DIVISION 17

COMMUNICATIONS & SECURITY

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Communications equipment coordination and installation.
2. Sleeves for pathways and cables.
3. Sleeve seals.
4. Grout.
5. Common communications installation requirements.
6. Training Requirements

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For sleeve seals.

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of communications equipment:
1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting pathways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."."

PART 2 - PRODUCTS

2.1 SLEEVES FOR PATHWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.
1. Basis-of-Design Product: Subject to compliance with requirements, product by one of the following:
a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.
2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of pathway or cable.
3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Communications penetrations occur when pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pathway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
   1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel or cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between pathway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

B. Provide Specified Technologies, Inc (STI) EZ Path Cable Pathway sleeves at all cable penetrations through walls in the telecommunications rooms (MDF and IDF rooms). Provide multiple Series 33 and Series 44 as needed to serve cabling being installed plus 100% spare capacity.

3.5 TRAINING REQUIREMENTS

A. All contractor provided training and demonstrations required in Division 27 and 28 specification sections shall be video recorded. Contractor shall provide the services of an audio-video recording specialist for the recording and making of the DVD of each training session.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Telecommunications mounting elements.
   2. Backboards.
   3. Telecommunications equipment racks and cabinets.
   4. Telecommunications service entrance pathways.
   5. Grounding.

B. Related Sections:
   1. Division 27 Section "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.
   2. Division 27 Section "Communications Horizontal Cabling" for voice and data cabling associated with system panels and devices.
   3. Division 28 Section "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

1.3 DEFINITIONS

A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.

B. BICSI: Building Industry Consulting Service International.

C. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel not exceeding 6 inches (152 mm) in width.

D. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

E. LAN: Local area network.

F. RCDD: Registered Communications Distribution Designer.

G. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of a bottom without ventilation openings within integral or separate longitudinal side rails.

H. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
   3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
   1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of RCDD.
   2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
   3. Field Inspector: Currently registered by BICSI as Commercial Instal**ler, Level 2** to perform the on-site inspection.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

D. Grounding: Comply with ANSI-J-STD-607-A.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

1.7 COORDINATION

A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.
   1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
   2. Record agreements reached in meetings and distribute them to other participants.

3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

B. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-A.

B. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.
1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
2. Support brackets with cable tie slots for fastening cable ties to brackets.
3. Lacing bars, spools, J-hooks, and D-rings.
4. Straps and other devices.

C. Cable Trays:
1. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Cable Management Solutions, Inc.
b. Cablofil Inc.
c. Cooper B-Line, Inc.
d. Cope - Tyco/Allied Tube & Conduit.
e. GS Metals Corp.
2. Cable Tray Materials: Metal, suitable for indoors and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch (0.012 mm) thick.
a. Basket Cable Trays: 12 inches (300 mm) wide and 4 inches (100 mm) deep. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).
b. Ladder Cable Trays: Nominally 18 inches (455 mm) wide, and a rung spacing of 12 inches (305 mm).
c. Channel Cable Trays: One-piece construction, nominally 4 inches (100 mm) wide. Slot spacing shall not exceed 4-1/2 inches (115 mm) o.c.

D. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems."
1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels specified in Division 06 Section "Rough Carpentry."

B. Paint all backboards “BLACK”.

2.3 EQUIPMENT FRAMES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. AMP; a Tyco International Ltd. company.

B. General Frame Requirements:
   1. Distribution Frames: Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
   2. Module Dimension: Width compatible with EIA 310 standard, 19-inch (480-mm) panel mounting.
   3. Finish: Manufacturer's standard, baked-polyester powder coat.

C. Floor-Mounted Racks: Modular-type, steel or aluminum construction.
   1. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug[, and a power strip].
   2. Baked-polyester powder coat finish.

D. Modular Freestanding Cabinets:
   1. Removable and lockable side panels.
   2. Hinged and lockable front and rear doors.
   3. Adjustable feet for leveling.
   4. Screened ventilation openings in the roof and rear door.
   5. Cable access provisions in the roof and base.
   6. Grounding bus bar.
   7. Rack-mounted, 550-cfm (260-L/s) fan with filter.
   8. Power strip.
   9. Baked-polyester powder coat finish.
   10. All cabinets keyed alike.

E. Cable Management for Equipment Frames:
   1. Metal, with integral wire retaining fingers.
   2. Baked-polyester powder coat finish.
   3. Vertical cable management panels shall have front and rear channels, with covers.
   4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.4 POWER DISTRIBUTION SWITCHED RACK UNIT

A. Power Distribution Switched Rack Unit: Comply with UL 1363.
   1. Rack mounting.
   2. Twenty Four 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R receptacles.
   3. LED indicator lights for power and protection status.
   4. LED indicator lights for reverse polarity and open outlet ground.

5. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
6. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
7. Cord connected with 10-foot (3.05-m) line cord.
8. Rocker-type on-off switch, illuminated when in on position.
9. Peak Single-Impulse Surge Current Rating: 26 kA per phase.
10. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all 3 modes shall be not more than 330 V.
11. Power Distribution Switched Rack Unit shall be APC Switched PDU model # AP7030.
12. Provide one Power Distribution Switched Rack Unit in each equipment rack and cabinet.

2.5 GROUNDING

A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems." for grounding conductors and connectors.

B. Telecommunications Main Bus Bar:
1. Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide (6 mm thick by 100 mm wide) with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart.
3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

C. Comply with ANSI-J-STD-607-A.

2.6 LABELING

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.

B. Install underground pathways complying with recommendations in TIA/EIA-569-A, "Entrance Facilities" Article.

C. Comply with NECA 1.

D. Comply with BICSI TDMM for layout and installation of communications equipment rooms.

E. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.

F. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.2 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."Comply with TIA/EIA-569-A, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

C. Provide Specified Technologies, Inc (STI) EZ Path Cable Pathway sleeves at all cable penetrations through walls in the telecommunications rooms (MDF and IDF rooms). Provide multiple Series 33 and Series 44 as needed to serve cabling being installed plus 100% spare capacity.

3.3 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.
   1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.4 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

B. See Division 27 Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion of TIA/EIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 3 level of administration including optional identification requirements of this standard.

C. Labels shall be preprinted or computer-printed type.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Complete and operational audiovisual (A/V) and remote control systems, including:
   1. Video projection
   2. Remote controls
   3. Program and speech audio reinforcement
   4. AV recording
   5. Baseband/broadband distribution systems
   6. Video Teleconferencing

B. The Contractor shall be responsible to provide a turnkey system. The drawings and specifications are for the design intent purposes. It shall be the Contractor's responsibility to review the drawings and specifications to ensure that the design intent and all required products are included in the project.

C. The Contractor shall be responsible for providing a complete, functional system including all necessary components, whether included in this specification or not. Quantities indicated on the Drawings and in these Specifications are for reference purposes only. It is the responsibility of the Contractor to provide appropriate quantities of materials and equipment to provide a complete functional system. In the event any item(s) is (are) not specified, but is (are) needed to complete the work properly, the Contractor shall provide the needed item(s) at no additional charge.

D. If mention has been omitted herein of any items of the work or materials usually furnished for, or necessary to, the completion of the cabling work, or if there are conflicting points in the Specifications, it shall be the Contractor's responsibility to call the Owner's and Engineer's attention to such an item or items in sufficient time for a formal addendum to be issued. Any and all conflicting points in the Specifications and/or drawings which are not questioned by the successful bidder and clarified at the Pre-Bid Meeting, prior to opening of bids shall be subject to the interpretation of the Owner after award of the contract, and its interpretation shall be binding upon the successful bidder. The Contractor shall be obligated to provide all equipment and materials, either specifically mentioned herein or not, to ensure a complete and operating system including all mounting brackets, hardware and materials.

1.2 RELATED DOCUMENTS

A. Divisions 26 Section Electrical Sections for Lighting Controls, power, connections, interconnectivity, and disconnects.

1.3 REFERENCES

A. Building Industry Consulting Services International (BiCSi), Telecommunications Distributions Methods Manual, Tenth Edition 2005.

B. Electronic Industries Association/Telecommunications Industry Association (EIA/TIA) -568A, Commercial Building Telecommunications Wiring Standard

C. EIA/TIA -569, Commercial Building Standard for Telecommunications Pathways and Spaces.

D. EIA/TIA-606, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

E. EIA/TIA-607, Commercial Building Grounding/Bonding Requirements

F. National Fire Protection Agency (NFPA) 70 - National Electrical Code (NEC), 2002

G. Institute of Electrical and Electronic Engineers (IEEE) 802.3 Carrier Sense Multiple Access with Collision Detection (Ethernet and 10BASE-T)

H. Belden Cabling Systems Manual. 2005 Edition

I. Federal Communications Commission (FCC), Title 47, Code of Federal Regulations, Part 68.

J. National Institution for Communications Engineering Technology (NICET)

K. International Communications Industry Association (ICIA).

1.4 SYSTEM DESCRIPTION

A. Performance Requirements: Provide following minimum performance for each item identified unless otherwise restricted by manufacturers' published specifications for individual items or systems:

1. Audio:
   a. S/N (including crosstalk and hum): 75 dB minimum
   b. Total Harmonic Distortion: 0.5% maximum from 30 Hz to 15,00Hz.
   c. Frequency Response: Flat within +1.0 dB, 30 Hz to 15,000Hz.

2. Video (signal):
   a. S/N (peak to RMS) unweighted DC to 4.2 MHz: 45-dB minimum
   b. Crosstalk, unweighted DC to 4.2 MHz: 45 dB minimum
   c. Frequency Response (composite): Within +0.5 dB to 10 MHz
   d. Frequency Response (component) Within +0.5 dB to 100 MHz
   e. Line and Field Tilt: 2% maximum
   f. Differential Gain: 3% maximum
   g. Differential Phase: 2 degrees maximum

3. Performance Tests, Signal Paths: Signal paths for above Performance Requirements shall be as follows:
   a. Audio: From every source input, such as microphones, audiotape units, and videotape units, through
   corresponding Audio Distribution Amplifiers (ADA), mixers, switchers, codec, and related equipment, to every signal destination.
   b. Video: From every source input, such as cameras, computers, and videotape units, through corresponding Video Distribution Amplifiers (VDA), processors, switchers, and related equipment, to every signal destination.

