PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Interbuilding Copper Cable

B. Copper Riser Cable

C. Copper Station Cable

D. Interbuilding Fiber Optic Cable

E. Fiber Optic Riser Cable

F. Fiber Optic Station Cable

G. Coaxial Riser Cable

1.2 RELATED SECTIONS

A. Contract General Conditions, Supplemental General Conditions, Special Conditions and Contract Terms

B. Section 16710 - Telecommunications General Requirements

C. Section 16715 - Acceptance Testing

D. Section 16720 - Basic Materials and Methods

E. Section 16730 - Underground Structures - Telecommunications

F. Section 16740 - Building (RF) CATV System

G. Section 16760 - Telecommunications Grounding and Bonding

1.3 APPLICABLE PUBLICATIONS

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

1.4 SUBMITTALS

The Contractor shall submit the following materials to the University prior to the placement of cable:

A. Product data, including both product construction and performance specifications, for each type and configuration of cable to be supplied. In addition, the Contractor shall provide product data and installation instructions for all firestopping, sealant materials and cable storage enclosures.

B. Comprehensive Cable Pulling Plan - This plan shall provide a well coordinated plan for interfacing the outside plant installation with the establishment of intrabuilding facilities being construction to receive the outside plant cabling.

C. Proof of Telecommunications Structured Cabling System certification.

D. Copies of signed optical cable reel tests.

PART 2 - MATERIALS

The products listed in this section represent the standards for materials, workmanship, and performance for a CSU project. Individual campuses may have specific requirements that shall supersede the products in these standards. All cable must be manufactured by an ISO9001 Certified Manufacturer.

2.1 INTERBUILDING COPPER CABLE (GEL-FILLED)

A. Material

(1) Application: Use for outside conduit and direct buried applications.

(2) Compliance: REA Specification PE-39.

(3) Core Construction

(a) Conductors: Solid, annealed copper, 24 AWG unless noted on design documents.

(b) Insulation: Solid, high density polyethylene, color coded in accordance with telephone industry standards.

(c) Twisted Pairs: Insulated conductors twisted into pairs with varying lay lengths to minimize crosstalk. Standard capacitance of 83 to 87 nanofarads per mile and a staggered twist design.

(d) Core Assembly: Cables of 25 pairs and less formed by assembling pairs together in a single group. Cables of more than 25 pairs formed by twisted pairs arranged in groups with each group having a color coded unit binder.

(e) Filling Compound: Core assembly completely filled with ETPR compound, filling the interstices between the pairs and under the core tape.

(f) Core Wrap: Non-hygroscopic dielectric tape applied longitudinally with an overlap.

(4) Qualpeth Sheath

(a) Aluminum Shield: Corrugated, copolymer coated, .008” aluminum tape applied longitudinally with an overlap. The sheath interfaces are flooded with an adhesive water blocking compound.

(b) Jacket: Black, linear low density polyethylene.

(5) Cable sizes defined in design documents.

B. Manufacturer: SCS Supplier’s Standard.

2.2 COPPER RISER CABLE

A. Material – Riser Rated

(1) Application: Use for placement in vertical risers in buildings and in general horizontal applications within buildings.

(2) Compliance: Bellcore Specification TS-TSY-000111, UL Listed Type MPR/CMR

(3) Core Construction

(a) Conductors: Solid-copper conductors, 24 AWG.

(b) Insulation: Dual insulation consisting of an inner layer of foamed polyolefin surrounded by a solid PVC skin, color coded in accordance with telephone industry standards.

(c) Twisted Pairs: Insulated conductors twisted into pairs with varying lay lengths to minimize crosstalk.

(d) Core Assembly: Cable cores made up of 100 pair super-units consisting of four (4) 25 pair sub-units. Each group individually identifiable by color coded unit binders. Each 25 pair-unit within the 100 pair super-unit identified with a different binder color

(e) Core Wrap: Non-hygroscopic dielectric tape applied longitudinally with an overlap.

(4) Alvyn Sheath

(a) Aluminum Shield: Corrugated, adhesive coated, 0.008” aluminum tape applied longitudinally with an overlap.

(b) Jacket: Gray, flame retardant PVC jacket bonded to the coated aluminum.

Cable sizes defined in Contract Documents.

