PART 1 - GENERAL

1.01 DESCRIPTION
A. Telecommunications systems shall be provided as indicated on drawings and as called for hereinafter.

1.02 REFERENCE STANDARDS
C. ANSI/NECA/BICSI-568, Standard for Installing Commercial Building Telecommunications Cable.
D. ANSI/TIA 569-C, Pathways and Spaces.
E. ANSI/TIA 568-C.0, Generic Telecommunications for Customer Premises Standard Series
   568-C.1 Commercial Building Cabling
   568-C.2 Copper Cabling Components
   568-C.3 Fiber Cabling Components
   568-C.4 Coax Cabling Components
F. ANSI/TIA 606-B, Addendum 1, Administration Standard for Commercial Telecommunications Infrastructure.
G. ANSI J-STD-607-B, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
H. ANSI/TIA 758-B, Customer owned Outside Plant Telecommunications Cabling Standard
I. ANSI/TIA-526, 7&14, Telecommunications Measurements of Optical Fiber Single and Multi Mode Power Loss
K. ANSI/TIA 310-D, Cabinets, Racks, Panels, and Associated Equipment.
L. FCC Part 68, Connection of Terminal Equipment to the Telephone Network.
M. ADA of 2010 and Telecommunications Act of 1996, Physically Impaired and Accessibility.
O. IEEE 8-2.11.xx Wireless LAN’s
S. ETA Electronic Technician Association Fiber Optics Installer
T. FOA Fiber Optics Association Certified Fiber Optics Technician
U. ANSI/SCTE 77 Underground Enclosure Integrity

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION
A. Furnish and install telecommunications outside plant (OSP) facilities as indicated on drawings and set forth hereinafter.

1.2 REFERENCE STANDARDS
A. See section 27.01.00 REFERENCE STANDARDS.

PART 2 - PRODUCTS

2.01 MATERIALS
A. Inner Duct: MaxCell 3x3 (MXD3456), locatable for OSP, with color ID.
B. Fiber Optic OSP Cable: Single Mode – Corning Altos OS2 XXXEU4-T4101D20(black); Multimode (50um) - Corning Altos OM3 XXXTU4-T4180D20 (black); Multimode (62.5um) Corning Altos OM1 XXXKU4-T4130D20 (black); XXX=strand count.
C. Handholes - Handhole lids shall be traffic rated (AASHTO H-20) with "Communications" logo on cover of lid.

PART 3 - EXECUTION

3.01 INSTALLATION
A. Provide two (2) 3x3 "MaxCell" innerducts in one of the 4" conduits entering building from OSP system. Provide conduits over 1” not filled with MaxCell, install 3/8” nylon rope with a pull rating of 200lb or more. Conduits 1” or less, fill with polyline (Greenlee 430). Each MaxCell is to have different color ID marking and shall be locatable. The use of flexible plastic innerduct shall not be permitted.
B. The use of 90-degree bends shall be prohibited for OSP conduits. Long communications sweeps shall be utilized where conduit turns are required. Use Schedule 80 PVC, under sidewalks, driveways, etc. Use Schedule 40 PVC elsewhere. Conduit to be free of water and debris throughout. Provide caps on ends.
C. OSP conduits shall be marked with Detectable Warning Tape, CH Hansen 16626 or equal.
D. Handholes (HH) shall be 36”x48”x 36” minimum size, with open bottom (on top of 4” rack). Seal conduits at each HH to keep moisture, insects, and rodents out of building. Conduits entering building must be sloped. All Handholes where fiber splices are made shall be 36”x60”x36” minimum. Use Quazite PG style with pull slot center pins, lid shall be labeled “COMMUNICATIONS”.
E. All OSP cabling shall be installed in neat and workmanlike manner. Cabling to be routed and secured around edges of HH to create additional space for future cabling.
F. Provide 25 foot maintenance loop for fiber optic lines in one HH. Service loop to side of HH.
G. Label all OSP cabling as follows:
1. "Caution Fiber Optic" adhesive marker every HH. Label to include SM an MM fiber count and "to and from".
2. "Caution Fiber Optic" adhesive marker every 50' of exposed fiber in building (including in cable tray). Label to include SM and MM fiber count and "to and from".
3. OSP UTP cables shall be labeled with permanent, neat penmanship in every HH with "to and
H. Prior to backfill, contractor shall arrange for inspection of OSP installation with ETSU ITS Department.

I. Prior to commencing with work, a pre-construction meeting will be held between the contractor's telecommunications cabling installer and appropriate representatives of the ETSU Physical Plant, ITS Department. Installation requirements shall be carefully discussed at the pre-construction meeting. Discrepancies between contract documents and pre-construction meeting shall be called to the attention of Project Engineer immediately prior to commencing with any telecommunications installation work.

