Data

a. The twisted-pair cable for station drop bundles shall be three (3) sheaths unshielded twisted 4-pair cable.

1) Required Product:
CM rated: Avaya 1061C + 4 pair
CommScope 55N4
CMP rated: Avaya 2061B + 4 pair
CommScope 55O4M

2. Multimedia

a. CATV

1) Coaxial cable shall be used for all in-building wiring of the RF distribution system drops. This cable shall have a bonded foil aluminum braid (90% minimum), foam dielectric with a copper clad steel center conductor. The cable shall be compatible with RG-6 CATV grade coax for use with frequencies between 5-1000 MHz. The nominal attenuation shall not exceed 4.55 dB per 100 feet at 550 MHz.

2) Recommended Product: CATVR: CommScope F690BVV

b. Video/Audio Station Cable

1) Baseband video cable carries analog baseband video over short distances (less than 400 feet). Provide 75-Ohm, low-loss video coax.

2) Recommended Products:
Belden 1505A (non-plenum rated)
Belden 1506A (plenum rated))

3) Serial digital video coaxial cable carries digital video short distances (less than 600 feet). This is 75-ohm, RG-6 type, low-loss coaxial cable.
Recommended Products:
Belden 1694A (non-plenum rated)
Belden 1695A (plenum rated)

c. Video/Audio Control Room Cable

[**A&E: Limited application to be coordinated with C&C**.]

The following products shall be used to terminate the video/audio riser cabling in the C&C Control Room (a separate room from the MDF/IDF Rooms).

1) Patch Panel (IDF)
Required Product: Refer to Section 2.2.2.2.2.3 within this document.
2) Fiber Termination Sockets (MDF/IDF)
Required Product: Refer to Section 2.2.2.2.2.4 within this document.
3) Digital Video Transmitter
Recommended Product: ADC/DV-6000
4) Video Wall Plane
Required Product: ADC ICON I-WB
5) Video Wall-mounted Bulkhead Panel
Recommended Product: ADC ICON VIW-(24/72/96) application specific
6) Audio Wall Plane
Required Product: ADC ICON I-WS
7) Audio Wall-mounted Termination Block
Recommended Product: ADC ICON I-(24A/48/96) application specific
8) Video equipment rack
Video equipment rack shall be 78 inches high x 30 inches deep x 19 inches wide, black with pontoon base, rear-hinged door, mid-rails, open top and full height power strip. Power strip shall have 120v, 15 amp simplex receptacles spaced at six inches on center.
Recommended Products:
Stantron series 200
Steel Equipment Rack SF2007830
Steel Equipment Rack - Side Panel SS2007830
Steel Adjustable Inside Rack Rail LM78
Steel Door - Right to Left D60078LD

C. Connectors/Hardware

1. The following paragraphs specify the standard modular voice, data, and multimedia outlet devices, which shall be used in all new construction and remodeled installations. Typical configurations combine a modular information jack with or without a mounting frame and a faceplate.

[A&E: Modify this section as required by project, edit product numbers, and coordinate with C&C.]

2. Combined Voice/Data
   a. Standard, Combined Voice/Data Wall Outlet
      1) Modular Information Jacks: three non-keyed RJ45. All jacks shall have rear-mounted, T568B configured, terminals for attachment of station drop cable.
      2) Required Products:

Jack
Avaya MPS 100E-112 (orange for data) (COMCODE 108 232 703)
Avaya MPS 100E-318 (blue for voice) (COMCODE 108 232 778)
Faceplate, 4 inches x 4 inches
Plastic
Avaya M28A-246
Stainless Steel
Semtron, Inc. 2FM-(8)0E-LUC

b. Voice/Data Surface-Mounted Raceway Outlet
   1) Wiremold
      Required Products:
      Bezel Faceplate (is comprised of 3 parts):
      Low Profile Mounting Interlink #AC-SFP-001
      Angled Mounting Adapter Interlink #AC-AMA-IV
      Dual Flushmount Interlink Insert #3A-U2ATT-GY
      In addition:
      For WM3000, Bridge Mounting Device Extension Bracket #G-3046
      For WM4000, Single Gang Device Plate
      (Incl. Cover and Bracket) #G-4007C-1
      Jack
      Avaya MPS 100E-112 (orange for data) (COMCODE 108 232 703)
      Avaya MPS 100E-318 (blue for voice) (COMCODE 108 232 778)
      Mounting frame
      Avaya M106FR2-270 (COMCODE 106 688 393)
   2) Isoduct
      Required Products:
      Jack
      Avaya MPS 100E-112 (orange for data) (COMCODE 108 232 703)
      Avaya MPS 100E-318 (for voice) (COMCODE 108 232 778)
      Mounting frame
      Avaya M106FR2-270 (COMCODE 106 688 393)

c. Voice/Data Flush Floor Box Outlet
   1) Required Products:
      Jack
      Avaya MPS 100E-112 (orange for data) (COMCODE 108 232 703)
      Avaya MPS 100E-318 (blue for voice) (COMCODE 108 232 778)
      Mounting frame
      Avaya M106FR2-270 (COMCODE 106 688 393)

d. Voice/Data Podium Box Outlet
   1) Required Products:
      Jack
      Avaya MPS 100E-112 (orange for data) (COMCODE 108 232 703)
      Avaya MPS 100E-318 (blue for voice) (COMCODE 108 232 778)

e. Wall-mounted Phone Unit
   1) Faceplate/jack assembly
   2) Required Product: Avaya M10LW-246 (COMCODE 108 258 450)

f. Landscape Furniture Faceplates

[**A&E: Specify furniture-specific Avaya adapter at these locations.**]