B. Material – Plenum Rated Riser

(1) Application: Use for placement in vertical and horizontal risers in buildings and in general horizontal applications within buildings where riser cable pathway is in open cable tray.

(2) Compliance: Bellcore Specification TS-TSY-000111, UL Listed Type MPR/CMR

(3) Core Construction

(a) Conductors: Solid-copper conductors, 24 AWG.

(b) Insulation: Dual insulation consisting of an inner layer of foamed polyolefin surrounded by a solid PVC skin, color coded in accordance with telephone industry standards.

(c) Twisted Pairs: Insulated conductors twisted into pairs with varying lay lengths to minimize crosstalk.

(d) Core Assembly: Cable cores made up of 100 pair super-units consisting of four (4) 25 pair sub-units. Each group individually identifiable by color coded unit binders. Each 25 pair-unit within the 100 pair super-unit

identified with a different binder color. (Note: "PIC MIRROR IMAGE" multi-unit identification used in cables over 900 pairs.)

(e) Core Wrap: Non-hygroscopic dielectric tape applied longitudinally with an overlap.

(4) Alvyn Sheath

(a) Aluminum Shield: Corrugated, adhesive coated, 0.008" aluminum tape applied longitudinally with an overlap.

(b) Jacket: Gray, flame retardant whiter low smoke PVC jacket bonded to the coated aluminum.

C. Manufacturer: SCS Supplier Standard

2.3 COPPER STATION CABLE

A. Material – plenum rated

(1) Use for voice applications to interconnect services from workstation to the wiring closet in all plenum rated spaces.

(2) CMP/MPP rated.

(3) Four pair, 24 AWG, Category rated UTP provided in accordance with Specification Section 16720 paragraph 2.1.B, as defined by the EIA/TIA standards intended for use with minimum transmission rates of 100 Mbps.

B. Material – Outdoor rated

(1) Use for voice applications to interconnect services from workstation to the wiring closet for runs requiring "outdoor rating".

(2) Outdoor rated PE with floodant. (Outdoor rating only required where indicated in the plans. Where cable path enters building to reach wiring closet cable shall be continually in EMT conduit.

(3) Four pair, 24 AWG, Category rated UTP provided in accordance with Specification Section 16720 paragraph 2.1.B, as defined by the EIA/TIA standards intended for use with minimum transmission rates of 100 Mbps.

C. Manufacturer: SCS Supplier Standard, Plenum UL Verified Category-rated cable as meeting the performance specifications consistent with the rating level identified in Section 16720, paragraph 2.1.B.

2.4 INTERBUILDING FIBER OPTIC CABLE (MULTIMODE)

A. Materials

(1) Application: Use for placement in outside plant conduit between buildings.

(2) Compliance: Meet or exceed ANSI/EIA/TIA-492 AAAA specifications and characteristics listed below.

(3) Characteristics

(a) Water exclusion gel-filled

(b) Dielectric

(c) Loose tube construction

(d) 50/125 µm (core/cladding) dual window (850 and 1300 nanometers)

(e) Maximum attenuation: 3.50 dB/km @ 850 nm and 1.5 dB/km @ 1300 nm

(f) Minimum bandwidth: 500 MHz/km @ 850 and 500 MHz/km @ 1300 nm

(g) .275 numerical aperture

(h) Minimum pulling tension of 600 lbs.

(i) Equipped with a breakout, furcation, or blocking kit to dress the end of the cable and eliminate the flow of fill compound

B. Manufacturer: SCS Supplier's Standard

2.5 INTERBUILDING FIBER OPTIC CABLE (SINGLEMODE)

A. Materials

(1) Application: Use for placement in outside plant conduit between buildings.

(2) Compliance: Meet or exceed ANSI/EIA/TIA-492 AAAA specifications and characteristics listed below.

(3) Characteristics:

(a) Water exclusion gel-filled.

(b) Dielectric.

(c) Loose tube construction.

(d) 9/125/250 µm (core/cladding/protective coating) dual window (1300 and 1550 nanometers)

(e) Maximum attenuation: .4 dB/km @ 1310 nm and .3 dB/km @ 1550 nm

(f) Maximum dispersion (1285 to 1330 nanometers): 3.5 ps/(nm/km)

(g) Zero dispersion slope (1300 - 1322 nm): -0.095/(nm2/km)

(h) Minimum pulling tension of 600 lbs.