J. All conduit shall be installed such that the top of the conduit is a minimum of 24” below grade.

END OF SECTION
SECTION 27.05.29

HANGERS AND SUPPORT

PART 1 - GENERAL

1.01 SCOPE OF WORK
   A. Furnish and install a system of cabling supports above lay-in ceilings for network, voice, and CATV cabling as set forth hereinafter.

1.02 REFERENCE STANDARDS
   A. See SECTION 27.01.00 REFERENCE STANDARDS

PART 2 - PRODUCTS

2.01 MATERIALS
   A. J-hooks shall be utilized above lay-in ceilings for support of low-voltage cabling. J-hooks shall be as follows:
      1. Use Non-Metallic J-hooks, Panduit J-Pro JP75W-L20 for Cat 6 and Cooper B-line BVH32 or Erico CAT425 for Cat 5e. Steel J-hooks shall not be used.
   B. Cabling support shall be located 4' to 5' on center throughout the entire length of network and CATV cabling runs above ceiling. Provide separate sets of low-voltage cabling supports along entire length of lowvoltage cabling runs above ceiling to allow separation of network cabling and CATV cabling. Network cabling shall be installed in separate J-hook support system from CATV cabling. Locate supports well clear of acoustical lay-in ceiling tiles. Supports shall be located such that tiles can be removed without interfering with support system. J-hook supports shall be secured directly to metal wall studs or masonry walls, as applicable. J-hooks shall not be attached directly to gypboard walls. J-hooks shall be located no further apart than 5'0" on center along entire length of runs, with supports adjusted to be closer together as needed to attach to metal studs. A maximum of 10 Category 6 cables shall be installed per J-hook. A maximum of 40 Category 5e cables shall be installed per J-hook.
   C. Provide all necessary supports and attachments to allow connection to structure for these supports.

PART 3 - EXECUTION

3.01 INSTALLATION
   A. Entire installation shall be in accordance with manufacturer's recommendations.
   B. Provide two separate sets of low-voltage cabling supports along entire length of low-voltage cabling runs above ceiling. One set of supports shall be of Category 6 network wiring. The second set of supports shall be for CATV wiring. Locate supports well clear of acoustical lay-in ceiling tiles. Supports shall be located such that tiles can be removed without interfering with support system.
   C. Coordinate installation of low-voltage supports with other trades as required.

END OF SECTION
SECTION 27.05.53
ADMINISTRATION / LABELING

PART 1 - GENERAL

1.01 DESCRIPTION
A. Provide administration and labeling of entire communications infrastructure in accordance with ETSU ITS Department requirements and as set forth hereinafter. Administration and labeling shall include but not be limited to all work area outlets (WAO's), patch panels, 110 blocks, conduits, cable trays, backbone cables, etc.

1.02 REFERENCE STANDARDS
A. See SECTION 27.01.00 REFERENCE STANDARDS

PART 2 - PRODUCTS

2.01 MATERIALS
A. Products shall be as set forth elsewhere in these specifications.

PART 3 - EXECUTION

3.01 INSTALLATION
A. All WAO's, patch panels, 110 blocks, conduits, cable trays, backbone cabling, outside plant cabling, etc., shall be labeled according to ANSI/TIA/EIA Standards with specific labeling scheme of ETSU OIT Department. Labeling is also to include the following:
   1. "Caution Fiber Optic" adhesive marker every 20' of exposed fiber in building (including in cable tray). Label to include SM and MM fiber count and "to and from".

END OF SECTION
SECTION 27.11.10
TELECOMMUNICATIONS SPACES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Telecommunications spaces shall be provided as indicated on drawings and as called for hereinafter. Telecommunications spaces shall consist of equipment rooms (ER).

1.02 REFERENCE STANDARDS

A. See section 27.01.00 for standards.

PART 2 - PRODUCTS

2.01 MATERIALS

A. ER layouts shall include network racks, vertical wire management, cable trays, and associated facilities. Each ER shall include, but not be limited to, the following equipment:

1. Equipment Racks shall be Hubbell No. CS1976, 84" x 19" with 6" Z channel vertical wire management or equivalent. Provide a Hubbell RKTGB grounding bus bar in each equipment room. Provide a Hubbell MCCPSS19TS surge protected power strip for each network rack. Provide cable management components at each rack including Hubbell HC219CE3N (2 per patch panel) horizontal management, Hubbell MCCPSR4 cable management rings, and Hubbell 110RA cable management troughs. Provide Hubbell MCCCS19P equipment shelves. Provide Chatsworth 10605-019 rack base insulator kit.

