

SECTION 27 05 28 - Communications Pathways

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Date	Section	Description of Change

PART 1 GENERAL

1.1 Work Included

- a. This Section includes pathway requirements specifically applicable to the communications sections of this project.
- b. Furnish and install communications conduit raceways, boxes, cable trays, innerduct and fittings including:
 - Communications conduit systems.
 - Wireway systems.
 - Surface raceway systems.
 - Telecommunications outlet boxes.
 - Pull box enclosures.
 - Cabinets.
 - Pulltape and duct plugs.
 - Raceway identification banding.

1.2 Submittals

- a. Provide the manufacturer's cut sheets, clearly indicating specific products proposed for use, with the bid submission.

1.3 Project Record Documents

- a. Plan drawings showing completions and as-built corrections which indicate type, size, placement, routing, and/or length for raceway and cable tray components; e.g., manholes, hand holes, conduit, wireway, boxes, enclosures, etc.

PART 2 PRODUCTS

2.1 Product Substitutions

- a. Equivalent product(s) may be considered for substitution for those products specified, however, the equivalent product(s) to be approved and show demonstrated and documented equivalence to the product(s) specified. Documentation to include, but is not limited to: product samples, data sheets, and actual test data. The request for product substitution, and supporting documentation, to be submitted, in writing, prior to submitting the bid. Written approval for product substitution to be submitted with the bid.

2.2 General

- a. Raceways, Boxes, Enclosures, Cable Tray Materials and Equipment: Labeled and/or listed as acceptable to the authority having jurisdiction as suitable for the use intended.
- b. The product identification codes used for the Communications Raceways and Boxes in Part 2, Products, are summarized in Table 1.

Table 1 - Product Identification

Product Designation	Product Type
RGS	Rigid galvanized steel
CRS	PVC externally coated RGS
EMT	Galvanized steel tubing
PVC	Polyvinylchloride conduit
ENT	Electrical nonmetallic tubing
LMC	Liquidtight metal conduit
LNC	Liquidtight nonmetal conduit

2.2 Rigid Metal Conduit and Fittings

- a. Conduit
 - Type RGS: Rigid galvanized steel.
 - Type CRS: PVC externally coated conduit; rigid steel conduit with external PVC coating and internal galvanized surface.
- b. Fittings and Conduit Bodies: In-line straight-through, threaded, galvanized steel fittings and Type C conduit bodies only; do not use bends or tees, e.g., Lbs.
- c. Bonding and Grounding Locknuts and Wedges: Malleable iron with set screws and lug screws.
- d. Insulated Bushing: Malleable iron with integral insulated throat, rated for 150 degrees C.
- e. Bonding and Grounding Bushing: Malleable iron with integral insulated throat, rated for 150 degrees C, with solder-less lugs or lug screws.
- f. Sealing Fittings: Threaded type conduit seal fittings and sealing compound suitable for hazardous location installations in accordance with NEC:
 - Crouse-Hinds retrofit sealing fitting EYSR.
 - Crouse-Hind CHICO A sealing compound.

2.3 Electrical Metallic Tubing and Fittings

- a. Type EMT: Electrogalvanized steel tubing.
- b. Fittings and Conduit Bodies:
 - General: No conduit bodies ie. LB's
 - Wet Areas: steel compression-type couplings and nipples.
 - Dry Areas: set screw-type couplings and nipples.
- c. Bonding Locknuts: Malleable iron with set screws and lug screws.
- d. Insulated Bushing: Malleable iron with integral insulated throat, rated for 150 degrees C.
- e. Bonding and Grounding Bushing: Malleable iron with integral insulated throat, rated for 150 degrees C, with solderless lugs or lug screws.

2.4 Conduit Accessories

- a. Duct Spacers: Nonmetallic base and intermediate duct spacers with locking keyways designed specifically for use with nonmetallic conduit; e.g., Carlon SNAP-LOC duct spacers for 4-inch (100 mm) diameter conduit with 1-1/2-inch (38 mm) separation.
 - Base Spacer: S288NHN.
 - Intermediate Spacer: S289NHN.
- b. Expansion/Deflection Fittings: Similar to Crouse-Hinds XD expansion/deflection coupling or Appleton DF Series deflection and expansion coupling.
- c. Pulltape: Measuring and pulling tape constructed of synthetic fiber with plastic jacket,

printed with accurate sequential footage marks; e.g., George-Ingraham 1/2-inch (13 mm) tape 9216-JK.

- d. Duct Plugs:
 - Aboveground Conduit Openings: Tapered PVC plugs with tab for pulltape; e.g., Carlon 4-inch (100 mm) PVC plugs with pull tab, P258NT.
 - Underground or Underslab Conduit Openings: Removable screwtight compression type duct plugs with wing-nut and corrosion resistant hardware; e.g., Pacific Plastics No. 5900514, George-Ingraham o605, or Vikimatic P4000WT.

2.5 Raceway Coating

- a. Acceptable Manufacturers:
 - Koppers Bitumastic.
 - Scotchwrap.
- b. Bitumastic material or plastic tape.

2.6 Penetration Sealing Systems

- a. Firestopping: Provide fire barrier penetration sealing materials as specified in Firestopping section.
- b. Duct Water Seal: Products suitable for closing underground and entrance duct openings, where innerduct or cable is installed, to prevent entry of gases, liquids, or rodents into the structure; e.g., SEMCO PR 851.

2.7 Telecommunications Outlet Boxes

- a. Sheet Metal Outlet Boxes: Minimum 4-inch by 4-inch by 2 1/8-inch-deep (100 by 100 by 50 mm-deep) galvanized steel for use with single- and double-gang plaster rings.
- b. Nonmetallic Outlet Boxes: Minimum 4-inch by 4-inch by 2 1/8-inch-deep (100 by 100 by 50 mm-deep). Provide gasketed, watertight cover.
- c. Cast Boxes: 4-inch by 4-inch by 2 1/8-inch-deep (100 by 100 by 50 mm-deep) cast Feralloy, gasketed single- or double-gang cover, threaded hubs. For hazardous locations, provide boxes approved for applicable atmosphere classification.
- d. Floor Boxes for Installation in Cast-In-Place Concrete Floors: Flush mounted and fully adjustable formed steel as shown on the Drawings.
- e. Plaster Rings: Single or double gang as shown on the Drawings.

2.8 Pull Boxes

- a. Construction: NEMA Standard No. 250.
 - Type 1 Steel: Galvanized steel enclosures designed for use as junction boxes and pull boxes with flat screw-applied covers, with or without knockouts, and gray enamel finish.

2.9 Outside Plant Vaults/Handholds

- a. Preformed concrete with metal cover or cast iron manhole cover. Utility Vault company or equivalent.

2.10 Innerduct

- a. Outdoor Innerduct: 1-inch (25 mm) and 1-1/4-inch (32 mm) inside diameter corrugated, ribbed, or smooth walled, semi rigid PVC or heavy-wall polyethylene tubing.
- b. Indoor Innerduct: 1-inch (25 mm) and 1-1/4-inch (32 mm) inside diameter corrugated, ribbed, or smooth walled, semi rigid nonflammable PVC tubing, which meets UL94V-O

vertical flame test for general applications.

- c. Plenum-Listed Indoor Innerduct: 1-inch (25 mm) and 1-1/4-inch (32 mm) inside diameter corrugated walled innerduct for use in plenum air handling spaces.

2.11 Innerduct Fittings

- a. Couplings: Metallic or nonmetallic quick-connect, reverse threaded, and Schedule 40 couplings for connecting sections of installed innerduct.
- b. Conduit Plugs: Compression-type conduit plugs with locking nuts for sealing and securing the outside walls of one or more innerduct ends to the inside wall of 4-inch (100 mm) inside diameter conduits, e.g.:
 - Four 1-inch (25 mm) innerduct configuration.
 - Three 1-1/4-inch (32 mm) innerduct configuration.
- c. Innerduct Plugs: 1-inch (25 mm) and 1-1/4-inch (32 mm) compression-type innerduct plugs for sealing innerducts, with wing nut for hand tightening and eyebolt for securing pulltape.
- d. Innerduct Caps: Removable push-in caps for plugging 1-inch (25 mm) and 1-1/4-inch (32 mm) innerduct.

2.12 Wire Basket Runway Systems

- a. Manufacturers: Subject to compliance with these Specifications, install wire basket runway. Cablofil, FlexTray, GS Metals.
- b. Cable Tray Sections and Components:
 - General: Except as otherwise indicated, provide metal wire basket runways, of types, classes and sizes indicated; with splice plates, bolts, nuts and washers for connecting units. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the following additional construction features.
 - Materials and Finish: Continuous steel welded and formed wire mesh, electro zinc finish.
- c. Type of Runway System:
 - Tray sizes have 2 or 4-inch side height.
 - Supply all straight sections in standard 120 inches, except where shorter lengths are permitted to facilitate tray assembly lengths as shown on Drawings.
 - Tray Widths: 6 inches, 12 inches, 18 inches, 24 inches.
 - Make splice plates the fast splice type as indicated below for each tray type.
 - i. Make splice plates of yellow zinc dichromate steel.
 - ii. Furnish splice plates with straight sections and fittings as required by manufacturer.
 - iii. Finish: Electro zinc.
 - Wire Basket Runway Supports: Place so that the support spans do not exceed a maximum of 4 feet o.c.
- d. Loading Capacities: Wire basket runways to meet NEMA Class Designations.

PART 3 EXECUTION

3.1 Workmanship

- a. Manufactured products, materials, equipment, and components to be provided, conditioned, applied, installed, connected, and tested in accordance with the manufacturer's specifications and printed instructions.
- b. The installation of all system components to be carried out under the direction of qualified personnel. Appearance to be considered as important as mechanical and electrical.

- c. efficiency. Workmanship to meet or exceed industry standards.
- d. Place support for framing, raceways, cable trays, backboards, equipment racks, and cabinets.

3.2 Protection During Construction

- a. Protect products from the effects of moisture, corrosion, and physical damage during construction. Except during installation activity in a section, keep openings in conduit, tubing, and wireway capped with manufactured seals during construction.