(i) Equipped with a breakout, furcation, or blocking kit to dress the end of the cable and eliminate the flow of fill compound.

B. Manufacturer: SCS Supplier's Standard

2.6 INTERBUILDING FIBER OPTIC CABLE (COMPOSITE)

A. Materials

(1) Application: Use for placement in outside plant conduit between buildings.

Or

(2) Application: Indoor/outdoor cable applied specifically where indicated in the construction plans meeting OFNR requirements.

(3) Compliance: Meet or exceed ANSI/EIA/TIA-492 AAAA specifications and characteristics listed below.

(4) Characteristics - Cable

(a) Combined multimode fibers and singlemode fibers under one cable sheath

(b) Water exclusion gel-filled

(c) Dielectric

(d) Loose tube construction

(e) Minimum pulling tension of 600 lbs.

(f) Equipped with a breakout, furcation, or blocking kit to dress the end of the cable and eliminate the flow of fill compound

(4) Characteristics - Multimode Fibers

(a) 50/125µm (core/cladding) dual window (850 and 1300 nanometers)

(b) Maximum attenuation: 3.5 dB/km @ 850 nm and 1.5 dB/km @ 1300 nm

(c) Minimum bandwidth: 500 MHz/km @ 850 and 500 MHz/km @ 1300 nm

(d) .275 numerical aperture

(5) Characteristics - Singlemode Fibers

(a) 9/125/250 µm (core/cladding/protective coating) dual window (1300 and 1550 nanometers)

(b) Maximum attenuation: .4 dB/km @ 1310 nm and .3 dB/km @ 1550 nm

(c) Maximum dispersion (1285 to 1330 nanometers): 3.5 ps/(nm/km)

(d) Zero dispersion slope (1300 - 1322 nm): -0.095/(nm2/km)

C. Manufacturer: SCS Supplier’s Standard

2.7. FIBER OPTIC RISER-RATED CABLE (MULTIMODE)

A. Materials – riser rated

(1) Application: Use for placement in vertical riser backbone within buildings.

(2) Compliance: Meet or exceed ANSI/ICEA S-83-596 per requirements of ANSI/TIA/EIA-568A specifications and characteristics listed below.

(3) Characteristics

(a) OFNR/FT4 rated for riser applications

(b) Dielectric strength member

(c) Tight buffer design

(d) 50/125 µm (core/cladding) dual window (850 and 1300 nanometers)

(e) Maximum attenuation: 3.5 dB/km @ 850 nm and 1.5 dB/km @ 1300 nm

(f) Minimum bandwidth: 500 MHz/km @ 850 and 500 MHz/km @ 1300 nm

(g) .275 numerical aperture

(h) Minimum pulling tension of 600 lbs.

(4) Equipped with a breakout, furcation, or blocking kit to dress the end of the cable and eliminate the flow of fill compound

B. Materials – plenum rated

(1) Application: Use for placement in vertical riser backbone within buildings in open cable tray.

(2) Compliance: Meet or exceed ANSI/ICEA S-83-596 per requirements of ANSI/TIA/EIA-568A specifications and characteristics listed below.

(3) Characteristics

(a) OFNP/FT4 rated for plenum applications

(b) Dielectric strength member

(c) Tight buffer design

(d) 50/125 µm (core/cladding) dual window (850 and 1300 nanometers)

(e) Maximum attenuation: 3.5 dB/km @ 850 nm and 1.5 dB/km @ 1300 nm

(f) Minimum bandwidth: 500 MHz/km @ 850 and 500 MHz/km @ 1300 nm

(g) .275 numerical aperture

(h) Minimum pulling tension of 600 lbs.

(4) Equipped with a breakout, furcation, or blocking kit to dress the end of the cable and eliminate the flow of fill compound

C. Manufacturer: SCS Supplier's Standard

2.8 FIBER OPTIC RISER RATED CABLE (SINGLEMODE)

A. Materials

(1) Application: Use for placement in vertical riser backbone within buildings.

(2) Compliance: Meet or exceed ANSI/ICEA S-83-596 per requirements of ANSI/TIA/EIA-568A specifications and characteristics listed below.