3. Multimedia

a. CATV

1) F-56 Connectors
Provide hex-crimp style, plated brass "F"-type connectors for RG-6 with an integral ribbed crimp ring and "O" ring seal.
Recommended Product: Gilbert GF-6-AHS/357

2) F-81 Splices
Provide standard machined Female-to-Female type high frequency, "F" splices. The center clutch shall adapt to both RG-59 and RG-6 center conductors.
Recommended Product:
Lucent Technologies #M81C (for use with modular wall plates)
Gilbert GF-81-TS (for use in all other applications)

3) 75-ohm Self-Terminating Faceplate Assembly
All television outlets shall include a 75-ohm terminator as part of the faceplate assembly.
Recommended Product: Gilbert GTR-59A

4) 75-ohm Non-Self-Terminating Faceplate Assembly
Where self-termination is not possible, install screw-on type 75-ohm terminators.
Recommended Products:
Gilbert "F" Series Connector GF-6-AH-S/342
Gilbert BF-81 Female Splice

5) Drop Taps
Provide indoor taps made of die-cast metal with machined (not cast) connectors. The band pass shall be 5-1000 MHz; the insertion loss will vary with isolation value but shall be comparable to Regal Technologies Ltd. indoor directional couplers.
Recommended Product: Regal RDCTxx

6) Drop Splitters
The Contractor shall conduct field measurements of the installed cable and install taps per design. Provide indoor splitters made of die-cast metal with machined (not cast) connectors. The band pass shall be 5-1000 MHz; the insertion loss will vary with isolation value but shall be comparable to Regal Technologies Ltd. gold label series indoor splitters.
Recommended Product: Regal GSxDGH gold series

b. Video/Audio Outlets

1) Faceplates
Faceplates are typically plastic and device dependent.
Depending on the application, one of the following faceplates shall be used:
<u>Video</u>
Required Products:
Avaya M28L-246 (COMCODE 108 685 017)
4x4 blank with custom hole
2x4 blank with custom hole
<u>Video with Audio</u>
4x4 with 2 electrical openings on left half

2) Video BNC Connectors
Provide a true 75-Ohm BNC connector for use with analog or digital baseband video systems.

Recommended Products:
Canare BCP-C77A for LV-77S
Canare BCP-C5FA for L-5CFB
Canare BCP-3CB for L-3CFB

3) Video BNC Bulkhead Connector
Provide a true 75-Ohm BNC connector for use with analog or digital baseband video systems.
Recommended Product: Canare BCJ-JR

4) Video 75-Ohm Terminator
Provide a true 75-Ohm BNC terminator for use with analog or digital baseband video systems.
Recommended Product: Canare BCP-TA

5) Audio XLR Connector
Provide a 3-pin female chassis-mount analog or digital audio connector for a baseband audio system.
Recommended Product: Neutrik LNE or NC3 series

2.5 TELEPHONE UNITS

[**A&E: Verify with C&C: "To be provided by Contractor".**]

A. Elevator phone units

1. Required Product: Ramtech R733-924M

B. Weatherproof Touch-tone phone unit with handset and keypad

1. Required Product: GAI-TRONICS 226C Industrial Telephone

C. Explosion-proof (Class 1, Division 2) phone unit with handset and keypad

1. Required Product: GAI-TRONICS 272 Intrinsically Safe Telephone

D. Emergency Code Blue phone units

1. Required Products:
   a. Code Blue I-S
   b. Talk-A-Phone #ETP-400V-S

E. Direct-connect 911 phone units

1. Emergency wall telephone units shall have a bright yellow, weatherproof casing with a push-button (no dial) "ring down" function.
2. Required Product: GAI-TRONICS emergency telephone 293AL-AD Yellow

F. Pay phones
[A&E: Request shall be coordinated with C&C prior to any inclusion in documents.]
1. Provided by local telephone company.

G. Wireless Access Points
[A&E: Develop this specification section per the project requirements after consulting with C&C.]