3.3 Minimum Conduit Size

- a. 1-inch (25 mm) for aboveground installations unless otherwise indicated on the Drawings.
- b. 4-inch (100 mm) for underground applications unless otherwise indicated on the Drawings.

3.4 Conduit Type to be Used

- a. Install the following types of circular communications raceway in the locations listed unless otherwise indicated on the Drawings.
 - Interior Dry Locations, Exposed: EMT with set screw fittings.
 - Interior Dry Locations, Concealed (Not Embedded in Concrete): EMT with set screw fittings.
 - Interior Wet Locations: EMT with compression fittings.
 - Exterior, Exposed Including Roof: Rigid steel conduit.
 - Concrete-Encased or Buried Duct Banks:
 - i. PVC Schedule 40 conduit.
 - ii. Rigid steel conduit when additional protection is required.
 - Flexible Conduit (Interior Exposed):
 1. Liquidtight flexible metal conduit for use with copper cable.
 2. Liquidtight flexible nonmetallic conduit for use with fiber optic cable.
 - Conduits that are to be used for service entrance conductors shall be either:
 1. Concrete encased PVC schedule 40 or
 2. Rigid or Intermediate metallic conduit (RMC or IMC)

3.5 Conduit Bends and Sweep

- a. Make changes in direction of communications conduit runs with sweeps of the longest possible radius.
- b. Make sweeps in parallel or banked runs of conduits, 2 inches (50 mm) and larger in diameter, from the same center or centerline so that sweeps are parallel and of neat appearance.
- c. Field-Made Bends and Sweeps:
 - Use an acceptable hickey or conduit-bending machine.
 - Do not heat metal raceways to facilitate bending.
 - Before installing 4-inch (100 mm) field-made sweeps in duct banks, pull a 3-1/2-inch (89 mm) diameter by 12-inch (300 mm) long mandrel through duct sections to verify circularity and sweep radius.
- d. The angular sum of the bends between pull points and/or pull boxes to not exceed

180 degrees.

- e. Minimum Inside Bend Radius for Communications Conduit Bends, Sweeps, Boxes, and Fittings:
- Underground or Underslab 4-inch (100 mm) Conduit: 60 inches. (1.5 m)
 - Other Conduit Runs:
 - i. One-inch (25 mm) conduit, 11 inches (275 mm).
 - ii. Two-inch (50 mm) conduit, 21 inches (525 mm).
 - iii. Three-inch (75 mm) conduit, 31 inches (775 mm).
 - iv. Four-inch (100 mm) conduit, 40 inches (1000 mm).
 - v. Other sizes, 10 times the inside diameter of the conduit.
- f. Do not install boxes, bends, elbows, tees, conduit bodies, and other conduit fittings, which do not provide for the minimum inside cable bend radius specified in paragraph E above.
- No Conduit Bodies
 - Refer any design or installation conflicts with these requirements to the Owner.

3.6 PENETRATIONS

- a. Seal conduit entering structures at the first box or outlet to prevent the entrance of gases, liquids, or rodents into the structure.
- Empty Conduits: Removable screwtight duct plugs.
 - Innerduct Installed: Suitable duct water seal between conduit and innerduct. Manufactured seals in empty innerduct.
 - Cable Installed: Suitable duct water seal between conduit and cable, or between innerduct and cable.
- b. Concrete Sleeves: Conduits routed perpendicular through floors, walls, or other concrete structures to pass through cast-in-place conduit sleeve openings wherever possible, or appropriate size holes to be bored to accommodate the installation of conduit sleeves. The size and location of the holes to not impair the structure's integrity.
- Concrete Boring: Bore a hole in the concrete with a diameter of 1/2 to 1 inch (13 to 25 mm) larger than the conduit sleeve to be installed. Grout around the conduit sleeve and finish to match existing surroundings.
 - Conduits that rise vertically through a slab to be stubbed 6-inches (150 mm) above the floor and capped pending future use.
- c. Drywall Sleeves: Install insulating throat bushings on both ends of conduit sleeves placed in fire-rated walls using drywall construction.
- d. Where conduit enters a structure through a concrete roof or membrane waterproofed wall or floor:
- Provide a watertight seal.
 - With Concrete Encasement: Install watertight entrance seal device on the accessible side.
 - Securely anchor malleable iron body of watertight entrance seal device into construction with one or more integral flanges.
 - Secure membrane waterproofing to watertight entrance seal device in a permanent, watertight manner.
- e. Where raceways penetrate fire-rated walls, floors, or ceilings, fire stop openings around communications penetrations to maintain the fire-

resistance rating as specified in Firestopping section.

3.7 ABOVE-GROUND CONDUIT INSTALLATION

- a. Support conduit installed in aboveground interior and exterior locations at a maximum of 7 feet (2.1 m) on center.
- b. Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps.
- c. Securely attach aboveground conduit under the provisions of this Section.
- d. Conceal conduit in finished areas, leave exposed in unfinished areas and where not possible to conceal. In finished areas, the Owner will make the final decision on conduit concealment.
- e. Run exposed and concealed conduits parallel or perpendicular to walls, structural members, or intersections of vertical planes to maintain headroom and provide a neat appearance. Follow surface contours as much as possible.
- f. No section of conduit located within buildings to exceed 100 feet (30 m) in length between pull points and/or pull boxes.
- g. Expansion/Deflection Joints:
 - Where indicated on the Drawings, provide specific purpose expansion/deflection fittings for conduit crossing building expansion/deflection joints in structures or concrete slabs. Expansion fittings to have copper bonding jumper.
 - For PVC conduit, provide expansion/deflection joints for 25 degrees F maximum temperature variation. Install in accordance with manufacturer's instructions.
 - For rigid steel conduit located in exterior areas, provide expansion/deflection joints for maximum site temperature variation, installed in accordance with manufacturer's instructions.
- h. Provide each conduit passing from a nonhazardous or noncorrosive area to a hazardous area and each conduit entering an enclosure within a hazardous area with a sealing fitting in accordance with NEC Article 500. The sealing fitting to be UL listed and to be filled with approved sealing compound of the same manufacture.
- i. Hubs, Bushings, and Insulating Sleeves:
 - Interior Box and Cabinet Connections: Install insulating throat connectors wherever conduit terminates in boxes or cabinets. In addition, install bonding type locknuts at metallic conduit terminations.
 - Wet and Hazardous Box and Cabinet Connections: Use watertight threaded conduit sealing hubs with insulated throat and bonding type locknuts for fastening rigid steel conduit to cast or sheet metal pull boxes.
 - Exposed Conduit Terminations: Cap exposed steel communication conduit ends with bushings or smooth collars to protect cable sheath.
- j. Flexible Conduit:
 - Make no bends in flexible conduit that exceed allowable bending radius of the cable to be installed or that significantly restricts the conduit's flexibility.
 - A flexible conduit section to be long enough to allow the item to which it is connected to be withdrawn or moved off its base.
 - For final connection to TO's or equipment, where flexible connection is required to minimize vibration or where required to facilitate removal or adjustment of

equipment, provide 12-foot (3600 mm) minimum lengths of flexible conduit or as indicated on the Drawings.

3.8 PULLTAPE AND DUCT PLUGS

- a. Following conduit installation, install pulltape (muletape) with preprinted foot markers in each empty conduit containing a bend or over 10 feet (3000 mm) in length, except sleeves, nipples, and runs with openings in cleanroom areas. Tie the pulltapes securely to duct plug or wall racking at each end.
- b. Immediately after pulltape installation, for conduit openings on conduits underground, install screwtight, removable, watertight, and dust-tight duct plugs in conduit ends.
- c. Verify lengths at the time of installation and provide as-built documentation.

3.9 WIREWAY TYPE TO BE USED

- a. Install the following types of wireway in the locations listed unless otherwise indicated on the Drawings:
 - Interior, Exposed: steel.
 - Interior, Concealed: not approved.
 - Exterior, Exposed: steel or nonmetallic.

3.10 WIREWAY INSTALLATION

- a. Install wireway, as indicated on the Drawings.
- b. Securely support wireways at intervals not to exceed 5 feet (1500 mm) and at each end or joint for individual sections.
- c. Attach wireways and related materials under the provisions of this Section.
- d. Run exposed wireways parallel or perpendicular to walls, structural members, or intersections of vertical planes to maintain headroom and provide a neat appearance.
- e. Close dead ends of wireway with fittings by the same manufacturer.
- f. Gasket each joint in oiltight gutter.
- g. Mount raintight gutter in horizontal position only.
- h. Maintain grounding continuity between raceway components to provide a continuous grounding path.
- i. Wireway for data channel to have a minimum depth of 3 1/2 - inches and height of 2 1/4 - inches when outlets are installed on the face of the system.

3.11 TELECOMMUNICATIONS OUTLET BOX INSTALLATION

- a. Provide 4-inch by 4-inch by 2 1/8-inch (100 mm by 100 mm by 50 mm) deep outlet boxes for mounting telecommunications outlets with single- or double-gang plaster rings as required, or as indicated on the Drawings.
- b. Do not install outlet boxes back to back in walls. Provide minimum 6-inch (150 mm) separation, except provide minimum 24-inch (600 mm) separation in acoustic-rated walls.
- c. Locate outlet boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for outlet boxes. Use boxes with sufficient depth to permit conduit hubs to be located in masonry void spaces.
- d. Provide knockout closures for unused openings.
- e. Support telecommunications outlet boxes independently of conduit.
- f. Use multiple-gang boxes where more than one device is mounted together; do not use sectional outlet boxes.

- g. Install outlet boxes in walls without damaging wall insulation.
- h. Coordinate mounting heights and locations of outlet boxes mounted above counters, benches, and backsplashes.
- i. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlet boxes in hollow stud wall.
- j. Provide cast outlet boxes in exterior and wet locations.