(3) Characteristics

(a) OFNR/FT4 rated for riser applications

(b) Dielectric strength member

(c) Tight buffer design

(d) 9/125/250 µm (core/cladding/protective coating) dual window (1300 and 1550 nanometers)

(e) Maximum attenuation: .4 dB/km @ 1310 nm and .3 dB/km @ 1550 nm

(f) Maximum dispersion (1285 to 1330 nanometers): 3.5 ps/(nm/km)

(g) Zero dispersion slope (1300 - 1322 nm): -0.095/(nm2/km)

(h) Minimum pulling tension of 600 lbs.

(i) Equipped with a breakout, furcation, or blocking kit to dress the end of the cable and eliminate the flow of fill compound

B. Manufacturer: SCS Supplier's Standard.

2.9 FIBER OPTIC RISER CABLE (COMPOSITE)

A. Materials

(1) Application: Use for placement in vertical riser backbone within buildings.

(2) Compliance: Meet or exceed ANSI/ICEA S-83-596 per requirements of ANSI/TIA/EIA-568A specifications and characteristics listed below.

(3) Characteristics - Cable

(a) OFNR/FT4 rated for riser applications

(b) Dielectric strength member

(c) Tight buffer design

(d) Minimum pulling tension of 600 lbs.

(4) Characteristics - Multimode

(a) 50/125 µm (core/cladding) dual window (850 and 1300 nanometers)

(b) Maximum attenuation: 3.5 dB/km @ 850 nm and 1.5 dB/km @ 1300 nm

(c) Minimum bandwidth: 500 MHz/km @ 850 and 500 MHz/km @ 1300 nm

(d) .275 numerical aperture

(5) Characteristics - Singlemode

(a) 9/125/250 µm (core/cladding/protective coating) dual window (1300 and 1550 nanometers)

(b) Maximum attenuation: .4 dB/km @ 1310 nm and .3 dB/km @ 1550 nm

(c) Maximum dispersion (1285 to 1330 nanometers): 3.5 ps/(nm/km)

(d) Zero dispersion slope (1300 - 1322 nm): -0.095/(nm2/km)

B. Manufacturer: SCS Supplier's Standard

3 FIBER OPTIC STATION CABLE

A. Not used

4 FIBER OPTIC STATION CABLE

A. Not used

5 COAXIAL RISER CABLE

A. Materials

(1) Application: Use for placement between IDFs on separate floors to distribute RF television signals.

(2) Compliance: Meet or exceed NEC specifications and characteristics listed below.

(3) Characteristics

(a) RG-11coaxial cable, riser-rated (CATVR) unless placed in an open cable tray in a plenum space (plenum-rated (CATVP)

(b) 75 ohm, foamed Teflon dielectric cable

(c) Support frequencies between 5 - 1000 MHz

(d) Nominal attenuation not to exceed 4.31dB per 100 feet at 1000 MHz

(e) Capacitance 16.4 pF/ft $\pm$ .5 pF/ft.

(f) Impedance 75 ohms $\pm$ 3 ohms

B. Manufacturer: Comm/Scope, Belden, or approved equivalent.

6 CROSS CONNECT WIRE

A. All wire shall be solid 24 AWG – Category 5 and supplied in reels of 1000 feet. Contarctor shall provide, install and test all system cross connects except the final cross connect from the main termination field for outside plant cable to the Ericson LIM cross connect fields in the Siemens Hall and Natural Resources MDF locations.

B. Contractor shall provide 10 reels of cross-connect wire at the Siemens Hall and Natural Resources MDF locations. Wire color shall be as specified by the Campus.

C. Manufacturer: SCS Supplier standard equivalent to campus standard wire identified above.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. All installation work shall be performed according to *published* industry guidelines, rules, and regulations. If disputes occur, local, state, and national codes have precedence; then CSU polices and procedures; then standards such as EIA/TIA; then guidelines from firms such as Building Industry Consulting Services International (BICSI), AT&T, GTE, Structured Cable System Installation Requirements; then finally, manufacturer recommendations.