4. Remote Control Programming: As a minimum, program remote control systems for each space to include the following:
   a. AM/ PM Clock Settings
   b. Automatic System Shutdown
   c. Owner Logo on first page
   d. 50% audio level default
   e. LAN IP Address
   f. LAN/ Numeric Pager diagnostic annunciation
   g. Individual Audio Level Controls with mute function for Programs and for Microphones.
   h. Panel layout, including user screens, with password protected technician pages
   i. Raise and lower projection screen when projection is powered on/ off respectively. Coordinate with Work of Section 11132.
   j. Assign room computer as default system source upon power up
   k. Activate a minimum of three (3) presets for each installed remote controllable video camera. Enable additional presets to facilitate use.

l. Provide remote control system room management software, including full licensing agreement.
m. Full function control of source components, display units, processing devices and switching electronics.
n. Touch panel layouts: Submit for approval as part of shop drawing review. Prior to establishing basis of design for touchpanel layouts, review existing control system standards and protocols on campus.
o. Provide intellectual property release and install editable source code for the entire remote control program and associated panel layouts on two (2) computers. Provide manual and automatic backup capabilities. Update and maintain editable source code to enable additions, modifications and changes to the remote control system during maintenance period and after the warranty period has elapsed.
p. Provide follow-up programming and modifications not more than 6 months after system acceptance. Incorporate feedback from client to improve function. Provide and install updated editable source code.
q. Include per-function status feedback indicating active/ passive modes of operation.
r. Provide control for the Lecture Capture System (Echo 360) including starting, pausing, stopping, and AdHoc.

1.5 SUBMITTALS

A. Comply with Division 1 Section Submittal Procedures. Original specification sheets or clear copies of same shall be submitted on all items. Manufacturers name, make and model number shall appear on each sheet. Submittals shall be bound in booklet form with cover sheet and index, and presented in a neat and logical order in a binder. Submittals shall contain installation, operation and programing manuals of the system to provide the Owner and Engineer complete information as to system features, functions and capabilities
   1. Submit a detailed equipment list in Microsoft Excel format (both hard copy and CD) showing equipment item number, manufacturer, part number, quantity, heat (BTU/hr), Power (Watts), Weight, and Price. Include manufacturer's specifications sheets for each piece submitted.

B. Product Data: Manufacturer's literature and catalog cuts indicating manufactured equipment and accessories including materials, fabrication, test results, operational ratings, and other pertinent information. Submit product data on each product and for all equipment specified in this section, including, but not limited to the smart classroom lectern/podium/desk and associated components, cabling, and cabling components, accessories, connectors, outlets, jacks, and other raceways and associated components, etc., in a bound, jacketed loose-leaf binder. Provide five (5) copies of the specification data. Each item proposed should be highlighted, tagged with a star, an arrow, etc

C. Drawings and Diagrams: Prior to fabrication the Contractor shall submit for approval the following information for the purposes of quality assurance and performance verification. Drawing submittal shall be on reproducible media and in electronic format (AutoCAD 2008 or later). Drawings shall be a minimum of 24" by 36" and minimum scale shall be 1/8" = 1'. Submit Shop Drawings indicating the proposed system configuration and all specified requirements. All Shop Drawings shall be Contractor's original drawings. Submission of Engineer's Contract Drawings as Shop Drawings is not permitted. A detailed set of floor plans for the complete building shall be furnished showing the locations of ***all*** equipment and devices and their required interconnections. The interconnections shown shall indicate the number, size, and type of wires. The Shop Drawing shall indicate installation details and system configuration. Shop Drawings shall indicate all deviations from or additions to the Contract Documents. These designs include, but are not limited to, the following:

   1. All point-to-point wiring schematic details, equipment interconnections, component values and showing complete letter and number identification of all wire and cable as well as jacks, terminals and connectors. Schematic drawings (AV & Control Signal Flow). System functional block drawings, including audio and video subsystems.

2. All panels, plates, and designation strips, including details relating to terminology, engraving, finish, and color.

3. Complete set of remote control panel layouts for touch sensitive and fixed button control panels and brief functional description of programming detailing the one (1) button to one (1) function relationship. All custom designed consoles, tables, carts, support bases, and shelves.

4. Project-specific equipment modifications and all unusual equipment modifications.

5. Run sheets or field wiring details.

6. Patch panel assignment layout drawings.

7. All items of equipment, either a stock manufactured item or a custom built, shall be supported by complete and detailed schematic drawings and replacement parts lists. No black boxes or unidentified components shall be acceptable.

8. Equipment racks, cabinets, consoles, tables, carts, support bases, and shelves including identification of individual components and connections at each unit. Equipment rack details and rack elevations including equipment in each rack and cabinet. Front mechanical drawings of each equipment rack.

9. Cable labeling plan and color coding schemes.

10. Shop Drawings shall include plans, elevations and sections of the building including viewing angles, screen sizes, and equipment mounting heights.

11. Submit wiring diagrams showing typical connections for all systems and equipment. Include detailed one-line drawings of each system. Each system drawing shall show proposed circuit numbers for all cables and terminal connections. Provide typical wiring termination details for all devices.

D. Quality Assurance Submittals: The Contractor shall include a list of certified test equipment that will be used for the testing of the audio and video systems in their submittals to confirm capability to perform the work described herein.

E. Submittal shall contain a complete schedule of manufacturer's part numbers and quantity listings of all supplied components.

F. Submittals not containing complete documentation of Specification items shall be automatically rejected before further review.

G. The Contractor shall submit a certificate with the RCDD signature, registration number, and seal verifying the completeness and accuracy of the design and installation. All distribution designs shall be submitted with the RCDD signature, registration number, and seal.

H. Review of and noted comments on Contractor's submitted shop drawings do not constitute a change order or a waiver of contract requirements. In the event of conflict between submittals or shop drawings and contract documents, the latter shall govern. If waiver of particular requirement is requested by Contractor, a formal written request shall be made to Owner as per General Conditions.

I. Shop Drawings and submittals shall bear the General Contractor's review and approval stamp prior to submission to the Engineer.

J. Manufacturer's Drawings, sketches, and instructions shall supplement, but not supersede, Contract Drawings and Specifications.

K. Quality Assurance Submittals
   1. Training plan.
   2. Testing plan.
   3. Informational Submittals, Weekly site reports: Submit weekly progress reports detailing audiovisual system installation progress against milestones dates as per installation schedule. Submittals may be attached to emails with "Information Submittal – Weekly Report for Week of (date)" located in Subject Line.

L. Closeout Submittals: Comply with Division 1 Section Operation and Maintenance Data
   1. Equipment manufacturer's operation and service manuals for each make and model of equipment.

   2. System Operation Manual. Provide detailed information for systems, subsystems, and equipment specified. Include procedures for activating each system; provide functional requirements. Include step-by-step 'How-to' users guides with procedures for operating each system. Include stand alone document explaining operation of systems equipment in the event of control system failure. Control system touchpanel layouts shall be accompanied by narrative text describing "step-by-step" function engagement.

   3. Include record diagrams for systems including, but not limited to:
      a. Schematic wiring diagrams with cable markings.
      b. Internal wiring diagrams of the equipment rack cabinets.
      c. Custom equipment modifications.
      d. Final test results and nominal settings for adjustable controls as outlined in the QUALITY ASSURANCE article of this Section.
      e. Provide editable versions of software associated with audiovisual systems included on this project. Provide CD-ROM/DVD copy and load software onto owner Identified PC.

1.6 QUALITY ASSURANCE

A. System Fabricator/Installer: Demonstrate three (3) years of experience in the fabrication, programming, assembly, and installation of audiovisual presentation and remote control systems of similar magnitude and quality. Submit manufacturer certification showing that Installer is authorized sales and service center for products approved for use.
   1. Project Manager: Designate person serving as Project Manager responsible for timely and consistent communication on progress. Project Manager shall have full knowledge of engineering, production, and installation procedures and schedules, including coordination with related and adjacent trades. Experience: Project manager shall have successfully managed not less than two (2) projects of similar size and nature.

   2. References: Furnish not less than three (3) references for installations of similar size, dollar amount, and number of spaces receiving integrated technology, performed in Maryland and surrounding region within the past eighteen (18) months. Include name of referring company or institution, contact person's name and title, telephone number, address, and detailed project description. Include Project Manager's name, and contact information of the individuals or companies responsible for day-to-day operation of the audiovisual installation.

   3. Certified Technology Specialist (CTS) – Provide the services of a Certified Technology Specialist In Design (CTS-D) to design and prepare all equipment submittals, shop drawings, audio-visual communications equipment interoperation and integration. Contractor may request and submit documentation for approval of equivalent experience and manufacturer certification to be considered in lieu of CTS certification.

4. Certified Technology Specialist (CTS) – Provide the services of a Certified Technology Specialist In Installation (CTS-I) to install all equipment, audio-visual communications equipment interoperation, integration, troubleshooting, problem solving, trade coordination, and systems maintenance. Contractor may request and submit documentation for approval of equivalent experience and manufacturer certification to be considered in lieu of CTS certification.

1.7 WARRANTY

A. Special Warranty: Provide warranty in accordance with Section 01795 for labor, equipment, and materials to maintain systems and equipment provided. Warranty corresponds with maintenance and service agreement specified below. When items cannot be repaired or adjusted to proper function based on performance and test requirements specified, remove and replace with new items.
   1. Warranty Period: **Three years from date of Final Acceptance**.

   2. To maintain certain manufacturers' warranties, said equipment must be installed, aligned and serviced by those installers authorized by said manufacturer to perform those duties. If the Contractor is not authorized by said manufacturer, it is the Contractor's sole responsibility to make the appropriate arrangements and bear all cost and consequences thereof.

   3. All projector lamps are warranted only to the extent as provided for under the manufacturers' warranties and guarantees.

   4. All manufacturer's equipment warranties shall be activated in the Owner's name by the Contractor and shall commence on the date of system acceptance. In the case of contractor-modified equipment, the manufacturer's warranty is normally voided. In such cases, the Contractor shall provide the Owner with a warranty equivalent to that of the original manufacturer. The Contractor shall be required to register, with each equipment item manufacturer, the product warranty for said item(s). The Owner is the named holder of the product warranty for all items provided.

   5. Provide response by an on-site service technician year-round, including Saturdays, Sundays, and holidays to service equipment and system failures. Contractor shall provide the following guaranteed service during the warranty period:
      a) TIER #1 – Hearing / Meeting Room & AV Equipment Room– Any service calls for the Lecture Hall & AV Equipment Room shall be considered mission critical and on-demand service call and shall be responded to within 12 hours.
      b) TIER #2 –MISC SPACES (Hall Way) - Any service calls for the misc spaces shall be on-demand service call and shall be responded to within 24 hours.
      c) Downtime for systems shall be no longer than a 24 hour period.

   6. All replacement parts and component shall be of equal or high level for service. Equivalent replacement equipment shall be temporarily provided when immediate on-site repairs cannot be made.

B. During Warranty period, no charges shall be made for any labor, equipment, or transportation to maintain performance and functions.

1.8 OWNER'S INSTRUCTIONS

A. Provide working Beta copies of system software for review and comment as per the below listed schedule:
   1. Initial Submittal: Submit for Review as part of Submittal process.
   2. First Beta Review: Timing (four weeks after return of the initial submittal)
   3. Second Beta Review; Timing (four weeks after return of the First Beta submittal)

4. Implementation and On-Site Training; Timing (one week prior to building occupancy)
5. Follow-up programming review and updates; Timing (within sixty-days from final acceptance)

B. Instruction Sheets: Provide 8-½ inch by 11 inch laminated instruction sheets. Include step-by-step instructions outlining system operations for each room equipped with AV systems. Provide Compact Disk/CD/ROM or DVD with room specific instructions for each type of equipment. Include one Adobe portable document format (pdf) file plus one file saved in current version of Microsoft Word for each room type.