2.6 SATELLITES
[A&E: Develop this specification section per the project requirements.]

2.7 ASSOCIATED PRODUCTS

A. Innerduct

1. Where innerduct is specified, it shall be corrugated and of diameter indicated in the contract drawings. Plenum rated innerduct shall be fabricated of flame retardant materials suitable for installation in plenum rated environments and meet all requirements for flame propagation as specified by test method UL-910.
2. UL stamp shall be visible to pass inspection.
3. Recommended Manufacturer: Carlon or Pyramid

B. Cable lubricants

1. Recommended Products:
   a. Twisted-pair cable: Dyna-Blue American Polywater
   b. Optical fiber cable: Optic-Lube Ideal

C. Fire stopping

1. Recommended Products:
   a. T&B Flame Safe Compound
   b. 3M Fire Barrier Caulk

PART 3 - EXECUTION

3.1 PRODUCT INSPECTIONS

A. All products shall be inspected prior to installation to verify that they are of proper gauge, contains the correct number of pairs, and otherwise meets specifications. Any physical damage to products is unacceptable. Uniform jacket thickness,

B. tightness, or buckling should be checked. All outlet devices, cross-connect blocks, and other components shall also be inspected prior to installation.

C. Within one week of inspection, the Contractor shall submit a statement certifying that all cable and components met specifications or were replaced.

3.2 SERVICE COORDINATION
[A&E: Include paragraphs below as necessary.]

A. Existing Service Interruption

1. The Contractor shall prevent interruption of service by identifying and providing temporary supports and protection of existing communications cables, cross-connect blocks, and equipment throughout demolition and construction. In the event existing active communications cabling, outside the scope of the project, needs to be relocated, the Contractor shall immediately notify the construction coordinator.
2. If accidental interruptions do occur, the Contractor shall immediately notify the construction coordinator so that service may be re-established as soon as possible.

B. Temporary Elevator Service

1. The Contractor shall disconnect and remove temporary communication cable and termination equipment installed to serve elevator car phones during construction. Contractor shall coordinate decommissioning with Owner's Representative prior to performing this work.
2. Permanent communication cable shall be installed as scheduled and indicated in the Contract Documents.

C. Construction Services

1. The Contractor shall disconnect and remove communication cable and termination equipment serving construction trailers and temporary offices installed for the purpose of supporting this project. Contractor shall coordinate decommissioning with Owner's Representative prior to performing this work.
2. Building Systems Interface
   [**A&E: Revise paragraph below as necessary. The following paragraph describes the Contractor's responsibilities to provide timely installation of services for the numerous building systems. These services are often needed for commissioning and AHJ inspections prior to substantial completion of the cable plant.**]
   a. The Contractor shall coordinate timely installation of communication cable and termination equipment with the Sub-Contractors providing Fire Alarm System, Security System, Card Access System, Building Automation System, etc. Termination outlets shall be mounted adjacent to respective system panel per the communication outlet schedule. Out-of-sequence construction may be required to support testing and Authority Having Jurisdiction (AHJ) witnessing of building systems. The Contractor shall provide timely installation of outlets serving the building systems to accommodate commissioning and testing.

3.3 CABLE INSTALLATION

A. General

1. The Contractor shall ensure that communications cable is installed with care, using techniques which prevent kinking, sharp bends, scraping, cutting, or deforming the jacket, or other damage. Installation shall be subject to periodic inspections by Owner's Representative. The Contractor shall replace unacceptable cable at no additional expense to the University.
2. Splices
   a. Optical fiber cable, voice/data/video station cable, riser cable, etc., shall not be spliced except under the following circumstances:
      1) <u>Outside plant voice copper cable</u>

When required, shall be spliced in UL listed splice cases.

2) Optical fiber cable

When specified, terminations shall utilize fusion-spliced pigtails.

3. Routing
   a. 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).
   b. The installation of cable around movable devices, instruments, sub-panels, etc., shall be provided with adequate support, length, protection, and flexibility so that the cable is not damaged in the event the equipment is moved.
4. Pull Lines
   a. A 3/32-inch diameter, 200-pound 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.
5. Cable Bend Radius and Pull Tension
   a. Communications cable cannot tolerate sharp bends or excessive pull tension during installation. Contractor shall observe manufacturer's recommended bend radius and pull tension for all cable.
6. Cable Lubricants
   a. 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.
7. Cable Support
   a. All cable shall be supported every 4 feet vertically and horizontally. Riser cables shall be supported at each floor level with strain relief clamps at each floor penetration. Cables shall be organized neatly, by system (voice/data/video/audio, etc.), and separately supported "D-rings" shall be used to support cable vertically and horizontally by means of D-rings screwed to the outside edge(s) of 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 of installed with excessive slack shall be rejected.
8. Grounding
   a. Outside Plant optical fiber cable containing metallic strength members shall be properly bonded and grounded at each cable end.
   b. Riser cable shields in the MDF and in each IDF shall be connected to the equipment ground bar tied to the building grounding electrode system.
9. Removal

[**A&E: Include if necessary: "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."**]

[**A&E: Include non-FDI installation instructions at this location. Prior approval from C&C is required to use this section.**]

10. Pre-Installation walk-through

a. Prior to commencing installation of cable plant, Contractor shall schedule a site walk-through with the Owner's Representative to conceptually layout and mark intended installation. Contractor shall provide seven days advance notice for scheduling the walk-through.

B. Conduit Usage/Fill

1. Grounding
   a. All communications cable shall be installed in grounded metal conduit as indicated in the Contract Documents.
2. Dedicated Use
   a. Communications cable shall not share conduit with electrical power wiring, department system wiring, or any other building system.
3. Fill
   a. Communications conduit shall not be filled beyond 40% capacity. Refer to NEC for conduit capacity for various trade sizes of conduit.
4. Cable Lubricants
   a. 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.