B. The Contractor shall prepare and submit for approval a “cable pulling plan”. This plan should coordinate the outside plant cable installation with the Contractor’s plans for establishing Building Service Entrances and Building Distribution Frames. Contractor shall refer to the interbuilding fiber and copper plans and associated manhole butterfly diagrams. These are provided as the criteria for utilizing new and existing duct bank capacity and maintaining desired spare capacity for the future. Should any pulling combination of the high-count copper interbuilding cabling be determined by the Contractor to be unfeasible due to site conditions or conflicts with manufactures recommendations, Contractor should make the University aware of this prior mobilizing cable installation crews and resolve this with the University Construction Administrator.

C. The Contractor shall provide sufficient trained staff to monitor all work undertaken and ensure that the requirements of these specifications are met throughout the installation process.

D. All tests will be conducted using equipment that has Laboratory or manufacturer certified calibration within six months of the tests. The Contractor shall provide a signed copy of the calibration test results for each item of test equipment with the acceptance documentation.

E. All installation work will be of the highest quality. The Contractor shall at all times make every effort to conduct all installation work in a manner so as to minimize the impact on the facilities, including hardscape and planted areas. Whenever possible, all work will be hidden behind finished materials and all surfaces will be returned to their original condition.

F. The Contractor shall provide and install all pathway and cable support hardware necessary to successfully complete the installation. This includes, but is not limited to, hangers, ladder racks, support brackets, conduit and sleeves, firestop materials, tie-wraps, and access openings such as core drills.

G. The Contractor shall ensure that only staff fully qualified to work on specific types of materials are allowed to undertake the required installation. Particularly, copper and fiber optic cable placement, termination, splicing, and testing shall only be undertaken by staff who are certified by the Structured Cabling System cable manufacturer.

H. The Contractor shall provide all hardware, software, and miscellaneous components necessary to provide a complete system.

I. The Contractor and Construction Administrator shall coordinate cutover schedules prior to installation. The work will be scheduled so that the voice and data networks will be out of service for a minimum period of time.

3.2 INTERBUILDING COPPER CABLE

A. The interbuilding cables shall be installed according to the Structured Cabling System manufacturer's procedures, by certified personnel.

B. Cables shall be routed in such a manner as to allow other maintenance activities to occur without damage to the cable. All cables in vaults shall be routed as close to walls as possible to reduce accidental damage. Cable routed through manholes shall be attached to the cable rack supports using "L" cable rack supports.

C. All cable runs installed in conduit or duct banks shall include a nylon pull cord (1/4 inch), tied off at each end of run, unless the conduit is full. A nylon or polyethylene pulling line shall be used in all fiber optics raceways. The pull cord shall be clearly labeled as "pulling line," indicating source and destination.

D. Placement of cable in individual conduits shall be determined by the Contractor and Construction Coordinator to ensure the best utilization of the distribution space. All conduits shall be pulled as full as possible without damage to the cable. All cables shall be secured to the wall of the building entry rooms , vaults, manholes, pull boxes, etc. using "L" cable rack supports.

E. All cables shall be clearly labeled with cable number (campus to determine scheme) and size at each end of the cable, when it enters or leaves a conduit, and at 30 foot intervals when run in accessible areas such as tunnels, manholes, ceilings, etc.

F. All cables shall be placed using swivel pulling eyes to reduce cable coils.

G. All cables shall be routed with wide sweeps without bends or kinks in the cable or sheath. The minimum bending radius for all cable is sixteen (16) times the cable diameter or manufacturer's specifications, whichever is greater.

H. Cuts and abrasions that penetrate the outer sheath of the cable shall be identified and immediately to the Construction Administrator by the Contractor. The Trustees/University reserves the right to determine whether the cable shall be repaired or replaced, and, specifically, the method of repair, if permitted. Decisions regarding the suitability of cables damaged during placement will be the responsibility of the CSU Construction Administrator and the Architect. This also applies to any existing cable that the Contractor may damage while accomplish his installation. The Trustees/University reserves the right to request complete replacement of the damaged cable by the Contractor.

I. All cable shields shall be bonded end-to-end and grounded per AT&T/Lucent Technologies Telecommunications Electrical Protection Specification.

J. Filled cables shall be spliced into shielded protector tails. Cable splices shall be attached to walls using "B" cable rack and "L" cable rack supports. Splices shall be properly secured to the "L" support preventing detachment by external forces. Cable splices in telecommunication rooms may be placed in horizontal ladder rack in a manner with

adequate maintenance space provided. Terminations shall be dressed and mounted to eliminate the movement of gel compound.