1.9 MAINTENANCE

A. Service Contract: Include a three-year service contract corresponding to specified warranty period, commencing with Substantial Completion. Include the following services:
   1. Equivalent of four (8) one-day visits per year for a total of thirty-two (32) engineering/service labor hours to conduct preventive maintenance and regular system adjustments. Each visit includes:
      a. Cleaning video and audio heads,
      b. Checking and replacing projection lamps and indicators
      c. Checking and repairing microphones and microphone cables
      d. Conducting subjective and objective tests of the audio, video, and control systems of audiovisual systems. Repair or adjust malfunctioning components identified and located by the technician during testing.
      e. Downloading and installing control system program updates and modifications. Provide updated, editable copies of the source code. Include updates for control and video wall system programming.

   2. Provide a service telephone number, staffed by a qualified technician familiar with the equipment installed. Staff this service during normal business hours.

   3. Provide response by an on-site service technician within 24-hours of a service call year-round including Saturdays, Sundays, and holidays to service equipment and system failures.

1.10 COORDINATION

A. Contractor shall coordinate with all trades for a complete installation.

B. Contractor shall attend all construction meetings including construction kick-off meeting, and pre-installation meeting, rough-in meeting, final installation meetings and meetings required elsewhere in the contract documents.

C. Contractor shall prepare and submit coordination drawings and documents to coordinate all rough-in requirements including conduit locations, mounting heights, floor boxes, power requirements, structural supports, coordination of ceiling plans, and elevations.

D. Electrical Coordination & Provisions.
   1. Floor boxes shall be furnished by Audio-Video Contractor and installed by Electrical Contractor. A/V Contractor shall provide all plates and boxes.
   2. All 120 volt AC power for AV equipment shall be provided by Electrical Contractor. A/V Contractor shall coordinate all power requirements and rough-in locations for the Electrical Contractor.
   3. All conduit, tubing and raceways for AV equipment shall be provided by Electrical Contractor. A/V Contractor shall coordinate all A/V requirements and rough-in locations for the Electrical Contractor.

E. Contractor shall coordinate all wireless frequencies of proposed equipment with existing frequencies being used by the Owner and with other wireless equipment being provided by other trades. Contractor shall prepare coordination documents and attend wireless frequency coordination meeting(s).

1.11 PROGRAMMING

A. Contractor shall meet with the Owner to determine exact requirements for all AV system programming, set-up and room function.

B. Programming will include custom graphics and logo's.

C. Contractor shall include programming for multiple one-touch buttons (such as, "all off", "shutdown", "all ON" etc).

D. Contractor shall program controls for audio, video, lighting and volume controls.

E. Contractor shall program network interface with Owner's network.

F. Contractor shall load all software and software updates onto equipment.

G. Contractor shall develop, populate, and setup all schedules.

H. Remote Control Programming: As a minimum, program remote control systems for each space to include the following:
   1. AM/ PM Clock Settings
   2. Automatic System Shutdown
   3. Owner Logo on first page
   4. 50% audio level default
   5. LAN IP Address
   6. LAN/ Numeric Pager diagnostic annunciation
   7. Individual Audio Level Controls with mute function for Programs and for Microphones.
   8. Panel layout, including user screens, with password protected technician pages
   9. Raise and lower projection screen when projection is powered on/ off respectively.
   10. Assign room computer as default system source upon power up
   11. Provide remote control system room management software, including full licensing agreement.
   12. Full function control of source components, display units, processing devices and switching electronics.
   13. Touch panel layouts: Submit for approval as part of shop drawing review. Prior to establishing basis of design for touchpanel layouts, review existing control system standards and protocols on campus.
   14. Provide intellectual property release and install editable source code for the entire remote control program and associated panel layouts on two (2) computers. Provide manual and automatic backup capabilities. Update and maintain editable source code to enable additions, modifications and changes to the remote control system during maintenance period and after the warranty period has elapsed.
   15. Provide follow-up programming and modifications not more than 6 months after system final acceptance. Incorporate feedback from client to improve function. Provide and install updated editable source code.
   16. Include per-function status feedback indicating active/ passive modes of operation.

I. Once the Control Programming is finalized and approved, all source code, programming, and touch panel software shall be copied onto a CD or DVD and delivered to the Owner. All Control System programming, including source, files, touch panel design and DSP is the property of the Owner.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Equipment Lists: Refer to below Schedules for Product information such Basis of Design, including materials and equipment required to complete the work of this Section.

Audio System			
18	Clock Audio	C34E/SR Halo-RF	Cardioid condenser gooseneck HALO microphone, Sonic range, 15.7", Semi Rigid shaft,
18	Clock Audio	S155	Table stand with programmable membrane switch fitted with 5 Pin female XLR input and 5 Pin male XLR output
18	Switchcraft	TA5MLX	Tini-QG "Mini XLR" 5 Pin Male Cable Mount, Large Flex Relief, Silver Pins, Nickel for microphones
1	Biamp	Tesira Server IO	DSP Frame
5	Biamp	SEC4	Analog input modules
2	Biamp	SOC4	Analog output modules
1	Biamp	STC-2	POTS or VoIP Interface (as required)
1	QSC	CX108V	8CH 70V 200wpc amplifier
17	Community	C6	6" ceiling speaker w. safety cables
1	Netgear	NG GS724T AVB	Netgear®24-port Gigabit Smart Switch with AVB software loaded, 2 SFP GBIC fiber slots, and rack mount kit
Extron Switching & Control System			
1	Extron	60-1167-001544	Custom XTP3200-444300003320000, ***including:***
1	*Extron*	*Crosspoint 3200 Frame*	*Frame*
3	*Extron*	*XTP CP 4i*	*Cat6 Input board*
3	*Extron*	*XTP CP 4i HDMI*	*HDMI Input board*
8	*Extron*	*Matrix Blank Plate*	*Blank filler plates*
3	*Extron*	*XTP CP 4o*	*Cat6 output board*
1	*Extron*	*CP 40 HDMI*	*HDMI output board*
10	Extron	60-1199-01	XTP SR HDMI Scaling receiver
7	Extron	60-1216-13	XTP T UWP 202 WHITE Dual input (VGA.HDMI) wall plate input
2	Extron	60-1043-12	XTP T HDMI (under desk HDMI input)
1	Extron	60-1396-020A	TLP Pro 720C Blk with US Module 7" Cable Cubby TouchLink Pro Touchpanel for Conf Rm
2	Extron	60-1341-02	TLP Pro 1220TG (for Two Commissioners in hearing room)
1	Extron	60-1396-02	TLP Pro 1020TG for Control Room)
1	Extron	60-1418-01	IPCP Pro Controller
1	HP	J9776A#ABA	Ethernet Switch -24 ports- managed - desktop, rack-mountable
Floorboxes-PokeThru			
5	FSR	FL500P 4"	Floorbox
A/R	Contractor	Custom	AV floorbox panels
1	LeGrand	8AT	Fire rated poke thru
A/R	Contractor	Custom	Poke Thru connection plates

		Camera Recording System	
4	Vaddio	WallViewCCU HD22 Cat-5	HD PTZ Camera with wall mount and CCU with HD-SDI and HDMi outputs
1	Vaddio	Production View HD-SDI MV	6x2 broadcaster switcher
1	Blackmagic	Mini Converter SDI to HDMI 4K	HDSDI to HDMI converter
1	Blackmagic	Mini Converter SDI to Analog 4K	HDSDI to Component converter
1	Sonic Foundry	MediaSite RL HD	MediaSite RL HD Recorder
1	Sonic Foundry	MSL-SSS-S09	Customer Assurance Maintenance for RL Recorder
1	Sonic Foundry	MSL-SSS-S09	Customer Assurance Maintenance for RL Recorder
1	C2G	42516	HDMI to DVID cable, 2M
1	Logitech	Media Combo MK200	KB/Mouse bundle
		Displays	
1	NEC	E324	32" LED monitor for production switcher multiviewer in control rm
1	Chief	FTR4100	Small Flat Panel Tilt Wall Mount
1	NEC	AS222WM-BK	AccuSync AS222WM-BK, 22" LED Backlit Widescreen LCD monitor, 1920 X 1080, NaViSet, Digital / Analog Inputs, Multimedia, Black, 3 Year Warranty for Sonic Foundry in Control Room
1	Sharp	LC-90LE657U	90" LED Monitor for Commissioners Hearing Room [CONSUMER]
1	Chief	XSMU	X-Large FUSION™ Micro-Adjustable Fixed Wall Display Mount
1	Sharp	LC-80LE650U	80" LED Monitor for Conference Room [CONSUMER]
1	Chief	XSMU	X-Large FUSION™ Micro-Adjustable Fixed Wall Display Mount
3	Sharp	LC-60LE650U	60" Class AQUOS HD Series LED Smart TV for corridor [CONSUMER]
3	Sharp	LTMU	Large Fusion™ Micro-Adjustable Tilt Wall Mount
2	NEC	E424	E424 - 42” LED LCD Public Display Monitor w/built in ATSC tuner, 1920x1080 (FHD) native resolution, RS-232 control, Full AV function, Built in speakers, Tabletop stand included, 3 Year Warranty, with free NEC content management software (CMS) for control room (1 for MV function)
2	Chief	LTMU	Large Fusion™ Micro-Adjustable Tilt Wall Mount
		Equipment Rack	
1	Middle Atlantic	WRK44SA-AV	Loaded equipment rack
1	SurgeX	SEQ	20A power sequencer
1	SurgeX	UPS-2000-DL	20A 120V 2000VA UPS
1	Middle Atlantic	Custom	Rack accessories
		On Air light	
1	Market Central	5101189	general purpose serial to latching relay dry contact closure converter for on air light
1	CBT	CBT-CLED-OA-BE	CBT Classic LED 12 Volt AC/DC On-Air Light Blue
		Miscellaneous	

2.2 MATERIALS AND COMPONENTS

A. Provide signal repeaters and amplifiers for equipment with control signals running distances greater than or equal to 30 feet.

B. Rack-Mounted Equipment, UPS: Provide a rack mounted uninterruptible power supply (UPS) device in each equipment rack. UPS devices shall provide minimum of thirty-minutes of back up power for full active mode usage of rack mounted equipment plus auxiliary equipment powered by, or otherwise attached to, rack-mounted equipment.

C. Voltage Indicator, Basis for Design: Provide a SurgeX SEQ in the equipment rack.

D. Projectors: Ensure that no more than thirty-lamp hours have elapsed for the projectors at time of Substantial Completion. Remove lamps with more than thirty-lamp hours and replace with new lamps.