C. Cable Tray Usage/Fill

1. General
   a. Contractor shall not attach any devices, raceway, or other building systems to sides or bottom of cable tray without prior approval from Owner's Representative.
2. Fill
   a. Communications cable shall be installed in cable tray as indicated in the Contract Documents. Cable tray fill shall not exceed 50% of total tray cross-sectional area per NEC.
3. Transitions
   a. 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.
   b. Where the cable bundle makes the transition from conduit to cable tray, the cables shall drop, as much as possible, perpendicular to the tray. (They shall not slope to a point more than one foot along the tray.
4. Dressing
   a. 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.

D. Fire-stopping

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 300-21. All firewall penetrations shall likewise be filled with suitable fire-stop material. Unused sleeves shall be capped or grouted.

2. In situations where cable tray, conduit, or sleeves extend outside the construction area into occupied portions of the building, they shall be capped or fire-stopped throughout the course of construction.
3. 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 caps may be used to seal unused sleeves and conduit except where conduits have grounding bushings.
4. In situations where cable tray, conduit, or sleeves extend outside the construction
5. area through fire-rated construction, they shall be capped or sealed throughout the course of construction.
6. 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.

E. Surface Mounted Raceway (SMR)

1. Corner Bends
   a. 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 the cable.
2. Divided SMR
   a. 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.

F. Systems Furniture Wiring

[**A&E: Confirm Owner intent to terminate faceplate serving systems furniture at structural element (i.e., wall, column, floor).**]

3.4 OUTSIDE PLANT

A. General

1. Provide outside plant-rated optical fiber cable as noted on the riser diagram in the contract drawings. Cable shall be singlemode and/or multimode and contain quantity of strands as specified in Part 2 Products. All cable shall be routed in appropriately rated innerduct while in duct bank, manholes/handholes, and cable tray as indicated in the Contract Documents.
2. Provide outside plant-rated shielded, twisted-pair cable as noted on the riser diagram in the Contract Documents. Cable shall contain quantity of pairs as noted in the Contract Documents.
3. Cable Installation
   a. Outside plant cable shall be terminated within 50 feet of the building entrance – otherwise refer to NEC. The Contractor shall notify Owner's Representative immediately if this is not possible.
   b. Do not exceed the cable manufacturer's minimum bend radius for cable under tension. Do not exceed the cable manufacturer's maximum tensile rating during installation. Cables damaged during installation and found with bend radii smaller

than manufacturer's recommendation shall be replaced in their entirety at no additional cost to the Owner.

4. Manholes/Handholes
   a. Optical fiber cable and copper cable routed through manholes and handholes shall be furnished with a 15-foot service loop at each manhole and/or handhole. Cable shall be neatly managed and racked to side walls of vault.
5. Duct Banks
   a. Cable shall be installed in duct bank as shown on the contract drawings. Unless otherwise noted in the Contract Documents, innermost conduits of bank shall be used before outer conduits are used. Conduits at the bottom of the bank shall be used before those at the top. Cable shall be pulled with specified lubricant. Lubricant shall be removed from cable at each handhole and manhole.

3.5 ROUTER ROOM

A. Cable Installation

1. Cable not dressed in a neat fashion or installed with excessive slack is unacceptable. Cabling routed along plywood backboard shall make optimum use of wall area and shall be routed such that future modifications shall not be compromised or require rerouting of cable along backboard.
2. Cable routed along plywood backboards shall be routed as close as possible to the ceiling, floor, or edges to ensure that adequate wall or backboard space is available for current and future equipment and for cable termination. Cable shall be at least 4 inches away from electrical outlets.
3. Exact cable routing and backboard layout shall be coordinated with Owner’s Representative.
4. Cable shall be routed over a path that will offer minimum obstruction to future installation of equipment, backboards, or other cables. Avoid crossing areas horizontally just above or below riser sleeve or cable tray penetrations.
5. Cable routed in cable tray shall be neatly managed, not bound in any way (tie wraps, Velcro straps, etc.). Where the cable makes the transition from cable tray to equipment rack or cabinet, the cables shall drop, as much as possible, above the footprint of the equipment rack. Cable shall not be unsupported for a distance greater than one foot from the tray or ladder rack.
6. Bond optical fiber shields (where applicable) and the copper cable shields to the ground bus in the Router Room with AWG #6 insulated green ground conductor.
7. Remove water repellant material from all copper cable prior to termination and installation of couplings.

B. Cable Terminations

1. Fiber
   a. All outside plant optical fiber cable ends shall have appropriate breakout kits installed, as well as the cable ends properly sealed to prevent egress of water-blocking gel. All outside plant optical fiber cable for data and video applications shall terminate in the splice and distribution shelf specified in Part 2 Products. Use SC-type couplings, pigtails, and connectors. Install connectors and couplings per manufacturer recommendations and locate shelves in equipment cabinets as noted

in the contract drawings. All OSP singlemode optical fiber strands shall be terminated by fusion-splicing pre-connectorized pigtails to each strand.

b. (A&E: unless specified otherwise by C&C).