3.12 RACEWAY IDENTIFICATION BANDING

- a. Degrease and clean surfaces to receive tape labels.
- b. Exposed conduits and wireway, including raceways above lay-in or accessible ceilings, together with associated pull boxes to be banded at intervals of not over 10 feet (2500 mm) and at direction changes. Two-band identification to be different contrasting colors as follows:

Raceway Use	Color
Grounding	Green
Building fire alarm system/voice evacuation	Red
Telecom/data	Yellow
Facility management system (FMS) and general control circuitry	Blue and black
CCTV	White
Building monitoring and security	Gray
Controls (non-FMS)	Brown and white

3.13 GENERAL CABLE TRAY INSTALLATION METHODS

- a. Cut standard straight sections of materials to length in the field.
- b. Deburr and file rough cable tray edges and any cut sections.
- c. Cable tray locations shown on the Drawings are approximate unless dimensioned.
- d. Install cable tray as shown on the Drawings and securely attach under the provisions of this Section.
- e. All cable tray ladder or trough to be accessible.
- f. Maintain minimum 6-inch (150 mm) clearance between cable tray and piping. Locate cable tray at least 12 inches (300 mm) away from heat sources such as parallel runs of flues, steam or hot water pipes, and heating appliances.
- g. Run exposed and concealed cable tray parallel or perpendicular to walls, structural members, or intersections of vertical planes to maintain headroom and provide a neat appearance.
- h. Passageways to not be obstructed.
- i. Cable tray routed at the ceiling to be routed within the assigned communications utility space.
- j. Install appropriate cable tray bends, dropouts, and other accessories to protect minimum cable bend radius and provide adequate support at locations where cable direction changes occur.

3.14 PENETRATIONS

- a. Provide firestopping per code requirements at all fire wall penetrations.

3.15 INNERDUCT TYPE TO BE USED

- a. Underslab and Underground Conduit Installation: Outdoor or indoor innerduct.
- b. Aboveground, Exterior, and Interior Conduit Installations: Indoor innerduct.

- c. Interior Exposed Locations Including Cable Tray Installations:
 - Nonplenum Areas: Indoor innerduct.
 - Plenum Areas: Plenum-listed innerduct.

3.16 INNERDUCT INSTALLATION

- a. Pull innerduct through conduit and wireways, or place innerduct in cable trays using continuous unspliced lengths of innerduct between pull boxes, and/or section termination points as indicated on the Drawings.
- b. Cut innerduct square. Deburr cut ends.
- c. Bring innerduct to the shoulder of fittings and couplings and fasten securely.
- d. Wipe innerduct and fittings clean and dry before joining. Apply full, even coat of cement to entire area that will be inserted into fitting. Let joint cure for 20 minutes minimum. Provide suitable innerduct slack in pull boxes, and at turns to ensure that there is no kinking or binding of the tubing.
- e. Make changes in direction of communications innerduct runs with sweeps of the longest possible radius and at least 10 times the inside diameter of the innerduct.
- f. During innerduct pulling, care to be taken to avoid excessive tension, which can cause deformation of the innerduct. Inspect innerduct following placement and replace any damaged sections.
- g. Indoor Conduit Installation:
 - Arrange innerduct neatly, cut to proper length, and remove surplus. Provide trained and bundled innerduct pigtailed extending at least 18 inches (450 mm) beyond exposed conduit openings.
 - At locations where the ends of innerduct sections appear in a pull box, join the pulltape and trim/deburr the ends on the innerduct.
- I. Cable Tray Installation: Tie wrap innerduct to one side of vertical ladder rack every 2 feet (600 mm) minimum, and to one side of horizontal ladder-type cable tray every 5 feet (1500 mm) minimum.
- J. Following installation, visually inspect innerduct, remove any burrs at openings, and, if necessary, clean innerduct interior.

3.17 PULLTAPE AND INSTALLATION

- a. All conduit runs longer than 10ft shall have pulltape with pre-printed footage markers installed.
- b. Following conduit or innerduct installation, install pulltape (muletape) with preprinted foot markers in all sections longer than 10ft, except runs with openings serving cleanroom areas. Tie the pulltape securely to wall racking at each location.
- c. Verify lengths at the time of installation and provide as-built documentation.

3.18 GROUNDING

- a. Provide ground connections and bonding continuity between raceway and cable tray sections, boxes, enclosures, cabinets, and fittings as required.

SECTION 27 13 13 - TELEPHONE BACKBONE CABLING

Document revision history: 01/2020 – Original Publication

Date	Section	Description of Change

PART 1 GENERAL

1.1 WORK INCLUDED

- a. Furnish and install all labor and materials required for the installation of a voice backbone cabling distribution system. This system is intended to provide for distribution of traditional analog and digital dial tone. Owner will provide all patch cords, cross connects, networking equipment, telephone and monitoring equipment. Close coordination with the owner will be required.

1.2 RELEVANT SECTIONS

- a. 27 05 28 Telecommunications Pathways
- b. 27 13 23 Optical Fiber Backbone Cabling
- c. 27 15 13 Category 6 Horizontal Cabling
- d. 27 70 80 Cable Television Cabling
- e. Appendix – Network Communications Design

1.3 QUALITY ASSURANCE

- a. Do all work in accordance with the guidelines published in EIA/TIA standard 568 and 569. Where conflicts exist, the plans and specifications shall take precedence. All manufacturer installation instructions shall be followed.
- b. All workers involved in the installation and termination of cable shall have at least one year of experience. No less than 33% of the installers on the job shall have attended a vendor sponsored training program covering installation and termination of cable.

1.4 SUBMITTALS

- a. Submit five sets of shop drawings and product data (or a greater number if specified in Division 1 “Submittals” Section). Submittals will be required for the following items.
 - Product data for all products being proposed.
 - Backboard layout for voice backboard in the telecommunications room/Intermediate Distribution Facility (IDF).

1.5 GUARANTEE

- a. Guarantee all work against faulty and improper material and workmanship for a minimum period of 1 year from the date of final written acceptance by Owner, except where guarantee or warranties for longer terms are specified herein.
- b. Upon notification of a problem, the warranty provider shall furnish within 48 hours and at no cost to the owner, such labor and materials as are needed to restore the system to proper operation.

PART 2 PRODUCTS

2.1 PRODUCTS

- a. Outdoor telephone backbone
 - Backbone cable: any 24 AWG REA PE89 or PE39 cable, pair count as specified on drawings.
 - Termination: Circa Enterprises 1880 ECA, sized to match pair count of cable, fully populated with Circa 3B1FS 5-pin protector modules.
 - Overlay: 24 pair rj-11 pre-terminated patch panel.
- b. Indoor telephone backbone
 - Backbone cable: Any ARMM type shielded twisted pair, pair count as specified on drawings.
 - Termination: 110 blocks with legs with C5 block connectors, sized appropriately to accommodate specified pair count.
 - 110 wire management: Jumper troughs installed between each 300 pair of 110 blocks.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION

- a. The Contractor shall furnish and install all cabling in accordance with these specifications, and as indicated on the cable schedules and drawings. Manufacturer installation specifications shall take precedence if there is a conflict with this section.
- b. Install each cable as an uninterrupted conductor section between the designated termination points, unless otherwise directed by the cable installation specifications. There shall be no splices or mechanical coupler installed between the cable points of origin and termination except as shown on drawings and or specifications.
- c. Contractor is responsible for insuring that cable jacket is suitable for the environment in which it is placed i.e.: CM, CMR, CMP rated. Unless otherwise noted on the drawings, all cable should be assumed to be rated CMR.
- d. All cable shown on drawings to be routed in conduit and cable tray system, where provided.
- e. At the same time cable is pulled into a cable pathway, also install a mule tape of appropriate size to facilitate future cable pulls along those pathways.

- f. Surface mounted raceway or exposed cable not specifically designated require written approval of the architect.
- g. Provide fire stopping at all locations where cables penetrate fire rated surfaces. Materials and methods used shall be acceptable to the code authority having jurisdiction and shall maintain the fire integrity of the wall, floor, or ceiling.
- h. Contractor shall closely coordinate and work with the owner on the construction of racking and panels and termination and routing of the cabling in the telecommunications room, overhead basket tray, and into the open relay racks.

3.2 TELEPHONE BACKBONE INSTALLATION

- a. Follow manufacturer instructions when installing and terminating cable.
- b. When breaking out cables with more than one 25-pair binder group, each binder group must be identified with a cable tie of appropriate color at the point of fan out.
- c. Outdoor telephone backbone cable:
 - Terminate cable in lightning protection units on both ends of the cable.
 - Install shield bond connectors at each end of each cable. Bond this connector to the bonding point inside the lightning protection unit.
 - Bond the lightning protection unit to the telecommunications grounding busbar.
- d. Indoor telephone backbone cable:
 - Terminate cable onto wall mounted 110 blocks. The location of this telephone backbone cabling block shall be coordinated with the work specified in the horizontal cabling section. The telephone backbone cabling block shall be placed under any 110 blocks installed as part of the work specified by the horizontal cabling specification.
 - The backbone cable terminated on 110 block will be overlaid with 25 pair cable and extended to the relay rack to terminate on a 24 port rj-11 patch panel. The overlay cable shall be a pigtail with a 50 pin Amphenol connector to mate with the patch panel. Coordinate panel location with owner.
 - Install shield bond connectors at each end of each cable. Bond this connector to the telecommunications grounding busbar.
- e. Lightning protection, backbone 110 blocks, and special dial tone 110 blocks shall be organized into a logical and easy to use cross connect field, with suitable wire management for cross connects between blocks, both vertically and horizontally. The scope of this work does not include installation of the special dial tone 110 blocks, however, it does include coordination with this work to provide a logical and easy to use cross connect field complete with cable management for routing of cross connect jumpers.

3.3 IDENTIFICATION

- a. Telephone Backbone Cable Identification
 - Each telephone backbone cable shall be assigned a unique identifier consisting of

the following components:

- i. Abbreviation for the originating telecommunications room. Typical originating telecommunications room is MDF.
 - ii. Abbreviation for the terminating telecommunications room. Typical terminating telecommunications room will be IDF-B, IDF-C, etc.
 - iii. Pair count.
- The unique cable ID shall be constructed from these 3 components. For example, if you were labeling a 25 pair cable that is run from the MDF room to IDF D, your cable label would be MDF-IDF-D-25.
 - Cable shall be labeled at each telecommunication room, near the location that the cable enters the telephone punch blocks.
 - Cable shall be labeled every 50' along the length of the cable in open trays, and on each side of all wall penetrations.
 - Cable routed in conduit systems shall be labeled at each pull point. This includes the every time cable enters or exits a conduit, j-box, or pull vault.
 - Labels shall consist of permanent typewritten label systems. Hand written labels are not acceptable.