E. Furnish cover plates, connectors, and cabling to link floor and wall boxes to corresponding local and remote A/V components. Coordinate with conduit, power, and workboxes furnished and installed as part of other Division 16 Sections. Surface-mounted raceways not permitted.

F. Equipment Labels: In addition to factory applied labels identifying make and model numbers of each item of equipment, provide metallic labels, engraved and filled, to identify controller switches such as ‘Off/On’, toggles and dials for adjustment such as ‘Volume’ and ‘Balance’, and locations of connections such as power, USB, serial or parallel ports. Printed labels, including ‘self-adhering’, ‘peel-and-stick’, and ‘tape-applied’ labels generated using laser, ink jet, other toner-based equipment, and similar technologies not permitted.

G. Provide low voltage control to lighting control interface. Coordinate with electrical contractor to provide compatible lighting control interface and all associated wiring and conduit.

H. Provide all cables, connectors, receptacles, plates, terminations, and miscellaneous hardware required to provide a complete and fully operation system.

2.3 FABRICATION

A. Provide security covers on electronic equipment with front panel controls to prevent adjustment after initial set-up except by authorized personnel.

B. Rack-Mounted Equipment: Furnish rack mounted equipment with appropriate rack mount kits and locking front doors.
   1. Provide each instructor’s station and rack enclosure with single button on/off power distribution panel. Include pull out lights and voltage indicator located in the first available rack unit.
   2. Rack mount uninterruptable power supplies or install as free-standing unit at bottom of rack.
   3. Include “security type” screws to secure rack-mounted components at racks and at instructor stations.
   4. Furnish each instructor’s station and equipment rack with 4 inch, low-noise fan unit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Comply with BiCSi and ICIA

2. Clearly label user controls for intended use. Identify nominal settings. Prevent access to controls that should not be changed such as audio equalizer settings. Provide locking cover with label identifying that settings are pre-programmed and should not be changed.
    a. Route audio, video and control cabling elements of the final design in a subtle, unobtrusive manner to maintain the architectural and visual integrity of the building.
    b. Except where plenum cable is used above finished ceilings, route cabling for microphone and line inputs, wideband RGBHV video, and other A/V-related cabling inside conduit furnished as part of Work specified in Division 16 - Electrical. Floor and wall boxes shall serve as the primary interface points to the A/V system.

B. Back rack CPU and power distribution equipment while loading associated front of rack spaces with blank panels. Install components permanently mounted to rack rail systems with industry accepted security screws.

C. Secure AV equipment located above finished ceilings to building structure. Do not support equipment or auxiliary items from finished ceiling systems.

D. Direct AC power from above finished ceiling or from associated equipment racks to low voltage transformers located within 60 feet of associated video camera locations. Identify corresponding UPS location; ensure sufficient UPS capacity to include transformers and cameras.

E. Equipment Installation:
    1. Secure equipment firmly in place unless requirements of portability dictate otherwise. Unless otherwise noted, install and secure electrical items such as boxes and equipment plumb and square with adjoining surfaces.

    2. Fastening assemblies, mounting brackets and supports shall be adequate to support equipment loads with a safety factor of at least three (3). Secure equipment suspended from structure above with safety chain or cables.

3.2 AUDIOVISUAL CABLE INSTALLATION

A. General: Follow engineering practice outlined above. Deviate only when necessary to minimize crosstalk and maximize signal-to-noise ratios. Inform the Owner prior to actually performing the work in the event there is a deviation from standard grounding practices.

B. Cables shall be marked with wraparound cable markers at both ends. Marking codes shall correspond to codes shown on “as-built” drawings and/or run sheets. Coordinate labeling and numbering system with the Owner.

C. All microphones shall include 30 ft. cable with heavy-duty jacket and XLR connectors.

D. Loudspeakers operating @ 8 Ohms shall be installed with minimum 12AWG cable.

E. Wall/ floorbox I/O panels shall be installed with audio/ video line drivers on runs exceeding 35ft.

F. All cabling shall be neatly strapped, dressed, and adequately supported. Any exposed cabling shall be neatly enclosed in a protective covering.

G. Terminal blocks, boards, strips, or connectors shall be furnished for all cables interfacing with racks, cabinets, consoles, or equipment modules. All audio signal lines shall be balanced at the wallplate.

H. All cables shall be grouped according to the signals being carried. In order to reduce signal contamination, separate groups shall be formed for the following cables:
   1. Power cables
   2. RGBHV, Video cables and Control cables
   3. Data cables (when applicable)
   4. Audio cables carrying low level signals
   5. Audio cables carrying line and high level signals

I. Cables shall meet the overall specifications. Cabling installed in walls or ceilings shall be plenum rated. Cables shall be cut to the length dictated by the run plus the required "slack" to permit future equipment movement and relocation. For equipment mounted in drawers or on slides, the interconnecting cables shall be provided with a service loop of appropriate length.

J. Cables shall not be installed with a bend radius less than that recommended by the cable manufacturer.

K. Grounding Procedures: The following grounding procedures shall be followed:
   1. System Ground: A single "system ground" shall be established for the system. Grounding conductors shall connect to this system ground. The system ground shall be provided in the equipment rack, and shall consist of a copper bar of sufficient size to accommodate all secondary ground conductors.

   2. A copper conductor, having a maximum of 0.1 Ohms total resistance, shall connect the system ground bar to the nearest grounded, metallic electrical conduit of at least 2 inches in diameter. Be responsible for determining if the metallic conduit is properly electrically bonded to the building ground system.

   3. Secondary system grounding conductors shall be provided from ungrounded equipment in each area, to the primary system grounding point for the area. Each of these grounding conductors shall have a maximum of 0.1 Ohms total resistance.

   4. Under no conditions shall the AC neutral conductor, either in the power panel or in a receptacle outlet, be used for a system ground.

L. Audio Cable Shields: Balanced audio cable shields shall be grounded at one point only. Audio lines shall be balanced at the source, prior to any cable pull longer than twenty feet. For ungrounded portable equipment the shield shall be connected at both ends but grounded at only one end.

M. Video Receptacles: Video receptacles shall be insulated from the mounting panel, outlet box, or wireway.

N. Securing Equipment: Secure surface-mounted loudspeakers, document cameras, video cameras, flat panel displays, and LCD projectors with steel cable security systems and padlocks secured to structure. Key padlocks provided for security to a single master key.

3.3 REPAIR/RESTORATION

A. Damage to either installed work or product caused by the unpacking, transporting, assembly, connecting, or configuring shall be repaired at no charge.

3.4 FIELD QUALITY CONTROL

A. Contractor System Checkout
   1. Perform system checkout before acceptance tests are scheduled. Furnish all required test equipment and perform all work necessary to determine and/or modify performance of the system to meet the requirements of this specification.

2. During performance testing, all equipment shall be operated under standard conditions as recommended by the manufacturer.

3. Test all audio and video systems for compliance with the Performance Standards using the test procedures that follow later in this specification.

4. Maintain documentation of all performance tests during the System Acceptance Tests.

5. At the conclusion of the tests, return all equipment settings to previously calibrated positions.

6. Provide written records of all test results in spreadsheet form.

7. Check all control functions, from all controlling devices to all controlled devices, for proper operation.

8. Adjust, balance, and align all equipment for optimum quality and to meet the manufacturer's published specifications. Establish and mark normal settings for all level controls, and record these settings in the System Operation and Maintenance Manual.

9. Provide testing results and settings for all equipment and systems at least three (3)business days prior to System Acceptance Testing.

10. Provide all test results, manuals, software, as-built documentation, etc. prior to acceptance testing in accordance with the dates and/ or lead-times listed within this document.

11. The works shall be considered ready for acceptance testing when the following conditions are met:
    a. All systems have been pre-tested such that all sub-systems, functions, software, and equipment are de-bugged and operational.
    b. Written test results and documentation have been supplied as listed above for all rooms and systems.
    c. Manuals, training materials, and other as-built documentation revised to reflect comments and/or revisions arising from the review cycles listed elsewhere within this document have been supplied.

B. Once installed and the System Checkout is complete, the system shall be tested.
1. If the A/V system fails to meet the requirements of this document or those stated by the technical documentation, the installed system shall be rejected. Notice shall then be given (either oral or in writing) to correct the failure as soon as possible.

2. If unable to overcome repeated performance deficiencies within thirty (30) days, the equipment shall be removed at no additional expense.

3. No warranties shall begin until acceptance has been authorized in writing.

4. Right to Revoke Acceptance: If any equipment and/or goods which have been previously accepted, specifically or by the making of payment, are found to have defects, damage, deficiencies or fail to conform to the specification, for any cause not attributable acceptance may be revoked.

C. Acceptance Test: Formal acceptance testing shall be performed with the Owner to determine that the A/V system equipment satisfies the manufacturers' performance specifications and that the A/V system installed satisfactorily performs the functions required by this specification.

D. Pre-acceptance Test: Conduct formal pre-acceptance tests prior to the Owner's formal acceptance testing to ensure that the performance and functional specifications are satisfied by the installed system and the system is ready for the Owner's acceptance. Provide equipment necessary to demonstrate correct system performance.

E. Test Equipment
   1. Assemble the following test equipment (or equivalent) on site.
      a. Video signal generator, Leader 410C
      b. RGBS signal generator, Extron VTG 150
      c. Combined waveform monitor/vectorscope, Leader 5872A
      d. Prerecorded VHS tape (NTSC)
      e. Prerecorded VHS tape (PAL), if required
      f. Prerecorded DVD (Blu Ray)
      g. Prerecorded DVD (NTSC)
      h. Blank VHS tape

      i. RGB HV cable, Extron BNC-5-6'HR
      j. Audio and Video cable, terminations, adapters, etc
      k. Signal generator, Leader LAG-120B
      l. AC millivoltmeter, Leader LMV-181A
      m. Audio test set, Audio Precision P1PLUS
      n. Prerecorded cassette tape
      o. Audio Test CD
      p. 35mm Calibrated Test Slide
      q. Programmable Video & Audio Test Generator, Extron VTG-400D

F. Audio
   1. Absolute Impedances: Set speaker level controls at zero attenuation. Measure absolute impedance value of each speaker line at 250, 500, 1000, 2000, 4000 Hz without the amplifier connected but with all speakers connected. Impedance must not be below the rated load impedance of respective amplifier and may be any value equal to or above that. Check resistance of lines to all speakers and microphone receptacles with receptacles open and short-circuited.

   2. Hum and Noise Level: Test overall hum and noise, it should be at least 60 dB below rated power output of each amplifier with amplifier controls set for optimum signal to noise and full output and with inputs terminated with proper shielded resistor. (150 and 600 ohms).

   3. Electrical Distortion:
      a. Load power amplifiers with resistors matching nominal impedance of output terminals used in system in place of actual loudspeaker loads.
      b. Adjust gain controls as for hum and noise level test.
      c. Apply 250, 500, 1000, 2,000, 4,000 Hz sine-wave signal from an oscillator having less that 0.1% T.H.D. to each microphone and line level input at level required to produce full amplifier output.
      d. Distortion must measure less than 1%.