2. Router Rooms
   a. All outside plant optical fiber cable shall terminate inside a wall-mount high capacity splice closure. A pre-connectorized plenum jacket optical fiber cable shall be installed between the rack mount termination panel (connector side) and the wall-mount high capacity splice closure. The wall-mount high capacity splice closure shall be used for transition splices.
3. Copper
   a. All outside plant shielded twisted-pair copper cable shall terminate in network protector fields mounted in the frames specified in Part 2 Products.
   b. Copper pigtails should be extended from network protector to 110 termination blocks.

C. Cable Identification - Outside Plant Cable Labels

1. Labels shall be embossed type on 22-gauge steel or aluminum material and tie-wrapped to the cable.
2. Labels shall be placed on cables at the following locations
   a. On both sides of every manhole/handhole and every 100 feet in cable tray
   b. At the entry point into a building, both inside and outside
   c. On network protector and distribution shelf

Utility-management identifier	(UW C&C)
Source/destination building names	(Schmitz-Kane)

Example:

C&C/Schmitz-Kane

3. Coordinate with Owner's Representative for use of proper building names.
4. Where feeder cable serves multiple buildings, labels shall indicate pair count and buildings being served.
5. Provide modification to existing cable labels as necessary where existing feeder cable is being re-routed or re-terminated.

3.6 RISER CABLE PLANT

A. Cable Installation

1. Category 3 voice riser cable, optical fiber cable, and coaxial cable shall be routed inside the MDF and IDF Rooms as three distinct separate cable bundles.
2. Cable sleeve usage and routing
   a. Install cable in the MDF and IDF per the Contract Documents. Use 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 NEC before adjacent sleeve is used. For existing conditions, fill partially filled sleeves before using adjacent unused sleeves.

b. 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. Cable shall be at least four inches away from electrical outlets.
c. Cable shall be routed over a path that will offer minimum obstruction to future installation of equipment, backboards, or other cables. Avoid crossing areas horizontally just above or below riser sleeve or cable tray penetrations.
d. Voice Riser Cables: Provide stand off for cable pass through behind blocks
e. Exact cable routing and backboard layout shall be coordinated with Owner's Representative.

3. Cable
a. Optical Fiber Riser Cable: Individual optical fiber cables shall be installed in a star configuration from the termination point in the MDF to the patch panel in each IDF. Refer to the contract drawings for strand counts and cable type. Cable shall be protected by innerduct through sleeves and into communication rooms. Provide service loop consisting of 15 feet of slack, coiled in 12-inch diameter loop, in the MDF and each IDF termination point.
b. Copper Riser Cable: Individual shielded twisted-pair riser cable(s) shall be provided in a star configuration from the riser field termination block(s) in the MDF to the termination block(s) in the IDF. Refer to the riser diagram for pair counts and cable counts.
c. Coaxial Riser Cable: Provide coax riser cable as necessary from the MDF to each of the IDF's. Coaxial cable configuration shall be as shown in the Contract Documents.

B. Cable Terminations

1. The exact position of voice, data, and video riser termination locations shall be based on a walk-through with the Owner's Representative prior to rough-in of the cable plant. This Contractor shall request the meeting be arranged two weeks before the information is needed that will be discussed in the walk-through.
2. MDF
a. Data riser cables shall be terminated in rack-mounted optical fiber patch panels using fiber termination sockets. The patch panels shall be organized by floor and by IDF as specifically shown in the Contract Documents. When terminating Volition singlemode or multimode cables, the send-and-receive fiber pairs shall be transposed between the MDF and the IDF such that a "send" fiber originating from the MDF shall be terminated on the "receive" fiber in the IDF.
b. Video riser cables shall be terminated as shown in the Contract Documents.
3. IDF
a. Data riser cables shall be terminated in wall-mounted optical fiber patch panels using fiber termination sockets. The patch panels shall be organized as specifically shown in the Contract Documents. When terminating Volition singlemode or multimode cables, the send-and-receive fiber pairs shall be transposed between the MDF and the IDF such that a "send" fiber originating from the MDF shall be terminated on the "receive" fiber in the IDF.
b. Category 3 voice riser cables shall be terminated on 110-style, 300-pair blocks. These blocks shall be organized into field sections designated for voice and

"future" voice connections and further sub-divided by floor and by IDF as specifically shown in the Contract Documents.

c. Video riser cables shall be terminated as shown in the Contract Documents.