3.4 IDF AND SERVICE ENTRANCE ROOMS

- a. Construction of the backboards, overhead ladder racking, and open relay racks is specified in other sections and is not included in work specified in this section.
- b. Telephone backbone cable shall be routed onto overhead ladder racking systems and around the room to the backboard location indicated for termination of telephone backbone cabling.

3.5 TERMINATION HARDWARE

- a. Quantities of termination blocks, racks, splice enclosures, and patch panels, etc. shown on drawings are illustrative only and are meant to indicate the general configuration of the work. The Contractor is responsible for providing the correct quantities of termination hardware required to terminate the volume of cable described herein and shown on the drawings.

3.6 CROSS-CONNECT

- a. The owner will perform all cross-connects and patching unless otherwise noted.

3.7 GROUNDING

- a. This specification does not include a grounding system. Grounding is specified elsewhere. That work will install a ground busbar mounted on the backboard in the IDF.
- b. A 6AWG insulated conductor shall be run from the telecommunications grounding busbar to the shield of the indoor cable or to the ground point of the outdoor lightning protection.

- c. All grounding shall be in compliance with the NEC code Article 800, Article 250, well as EIA/TIA standard 607.

3.8 CABLE TESTING

- a. General
 - Provide 48 hour advance notice of testing.
 - Visually inspect all cables, cable reels, and shipping cartons to detect cable damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.
 - Conduct cable testing as described below upon completion of installation. Test fully completed systems only.
 - Remove all defective cables from pathways system. Do not abandon cables in place.
 - The Engineer reserves the right to observe the conduct of any or all portions of the testing process.
 - The Engineer further reserves the right to conduct, using Contractor equipment and labor, a random re-test of up to five percent (5%) of the cable plant to confirm documented test results.
 - All test results and corrective procedures are to be documented and submitted with the as-built drawings.
- b. Telephone backbone testing
 - All telephone backbone twisted pair cabling shall be tested for grounds, shorts, continuity of conductors and shields, reversals, and transpositions. The contractor shall guarantee 99% good pairs on all backbone cable with no more than one bad pair in any binder group.

3.9 ACCEPTANCE

- a. Upon receipt of the Contractor's documentation of cable testing, the Engineer will review the installation and may request a test in his presence, of up to 1% of the cables/wires installed.

3.10 AS-BUILT DOCUMENTATION

- a. As built documentation shall include 3 copies of the following:
 - Annotated CAD prints and disks of the electrical set of prints indicating routes of installed cables, slack loop locations, and termination points.
 - All test results both in machine readable format as well as printed neatly bound and organized. Each test shall clearly indicate cable and pair designations

SECTION 27 13 23- OPTICAL FIBER BACKBONE CABLING

Document revision history: 01/2020 – Original Publication

Date	Section	Description of Change

PART 1 GENERAL

1.1 WORK INCLUDED

- a. Furnish and install all labor and materials required for the installation of a Corning fiber cable system.
- b. Owner will provide all patch cords, cross connects, networking equipment, telephone and monitoring equipment. Close coordination with the owner will be required.

1.2 RELEVANT SECTIONS

- a. 27 05 28 Telecommunications Pathways
- b. 27 13 13 Telephone Backbone Cabling
- c. 27 15 13 Category 6 Horizontal Cabling
- d. 27 70 80 Cable Television Cabling
- e. 27 13 33 Category 6a Horizontal Cabling
- f. Appendix – Network Communications Design

1.3 QUALITY ASSURANCE

- a. Do all work in accordance with the guidelines published in EIA/TIA standard 568 and 569. Where conflicts exist, the plans and specifications shall take precedence. All manufacturer installation instructions shall be followed. Where conflicts exist between manufacturer instructions and these plans and specifications, the manufacturer instructions shall take precedence.
- b. The installed system shall be covered by the Corning Cable Systems Corning Extended Warranty Program.

1.4 SUBMITTALS

- a. Submit five sets of shop drawings and product data (or a greater number if specified in Division 1 “Submittals” Section). Submittals will be required for the following items.
 - Evidence that installing contractor is certified by Corning
 - All product data.
 - Rack layouts, including panels and wire management for all racks and cabinets.

1.5 GUARANTEE

- a. The installed optical fiber cable system shall be covered by the Corning LANscape

Extended Warranty Program. This warranty must cover each product component installed as well as the total performance of the optical fiber cable system. Corning Cable Systems shall guarantee to repair or replace defective products free of charge after installation.

PART 2 PRODUCTS

2.1 PRODUCTS

- a. Fiber optic distribution units shall be sized according to total number of fiber panels or modules installed:
 - 1 to 4 cassettes: Corning CCH-o3U
 - 4 to 12 cassettes: Corning CCH-o4U
 - Above 12 cassettes: provide as many Corning CCH-o4U as are required to accommodate the cassettes.
- b. All fiber cables shall be of an all dielectric construction
- c. Outdoor Fiber Cable Package
 - Cable must be warranted by the Corning for use in outdoor applications and listed for use in applications requiring a UL listing of CMR or OFNR.
 - Cable must utilize loose buffer tube construction with no more than 12 fibers per buffer tube.
 - Cable must be water blocked, either with construction flooded or gel free with water blocking yarns and tapes.
- d. Indoor Fiber Cable Package
 - Cable must fire rated for use in the space it is installed.
 - Individual fiber subunits shall consist of 900 micron tight buffer.
- e. Single Mode Fiber
 - Cable: Corning SMF28 single mode fiber.
 - Splice Cassettes: 12 or 24 Fiber Single mode LC fiber preloaded splice cassettes CCH-CS12-A9-PooRE OR CCH-CS24-AH-PooRE.
- f. Racking and Cabinets:
 - All racking will be provided by work in other sections. No racking is specified in this section.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION

- a. The Contractor shall furnish and install all cabling in accordance with these specifications, and as indicated on the cable schedules and drawings. Corning installation specifications shall take precedence if there is a conflict with this section.
- b. Install each cable as an uninterrupted conductor section between the designated termination points, unless otherwise directed by the cable installation specifications. There shall be no splices or mechanical coupler installed between the cable points of origin and termination except as shown on drawings and or specifications.

- c. Contractor is responsible for insuring that cable jacket is suitable for the environment in which it is placed i.e.: OFNR, OFNP rated. Unless otherwise noted on the drawings, all cable should be assumed to be rated OFNR.
- d. All cable shown on drawings to be routed in conduit and cable tray system.
- e. At the same time cable is pulled into a cable pathway, also install a mule tape of appropriate size to facilitate future cable pulls along those pathways.
- f. Surface mounted raceway or exposed cable not specifically designated require written approval of the architect.
- g. Provide fire stopping at all locations where cables penetrate fire rated surfaces. Materials and methods used shall be acceptable to the code authority having jurisdiction and shall maintain the fire integrity of the wall, floor, or ceiling.
- h. Contractor shall closely coordinate and work with the owner on the construction of racking and panels and termination and routing of the cabling in the telecommunications room, overhead basket tray, and into the open relay racks and cabinets.

3.2 FIBER OPTIC CABLE INSTALLATION

- a. Manufacturer instructions shall be carefully followed during the installation of fiber optic cable. Particular attention should be paid to pulling tension and bend radius.
- b. At least 30ft of slack cable shall be coiled neatly and mounted to the telecommunications backboards using Velcro tie wraps in at each termination point.
- c. Each cable shall be individually attached to the respective fiber enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.
- d. Fiber optic splicing/distribution shall be placed at the top of the left-most rack or cabinet in the IDF when viewed from the front of the rack or cabinet unless otherwise noted on the drawings or in this specification.
- e. Indoor Fiber Cable
 - Where routed through tray system, all indoor fiber cable shall be installed in plenum rated inner duct.
 - Inner duct is not required where cable is installed in conduit and that conduit does not contain any other than fiber optic cables. In conduits that are populated with other cabling, inner duct shall be provided and installed.
- f. Outdoor Fiber Cable
 - Each intermediate vault shall have 80ft of slack cable coiled and stored neatly.
 - Fanout kits shall be installed on all buffer tubes containing multi mode fiber.
 - Fanout kits are not required for single mode fiber.
- g. Single Mode Fiber Cable
 - Single mode fiber cable shall be terminated by fusion splicing factory LC/UPC pigtail modules onto the backbone cabling.
 - The fiber count in the LC/UPC pigtail modules shall be matched to the fiber count in the cabling being terminated.
 - i. If a cable has 12 single mode fibers, then 12-fiber pigtail cassettes shall be

- used to terminate that cable.
- ii. If a cable has 24 single mode fibers, then 24-fiber pigtail cassettes shall be used to terminate the cable.
 - Fiber slack of buffer tubes or indoor fiber sub-units shall be neatly coiled within the fiber splice enclosure. No slack loops of buffer tubes shall be allowed in the cabinet or on the relay rack.
 - A maximum of 24 strands of fiber shall be spliced in each cassette and no more than one cable shall be spliced in a cassette.

3.3 IDENTIFICATION

- a. Fiber Optic Backbone Cable Identification
 - Each fiber optic cable shall be assigned a unique identifier consisting of the following components:
 - i. Abbreviation for the originating telecommunications room. Typical originating telecommunications room is Core1 or Core 2.
 - ii. Abbreviation for the terminating telecommunications room. Typical terminating telecommunications room will be MDF, IDF-B, IDF-C, Warehouse IDF, etc.
 - iii. Fiber type: SM for single-mode cable.
 - iv. Strand count. Add strand count to label
 - The unique cable ID shall be constructed from these 4 components. For example, if you were labeling a 24 single mode fiber cable run from the MDF to IDF B, your cable label would be MDF-IDFB-SM-24.
 - Cable shall be labeled at each telecommunication room, near the location that the cable enters the fiber optic panels or splice enclosures.
 - Each splice cassette shall be clearly labeled with cable ID and specific strand counts in that tray.
 - Cable shall be labeled every 50' along the length of the cable in open trays, and on each side of all wall penetrations.
 - Cable routed in conduit systems shall be labeled at each pull point. This includes the every time cable enters or exits a conduit, j-box, or pull vault.
 - Fiber optic panels shall be labeled with the destination of the fiber cable, the fiber type, the strand number within the cable.