2. Patch Panels shall be Hubbell Category 6 patch panels. Use Hubbell HP648A with HC219CE3N, black. Provide 25% extra capacity for future growth.

3. Cable Tray: In each ER room, provide 18" wide cable tray around room and to each rack. Cable tray shall be Hubbell Next Frame 18" "HL" Series or Cooper B-Line SB17U18B.

4. Plywood Backboards: All walls of each ER room shall be provided with 3/4" AC grade plywood, covered on all six sides with two coats of Benjamin Moore M59-220 (white) paint, with up to 2 ounces of tint allowed per gallon.

5. All fiber, OSP and Riser shall be terminated

PART 3 - EXECUTION

3.01 INSTALLATION

A. Furnish and install at each ER location a grounding conductor from grounding bus in local ER Room AC panelboard to grounding bus bar mentioned in 2.01, A, Materials. Grounding conductors shall be copper, with "THHN/THWN" insulation, with green tape marking to indicate grounding conductor. Refer to drawings for grounding conductor sizes. Grounding and bonding shall be in accordance with BICSI TDMM current edition, Chapter 8, and NFPA 70.

B. Before any terminations and installation of equipment, the ER must be in finished stage, free of dust and debris with all walls and ceilings painted to finish coats and finished flooring installed and treated. After terminations and equipment are installed, contractor shall keep ER room door closed and locked at all times.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish and install voice and network cabling for the building as indicated on drawings and as called for hereinafter. This specification is for a voice and network cabling system. Products specified hereinafter are Hubbell, Mohawk or Belden cable and Hubbell connectivity including jacks, patch panels, patch cords, and faceplates shall be utilized. The Hitachi/Hubbell products specified hereinafter are utilized as campus standard for ETSU. Any proposed replacement products must meet or exceed the published specifications. Alternates must be verified with ETSU ITS by furnishing proper documentation of specifications verified by an industry-recognized test laboratory (U.L., ETL, ASTM).

B. This standard also establishes performance criteria for various system configurations and their elements.

C. Installer of cabling installation specified herein must be a certified trained installer using ANSI TIA Standards and the current edition of the BICSI TDMM (Telecommunications Distribution Methods Manual, Current Edition) as a guide for installation of inside cabling and associated components. Installer must be Hubbell Certified. Provide written documentation of these qualifications as part of the submittal process.

1.02 CABLING STRUCTURE

A. The elements of a cabling system are listed below:
   1. Horizontal Cabling
   2. Work Area Outlets (WAO)
   3. ER Rooms (See Section 27.11.00)

B. HORIZONTAL CABLING
   1. Horizontal cabling shall be of star topology, each work area connector shall be terminated in the telecommunications room. The maximum horizontal distance from ER to the WAO shall be 90 meters. When deductions are made for mandatory minimum slack, the cable distance is approximately 85 meters (281 feet).
   2. The amount of untwisting of individual pairs to terminate shall be less than or equal to .5 in. for Category 6.
   3. Minimum bend radius shall be 4 times the cable diameter.

C. REFERENCE STANDARDS
   1. See Section 27.01.00 REFERENCE STANDARDS

D. ADMINISTRATION STANDARD FOR COMMUNICATIONS INFRASTRUCTURE:
   1. Purpose: The purpose of this standard is to provide a uniform administration scheme that is independent of the applications. This standard defines guidelines for contractors involved in the installation of the computer cabling system.
   2. Scope: This standard specifies the administrative requirements of the communications infrastructure within a building or campus.
   3. Areas to be administered are as follows:
      a) Terminations for the communications media
      b) Communications media between terminations
      c) Pathways between terminations
      d) Spaces where terminations are located
      e) Bonding and grounding
   4. Pathway and Space Administration: All spaces must be labeled. Labels should be affixed at the entrance of the space.
5. Wiring System Administration: This section describes the administration of cables, termination hardware, splices and termination position. As changes are made, affected labels, records, drawings and reports shall be updated.
   a) Horizontal and backbone subsystem cables shall be labeled at each end.
      Each termination hardware or label shall be marked with an identifier.
   b) Each termination position label shall be recorded with an identifier.
   c) Each splice closure or label shall be marked with an identifier.
   d) "TMGB" shall be marked on the Telecommunications Main Grounding Busbar.