C. Cable Identification

1. All cables shall be labeled. The typed labels shall be legible, permanent and securely attached to the respective cable.
2. Vertical Riser Cable Labels
3. Labels shall be placed at the following locations
   a. Riser blocks and patch panels in the Router Room and in each MDF and IDF
   b. Six inches above the floor penetration in each MDF and IDF
   c. For optical fiber, labels shall be placed six inches before the service loops, six inches after the service loops, and six inches below the sleeve opening at the ceiling or from the wall.
4. Labels shall contain the following information
   a. Utility-management identifier (C&C)
   b. Building name (Kane)
   c. Origination MDF Room #/destination IDF Room #
   d. Cable pairs serving floors
   EXAMPLE: UW C&C/Kane/MDF 030/IDF 130/ 1-300

3.7 STATION CABLE PLANT

A. Cable Installation

1. Cable Routing
   a. 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).
   b. Stand off for cable pass through behind blocks

B. Cable Terminations

1. The exact position of voice, data, and video station termination hardware shall be based on a walk-through with the Owner's Representative prior to rough-in of the termination points. The Contractor shall request the meeting be arranged two weeks prior to needing the information that will be discussed in the walk-through.
2. Unless noted otherwise, termination hardware shall be grouped in rows and columns. No termination hardware shall be located closer than 12 inches from a corner. The top edge of the termination hardware shall be 62 inches above the finished floor. The termination hardware shall be grouped by application (i.e. voice and data), and arranged with from left to right, top to bottom. Adequate space shall be provided adjacent to voice and data termination hardware to allow for future growth.
3. Termination hardware space is allocated for each cabled communication outlet.
4. Termination Point Sequence
5. Voice Station Block

Voice #1 201.1V1

6. Data Station Patch Panel
   a. Data station cable shall be terminated left to right on a patch panel.
7. Refer to the Contract Documents for deviations from the standard sector sequence.

C. Outlet Device

1. Cable Termination at Workstation
   a. The standard communications cable bundle consists of three sheaths of unshielded twisted 4-pair cables (1 sheath of Category 5e for voice; 2 sheaths of Category 5e for data). Unless noted otherwise, this cable bundle shall be installed from each outlet location to the MDF and/or IDF designated in the Outlet Schedule.
   b. At the outlet location, approximately 6-9 inches of slack cable shall remain to facilitate servicing after the installation.
2. Standard Outlet Box
   a. The standard outlet box is a deep 4-inch by 4-inch by 2.125-inch flush-mounted electrical outlet box with a double gang mud-ring. This box houses three station termination devices and appropriate number of blanks: The voice outlet device is in the top left-hand position and the data devices are in the bottom left-most positions, as shown in a detail in the Contract Documents.
3. Surface Mounted Raceway (SMR) - Wiremold
   a. Applications in Wiremold SMR require (2) single-gang faceplates per workstation location. A 2-inch horizontal separation between adjacent faceplates shall be provided. In addition to divided Wiremold SMR, the communication system faceplate shall be offset from the power receptacle faceplate by 2 inches. Refer to additional assembly details in the Contract Documents for Wiremold SMR mounting configurations. Provide blank faceplate where communication outlet has not been activated with cable plant. All faceplates shall match color of new or existing SMR.
4. Surface Mounted Raceway (SMR) - Isoduct
   a. Applications in Isoduct SMR require factory-punched covers in lieu of faceplates. Where communication outlets are to be activated with cable plant, provide a factory-punched faceplate. Refer to additional assembly details in the Contract Documents for various Wiremold SMR mounting configurations. Provide blank covers where a communication outlet has not been activated with cable plant. All covers shall match color of new or existing SMR.
5. Furniture Outlets

   [**A&E: Provide device termination instructions for special situations (e.g., landscape furniture) shall be obtained from C&C and incorporated here.**]
   a. The Contractor shall terminate system furniture outlets after the completion of the furniture installation. Refer to the Contract Documents for details of this activation.
6. Wall-Mounted Telephone

a. The Contractor shall terminate cable in the prescribed wall outlet termination device.

7. Elevator Phone

[**A&E: Customize paragraph combining info from Section 16750, 1.9 and 2.9.7.**]

a. Opening in elevator cab shall accommodate phone unit specified in the Contract Documents.
b. Install per manufacturer's instructions.

8. Direct Connect Telephone without Light
   a. Telephone units are 8-1/2 inches wide by 11 inches high. Conduit enters through either the top or bottom edge of the unit. The unit shall be permanently secured to the wall surface.
9. Direct Connect Telephone with Light Phone
   a. Install per manufacturer's instructions.
10. Outdoor Weatherproof Phone
    a. Install per manufacturer's instructions.
11. Video Outlets
    a. For Video the manufacturer's instructions for installation shall be followed, including use of the appropriate specified crimp tool and die. Test the strength of both the pin and body crimp by manually pulling on the assembly and the cable.
12. Audio Outlets
    a. The audio cable wiring convention for XLR-3 connectors is

Pin 1	↔	Shield
Pin 2	↔	Positive "+" white or red
Pin 3	↔	Negative "-" black

13. Fire Alarm System
    a. Coordinate outlet requirements with fire alarm vendor. Terminate station cable per manufacturer's recommendations.
14. Card Access/Security/Monitoring/Debit Cards/A La Cards System
    a. Coordinate outlet requirements with equipment vendor. Terminate station cable per manufacturer's recommendations.
15. Building Automation System (BAS)
    a. Coordinate outlet requirements with equipment vendor. Terminate station cable per manufacturer's recommendations.
16. Utility Meter
    a. Coordinate outlet requirements with equipment vendor. Terminate station per manufacturer's recommendations.