3.4 IDF ROOMS

- a. Construction of the backboards, overhead ladder racking, open relay racks, and server cabinets is specified in other sections and is not included in work specified in this section.
- b. In all IDFs, the fiber optic cable shall be routed onto overhead ladder racking systems. The installation shall be coordinated with work by others.
- c. Fiber optic slack loops shall be placed in out of the way locations on the walls. Slack loops shall not be placed on the overhead ladder racking, open relay racks, or server cabinets.
- d. The sections that specify the work of installing the open relay racks in IDF rooms has

stipulated that space at the top of the left most rack is to be reserved for fiber optic enclosures that will be installed as work specified in this section. Close coordination with the contractor installing the open relay racks is required.

3.5 TERMINATION HARDWARE

- a. Quantities of termination blocks, racks, splice enclosures, and patch panels, etc. shown on drawings are illustrative only and are meant to indicate the general configuration of the work. The Contractor is responsible for providing the correct quantities of termination hardware required to terminate the volume of cable described herein and shown on the drawings.

3.6 CROSS-CONNECT

- a. The owner will perform all cross-connects and patching unless otherwise noted.

3.7 CABLE TESTING

- a. General
 - Provide 48 hour advance notice of testing.
 - Visually inspect all cables, cable reels, and shipping cartons to detect cable damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.
 - Conduct cable testing as described below upon completion of installation. Test fully completed systems only.
 - Remove all defective cables from pathways system. Do not abandon cables in place.
 - The Engineer reserves the right to observe the conduct of any or all portions of the testing process.
 - The Engineer further reserves the right to conduct, using Contractor equipment and labor, a random re-test of up to five percent (5%) of the cable plant to confirm documented test results.
 - All test results and corrective procedures are to be documented and submitted with the as-built drawings.
- b. Fiber Optic Cable Testing
 - After all terminations have been completed, tests will be conducted using an OTDR prior to loss testing. Contractor will test all fibers with an OTDR in both directions. OTDR testing will verify proper installation of the cable, splices, and connectors and will establish the length of the cable to be used during acceptance.
 - After OTDR testing on a span is complete, contractor shall then perform loss testing at two wavelengths specified below. Loss tests shall be recorded for each fiber for each wavelength. These values shall be used to perform acceptance calculations described below.
 - i. Single Mode fiber wavelength testing shall be at 1310nm and 1550nm.
 - Contractor shall perform span loss calculations to compute the maximum allowed loss for each span at each wavelength. These span loss calculations shall be compared to measured performance. Span loss shall be calculated based on manufacturer guaranteed performance at the measured wavelength adjusted by the length of the cable. To that figure, span loss shall add .5dB for each mated connector and .25dB for each

fusion splice. This figure is the maximum loss at that wavelength that is allowed for the cable span.

- A fiber cable is accepted when the measured loss in all fiber strands in the cable less than the calculated span loss.
- Cables that are not accepted will be removed and replaced at the contractors' expense.

3.8 ACCEPTANCE

- a. Upon receipt of the Contractor's documentation of cable testing, the Engineer will review the installation and may request a test in his presence, of up to 1% of the cables/wires installed.

3.9 AS-BUILT DOCUMENTATION

- a. As built documentation shall include 3 copies of the following:
 - Annotated CAD prints and disks of the electrical set of prints indicating routes of installed cables, slack loop locations, and termination points.
 - All test results both in machine readable format as well as printed neatly bound and organized. Each test shall clearly indicate cable and fiber strand designations.

SECTION 27 13 33 - CATEGORY 6A HORIZONTAL CABLING

Document revision history: 01/2020 – Original Publication

Date	Section	Description of Change

PART 1 GENERAL**1.1 Work Included**

- a. Furnish and install all labor and materials required for the installation of PANDUIT® Augmented Category 6 cabling shown on the drawings. This cabling system will provide connectivity to workstations and equipment that require 10 Gigabit applications.
- b. Unless otherwise noted, owner will provide all patch cords, cross connects, networking equipment, telephone and monitoring equipment. Close coordination with the owner will be required.

1.2 Relevant Sections

- a. 27 05 28 Telecommunications Pathways
- b. 27 13 13 Telephone Backbone Cabling
- c. 27 13 23 Optical Fiber Backbone Cabling
- d. 27 15 13 Category 6 Horizontal Cabling
- e. 27 70 80 Cable Television Cabling
- f. Appendix – Network Communications Design

1.3 Quality Assurance

- a. Do all work in accordance with the guidelines published in EIA/TIA standard 568 and 569. Where conflicts exist, the plans and specifications shall take precedence. All manufacturer installation instructions shall be followed.
- b. Horizontal cabling system shall be provided with a one year system warranty to guarantee end-to-end high performance cabling systems that meet application requirements. The guarantee shall include cable and connectivity components and have one point of contact for all cabling system issues. The system shall be warranted for a period of at least 1 year and will include all labor and materials to correct any defect during the warranty period.
- c. The contractor shall have completed Panduit product and installation training. All workers involved in the installation and termination of cable shall have at least one year of experience. No less than 33% of the installers on the job shall have attended a vendor sponsored training program covering installation and termination of cable.

1.4 Submittals

- a. Submit five sets of shop drawings and product data (or a greater number if specified in

Division 1 "Submittals" Section). Submittals will be required for the following items.

- All product data.
- Backboard layout for voice/data backboard in the telecommunications room/Intermediate Distribution Facility (IDF).
- Rack layouts, including panels and wire management for all racks.

1.5 Guarantee

- a. The Category 6A Backbone Cabling system shall be provided with a one year system warranty to guarantee end-to-end high performance cabling systems that meet application requirements. The guarantee shall include cable and connectivity components and have one point of contact for all cabling system issues. The system shall be warranted for a period of at least 1 year and will include all labor and materials to correct any defect during the warranty period.

PART 2 PRODUCTS

2.1 Products

- a. Category 6A unshielded twisted pair cable: any owner approved cable warranted by manufacturer to support 10 Gigabit applications and meets or exceeds ANSI/TIA-568-C.2 Category 6A.
- b. Category 6A angled patch panels: Panduit CPPLA24WBLY mini-com 24 port patch panels.
- c. Jacks: Panduit mini-com CJ6X88TGBL 10Gig UTP jack modules.

PART 3 EXECUTION

3.1 General Cable Installation

- a. The Contractor shall furnish and install all cabling in accordance with these specifications, and as indicated on the cable schedules and drawings.
- b. Install each cable as an uninterrupted conductor section between the designated termination points, unless otherwise directed by the cable installation specifications. There shall be no splices or mechanical coupler installed between the cable points of origin and termination except as shown on drawings and or specifications.
- c. Contractor is responsible for insuring that cable jacket is suitable for the environment in which it is placed i.e.: CM, CMR, CMP rated.
- d. All cable shown on drawings to be routed in conduit and cable tray system, where provided.
- e. At the same time cable is pulled into a cable pathway, also install a pull string of appropriate size to facilitate future cable pulls along those pathways.
- f. Surface mounted raceway or exposed cable not specifically designated require written approval of the architect.
- g. Provide fire stopping at all locations where cables penetrate fire rated surfaces. Materials and methods used shall be acceptable to the code authority having jurisdiction and shall

maintain the fire integrity of the wall, floor, or ceiling.

- h. Contractor shall closely coordinate and work with the owner on the construction of racking and panels and termination and routing of the cabling in the telecommunications room, overhead basket tray, and into the open relay racks.
- i. Unless otherwise specified in the drawings, each outlet shall be served by at least 2 category 6A cables.
- j. No installed category 6A cable shall exceed 90 meters in length.
- k. The contractor will be responsible for the installation of all "J-hooks" for horizontal cable support. Coordinate location of support hardware to avoid conflicts with other trades. All support hardware shall be category 5e compliant, which means that D-rings and bridle rings are not allowed.
- l. Cabling shall be secured to the "J-hooks" and cable basket tray using Velcro wraps. The Velcro wraps will be cinched snug enough around the cable bundle to keep them uniform and routed neatly through the hooks or basket tray, but not so tight as to damage the cables themselves.
- m. Where conduit is not provided, cable shall be bundled neatly and attached securely to building structure at intervals not to exceed 5 feet. Cable shall not be attached to conduit, ducting, or piping. It shall not be allowed to drape over building elements.
- n. The category 6A cabling in the racks shall be installed with sufficient and appropriate rear mounting clips, brackets, and rear cable management to provide a secure and maintainable system.
- o. Unless otherwise noted below, the category 6A cabling shall be terminated in category 6A jacks that are mounted into category 6A patch panels.
- p. Horizontal front facing wire management panels are to be two position finger duct. A single wire management panel must be installed facing the front of the racks at the top position in the rack and under each patch panel. Thus, there is to be one more wire management panel than patch panel.
- q. In each IDF, space at the top of the left most rack shall be reserved for a fiber optic enclosure that will be installed under work specified in other sections.
- r. The category 6A backbone cable shall be installed into patch panels that are installed under the fiber optic enclosure referenced in the above item.
- s. Only category 6A backbone cabling shall be installed in the category 6A backbone patch panels. These panels shall be dedicated to backbone cabling use and not used for category 5e horizontal cabling.
- t. Unless specifically directed by the owner, relay racks shall be filled from top to bottom, left to right. No IDF relay rack shall be filled with more than 22 RU of patch panels and wire management. The bottom 20RU of each IDF rack is reserved for use by the owner.