E. LABELING AND COLOR CODING:
   1. Labels are divided into 3 categories:
      a) Adhesive labels shall meet adhesion, defacement and legibility requirements defined in U.L. 969. Labels shall also meet exposure requirements in U.L. 969.
      b) Insert labels shall also meet U.L. 969 requirements for defacement, legibility and general exposure.
      c) Other labels include special purpose labels, such as tie-on labels.
      d) Labels shall be used instead of marking the cable.
   2. All bar codes shall be either Code 39 or Code 128 confirming to USS-39 and USS-128 respectively. All Code 39 bar code ratios shall be within 2.5:1 to 3.0:1. If a wand scanner is to be used, a minimum quiet zone of 6.35mm is required on each side of the bar code.
   3. Refer to ITS Guidelines, Appendix M

F. COLOR CODING RULES:
   1. Termination labels at the two ends of the cable shall be of the same color.
   2. Cross-connectors made between termination fields are generally of two different colors.
   3. The color orange is used for the demarcation point.
   4. Green is for the network connections on the customer side of the demarcation point.
   5. Purple is for the termination of cables originating from common equipment.
   6. White is for the first level backbone media.
   7. Gray is for the second level backbone.
   8. Blue is for the termination of station telecommunicators media.
   9. Brown is for inter-building backbone cable terminations.
   10. Yellow is for termination of auxiliary circuits, alarms, security, and other miscellaneous circuits.

G. DIFFERENTIATION OF TERMINATION FIELDS BY PERFORMANCE CATEGORY
   1. If cables are of different performance classes, their ends should indicate the difference. The labels shall be marked with the proper category of the cable.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Wall-Station Jacks:
   1. Network: Hubbell Speedgain, orange, HXJ6OR.
   2. Network Icon: Hubbell IR100C.
   3. Voice: Hubbell Speedgain, white, HXJ6W.
   4. Voice Icon: Hubbell IGY100T.

B. Wall-Station Faceplates: Wall station faceplates in office areas shall be Hubbell AFPI4EI Series with four port angled plate, color to match electrical outlets. All unused ports shall be provided with blank inserts, Hubbell SFBE10 Series. Provide blank inserts as required.

C. Equipment Racks: See Section 27.11.10.

D. ER Cable Tray: See Section 27.11.10.

E. Voice and network horizontal cabling: Cabling shall be as specified in ITS Guidelines, Appendix A. All network cable shall have blue outer insulation. All voice cable shall have white outer insulation. Leave 8" of slack for each termination at wall outlet location. Leave one meter (3.28') slack at the end of each
conduit run. Cable slack shall not be stored in bundled loops. Cable slack shall be stored in an extended loop or in a Figure 8 configuration. Provide two data cables to each communications outlet illustrated on the drawings, unless noted otherwise.

F. Patch Cords: Provide 6’ grey patch cords to the ETSU ITS department. The patch cords shall be Hubbell model number PSX6GY. Provide one cable per patch panel port.

G. Backbone Voice Cable: Provide 50 twisted pair Cat 3 UTP riser as indicated on drawings. Backbone voice cable shall be terminated on plywood with 110, 5-pair blocks. Provide 110 troughs between backbone and horizontal 110 blocks. Use Mohawk M58522.

H. Backbone Fiber Optic Riser Cable: Single Mode – Corning MIC DX Armored Cable OS2 XXXE81-33131-DI (yellow); Multimode (50um) - Corning MIC DX Armored Cable OM3 XXXT81-33180-DI (aqua); Multimode (62.5um) Corning MIC DX Armored Cable OM1 XXXK81-31130-DI (orange); XXX=strand count. All fiber shall be terminated in fiber hubs per ETUS ITS standards.

I. Firestopping: Hilti CP-618 putty shall be installed inside the conduits and FS One or CP-653 re-entry sleeve shall be used outside and around the conduits.

PART 3 - EXECUTION

3.01 INTERIOR BUILDING INSTALLATION:

A. Installation of all voice and network wiring facilities shall be by personnel regularly engaged in the installation of local area network cabling.

B. All wiring shall be color coded and terminated. All cabling shall be Cat 6 terminated to T568A wiring scheme. All network cabling shall have blue outer insulation. All voice cabling shall have white outer insulation.

C. Submit shop drawings for approval.

D. Testing shall conform to ANSI/TIA-568-B.1 standard. Testing shall be accomplished using a Hubbell approved tester. Include tester calibration date. Refer to ITS DESP for Commissioning, Warranties, and Documentation.

E. All testing shall meet or exceed manufacturer’s recommendation for 25-year warranty program.

F. Test each pair and shield of each cable for opens, shorts, grounds, and pair reversal. Correct grounded and reversed pairs. If horizontal cable contains bad conductors or shield, remove and replace cable. Cable shall have no visible defects such as twist, kinks, and dents.