   4. Parasitic Oscillation and RF Pickup
      a. Set up system for each specified mode of operation.
      b. Use 5 MHZ band with oscilloscope and speaker monitoring.
      c. Check to insure that the system is free of spurious oscillation and RF pickup in the absence of any input signal and also with the system driven momentarily to full output at 160 Hz.

   5. Buzzes, Rattles, Distortions:
      a. Apply high quality music signal to the system. Adjust the sound system for frequent peaks at its specified maximum sound pressure level.

b. Apply sine-wave sweep from 50 to 5,000 Hz to 6 dB below full amplifier power.
c. In both cases, listen carefully for buzzes, rattles and objectionable distortion.
d. Correct all causes of such defects. If cause is not from system, promptly notify the architect indicating cause and suggested corrective procedures.

6. Level Balance:
   a. Adjust all items of similar equipment for identical measured voltage gain.
   b. Unless otherwise specified, render tamper proof using security covers on all controls effecting overall system level balance and signal to noise ratio, such as power amplifier input level control, and input-output level controls for equalizers etc. Some controls may require readjustment as the result of Acceptance Testing.

7. Equalize all audio systems for maximum gain before feedback in all room configurations.

8. Record all systems settings for inclusion into systems manuals

G. Video
1. Signal Paths: Utilizing a NTSC color bar generator and waveform analyzer with the video signal set at 100% saturation and 75% amplitude check that the video performance specifications are met at the display devices from all source inputs to all system outputs. Connect the combined waveform monitor/vectorscope to a final output point, e.g. an input to a picture monitor or video projector. Ensure that the test signal is routed to the selected output.

2. Level Balance:
   a. Adjust all video projection equipment to produce the best image possible. Ensure that horizontal sweep circuitry is not over driven to the point of audible sweep frequencies being emitted.
   b. Adjust all video monitor and videocassette players, video sources to produce the best image possible.
   c. Record all systems settings for inclusion into systems manuals

H. RGBHV:
1. For all RGBHV inputs, connect the RGBHV output of the signal generator to a floorbox/table/rack connector and select the SMPTE & PLUGE signal at the following computer scan rates:
   a. 640 x 480 31.5kHZ H, 60Hz V
   b. 640 x 480 37.5kHz H, 75Hz V
   c. 800 x 600 38kHz H, 60Hz V
   d. 1024 x 768 48kHz H, 60Hz V
   e. 1280 x 1024 64kHz H, 60Hz V

2. Check that the image is correctly displayed at all system outputs including the monitor(s) and/or by the video projector.

3. Repeat using Crosshatch, Checkerboard, and H Pattern Signals

I. Optical
1. All optical projection systems shall meet the following performance standards:
   a. The total averaged light output from a projector, in lumens, shall be within plus- or minus 15% of that specified by the projector manufacturer.
   b. The light fall-off from the center of the projected image to all four corners, as measured at the projected image plane, shall not exceed 35% for slide projector images. The light intensity shall be measured at all five positions of the projected image after the projector has been adjusted to provide the light output as specified above.
   c. The “corner” locations shall be defined as the four points determined by intersecting lines drawn 5% of the distance in from the focused edges of the image.

d. The light meter used for the above measurements shall be properly calibrated footcandle (or lux) meter and shall be cosine-corrected
e. Projectors, lenses, and mirrors shall be solidly mounted and braced so that there will be no observable movement in the image induced by motor vibration or other mechanical operations.

J. Qualification Methods: Three methods will be used to qualify the A/V system for acceptance.
1. Inspection - A critical observation of qualifying factors, such as quality of workmanship, equipment placement, routing of cables, adequacy of technical documentation, etc., that do not lend themselves to demonstration or measurement.
2. Demonstration - A process of showing by reason or evidence that a given condition clearly satisfies the requirement.

K. Measurement - A process of determining the actual dimension, capacity, or amount of something, by measuring using calibrated standards.

3.5 EQUIPMENT LISTS

A. Each piece of equipment shall be individually priced and submitted. Provide itemized bid response to include equipment description, manufacturer, model number, unit price, and quantity on a per room basis. All equipment prices shall reflect any required modifications and accessories. Non-equipment charges shall be outlined separately as a single line item on a per room basis. Identify equipment bid responses according to the numbering system used in the supplied equipment lists.
1. Alternate Proposals: The Equipment Lists attached identify specified equipment by make and model. Alternate equipment choices may be proposed prior to the proposal submission, as well as, any equipment of similar function that can be bought with educational discounts. Each item on the alternate equipment list must be accompanied by catalog cuts and technical specifications.

2. Non-Equipment Charges: These non-equipment costs shall include, but not be limited to:
a. Engineering: Required design drawings, run sheets, instruction manuals, console layout, step-by-step user guides.
b. Pre-Installation: Fabrication, modification, assembly, rack wiring performed on the Installer’s premises.
c. Installation: On-site installation and wiring, shop drawing, coordination and supervision, testing, checkout, Owner training performed on the Owner’s premises.
d. General and Administrative: Including G & A expenses, shipping, insurance, and guarantees.

3. The A/V system total cost shall be entered at the end of the last equipment list.

3.6 SITE SURVEY

A. Provide examination of site as required by specification.

B. Prior to placing any cable pathways or cable, the Contractor shall survey the site to determine job conditions will not impose any obstructions that would interfere with the safe and satisfactory placement of the cables, and to arrange the removal of any obstructions with the Project Manager accordingly.

C. The Drawings provided are diagrammatic and generally representative of the existing conditions, but not necessarily accurate in all aspects; therefore, verification of these drawings is solely the responsibility of the Contractor. The Contractor shall verify all field conditions and make field measurements as required.

D. Visit the site before submitting bid and check location of existing utilities, check conditions, verify dimensions and locations shown on the plans, and verify over-all costs and work herein described or shown.

E. Take measurements necessary for this work and be responsible for their accuracy. Necessary pullboxes and junction boxes as required to accomplish distribution shall be provided.

F. Review all conduit runs, junction boxes, and electrical outlets provided and installed by the electrical contractor and provide fit-up drawings based on these provisions.

G. Provide written acceptance of all field conditions and list any discrepancies. Notify Owner's representative of any discrepancies, conflicts, or omissions promptly upon discover in writing.

H. If conditions exist on the jobsite which make it impossible to install the work per the contract documents, the contractor shall prepare recommendations of potential solutions and submit drawings and details showing how the work may be installed to the Owner for approval.

3.7 BEND RADIUS

A. The maximum cable bend radii shall not exceed manufacturer's specifications.

B. In spaces with UTP cable terminations, the maximum bend radius for 4-pair cable shall not exceed four times the outside diameter of the cable and ten times for multi-pair cable. This shall be done unless this violates manufacturer specifications.

C. During the actual installation, bend radius on 4-pair cable shall not exceed eight times the outside diameter of the cable and ten times for multi-pair cable. This shall be done unless this violates manufacturer specifications.

3.8 SLACK

A. In the work area, a minimum of 300 mm (12 inches) should be left at outlets.

B. Provide a service loop for all Audio and video cables.
   1. Provide a minimum of 10 foot service loop for all AV cables serving video projectors.

   2. Provide a minimum of 10 foot service loop for all AV cables serving wall displays.

   3. Provide a minimum of 12" of cable in all AV cabling serving floor boxes. Locate slack cable above ceiling where conduit from floor box turns up.

3.9 CABLE TIE WRAPS

A. Tie wraps shall be used a appropriate intervals to secure cable and to provide strain relief at termination points. These wraps shall not be over tightened to the point of deforming or crimping the cable sheath. Tie wraps shall be attached with screws to walls, backboards, and other structures. Tie wraps shall be spaced between 6" and 10" apart, 8" on the average.

B. No stick-on cable wraps, raceways, or terminal devices are acceptable.

C. Cables in cable trays shall be segregated by signal type and secured with non-metallic fasteners.

3.10 FIRE STOP

A. Provide properly installed firestop systems to prevent or retard the spread of fire, smoke, water, and gases through the building. This requirement applies to openings designed for telecommunications use that may or may not be penetrated by cables, wires, or raceways. Contractor shall seal all floor, ceiling, and wall penetrations.

B. Provide fire and smoke stopping in accordance with all applicable codes.

C. Contractor shall provide firestopping protection that meets NFPA Life Safety Code #101, 6-2.3.6, Penetrations and Miscellaneous Openings and Fire Barriers and the NEC 300.21Fire Stopping Regulations and Standards.

D. All vertical penetrations consisting of conduit, sleeves, or chases shall be firestopped at the bottom of the penetration.

E. All horizontal penetrations consisting of conduit, sleeves of chases, shall be firestopped on both sides of the penetration.

F. Individual cable penetrations in plenum air return areas not enclosed in conduit shall be firestopped.

G. Openings made in concrete floors shall be UL approved. Thickness or depth of firestop materials shall be as recommended by the material manufacturer and backed by formal ASTM E-814 tests.

H. Plenum air return ceiling penetrations for conduit and cables shall be sealed with a system appropriate for the substrate and level of protection required.

I. All metal conduits designed for communications with or without wire/cable inside shall be firestopped to restrict transfer of smoke.

J. Comply with the requirements of Section on Firestopping.

K. Provide fire-rated seals for all penetrations through fire-rated floors and walls. Provide UL listed fire sealant, Dow Corning Silicon foam, or approved equal. Provide UL listed expanding fire barrier and expanding type grout.

3.11 WORKMANSHIP

A. All work shall be done in a workman like fashion of the highest standards in the telecommunications industry. All equipment and materials are to be installed in a neat and secure manner, while cables are to be properly dressed. Workers must clean any debris and trash at the close of each workday.

B. The installation shall be in strict accordance with all applicable codes and standards, the respective manufacturer's written instructions, contract drawings, and these Specifications. All materials, equipment, and devices shall be new and unused, of current manufacture of the highest grade, free from defects. Workmanship shall be of the highest grade in accordance with modern practice. The installed system shall be neat, clean, and well organized in appearance. Contractor shall provide working clearances for normal system operation, reconfiguration, and repair.

C. The Owner reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

D. The Contractor shall replace any damaged ceiling tiles that are broken during cable installation.

E. The Contractor shall replace or rework cables showing evidence of improper handling, including stretches, kinks, short radius bends, over-tightened bindings, loosely twisted and over-twisted pairs at terminals, and cable sheath removed too far (over 1-1/2 inches), at no additional cost to the Owner.

3.12 LABELING

A. Cables shall be labeled at each end, 1" from end of the sheath. The cable or its label shall be marked with its identifier.