D. Cable Identification

1. All station cables shall be labeled per the Contract Documents. Labels shall be typed in a permanent and legible fashion and securely attached. Cable shall be labeled in the MDF/IDF Rooms on the termination hardware at both ends. When the Contractor has been directed to install but not to terminate station cable, temporary labels shall be securely affixed to both ends of each cable identifying the cable per the Outlet Schedule.
2. Station Termination in MDF/IDF
   a. Copper Cable Labels

b. The outlet number shall be typed on the blue label strips affixed to each row of the station termination points.

1) Voice Station Block Example

237. 1	237. 2	238. 1	239. 1	239. 3	239. 4

2) Data Patch Panel Example

237. 1 D1	237. 2 D1	238. 1 D1	239. 1 D1	239. 3 D1	239. 4 D1
237. 1 D2	237. 2 D2	238. 1 D2	239. 1 D2	239. 3 D2	239. 4 D2

c. Optical Fiber Patch Panel Labels

1) Optical fiber station cable shall be terminated on optical fiber patch panels in the IDF and on faceplates at the station (refer to Section X). A label is provided on the face of the unit. The order of the cables shall be consecutive from top to bottom of unit, making sure that each label's port position coincides with each connector's port position.

d. CATV and Video/Audio Cable Labels

1) All installed CATV and Video/Audio cable shall be identified with unique numbers or characters attached to both ends of a run, six inches from each end. Cables shall be identified on the drawings by number and be described on a CATV/Video/Audio cable schedule as part of the Contract Documents.

3. Station Termination at Outlet Device

a. All faceplate identification shall be consistent with the numbers on the Outlet Schedule included in the Contract Documents. Document grid numbers are unacceptable. Owner-assigned room numbers shall be used.

b. As specified on the Construction Documents, all plastic faceplates shall be provided with a typed label securely attached to the faceplate indicating that location's ID number The Contractor 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.

c. Labeling

1) All faceplates shall be labeled. The typed labels shall be legible, permanent and securely attached to the respective faceplate. Position the room and outlet identifier at the top of the faceplate and the IDF room number at the bottom.

2) Departmentally-managed outlets in boxes and SMR shall be labeled as noted in the Contract Documents.

3.8 TESTING

A. General

1. Before requesting a final inspection, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms, and timetable. Owner's Representative shall be notified two weeks prior to any testing so that the testing may be witnessed.
2. Acceptance of the simple test procedures discussed below is predicated on the Contractor's use of the recommended products (including, but not limited to, twisted-pair, fiber and coaxial cable, and outlet devices specified in the Products paragraph), and adherence to the inspection requirements and practices set forth.
3. At a minimum, the Contractor shall test:
4. All outside plant cable from Router Room to MDF Rooms.
5. All cable from MDF termination points to MDF termination points.
6. All riser cable from MDF termination points to IDF termination points.
7. All station drop cable from IDF termination points to outlet device.

B. Outside Cable Plant Testing

1. Optical Fiber Cable
   a. The procedure for testing optical fiber cables requires the use of a high-quality OTDR (Optical Time-Domain Reflectometer) with the capability to record test data on a floppy/CD in non-proprietary standard format. The recorded data shall show besides summary information, the complete test trace and all relevant scale settings. The OTDR shall have the proper interface (patch cord) to test individual bare fiber strands on the cable reel (prior to installation) as well as SC-connector terminations.
   b. Each optical fiber strand shall be tested bi-directionally using the same patch cord for each outlet to keep readings consistent.
   c. Before installation, all optical fiber cable shall be tested on the reel to ensure that it meets the manufacturer's specifications.
   d. After installation, the Contractor shall test each fiber strand of singlemode at both 1310 nm and 1550 nm wavelengths and of multimode at both 850 nm and 1310 nm wavelengths to include:
      1) Continuity
      2) Length
      3) Total segment (end-to-end) loss (dB) from each end
   e. For optical fiber cable, acceptable connector loss shall not exceed 0.4 dB.
   f. If loss is greater than 0.4 dB, check connector for proper buffing or contaminants before retesting.
   g. If the source of high loss is the SC to SC interface and it cannot be corrected, verify that the fault does not lie with the patch cord.
   h. When loss is greater than 0.75 dB, replace the SC.
   i. If any fractures, no matter how small, are detected during examination of the fiber in the SC, the SC shall be replaced.
   j. Each optical fiber strand shall be tested bi-directionally using a power meter and light source to verify proper strand/patch panel port position.