G. During installation of cabling, the bend radius of cables is not to be less than the manufacturer's specific recommendation. Minimum bend radius shall be 10 times the diameter of the cable for fiber optic cable, and 4 times the diameter of the cable for copper cable. Contractor shall take and precaution not to exceed maximum tensile rating of cabling during installation.

H. Each horizontal cabling run shall include 10’ of slack at telecommunications room end and 8” of slack at the outlet end. There shall also be one meter (3.28’) of slack above each wall outlet. Station cables in the telecommunications rooms can be stored in a "Figure 8" configuration to maintain the proper bend radius and provide the needed slack.

I. Labeling of cables, wall outlets, 110 blocks, conduits, cable trays, patch panels, and backbone cabling shall be performed in accordance with requirements of the ETSU ITS Department.

J. Building Automation System (BAS) Connection: Cabling connecting BAS to the ETSU ITS network must follow the standards set forth in ANSI/TIA 862.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION
A. Furnish and install a complete a 1 GHz CATV wiring system as described on drawings and called for hereinafter.
B. The catalog numbers specified herein are those of the Blonder-Tongue Company and constitute the type and quality of the products to be installed.
C. The quality and type of CATV materials must be accepted by industry standards. All passive and active equipment must be two-way and pass signals up to one GHZ "passive" and 750 MHZ “active”.

1.02 INSTALLER QUALIFICATIONS
A. Installation of CATV cabling system shall be done by personnel regularly engaged in installation of such facilities. Installers shall have NCTI, SCTE, and BICSI certifications. Provide documentation of these certifications as part of the submittal process. Installer shall have working knowledge of all codes/standards related to CATV wiring installation.

1.03 DISTRIBUTION LEVELS
A. Line extender outputs shall be 46/40 DBMV for single cascade, and 43/37 DBMV for two cascades. No more than two line extenders shall be provided in cascade. Tap levels shall not exceed 17 DBMV on any "F" fitting. Typical tap level shall be 12 DBMV. Output level at faceplate shall be 3 DBMV and maximum of 10 DBMV. Maximum 3 DB variation shall be allowed between adjacent channels.

1.04 REFERENCE STANDARDS
A. SECTION 27.01.00 – REFERENCE STANDARDS
B. ANSI/SCE 74 2003, Specification for braided 75 ohm Flexible Coaxial Cable.
C. FCC Part 76, Cable Television Service.

PART 2 - PRODUCTS

2.01 MATERIALS
A. Splitters: In the Telecommunications Room, Install splitters to take the cable TV feed and distribute it to each individual room. Splitters/combiners shall be vertical ports, capable of passing one GHZ signal with built-in grounding lug, Truespec DSVXG or equivalent. "X" represents the number of ports. Arrange splitters/combiners so that signal is evenly distributed among all ports.
B. Wall Plates: Wall plates for CATV outlets shall be flush mounted with single-gang Standard F81 through connector with 0 db isolation, and one data jack, Hubbell AFP14EI.
C. Coaxial Cable: Coaxial cable shall be installed from each television outlet location shown on drawings to the Telecommunications Room on a homerun basis. No series wiring for TV shall be permitted. The coaxial cable from the outlet to the Telecommunications Room shall be Belden 7915A Series RG6 cable, aluminum braid shield, flame retardant PVC jacket meeting NEC Article 820V rating, ETL listed or equivalent.
D. Coaxial Connectors: Use compression type, Belden Thomas and Betts FSNS6U.
E. Amplifier: Provide one amplifier in Telecommunications Room. Each amplifier shall be two-way broadband distribution amplifier, Blonder-Tongue Model No. BIDA-750-30 or 750-50 as directed by ITS.
PART 3 - EXECUTION

3.01 INSTALLATION

A. Each coaxial cable shall be tested for signal loss, length of cable, and meet the manufacturers specifications. Testing shall be in accordance with FCC Part 76 signal leakage requirements. Coaxial cable tests will involve continuity and RF leakage, 20-uV/m leakage limit (10 feet from network). Limit will yield a dipole level of -43.67 dBmV 75 ohms. Carefully coordinate tie-in of incoming line with local cable operator. Complete TV feed to each individual outlet to verify that a proper signal is being distributed. After proper documentation disconnect each room at the headend location and make each connection for proper identification.

B. Cable drops shall be bundled by use of approved plastic ties. Tape shall not be permitted to bundle cable drops.

C. Grounding will meet NEC requirements for CATV. Refer to Article 820 of National Electrical Code for information.

END OF SECTION