B. A unique identifier shall be marked on each faceplate to identify it as connecting hardware.

C. Each port in the faceplate shall be labeled with its identifier.

D. A unique identifier shall be marked on each piece of connecting hardware to identify it as connecting hardware.

E. Each port on the connecting hardware shall be labeled with its identifier.

F. Each data jack served by a particular patch panel shall be numbered with the patch panel jack number feeding the work station jack to the closet in which the patch panel is located, using the patch panel designation as a prefix (i.e., C-21).

G. Tag all cables, terminal blocks, outlets, and other components for which tests have been satisfactorily completed.

H. Identify terminals at terminal strips, telecommunications outlets, and pull and junction boxes with approved designations.

I. Labeling requirement: Generally, all wiring shall be labeled consistent with ANSI/TIA/EIA-606, and include the following:
   1. Adhesive labels shall meet the legibility, defacement, and adhesion requirements specified in UL 969 for indoor use. Cable labels shall have a durable substrate, such as vinyl, suitable for wrapping. Labeling practices shall be consistent across the installation.

   2. Data and communications voice outlets. The outlet faceplate shall be provided with a permanently affixed machine label that provides the distribution frame location, the rack field location and the position of the connection within the rack field. For example: 1-A-01 would refer to the other end of the termination being IDF 1, Rack Field A, Position 01. The cable run shall be machine labeled with Mylar wrap wire markers within 1" of termination. Final termination at the distribution frame is also to be appropriately tagged. All cabling and fiber optics are to be tagged in a consistent manner.

   3. No handwritten labels shall be accepted.

   4. All labels shall be machine-printed on clear or opaque tape, stenciled onto adhesive labels, or typewritten onto adhesive labels. The font shall be at least one-quarter inch (1/4") in height, block characters, and legible. The text shall be of a color contrasting with the label such that it may be easily read. If labeling tape is utilized, the font color shall contrast with the background.

   5. Labeling Systems shall be Panduit Pan-Mark PROG-WIN2 Labeling Systems and Panduit L53E Hand-Held Labeler, or approved equal by Brady.

J. Provide custom plates and panels for a fully operable system for all AV plate connections.
   1. Custom plates shall be 1/8” thick aluminum, standards EIA sizes brushed black anodized finish unless otherwise noted.
   2. Plastic plates are not allowed.

3. Lettering shall be in all caps and numbers engraved with a color contrasting to the base material with a minimum of 0.25" size,
4. Acceptable manufacturers of custom plates and panels include: Panel Authority, Panelcrafters, Extron, RCI Custom, or Whirlwind.

K. Provide engraved lamicold label for each piece of rack mounted equipment and attach to both the front and back of the rack mounted equipment.

L. Provide engraved labels over each user operated control. Label shall describe the function or purpose of the control. Adjust size of label to suit location of label.

M. Provide custom project plates at the top of each equipment rack designating consultant and installation contractor.

3.13 TRAINING

A. The Contractor shall include sixteen (16) hours on-site training sessions, or as required, of startup and training assistance during cutover and Owner installation of equipment to ensure a fully functional system. This training may also be used for system configuration during initial system startup or other services as required at the Owner's request.

B. The Contractor shall provide key personnel at each training session, as required by the Owner, at no additional cost to the Owner. Key personnel include a CTS on Contractor's staff, manufacturer's representative, and manufacturer's specialists. In the event the Contractor does not have qualified instructors on staff for certain sophisticated equipment, a manufacturer's representative for such instruction shall be provided by the Contractor at no additional cost to the Owner. All training shall take place after the systems are operational, but before the acceptance tests. There shall be a minimum of sixteen hours of training on the systems included in this specification.

C. The Contractor shall include sixteen (16) hours on-site training sessions, or as required, of training assistance during the first day of beneficial use. Provide the services of an audio video systems trainer certified by the manufacture on the programming and use of the systems. Provide a signed letter of Acceptance by the Owner, demonstrating that the Owner has received such instruction. Attach a list of all those that performed the instruction and attended the instruction. This training shall include, but not be limited to, the following:
1. Operator safety precautions.
2. Proper power-up and shut down procedures.
3. Purpose and function of each component.
4. Operation of each individual component
5. System "Normal" configuration
6. Operation of system in various configurations
7. Advanced operations/abnormal system configurations
8. Troubleshooting
9. Maintenance Procedures including lamp and filter replacement.

D. Video Recording of Training: Provide video recording of all the training courses and turn over (3) copies on DVD to the Owner for future training and refresher on systems. Include both operations and maintenance classes on the same DVD.

E. Submit an outline of the course with sample instructional aids for approval thirty (30) days prior to scheduled instruction sessions.

F. Provide a one-page quick reference guide for each space to be located at the instructor stations and touch panel locations.

3.14 DOCUMENTATION

A Minimum documentation requirements of the systems are described below. The Contractor shall also include other information that is needed to successfully operate and maintain the systems.

B. System Operation and Maintenance Manual. This manual shall be produced by the Contractor specifically for the systems detailed herein.

1. Operations/Maintenance Manuals. Two sets of operations and maintenance manuals shall be provided for each component delivered.

   a. The Operation section shall describe all typical procedures necessary to activate each system to provide for the functional requirements as listed under the Detailed Specifications, including the step-by-step instructions required to use each of the control panel buttons.

   b. The reader of this manual shall be assumed to be technically competent, but unfamiliar with this particular facility.

   c. The Maintenance section shall provide a recommended maintenance schedule with reference to the applicable pages in the manufacturers' maintenance manuals. Where inadequate information is provided by the manufacturer, the Contractor shall provide the information necessary for proper maintenance.

2. Installation Records. Documentation of the installation/system configuration shall be provided to the Owner at the completion of the project. This must be in both hard copy and CD-ROM formats.

C. Close Out Submittals. At the completion of the installation, the Contractor shall provide the following information as required in the general and special conditions:

1. Equipment manufacturers' operation and maintenance manuals for each piece of equipment.

2. Equipment inventory listing manufacturer, model number, and serial number for all equipment items furnished under this contract.

3. As-built drawings for each system installation, showing all equipment items, interconnection of equipment and all cable label designations.

4. System functional block drawing identical to the specification drawing with addition of all input and output circuit cable and terminal block numbers as well as all jack field circuit ID designations. A copy of this drawing shall be framed in protective plastic and mounted on the inner surface of the equipment rack door.

5. Documentation of proof of installed system performance testing, and system performance results.

END OF SECTION

PART 1 - INTRODUCTION

1.1 PURPOSE

A. The intent of this document is to provide a standard specification that will be used for all County Building facilities requiring cabling installation. This document provides the minimum performance criteria for the components and sub-systems comprising a complete cabling system that shall accommodate the Owner's requirements in excess of ten years.

B. Product specifications, general design considerations, and installation guidelines are provided in this written document. Quantities of telecommunications outlets, typical installation details, cable routing and outlet types for a specific Customer facility will be provided as an attachment to this document. If the bid documents are in conflict, the written specification shall take precedence. The successful vendor shall meet or exceed all requirements for the cabling system described in this document.

C. The Customer's Cable Infrastructure Project requires a TE Connectivity (formerly AMP NETCONNECT) Systems structured cabling system, or equivalent single-manufacturer solution. The Category 6 portion of the cabling system shall comply with the link and channel performance requirements of ANSI/TIA-568-C.2, *Balanced Twisted-Pair Telecommunications Cabling and Components Standards*, and its published addenda. The cabling system shall be backed by a Tyco Electronics, or equivalent, 25-Year System Warranty. The system warranty shall be facilitated by the Contractor and be established between the Customer and the cabling system Manufacturer.

D. The successful Contractor is required to furnish all labor, supervision, tooling, miscellaneous mounting hardware and consumables for each cabling system installed. The Contractor shall maintain current status with the warranting manufacturer, including all training requirements, for the duration of the Cable Infrastructure Project. The Contractor shall staff each installation crew with the appropriate number of trained personnel, in accordance with their manufacturer/warranty contract agreement, to support the 25-Year System Warranty requirements. After installation, the Contractor shall submit all documentation to support the warranty in accordance with the manufacturer's warranty requirements, and to apply for said warranty on behalf of the customer. The system warranty will cover the components and labor associated with the repair/replacement of any failed link as a result of a defective product when a valid warranty claim is submitted within the warranty period.

1.2 SCOPE

A. This document defines the cabling system and subsystem components to include cable, termination hardware, supporting hardware, and miscellany that Customer will furnish to install a complete telecommunications system supporting voice and data. The intent of this document is to provide all pertinent information to allow the vendor to bid the labor, supervision, tooling, and miscellaneous mounting hardware and consumables to install a complete system. However, it is the responsibility of the vendor to propose any and all items required for a complete system if not identified in the BOM attached to this specification.

1.3 APPLICABLE DOCUMENTS

A. Design, manufacture, test, and install data distribution systems per manufacturer's requirements and in accordance with NFPA 70 (National Electric Code), state codes, local codes, requirements of authorities having jurisdiction, and particularly the following specifications.

1. This Technical Specification and Associated Drawings
2. ANSI/TIA-568-C.0, *Generic Telecommunications Cabling for Customer Premises,* and its published addenda.
3. ANSI/TIA-568-C.1, *Commercial Building Telecommunications Cabling Standard,* and its published addenda.
4. ANSI/TIA-568-C.2, *Copper Cabling Components Standard, and its published addenda.*
5. ANSI/TIA-568-C.3, *Optical Fiber Cabling Components Standard, and its published addenda.*
6. ANSI/TIA/EIA-569-B, *Commercial Building Standard for Telecommunications Pathways and Spaces, and its published addenda*
7. ANSI/TIA/EIA-606-A, *Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, and its published addenda*
8. ANSI/J-STD-607-A, *Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, and its published addenda.*
9. ANSI/TIA-942, *Telecommunications Infrastructure Standard for Data Centers, and its published addenda.*
10. TE Connectivity *Undercarpet Cabling Planning and Installation Manual* 409-5566

Determine and adhere to the most recent edition of these specifications when developing responses

B. If a conflict exists between applicable documents, then the order in the list above shall dictate the order of precedence in resolving conflicts. This order of precedence shall be maintained unless a lesser order document has been adopted as code by a local, state or federal entity, and is therefore enforceable as law by a local, state or federal inspection agency.

C. If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents; the vendor is responsible to determine and adhere to the most recent release when developing the proposal for installation.

1.4 SUBMITTALS:

A. General: Submit the following according to Division 26 Specification Sections.

B. Product Data and Shop Drawings: Submit these items, and the Certifications specified below, as a complete package. Submittal will not be reviewed if it is incomplete.

1. A complete schedule of equipment and materials that are to be furnished for the work. Accompanying the schedule shall be manufacturer's specifications or cut sheets for each major component. Original specification sheets or clear copies of same shall be submitted on all items. Manufacturers name, make and model number shall appear on each sheet. Submittals shall be bound in booklet form with cover sheet and index, and presented in a neat and logical order in a binder. Submittals shall contain installation, operation and programming manuals of the system to provide the Owner and Engineer complete information as to system features, functions and capabilities.