3.2 Identification

- a. Category 6A cable identification:
 - Each category 6A backbone cable shall be assigned a unique cable ID that is constructed out of the following components:

- i. The three digit building number
 - ii. The IDF identification that the cable terminates in (IDF-B, IDF-C, etc.).
 - iii. A 6-digit cable number. Each category 6A cable pulled to an IDF shall be number sequentially starting at 10G001 and increasing for each cable pulled to that IDF.
 - For example, the label for the 12th cable run to IDF B in building 16 shall have cable ID 016B10G012.
- b. Patch Panel Identification
- Each group of four sequential jacks representing a typical device plate in the category 6A panels must be labeled with the room number of that the device plate resides in. This room number must be the permanent room numbers assigned by the owner, not the construction room numbers. The room designation shall be placed above the jacks in the panel.
 - Below each jack in every patch panel, the 4-digit cable number representing that jack. All cable numbers in all patch panels must be sequential.
 - Label shall be typewritten label tape, 3/8 inch wide with industrial strength adhesive.

3.3 Termination Hardware

- a. Quantities of termination blocks, racks, splice enclosures, and patch panels, etc. shown on drawings are illustrative only and are meant to indicate the general configuration of the work. The Contractor is responsible for providing the correct quantities of termination hardware required to terminate the volume of cable described herein and shown on the drawings.

3.4 Cross-Connect

- a. The owner will perform all cross-connects and patching unless otherwise noted.

3.5 Cable Testing

- a. General
 - Provide 48 hour advance notice of testing.
 - Visually inspect all cables, cable reels, and shipping cartons to detect cable damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.
 - Conduct cable testing as described below upon completion of installation. Test fully completed systems only.
 - Remove all defective cables from pathways system. Do not abandon cables in place.
 - The Engineer reserves the right to observe the conduct of any or all portions of the testing process.
 - The Engineer further reserves the right to conduct, using Contractor equipment and labor, a random re-test of up to five percent (5%) of the cable plant to confirm documented test results. All test results and corrective procedures are to be documented and submitted with the as-built drawings.
- b. Category 6A cable:
 - Visually inspect all cables, cable reels, and shipping cartons to detect cable damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.
 - All category 6A cables shall be tested and certified to support 10GbaseT Gigabit Ethernet.

3.6 Acceptance

- a. Upon receipt of the Contractor's documentation of cable testing, the Engineer will review the installation and may request a test in his presence, of up to 1% of the cables installed.

3.7 As-Built Documentation

- a. The contractor shall provide CAD prints and disks of the electrical set of prints indicating final faceplate location, faceplate designations, rack designations, as well as major conduit, cable tray, and installed cable routes.
- b. The contractor shall include machine-readable results of all test results neatly bound and organized. Each test shall clearly indicate jack and/or cable designations.

SECTION 27 15 13 - Category 6 Horizontal Cabling

Document revision history: 01/2020 – Original Publication

Date	Section	Description of Change

PART 1 GENERAL

1.01 WORK INCLUDED

- a. Furnish and install all labor and materials required for the installation of a PANDUIT® category 6 cabling system. This horizontal cabling system will provide connectivity from each IDF to indicated station outlets, and provide and install all open relay racks and overhead ladder racking in the IDFs.
- b. Work described in this section includes all open relay racks in all IDF rooms, all overhead ladder racking for cable routing and support inside all IDF rooms.
- c. Unless otherwise noted, owner will provide all patch cords, cross connects, networking equipment, telephone and monitoring equipment. Close coordination with the owner will be required.
- d. The scope of this work includes coordination with the division 28 access control and CCTV security contractors who may need to place UTP cable and patch panels in open relay racks in the IDF.

1.02 RELEVANT SECTIONS

- a. 27 05 28 Telecommunications Pathways
- b. 27 13 13 Telephone Backbone Cabling
- c. 27 13 23 Optical Fiber Backbone Cabling
- d. 27 13 33 Category 6A Horizontal Cabling
- e. 27 70 80 Cable Television Cabling
- f. Appendix – Network Communications Design

1.03 QUALITY ASSURANCE

- a. Do all work in accordance with the guidelines published in EIA/TIA standard 568 and 569. Where conflicts exist, the plans and specifications shall take precedence. All manufacturer installation instructions shall be followed.
- b. Horizontal cabling system shall be provided with a one year system warranty to guarantee end-to-end high performance cabling systems that meet application requirements. The guarantee shall include cable and connectivity components and have one point of contact for all cabling system issues. The system shall be warranted for a period of at least 1 year and will include all labor and materials to correct any defect during the warranty period.
- c. The contractor shall have completed Panduit product and installation training. All workers involved in the installation and termination of cable shall have at least one year of experience. No less than 33% of the installers on the job shall have attended a vendor sponsored training program covering installation and termination of cable.

1.04 SUBMITTALS

- a. Submit five sets of shop drawings and product data (or a greater number if specified in Division 1 "Submittals" Section). Submittals will be required for the following items.
 - All product data.
 - Backboard layout for voice/data backboard in the telecommunications room/Intermediate Distribution Facility (IDF).
 - Rack layouts, including panels and wire management for all racks.

1.05 GUARANTEE

- a. Horizontal cabling system shall be provided with a one year system warranty to guarantee end-to-end high performance cabling systems that meet application requirements. The guarantee shall include cable and connectivity components and have one point of contact for all cabling system issues. The system shall be warranted for a period of at least 1 year and will include all labor and materials to correct any defect during the warranty period.

PART 2 PRODUCTS

2.01 PRODUCTS

- a. Horizontal Cabling:
 - Category 6 unshielded twisted pair cable: Berk-Tek Lanmark-6 or UO approved equivalent.
 - Category 6 Station Jacks: Panduit mini-com cat 6 jacks CJ688TGXX, color to match electrical outlet color.
 - Single gang device plates: Panduit mini-com CFPnXX classic series device plates or CFPnSY for stainless steel device plates, number of jack positions as required. Match color and style of electrical trim.
 - Modular Furniture device plates: Panduit mini-com appropriate for modular furniture yet to be selected. This is a coordination issue. Bid shall include modular furniture device plates.
 - Panduit mini-com patch panels: Panduit CPPLA48WBL mini-com 48 port patch panels loaded with mini-com cat 6 jacks, black in color.
 - Special alarm and emergency dial tone IDF termination hardware: 110 blocks with legs, terminations with C4 block connectors
- b. Wireless Access Point Horizontal Cabling:
 - See 2.01 A. and B. for materials with the following exception:
 - i. Station termination: Panduit 2-port surface mount housing for above ceiling applications and 2-port single gang device plate for terminations in finished walls.
 - ii. Category 6 Station Jacks: Panduit mini-com cat 6 jacks.
- c. Security Panels, Building Automation and Power Meter Horizontal Cabling:
 - See 2.01 A. and B. for materials with the following exception:
 - i. All cables shall be terminated within the enclosure that serves each BAS or metering data connection.
 - ii. Station Termination: Utilize Panduit CBXJ2EI-A surface mount box.
- d. Security Cameras:
 - See 2.01 A. and B. for materials.
 - For grid ceiling mount cameras: Utilize Panduit CBXJ2EI-A surface mount box attached to closest building structure.
 - For wall mount cameras: Utilize appropriate deep electrical box for camera type.
- e. Area of Rescue Phones:
 - See 2.01 A. and B. for materials.

- All cables shall be terminated within the back box enclosure that serves each AoR connection.
 - Station Termination: Utilize Panduit CBXJ2EI-A surface mount box.
 - Phone equipment: Use Gai-tronics model 397-001 phones.
- f. IDF Racks and Ladder Rack:
- Relay Racks: Chatsworth/CPI 55053-703 7ft relay racks
 - Vertical Wire Management Panels: Chatsworth/CPI 40093-703 MCS-EFX Vertical Wire Management.
 - No horizontal management between patch panels.
 - Overhead ladder racking: Chatsworth/CPI 10250-718 18" wide rack, and Chatsworth/CPI 10250-724 24" wide rack.
 - Cable Runway Radius Drop: Chatsworth/CPI 12100-7XX cross member runway radius drop and Chatsworth/CPI 12101-701 string runway radius drop.
 - Cable Retaining Post: Chatsworth/CPI 10596-706 6" retaining post and 10596-708 8" retaining Post
 - Mounting hardware, splices, grounding kits, and support brackets: Chatsworth/CPI

PART 3 EXECUTION

3.01 GENERAL CABLE INSTALLATION

- a. The Contractor shall furnish and install all cabling in accordance with these specifications, and as indicated on the cable schedules and drawings.
- b. Install each cable as an uninterrupted conductor section between the designated termination points, unless otherwise directed by the cable installation specifications. There shall be no splices or mechanical coupler installed between the cable points of origin and termination except as shown on drawings and or specifications.
- c. Contractor is responsible for insuring that cable jacket is suitable for the environment in which it is placed i.e.: CM, CMR, CMP rated.
- d. All cable shown on drawings to be routed in conduit and cable tray system, where provided.
- e. At the same time cable is pulled into a cable pathway, also install a pull string of appropriate size to facilitate future cable pulls along those pathways.
- f. Surface mounted raceway or exposed cable not specifically designated require written approval of the architect.
- g. Provide fire stopping at all locations where cables penetrate fire rated surfaces. Materials and methods used shall be acceptable to the code authority having jurisdiction and shall maintain the fire integrity of the wall, floor, or ceiling.
- h. Contractor shall closely coordinate and work with the owner on the construction of racking and panels and termination and routing of the cabling in the telecommunications room, overhead basket tray, and into the open relay racks.