K. Entrance Cables

(1) To prevent shear, all conduit entering a building shall transition from PVC to metal or shall be contained in a metal sleeve from a distance of 24 inches beyond the exterior of the foundation to six inches within the building. These conduits shall slope downward away from the building to reduce the potential of water entering the building. Spare innerduct will be placed to fill the conduit to ensure maximum utilization of the conduit.

(2) A separate conduit with innerduct shall be used for fiber optic and coaxial cables.

(3) Cables shall not penetrate more than 50 feet (except in metallic conduit) before a conversion splice is made to fire resistant type cable (ARMM).

(4) Filled cable shall not be terminated on 110 hardware without a transition splice to fire resistant type cable (ARMM) or tip cables.

(5) All entrance cables and protectors shall be grounded per and have continuous sheath continuity.

L. All installed empty conduits shall be plugged with a neoprene or rubber duct plug to prevent water and/or gas seepage into a building or manhole. Conduit containing cable will be filled with the appropriate compound.

M. No splices shall be made in the installed interbuilding copper cable except where noted in the construction documents. Any other splice must have the approval of the Project Manager.

3.3 COPPER RISER CABLE

A. All riser cables shall be installed in a neat and orderly manner that provides the maximum amount of room for future cable additions. All riser conduits shall be pulled as full as possible while segregating fiber from copper cabling. All cables shall be supported on each floor using at least three straps (not more than 30 inches apart) per floor. Riser cable shields shall be grounded on any floor in which pairs enter or leave the sheath. All shields shall be bonded end-to-end.

B. All riser conduits shall be sealed using a UL classified firestop. The Contractor shall provide a copy of the fire seal manufacturer's installation instructions and rating information prior to inspection of the installed materials.

3.4 COPPER STATION CABLE

A. All station cables shall be neatly dressed, secured, and concealed throughout the installation. Cables shall be secured with velcro straps to a snug fit but shall not deform the cable geometry. Ties shall be of a plenum-rated material if cable is installed within a plenum ceiling space.

B. All station cables shall be secured a minimum of six (6) inches above the ceiling T-bar grid. Ceiling grid supports, electrical conduit, water pipes, and HVAC ducting may not be used to support cables. No more than 12 individual cables will be secured to a single ceiling hanger without the use of a two-inch wide saddle to eliminate strain on individual

cables. Cables shall not be placed within 24 inches of overhead lights or any other potential source of electrical interference.

C. In any area in which a fire-rated wall, partition, floor, or ceiling is penetrated, the Contractor shall be responsible for creating the pathway and sealing around all cables and sleeves with a UL classified fire seal sufficient to return the structure to its original rating. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of the Contractor. Any opening in a rated structure created by the Contractor that is larger than one inch in diameter shall be equipped with a metal sleeve secured and fire-stopped in place.

D. In station locations with walls that must be fished, the Contractor shall place a plaster wall retaining ring or metal supporting "ears" around the outlet location to secure the outlet and faceplate. No exposed cable shall be permitted.

E. In locations where the wall will not be fished and surface-mount raceways are utilized, all raceways must be mechanically secured to the structure a minimum of every four feet, must be routed at right angles to nearby structures or wall corners, and shall be neatly installed and trimmed to fit into and around other existing moldings or pathways such as the ceiling area. Raceways shall be placed vertically only in corners of rooms and horizontal raceway placed at baseboard height to extend the cable run to the actual outlet location.

F. All station cables shall be placed with a 1 meter maintenance loop (slack cable) neatly coiled in a figure-eight configuration and secured in the ceiling space above the BDF and IDF terminals to allow for future rearrangement.

G. All station cables shall be placed with a 1 foot slack at the outlet location in the outlet box where boxes are used or in the wall where cables are fished and retaining rings are utilized.

H. The Contractor is responsible for removing, replacing, and repairing ceiling tiles in order to route all cables. Concealed spline ceiling tiles shall not be replaced until installation work in that area has been inspected and reviewed with campus personnel and approval given to re-fix the ceiling in place.

I. Voice station cables shall be terminated on insulated displacement hardware (SCS Standard 110 blocks) and shall be clearly marked with a unique identification number following the campus standard.