2. Complete drawings of equipment racks and special assemblies. Each drawing shall show all equipment with its manufacturer and model number.

3. Complete drawings detailing installation locations of equipment, cable quantities and types with terminal block or patch panel locations. Submit Shop Drawings of each proposed system indicating the proposed system configuration and all specified requirements. Shop Drawing shall indicate proposed cable routing, detail installation locations of equipment, cable quantities, cable types, and terminal block locations. All Shop Drawings shall be Contractor's original drawings. Submission of Engineer's Contract Drawings as Shop Drawings is not permitted. Clear and detailed sets of floor plans for the complete building shall be furnished showing the locations of all equipment and devices and their required interconnections. The interconnections shown shall indicate the number, size, and type of wires as described in this Specification. The layout of all telecommunications system equipment, devices, and conduit routings shall closely follow that shown on the Drawings.

4. Certification reports for all data wiring run shall be emailed to the Owner in Fluke Linkware format, or cvs for import into data cabling tracking system.

5. Submit dimensional outline drawing of systems control cabinet(s) and racks showing relative position and size of all major components and equipment involving dimensions, elevations, and terminations. Each drawing shall indicate all equipment with its manufacturer and model number shown.

6. Submit wiring diagrams showing typical connections for all systems and equipment. Include detailed one-line drawings of each system. Each system drawing shall show proposed circuit numbers for all cables and terminal connections. Provide typical wiring termination details for all devices.

7. The Contractor shall submit a certificate with the RCDD signature, registration number, and seal verifying the completeness and accuracy of the design and installation. All distribution designs shall be submitted with the RCDD signature, registration number, and seal.

D. Provide Operation and Maintenance Manuals, as specified in Division 1 and Division 26, for work specified in this Section. Include complete service information, including schematics, prints of the Special System Drawings, interconnecting diagrams for this particular project, and parts lists to permit quick and efficient maintenance and repair of the equipment by a qualified technician. Provide a separate binder with copies of all system test reports.

E. Provide a DVD of all Record As-Built drawings and all O&M manuals and product data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. The installing contractor shall submit proof of having installed at least six (6) similar Data And Voice Structured Cabling And Outlet Systems. These systems shall have been in service for a minimum of three (3) years. These systems must have been within a fifty (50) mile radius of the project location. Included with this proof shall be the customer

name, customer contact and telephone number, and, if applicable, the architect and electrical engineer on the project. The Architect and Owner retain the right to reject any installing contractor who, in their sole judgment, has not met the above criteria or has received a less than favorable reference from any of the submitted references OR from any other customer for which the installing contractor has performed similar installations, whether or not such customer has been listed on the submittal.

2. In order to assure full compliance with all codes and regulations, the installing contractor must have on its regular staff a Master Electrician licensed within the jurisdiction in which the installation occurs. Proof of such licensing must be included with the original submittal.

3. The Contractor shall make application for all necessary permits, licenses and inspections as required by the Authority Having Jurisdiction, and shall pay all fees and charges appurtenant thereto.

4. The installing contractor must be certified by the manufacturer of the Cabling System being proposed for installation. Proof of such certification must be included with the original submittal.

B. Manufacturer Qualifications: Materials proposed for use on this project shall be provided by a manufacturer experienced in manufacturing components that comply with ANSI/TIA-568-C specifications and who comply with these Specifications.

1.6 COORDINATION

A. Contractor shall field coordinate the data drop locations serving the wireless access points with the wireless access point vendor to determine actual location based on a site survey.

PART 2 – PRODUCTS

2.1 TELECOMMUNICATIONS SYSTEM REQUIREMENTS

A. Facilities Description: Customer shall deploy four data circuits to each user outlet as a standard configuration. The four data circuits are provided via four Category 6 cables to each outlet. Horizontal data cables shall be terminated on rack-mounted Category 6 patch panels. Horizontal data circuits shall be connected to LAN electronics within each Telecommunications Room or MDF/IDF (Main Distribution Facilitly/ Intermediate Distribution Facility).

B. Where applicable a 24 Strand, 62.5 µm multimode fiber optic backbone shall be employed between the data Main Distribution Facility (MDF) and each (IDF) for data connectivity, 50 pair Cat 5e CMP will be installed from the (POP) point of presence…(Where all utilities enter the facility) to the (MDF).. High pair-count 50-pair Category 5e CMP riser cables are employed between the voice (MDF) and each (IDF) for voice/fax connectivity. Within the data (MDF) and the each (IDF), backbone fiber strands shall be terminated and housed in rack-mount fiber optic LIU enclosures. Within the (POP), backbone fiber strands shall be terminated in a wall-mount fiber optic LIU enclosure in close proximity to the entering fiber. Within the voice (POP),(MDF) and each (IDF), backbone copper pairs shall be terminated on wall-mount 110Connect XC Cross-Connect termination frames.

2.2 HORIZONTAL DISTRIBUTION SUBSYSTEM

A. Telecommunications Outlets: Each telecommunications outlet (TO) location, unless otherwise noted, shall be provided with four Category 6 cables. Each Category 6 cable shall be terminated on an 8-position, 8-conductor Category 6 modular jack to the T568B wiring code. The TO faceplates, unless otherwise noted, shall be mounted to single gang boxes, box eliminators, surface mount boxes and/or floor monuments (provided by a 3rd party) as required.

B. Modular Jacks for Data Circuits: Modular jacks shall be unkeyed, unshielded, 4-pair, RJ-45, and shall fit in a .790" X .582" opening. Modular jacks shall terminate using 110-style pc board connectors, color-coded for both T568A and T568B wiring. Each modular jack shall be wired to T568B. The 110-style insulation displacement connectors shall be capable of terminating 22-24 AWG solid or 24 AWG stranded conductors. The insulation displacement contacts shall be paired with additional space between pairs to improve crosstalk performance. Modular jacks shall utilize a secondary PC board separate from the signal path for crosstalk compensation. Each modular jack shall meet the ANSI/TIA -568-C.2, Category 6 or ISO/IEC 11801 Class E performance standards and the requirements listed in Table-3.

Frequency MHz	Insertion Loss dB		Return Loss dB		NEXT dB		FEXT dB	
	Standard	Max	Standard	Min	Standard	Min	Standard	Min
1	0.10	0.02	30	52.4	75.0	84.8	75.0	83.7
4	0.10	0.02	30	53.7	75.0	80.3	71.1	74.8
8	0.10	0.02	30	55.3	75.0	77.4	65.0	69.4
10	0.10	0.03	30	56.1	74.0	76.4	63.1	67.5
16	0.10	0.03	30	57.6	69.9	72.0	59.0	62.9
20	0.10	0.04	30	59.3	68.0	71.9	57.1	61.7
25	0.10	0.04	30	59.4	66.0	69.1	55.1	59.8
31.25	0.11	0.05	30	56.8	64.1	67.7	53.2	58.2
62.5	0.16	0.06	28	42.3	58.1	61.5	47.2	52.6
100	0.20	0.06	24	33.2	54.0	57.7	43.1	48.7
200	0.28	0.06	18	21.2	48.0	52.5	37.1	42.2
250	0.32	0.10	16	18.9	46.0	47.9	35.1	40.1

Table-3
Worst-Case Performance Characteristics for Category 6 Modular Jacks

Modular jacks shall be compatible with the TE Connectivity (AMP NETCONNECT) SL Series Modular Jack Termination Tool part number 1725150-1. Each modular jack shall be provided with a bend-limiting strain relief. The strain relief shall provide cylindrical support to limit the bend radius at the point of termination. [Each jack shall incorporate an integral, hinged dust cover]. Modular jacks shall be UL Listed under file number E81956. Modular jacks shall be TE Connectivity (AMP NETCONNECT) SL Series part number 1375055-6 and be BLUE in color.

C. Wall Faceplates: Work area wall outlets shall be constructed utilizing 110Connect single gang 4-Port faceplates 4.53” X 2.77” X .60” in size, colored [almond, black, white, gray, electrical ivory, alpine white]. Data/voice outlets shall be loaded with modular jacks as described in 3.1. The 110Connect faceplates shall contain [define labeling and icon requirements and part numbers]. The 110Connect faceplates shall be AMP NETCONNECT part number 558088-X (X denotes color, see Table-7).

Description	Color	Part Numbers
4-Port Faceplates	Almond	406185-1

	Electrical Ivory	1-2111011-1

Table-7 110Connect 4-Port Faceplate Part Numbers

D. Telecommunications Outlet Installation: All outlets shall be installed in the following manner. Cables shall be coiled in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturer's bend radius. In hollow wall installations where box-eliminators are used, excess wire can be stored in the wall. No more than 12" of slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. Excess slack may be neatly coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable. In addition, each cable type shall be terminated as indicated below. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-C specifications document, manufacturer's recommendations and/or best industry practices. Pair untwist at the termination shall not exceed 0.5 inch for Category 6 connecting hardware. Bend radius of the cable in the termination area shall not be less than 4 times the outside diameter of the cable. The cable jacket shall be maintained as close as possible to the termination point. Modem jacks shall be considered the last voice jack in the sequence. Data jacks shall occupy the top position(s) on the faceplate. Data jacks in horizontally oriented faceplates shall occupy the left-most position(s).

E. Horizontal Distribution Cable Product Specifications: Horizontal Cabling for Data Circuits -- Horizontal cabling shall be 23 AWG, 4-pair UTP, NEC/NFPA [CMP] rated and be independently verified for compliance. Cable shall exceed all ANSI/TIA/EIA and ISO Category 6/Class E requirements as well as meet the performance and technical requirements listed in Table-8 and Table-9.8. **Yellow Jacket TE620P-YL02 and BLUE Jacket TE620P-BL02** See next page.