3.02 HORIZONTAL CATEGORY 6 CABLE INSTALLATION

- a. Unless otherwise specified, each station outlet shall consist of four (4) category 6 cables. Four port device plates shall be loaded with four jacks.
- b. No installed category 6 cable shall exceed 90 meters in length.
- c. All cables shall be terminated in station jacks, no direct RJ-45 or RJ-11 connections are allowed.
- d. The contractor will be responsible for the installation of all "J-hooks" for horizontal cable support. Coordinate location of support hardware to avoid conflicts with other trades. All support

- hardware shall be category 6 compliant, which means that D-rings and bridle rings are not allowed.
- e. Cabling shall be secured to the “J-hooks” and cable basket tray using Velcro wraps. The Velcro wraps will be cinched snug enough around the cable bundle to keep them uniform and routed neatly through the hooks or basket tray, but not so tight as to damage the cables themselves.
 - f. Where conduit is not provided, cable shall be bundled neatly and attached securely to building structure at intervals not to exceed 5 feet. Cable shall not be attached to conduit, ducting, or piping. It shall not be allowed to drape over building elements.
 - g. Cabling shall be installed with a 12 inch slack loop placed as near to the station outlet as possible. Often this slack loop will be in the cable tray or above a drop ceiling where conduit is stubbed from the outlet box.
 - h. The scope of this work includes Installation of workstation cables into modular furniture systems. These systems have not yet been specified, so bid should be based on quantities of jacks shown on drawings. The actual installation shall be coordinated with the modular furniture system contractor. This includes assisting in planning cable routes into the furniture systems, selecting appropriate device plates for the furniture system, selecting appropriate outlet locations, and installing the cabling into the furniture systems at the appropriate time during the furniture system installation. Prior to the furniture system installation, the workstation cables will be pulled near the entrances to the furniture systems. The cabling shall be pulled with sufficient slack to reach the outlet location. This slack left coiled in a location where it will not be susceptible to damage. After the modular furniture systems are installed, the contractor will pull cable to the outlet locations and complete the cable installation. As of the date of the bid set of construction drawings, the modular furniture plan is not complete. Drawings are representative only and should be used to bid quantities of cabling and outlets. The drawings do not reflect actual outlet locations.
 - i. Installation of communications cabling into floor boxes shall be coordinated with the electrical sub-contractor. Provide and install appropriate device plates for mounting the jacks in the electrical contractor installed floor boxes.
 - j. Installation and termination of communications cabling will require coordination with the cable television cabling work specified in 27 70 80. Coordinate cable pulls and communications device plates with this work.
 - k. The category 5e cabling in the racks shall be installed with sufficient and appropriate rear mounting clips, brackets, and rear cable management to provide a secure and maintainable system.
 - l. Unless otherwise noted below, the category 5e cabling shall be terminated in category 5e jacks that are mounted into category 5e patch panels. All cables run to a single station device plate shall be terminated on sequential jacks in the patch panels.
 - m. Horizontal front facing wire management panels are to be two position finger duct. A single wire management panel must be installed facing the front of the racks at the top position in the rack and under each patch panel. Thus, there is to be one more wire management panel than patch panel.
 - n. In each IDF, space at the top of the left most rack shall be reserved for a fiber optic enclosure that will be installed under work specified in other sections. Rack layout shall be coordinated with this work.
 - o. Unless specifically directed by the owner, relay racks shall be filled from top to bottom, left to right. No IDF relay rack shall be filled with more than 22 RU of patch panels and wire management. The bottom 20RU of each IDF rack is reserved for use by the owner.
 - p. Wall phone wiring: All outlets for wall phones are to meet ADA height and location requirements for

handicapped access. For specifically identified wall phone locations, a single voice outlet shall be installed to provide voice-only communication. Two category 5e cables shall be pulled to each location. At the station end, one cable shall be tagged and coiled for future use and the other cable shall be terminated in a single category 5e jack and the jack mounted into a stainless steel wall phone plate. Both of the category 5e cables pulled to a wall phone location shall be terminated on the IDF end in the category 5e patch panel system.

- q. Elevator wiring: For each elevator location, a duplex outlet shall be installed to provide voice-only communication. Two category 6 cables shall be installed to each elevator controller. All elevator cabling shall be terminated in the IDF on wall-mount 110-style punch blocks. Installation of elevator system jacks shall be coordinated with the elevator installer. Provide cross connects to extend elevator dial tone from the telephone service entrance blocks to telephone backbone cabling, and then onto to this cabling.
- r. Fire and Security Alarm wiring: For each alarm location, a duplex outlet shall be installed and terminated as specified in 2.01 A. 2. Two category 6 cables shall be pulled to each location. All fire and security voice cabling shall be terminated in the IDF on wall-mount 110-style punch blocks. Installation of alarm system jacks shall be coordinated with the alarm installer. Provide cross connects to extend dial tone from the telephone service entrance blocks to telephone backbone cabling, and then onto to this cabling. Network cabling shall be terminated as described in Section 3.02 T., coordinate with owner and alarm contractor for specific cable count.
- s. Building Automation and Power metering wiring: For each monitoring location an outlet shall be installed and terminated as specified in 2.01 A. 2. A minimum of two category 6 cables shall be installed at each location. They shall be terminated in the enclosure housing the BAS and metering applications. No active networking devices are allowed in the BAS and Power metering system. All devices shall be connected via structured cabling to the closest data closet and are to be directly connected to the University operations network.
- t. Security Camera wiring: For each camera a duplex outlet shall be installed and terminated as specified in 2.01 A. 2. A minimum of two category 6 cables shall be installed at each location. For cameras mounted to ceiling grid a surface mount box shall be utilized and affixed to the nearest stable location. For wall mount cameras terminate the cables in the box utilized as the camera mount, see
- u. B. 4 for identification.
- v. Area of Rescue wiring: For each Area of Rescue location, a duplex outlet shall be installed and terminated as specified in 2.01 A. 2. A minimum of two category 6 cables shall be installed at each location. They shall be terminated in the back box enclosure housing the AoR phone. Gai-tronics model 397-001 phones will be installed in back boxes. Cables shall be terminated in the nearest IDF.
- w. The scope of this work includes coordination with the contractor installing the cable TV system. This coordination requires coordination of cable pulls and device plates where TV outlets share conduit and/or device plates with cable TV.

3.03 WIRELESS ACCESS POINT CATEGORY 6 CABLE INSTALLATION

- a. Please refer to specifications outlined in the above Horizontal category 6 cable installation section.
- b. Unless otherwise specified, each wireless access station outlet shall consist of two (2) category 6 cables.
- c. Where the wireless access point station termination point is above the drop ceiling, the station outlet shall be terminated in a two port surface housing that is attached to the building structure or basket tray.
- d. Where the wireless access point station termination is on a wall, it shall be mounted in a standard two port single gang device plate.

- e. The wireless access point category 6 cabling shall be terminated on the patch panel system.

3.04 IDENTIFICATION

- a. Horizontal cable identification:
 - Each category 6 cable shall be assigned a unique cable ID that is constructed out of the following components:
 - i. The three digit building number.
 - ii. The IDF identification that the cable terminates in.
 - iii. A 4-digit cable number. Each cable pulled to an IDF shall be number sequentially starting at 001 and increasing for each cable pulled to that IDF.
 - For example, the label for the 92nd cable run to IDF B in building 16 shall have cable ID 016B0092.
- b. Device Plate identification
 - Each device plate shall be labeled as follows:
 - i. At the top of the device plate, the building number and IDF letter (for example, every device plate with conductors run to IDF B in building 16 shall have 016B at the top of the device plate).
 - ii. Under each individual jack, the 4-digit cable number.
 - All jacks in a single device plate must have sequential cable numbers.
 - Device plate labeling shall be typewritten label tape with industrial strength adhesive.
 - For cables that not terminated in device plate or surface mount box, identify with a label equivalent to horizontal cable identification.
- c. Patch Panel Identification
 - Each group of four sequential jacks representing a typical device plate in the category 5 panels must be labeled with the room number of that the device plate resides in. This room number must be the permanent room numbers assigned by the owner, not the construction room numbers. The room designation shall be placed above the jacks in the panel.
 - Below each jack in every patch panel, the 4-digit cable number representing that jack. All cable numbers in all patch panels must be sequential.
 - Label shall be typewritten label tape, 3/8 inch wide with industrial strength adhesive.
- d. Security Camera Identification
 - Each security camera shall have a unique identifier label (ie: Camera 1, Camera 2, etc) that is visible from the outside. See above section A for cable identification.
- e. 110-Block Identification
 - Each 4-pair position on the special horizontal cable 110 blocks shall be labeled with the cable ID and the function (elevator, fire alarm, etc) on the 110 designation strip.

3.05 IDF AND SERVICE ENTRANCE ROOMS

- a. Backboards are specified in other sections and will be provided and installed by others.
- b. Drawings indicate number of racks to install in each IDF and provide a diagrammatic view of the overhead ladder racking. The drawings are diagrammatic only and are not necessarily indicative of the amount of overhead ladder racking that will be required to support the cabling from where it enters the room and is routed to the open relay racks. The scope of this work includes installing any and all overhead ladder racking to support all voice/data cabling that is routed inside of each IDF.
- c. Contractor is responsible for providing earthquake bracing and support for all racks installed in telecommunications rooms.

- d. Each relay rack must have front facing vertical wire management chases installed on each side of the rack.
- e. Racks shall be firmly fastened to the floor and have overhead ladder rack run from the top of the each rack to the wall at the rear of the rack.
- f. Each IDF shall have space reserved in the top left most rack for fiber optic enclosures that are specified in other sections.
- g. Relay racks shall be filled from top to bottom, left to right. No IDF relay rack shall be filled with more than 22 RU of patch panels and wire management. The bottom 20RU of each IDF rack is reserved for use by the owner.
- h. Contractor shall install overhead ladder racking to provide bracing as well as pathway to support and route all cabling to racks in low voltage and telecommunication rooms. The overhead ladder racking shown on drawings is illustrative only and is meant to indicate the general configuration of the work. The Contractor is responsible for providing the correct quantities of ladder racking hardware required to support the cabling described herein and shown on the drawings.
- i. Overhead ladder racking must be installed to provide sufficient pathways to route limited energy cabling in the IDF rooms. Drawings are schematic design only and do not necessarily indicate the size, routing, or amount of ladder racking required to support all installed cabling. Size as needed; minimum size 18 inches. Category 5e bend radius shall be maintained by avoiding sharp corners where tray joins together at right angles as well as routing cable properly out of the tray and onto the relay racks using radius runway drops. Cable retaining posts shall be installed where needed to dress cable to the overhead ladder racking. When used, posts shall be installed with spacing no greater than 18”.