C. Riser Cable Testing

1. Optical Fiber Cable
   a. The procedure for testing optical fiber cables requires a Volition power meter and light source with the capability to record test data on a floppy/CD in non-proprietary standard format. A hard copy of the test results on floppy/CD shall be provided to the Owner including link loss and a reference reading. The power meter and light source shall have the proper interface (patch cord) to test socket connector terminations.
   b. Each optical fiber strand shall be tested using the same patch cord for each port to keep readings consistent.
   c. Before installation, all optical fiber cable shall be tested on the reel using an OTDR (Optical Time Domain Reflectometer) to ensure that it meets the manufacturer's specifications.
   d. After installation, the Contractor shall test each fiber strand at both 850 and 1300 nm wavelengths to include:
      1) Continuity
      2) Length (calculated from difference between footage markers on cable)
      3) Total segment (end-to-end) loss (dB) at each end
   e. Riser cable shall be tested bi-directionally.
   f. Acceptable connector loss shall not exceed 0.4 dB.
      1) If loss is greater than 0.4 dB, check connector for proper buffing or contaminants before retesting.
      2) If the source of high loss is the socket to socket interface and it cannot be corrected, verify that the fault does not lie with the patch cord.
      3) When loss is greater than 0.75 dB, replace the socket.
      4) If any fractures, no matter how small, are detected during examination of the fiber in the SC, the SC shall be replaced.
2. Twisted-Pair Voice Cable
   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 blocks.
   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.

D. Station Cable Testing

1. Voice and Data
   a. All testing shall be done using the permanent link parameters.
   b. 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 100% of all station cable.

c. Test results shall meet or exceed the performance test requirements as specified in the current ANSI/TIA/EIA specifications.
d. Provide 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 on IBM formatted 3.5 inch disks or archived on to a CD-ROM. Test results shall be submitted and approved prior to substantial completion and final payment approval.
e. Special Case: Wall-mounted phone unit locations: These are pre-assembled with a Cat 3 jack, therefore test to Cat 3 standards for continuity, polarity and loss.

2. CATV (Broadband) Distribution System Testing
   a. The Contractor shall conduct witnessed acceptance tests on the complete CATV distribution system including all cable and all passive and active devices. Overall the system shall provide a Carrier/Noise ratio of >43 dB and a minimum signal level (at each jack) of +7 dBmV. Details of the methods which shall be followed in conducting the acceptance testing can be found in the current edition of the NCTA (National Cable Television Association) Recommended Practices for CATV Measurement. The Contractor shall perform the following tests on the completed distribution system.
   b. All coaxial cable shall be sweep tested after installation for opens, shorts, and kinks with a Time Domain Reflectometer (TDR). Damaged sections shall be replaced by pulling a new cable. Indicate on the floor plans the actual length of each cable section as installed.
   c. NCTA Standard Broadcast Sweep (40 to 870 MHz) tests shall be performed on the broadband system in the following manner
      1) Conduct a signal sweep test from the input side of the building distribution amplifier to the output side of the last amplifier in the riser stack.
      2) After the sweep of the riser system is completed and the building system is balanced, a sweep shall be performed from the input to the building distribution amp to the most distant jack on each floor at the output. An additional sweep shall be performed on the return system from the most distant jack on each floor at the input to the headend at the output. The Frequency Response of the installed and operating system should fall within N/10+2 where N is the number of trunk amps and distribution amps in cascade.
   d. Visual Carrier/Noise (C/N) shall be measured over the system from the input of the distribution amp to the output of the most distant CATV jack in the building. The test procedure shall be as outlined in the NCTA. Minimum C/N specifications are no less than 43 dB.
   e. Each and every CATV jack installed as part of this system shall output a minimum signal per channel of +7 dBmV into 75 Ohms.
   f. The signal at each CATV jack shall be free of additional noise and distortion as judged by Owner's Representative. The Contractor shall demonstrate (using Sencore Channelizer FS 74 or similar device) that the signal at each jack conforms to the quality standard specified by Owner. If excessive noise is present, the Contractor shall either resolve the problem or demonstrate the problem is not caused by the video distribution system installed as part of this Project. At a minimum, the following tests may be required to demonstrate the origin of the problem;

1) Modulation distortion at power frequencies
2) Composite third order distortion for CW and modulated carriers
3) Carrier to second order beat ratio
4) Complete Frequency Response testing using the NCTA guidelines

3. Video (Baseband) Distribution System Acceptance Testing
   a. The Contractor shall conduct witnessed acceptance tests on the complete baseband video distribution system. Overall the installed system shall meet EIA RS-250C for short haul video systems. The Contractor as part of the acceptance procedure shall perform the following tests on the completed video system:
   b. All coaxial cable shall be sweep tested after installation for opens, shorts, and kinks with a Time Domain Reflectometer (TDR). Damaged sections shall be replaced by pulling a new cable. Indicate on the floor plans the actual length of each cable section as installed.
4. Audio (Baseband) Distribution System Acceptance Testing
   a. The Contractor shall conduct witnessed acceptance tests on the complete baseband audio distribution system. The Contractor, as part of the acceptance procedure, shall perform the following on the completed audio system.
   b. All audio cable shall be tested after installation for opens and shorts among all conductors of each audio cable. Damaged sections shall be replaced by pulling a new cable. Indicate on the floor plans the actual length of each cable section as installed.

E. Defects

1. When errors are found, the source of each error shall be determined and corrected and the cable retested.
2. All defective components shall be replaced and retested following the procedure described above.
3. A list shall be submitted for University approval of any defective components that the Contractor is unable to correct with a detailed explanation and alternative proposals.

F. Test Records

1. 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 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.

END OF SECTION 27 15 00