J. Data and network station cable shall be terminated on 110 blocks and shall be clearly marked with a unique identification number following the campus standard.

3.5 INTERBUILDING FIBER OPTIC CABLE

A. All fiber cable will be pre-tested by the manufacturer, before shipping, to guarantee there are no defective fibers. These cables shall be re-tested, on the reels, before installation to ensure no damage occurred during shipping using an approved OTDR. Test traces shall be provided to the campus for verification.

B. No splices shall be made in the installed fiber optic cable except where noted in the construction documents. Any other splice must have the approval of the Construction

Administrator. Any splices allowed must be fusion splices, and splice loss must not exceed .2dB at 1300 nm.

C. All splices must be fusion splices, any pigtails used must be tight buffered Kevlar, and splice loss must not exceed .2dB at 1300 nm.

D. All fiber optic cable slack must be coiled and securely mounted to the wall in a manner that will prevent physical damage.

E. All cables (and panels) must be clearly identified. All labels will be securely attached to each end of the cable whenever it enters or leaves a conduit and at 30 foot intervals when run in accessible areas such as tunnels, manholes, ceilings, etc. Labels shall use the University's approved cable/optic numbering system.

F. Interbuilding fiber optic cable shall be placed within innerduct unless otherwise noted. All fiber optic cable installed within a tunnel shall be placed in innerduct that is secured every six feet or is placed within the cable tray.

G. Direct termination of the interbuilding fibers is recommended; however, if pigtail splices are used (requires campus approval), the terminating patch panels must provide adequate enclosed splice trays to secure the splices.

H. The Contractor shall ensure proper placement and pulling techniques are employed throughout the installation and testing of this cable. All fiber optics cables shall be continuously lubricated during the pulling-in process. Breakaway swivel grips shall be used to reduce coiling of cable during the pull and to limit the potential of exceeding the stated pulling tension. Any observed bending of fiber cable during and after the installation that exceeds the manufacturer's recommended bending radius shall be cause for complete replacement of that cable by the Contractor.

I. All fiber must be terminated in a patch panel with SC style connectors. Fiber shall be terminated in patch panels in order of standard industry numbering/color coding (left-to-right / top-to-bottom). Field termination kits shall be utilized for all fiber terminations and shall be properly secured and protected from mechanical damage.

J. Three meters slack cable shall be provided in each fiber termination unit (patch panel) prior to terminating the cable on connectors. The amount of cable should comply with the manufacturer's requirements that are specified for the fiber termination unit.

K. At least 10 meters of cable (maintenance loop) neatly coiled and secured to the wall is required at each end of the fiber optic run. Slack cable shall be permanently stored in fiber optic cable storage enclosure designed specifically for the purpose.

3.6 FIBER OPTIC RISER CABLE

A. The fiber riser and horizontal tie cables, as defined in the drawings, and shall be continuous (no splices) end-to-end.

B. A total of fifteen (15) feet of slack (in each closet) shall be provided for each cable, and the slack shall be coiled and secured to the wall.

C. The Contractor shall install the fiber optic riser cables within a single 4" conduit in the riser pathway.

D. All cables (and panels) must be clearly identified at both ends with a unique cable/optic numbering system. The number system must be coordinated with the Construction Administrator.

E. All cables shall be installed using the Structured Cabling System manufacturer's procedures, tools, and equipment and must be protected from physical damage. All fiber cables must be installed so as to protect the optical fibers and connectors from strain and physical damage. The minimum bending radius must not be exceeded during cable placement.

F. All riser cables shall be supported with strain relief on each floor. All exposed cables shall be contained in an orange innerduct clearly labeled "Fiber Optic Cable."

3.7 FIBER OPTIC STATION CABLE

A. Not used.

3.8 COAXIAL RISER CABLE

A. The Contractor shall install the coaxial riser cables within a single 4" conduit in the riser pathway (sleeves only).

B. All cables, devices, and equipment must be clearly identified using the University's labeling plan.

C. All cables shall be installed using published industry standard procedures, tools, and equipment and must be protected from physical damage. The minimum bending radius must not be exceeded during cable placement.

D. Proper connect tools must be utilized. "Quick connect" connectors will not be allowed.

3.9 COAXIAL STATION CABLE

A. not used.

- END -