3.06 TERMINATION HARDWARE

- a. Quantities of termination blocks, racks, splice enclosures, and patch panels, etc. shown on drawings are illustrative only and are meant to indicate the general configuration of the work. The Contractor is responsible for providing the correct quantities of termination hardware required to terminate the volume of cable described herein and shown on the drawings.

3.07 CROSS-CONNECT

- a. The owner will perform all cross-connects and patching unless otherwise noted.

3.08 GROUNDING

- a. Furnish and install a telecommunications grounding system. This grounding system shall consist of a main ground busbar in the service entrance location and a ground busbar installed in each of the telecommunications rooms in the project.
- b. The ground busbar shall be mounted on the IDF backboard.
- c. A 2AWG insulated conductor shall be run from the main grounding busbar to each of the ground busbars in each telecommunications room. Conductor insulation shall be green in color.
- d. All metallic cable tray, ladder rack, raceways, cable sheath/armor, enclosures, and equipment racks and other conductive surfaces shall be properly bonded with 5eWG insulated conductors to the grounding system. All paint and other coatings shall be removed at all contact surfaces to ensure proper ground.
- e. All grounding shall be in compliance with the NEC code Article 800, Article 250, well as EIA/TIA standard 607.

3.09 CABLE TESTING

- a. General
 - Provide 48 hour advance notice of testing.
 - Visually inspect all cables, cable reels, and shipping cartons to detect cable damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.
 - Conduct cable testing as described below upon completion of installation. Test fully completed systems only.
 - Remove all defective cables from pathways system. Do not abandon cables in place.
 - The Engineer reserves the right to observe the conduct of any or all portions of the testing process.
 - The Engineer further reserves the right to conduct, using Contractor equipment and labor, a random re-test of up to five percent (5%) of the cable plant to confirm documented test results.
 - All test results and corrective procedures are to be documented and submitted with the as-built drawings.
- b. Category 6 cable:
 - Visually inspect all cables, cable reels, and shipping cartons to detect cable damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.
 - All category 6 cables shall be tested and certified to support 100baseT Gigabit Ethernet or greater.

3.10 ACCEPTANCE

- a. Upon receipt of the Contractor's documentation of cable testing, the Engineer will review the installation and may request a test in his presence, of up to 1% of the cables installed.

3.11 AS-BUILT DOCUMENTATION

- a. The contractor shall provide CAD prints and disks of the electrical set of prints indicating final faceplate location, faceplate designations, rack designations, as well as major conduit, cable tray, and installed cable routes.
- b. The contractor shall provide 3 copies of all test results neatly bound and organized. Each test shall clearly indicate jack and/or cable designations.

SECTION 27 70 80 – Cable Television Cabling

Document revision history: 01/2020 – Original Publication

Date	Section	Description of Change

PART 1 GENERAL

1.1 WORK INCLUDED

- a. Furnish and install all labor and materials required for the installation of cabling that will support an OFOI cable TV distribution system. This work is to provide a “pull only” and termination of the station outlets for the system.
- b. Owner will provide all amplifiers, splitters, taps, and IDF closet terminations. Close coordination with the owner will be required.

1.2 RELEVANT SECTIONS

- a. 27 05 28 Telecommunications pathways
- b. 27 13 13 Telephone Backbone Cabling
- c. 27 13 23 Optical Fiber Backbone Cabling
- d. 27 13 33 Category 6a Horizontal Cabling
- e. 27 15 13 Category 6 Horizontal Cabling
- f. Appendix – Network Communications Design

1.3 QUALITY ASSURANCE

- a. Do all work in accordance with the guidelines published in EIA/TIA standard 568 and 569. Where conflicts exist, the plans and specifications shall take precedence. All manufacturer installation instructions shall be followed.
- b. All workers involved in the installation and termination of cable shall have at least one year of experience. No less than 33% of the installers on the job shall have attended a vendor sponsored training program covering installation of cable TV systems.

1.4 SUBMITTALS

- a. Submit five sets of product data. Submittals will be required for the following items.
 - Cut sheets for all products used.

1.5 GUARANTEE

- a. Guarantee all work against faulty and improper material and workmanship for a minimum period of one (1) year from the date of final written acceptance by Owner, except where guarantee or warranties for longer terms are specified herein.
- b. Upon notification of a problem, the warranty provider shall furnish within 48 hours and at no

cost to the owner, such labor and materials as are needed to restore the system to proper operation.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- a. Amplifiers: by owner
- b. RG6 drop cable: quad-shield Commscope, Belden
- c. Cable TV Backbone Cable: Commscope PIII-500
- d. Splitters/taps: by owner.
- e. F-connectors: any manufacturer compression type F connectors similar to Thomas and Betts snap-n-seal product
- f. Station device plates: Panduit device plates with mini-com CMFSRIxx self-terminating F connector.

2.2 CABLE TV DISTRIBUTION

- a. All cable TV drop cable shall be CATV/CL2 or CATVP/CL2P rated quad-shield RG6.
- b. Cable TV backbone cable shall be run from the service entrance room location to each of the telecommunication rooms. Cable TV backbone cable shall be of .500" rigid construction.
- c. The actual cable TV distribution system itself will be provided by others. This work is to install horizontal and backbone cabling and station termination of horizontal cable.

PART 3 EXECUTION

3.1 INSTALLATION

- a. The Contractor shall furnish and install all cabling in accordance with these specifications, and as indicated on the cable schedules and drawings.
- b. Install each cable TV drop as an uninterrupted conductor section between the IDF location and the station outlet. There shall be no splices or mechanical coupler installed between the cable points of origin and termination except as shown on drawings and or specifications. Daisy chaining of station outlets is not acceptable.
- c. At the IDF location, all cable TV RG6 drop cabling shall be installed to an owner-specified area of the communications backboards, identified, and coiled for finish work by others.
- d. The station end of the drop cable must be terminated with a compression F connector and installed into a self-terminating F connector bulkhead mounted in a communications device plate.
- e. There are locations where the station end device plate will be shared with the existing augmented category 5e cabling. Coordination with the 271513 sub-contractor will be required to coordinate the provisioning of communications device plates. It is in the scope of this work to coordinate the device plate and cable installation in these shared locations.
- f. Backbone cable TV cabling shall be installed as shown on the drawings. This cable shall be identified and coiled on the owner-specified area of the communications backboards.

- g. Cable pulling shall be coordinated with other limited energy cabling installation contractors to eliminate any possibility of damaged cabling.
- h. The cable TV cabling in the IDF shall be installed with sufficient and appropriate mounting clips, brackets, and cable management to provide a neat, secure, and maintainable system.
- i. Contractor is responsible for insuring that cable jacket is suitable for the environment in which it is placed (i.e., CATV/CL2, CATVP/CL2P rated).
- j. All cable shall be routed through the building cable tray/conduit system, where available.
- k. Where cable tray or conduit is not available, cable bundled neatly and shall be attached to building structure at intervals not to exceed 5 feet.
- l. At the same time cable is pulled into a cable pathway, also install a pull string of appropriate size to facilitate future cable pulls along those pathways.
- m. The contractor will be responsible for the installation of all "J-hooks" for horizontal cable support. Coordinate location of support hardware to avoid conflicts with other trades.
- n. At no point will any station cable be tie wrapped or fastened to the cable tray. After cables have exited the cable tray they will be tie wrapped to the "J-hooks". The tie wraps will be cinched snug enough around the cable bundle to keep them uniform and in the hooks, but not so tight as to damage the construction of the cables themselves.
- o. Provide fire stopping at all locations where cables penetrate fire rated surfaces. Materials and methods used shall be acceptable to the code authority having jurisdiction and shall maintain the fire integrity of the wall, floor, or ceiling.
- p. Contractor shall closely coordinate and work with the owner and engineer on the construction, termination and routing of the cabling in the IDFs, overhead ladder racking, and backboard space allocation.

3.2 IDENTIFICATION

- a. Cable tags containing a unique cable ID designator shall be placed on both ends of all cables, 6 inches from the connector. Each label shall be typewritten with permanent ink with the appropriate cable number as indicated. Hand written cable labels are not acceptable
- b. Individual cable sheaths and station end faceplates shall be labeled with the designator of the specific cable. Cable designation shall consist of the IDF letter designation and the individual cable number. Cable sheaths shall be labeled on each end. Station device plates shall be permanently labeled in typewritten ink with the letter of the IDF the cable is run followed by the 3 digit cable number. Cables shall be numbered sequentially, starting from 1. Each IDF termination shall be labeled with cable number and permanent (not construction) room designation

3.3 TERMINATION HARDWARE

- a. All terminations of cable TV RG6 shall be via compression F connectors.

3.4 SYSTEM TESTING

- a. Visually inspect all cables, cable reels, and shipping cartons to detect cable damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.

- b. Conduct cable testing as described below upon completion of installation. Test fully completed systems only. Piecemeal testing is not acceptable, except by prior written approval from the Architect.
- c. Remove all defective cables from pathways system. Do not abandon cables in place.
- d. Testing shall involve continuity testing to verify that the installed cabling has not be cut or shorted during the installation process.
- e. The owner further reserves the right to conduct, using Contractor equipment and labor, a random re-test of up to five percent (5%) of the cable plant to confirm documented test results.
- f. All test results and corrective procedures are to be documented and submitted to the Owner within fourteen (14) working days of test completion.

3.5 ACCEPTANCE

- a. Upon receipt of the Contractor's documentation of cable testing, the Architect will review the installation and may request a test in his presence, of up to 1% of the cable drops installed.
- b. The contractor shall provide the owner with hands-on training for the use and operation of the system.

3.6 AS-BUILT DOCUMENTATION

- a. The contractor shall provide CAD prints and disks of the electrical set of prints indicating final faceplate location, faceplate designations, as well as major conduit, cable tray, and installed cable routes.
- b. The contractor shall provide CAD prints of the one-line diagram of the system showing signal levels at every device, including every outlet in the system.
- c. The contractor shall provide 3 copies of all test results neatly bound and organized. Each test shall clearly indicate cable designations.