Performance Data, 620 Series CMP Category 6 UTP Cable, 219567-X

Freq	Fitted Impedance Ohms	Insertion Loss dB/100m		Return Loss dB/100m		Pair-Pair NEXT dB/100m		PSNEXT dB/100m	
MHZ	Spec	Max	Spec	Min	Spec	Min	Spec	Min	Spec
1	100+/-5	1.7	2.0	28.5	20.0	83.8	74.3	81.9	72.3
4	100+/-3	3.4	3.8	32.1	22.9	74.9	65.3	74.3	63.3
8	100+/-3	4.9	5.3	35.0	24.5	74.4	60.8	71.0	58.8
10	100+/-3	5.5	6.0	34.6	25.0	70.3	59.3	68.0	57.3
16	100+/-3	7.0	7.6	31.7	25.0	67.2	56.2	66.7	54.2
20	100+/-3	7.9	8.5	32.1	25.0	66.8	54.8	64.7	52.8
25	100+/-3	8.9	9.5	36.5	24.3	65.6	53.3	63.6	51.3
31.25	100+/-3	9.9	10.7	36.7	23.6	61.8	51.9	60.9	49.9
62.5	100+/-3	14.3	15.4	34.0	21.5	61.0	47.4	59.3	45.4
100	100+/-3	18.4	19.8	30.8	20.1	60.2	44.3	57.4	42.3
155	100+/-3	23.3	25.2	27.3	18.8	54.8	41.4	51.4	39.4
200	100+/-3	26.8	29.0	31.0	18.0	54.9	39.8	52.4	37.8
250	100+/-3	30.4	32.8	28.6	17.3	49.5	38.3	48.5	36.3
300	100+/-3	33.7	–	27.2	–	49.0	–	48.2-	–
350	100+/-3	36.7	–	24.3	–	46.3	–	44.8	–
400	100+/-3	39.6	–	25.0	–	47.5	–	45.2-	–
550	100+/-3	47.7	–	18.6	–	40.2	–	39.4	–
600	100+/-3	47.5	–	15.2	–	38.3	–	35.4	–

Freq	Pair-Pair ACR dB/100m		PSACR dB/100m		Pair-Pair ACRF dB/100m		PSACRF dB/100m		TCL dB/100m	ELTCTL dB/100m
MHZ	Min	Spec	Min	Spec	Min	Spec	Min	Spec	Min	Min
1	82.2	72.3	80.3	70.3	73.6	67.8	72.6	64.8	40.0	35.0
4	71.7	61.5	71.2	59.5	62.7	55.8	61.8	52.8	40.0	23.0
8	69.8	55.4	66.4	53.4	57.2	49.7	56.2	46.7	40.0	16.9
10	65.1	53.3	62.8	51.3	55.2	47.8	54.2	44.8	40.0	15.0
16	60.5	48.7	60.0	46.7	51.1	43.7	49.8	40.7	38.0	10.9
20	59.4	46.3	57.4	44.3	49.3	41.8	48.2	38.8	37.0	9.0
25	57.3	43.8	55.3	41.8	47.4	39.8	46.5	36.8	36.0	7.0
31.25	52.5	41.2	51.3	39.2	45.5	37.9	44.4	34.9	35.1	5.1
62.5	47.3	32.0	45.7	30.0	40.1	31.9	39.4	28.9	32.0	–
100	42.7	24.5	39.8	22.5	36.8	27.8	35.9	24.8	30.0	–
155	32.4	16.3	28.9	14.3	33.6	24.0	33.2	21.0	28.1	–
200	29.6	10.8	26.9	8.8	31.7	21.8	30.6	18.8	27.0	–
250	20.3	5.5	19.3	3.5	29.1	19.8	28.9	16.8	26.0	–
300	16.6	–	15.8	–	26.2	–	25.5	–	–	–
350	10.9	–	9.4	–	21.3	–	21.8	–	–	–
400	10.1	–	7.9	–	22.1	–	22.5	–	–	–
550	–	–	–	–	25.7	–	24.7	–	–	–
600	–	–	–	–	11.5	–	9.6	–	–	–

NOTE: The above listed discrete frequency electrical performance values are provided for engineering information only. Actual compliance testing is based on swept frequency measurements.

TABLE 8
CAT 6 CABLE PERFORMANCE CHARACTERISTICS

Technical Specifications, 620 CMP Category 6 UTP Cable, 219567-X

Mutual Capacitance:	5.6 nF/100 m maximum
Conductor DC resistance:	28.6 Ω/1000 ft (9.38 Ω/100 m) maximum
Voltage:	300 VDC
Delay Skew:	25 ns/100 m
Propagation Delay:	454 ns/100 m @ 250 MHz
nominal Velocity of Propagation:	75%
Operating Temperature:	-20°C – 60°C (-4°F – 140°F)
Storage Temperature:	-20°C – 80°C (-4°F – 176°F)
installation Temperature:	5°C - 50°C (41°F - 122°F)
Bend radius:	4 × cable diameter
Packaging: 1000ft Reel-in-a-box:	31 lbs
1000ft Reel:	28 lbs
1000ft Pull-box:	28 lbs
Materials: Conductors:	23 AWG, Solid Copper (0.0224" nominal)
Insulation:	0.039 nominal, FEP
Jacket:	0.206 nominal, FR PVC
Compliances:	UL Subject 444 (UL)-C(UL) Type CMP ICEA S-90-661 ETL Verified TIA-568-C.2 Category 6 Horizontal Cable Requirements ISO/IEC 11801 Category 6 Horizontal Cable Requirements 2002/95/EC RoHS

TABLE 9
CAT 6 CABLE TECHNICAL SPECIFICATIONS

F. Cable performance shall be independently verified and characterized to 600 MHz. Cable jacketing shall be [white, gray, blue, or yellow] ~~[orange]~~ and shall be lead-free. Cable shall be supplied [in a reel-in-box]. Independent verification for flammability compliance shall be to NEC article 800 and NFPA 70; [CMP (NFPA 262, UL 910)]. Horizontal cable shall be AMP NETCONNECT part number [219567-X (X denotes color and packaging, see Table-10)].

Description	NEC/NFPA Rating	Packaging	Part Numbers			
			White	Gray	Blue	Yellow
Category 6 UTP Cable, **620 Series**	CMR	Pull-box, 1000 ft	5-219560-2	5-219560-4	5-219560-6	5-219560-8
		Reel-in-box, 1000 ft	219560-2	219560-4	219560-6	219560-8
		Reel, 1000 ft	219560-1	219560-3	219560-5	219560-7
	CMP	Pull-box, 1000 ft	5-219567-2	5-219567-4	5-219567-6	5-219567-8
		Reel-in-box, 1000 ft	219567-2	219567-4	219567-6	219567-8
		Reel, 1000 ft	219567-1	219567-3	219567-5	219567-7

Horizontal Data Cable Part Numbers

G. Horizontal Distribution Cable Installation: Cable shall be installed in accordance with manufacturer's recommendations and best industry practices. Cable raceways shall not be filled greater than the NEC maximum fill for the particular raceway type. Cables shall be installed in continuous lengths from origin to destination (no splices) unless specifically addressed in this document. Where cable splices are allowed, they shall be in accessible locations and housed in an enclosure intended and suitable for the purpose. The cable's minimum bend radius and maximum pulling tension shall not be exceeded. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of four-foot intervals - at no point shall cable(s) rest on acoustic ceiling grids, concrete block, brick or panels. Horizontal distribution cables shall be bundled in groups of not greater than 40 cables (cable bundle quantities in excess of 40 cables may cause deformation of the bottom cables within the bundle). Cable shall be installed above fire-sprinkler and systems and shall not be attached to the system or any ancillary equipment or hardware. The cabling system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices. Cables shall not be attached to ceiling grid or lighting support wires. Where light support for drop cable legs is required, the Contractor shall install clips to support the cabling. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor prior to final acceptance at no cost to the Owner. Cables shall be identified by a self-adhesive label in accordance with the System Documentation Section of this specification. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate. Unshielded twisted pair cable shall be installed so that there are no bends less than four times the cables outside diameter (4 X cable O.D.) at any point in the run. Pulling tension on 4-pair UTP cables shall not exceed 25-pounds for a single cable or cable bundle.

H. Horizontal Cross-Connect Termination Hardware Product Specifications: Horizontal Cross-Connect for Data Circuits - Horizontal cross-connect shall consist of Category 6 patch panels,

which shall be [2U] high and provide [48] modular jack ports, wired to [T568B]. Patch panels shall be configured as 6-port modules with individually replaceable jacks. Modular jacks shall be compatible with TE AMP NETCONNECT SL Series Modular Jack Termination Tool part number 1725150-1. Each modular jack shall be provided with a bend-limiting strain relief. The strain relief shall provide cylindrical support to limit the bend radius at the point of termination. [Each modular jack shall be bagged separately from the patch panel and terminated with the SL Series Modular Jack Termination]. The front of each 6-port module shall be capable of accepting 9mm to 12mm labels. Each port shall be capable of accepting an icon to indicate its function. Patch panels shall terminate the building cabling on 110-style insulation displacement connectors. The installed system shall comply with the Category 6 performance characteristics listed in Table-14.

Frequency MHz	Insertion Loss dB		Return Loss dB		NEXT dB		FEXT dB	
	Standard	Max.	Standard	Min.	Standard	Min.	Standard	Min.
1	0.10	0.02	30	52.4	75.0	84.8	75.0	83.7
4	0.10	0.02	30	53.7	75.0	80.3	71.1	74.8
8	0.10	0.02	30	55.3	75.0	77.4	65.0	69.4
10	0.10	0.03	30	56.1	74.0	76.4	63.1	67.5
16	0.10	0.03	30	57.6	69.9	72.0	59.0	62.9
20	0.10	0.04	30	59.3	68.0	71.9	57.1	61.7
25	0.10	0.04	30	59.4	66.0	69.1	55.1	59.8
31.25	0.11	0.05	30	56.8	64.1	67.7	53.2	58.2
62.5	0.16	0.06	28	42.3	58.1	61.5	47.2	52.6
100	0.20	0.06	24	33.2	54.0	57.7	43.1	48.7
200	0.28	0.06	18	21.2	48.0	52.5	37.1	42.2
250	0.32	0.10	16	17.4	46.0	47.9	35.1	40.1

Table-11
Horizontal Data Cross-Connect Performance Characteristics
(exceed TIA/EIA-568-B.2 Category 6 and ISO/IEC 11801 Class E)

The horizontal cross-connect for data circuits shall consist of patch cords from the horizontal Category 6 termination panels to the network equipment within the same or adjacent racks The horizontal data cross-connect shall be contained in 19" x 7' rack(s). All equipment racks shall be augmented with horizontal and vertical cable management hardware, both front and rear, to properly dress horizontal cables and patch cords. Patch panels shall be 3.5 inches high and provide 48 modular jack ports, wired to T568B. Patch panel modular jacks shall be configured as 6-port, replaceable modules. Each patch panel shall be separated vertically on the rack by a [2U (for 2U patch panels)] horizontal finger duct cable management panel. Patch panels must be UL Listed under file number E81956. Patch panels shall be TE AMP NETCONNECT part number(s) 1375015-2 with color coded inserts, or an approved equivalent, cable management panels shall be AMP NETCONNECT part number(s) 1933532-1 (single sided) or 1933533-1 (double sided).

I. Horizontal Cross-Connect Installation: Copper termination and management hardware shall be installed in the following manner. Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-C specifications document, manufacturer's recommendations and/or best industry practices. Pair untwist at the termination shall not exceed 0.5 inch for Category 6 connecting hardware. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable. Cables shall be neatly bundled and dressed to their respective panels or blocks. Only Velcro cable ties should be used to bundle and

dress cables. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame. The cable jacket shall be maintained as close as possible to the termination point. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cable labels shall not be obscured from view.

J. Fiber optic termination hardware shall be installed in the following manner: Fiber slack shall be neatly coiled within the fiber termination panel. No slack loops shall be allowed external to the fiber panel(s). Each cable shall be individually attached to the respective termination panel by mechanical means. The cables strength member(s) shall be securely attached the cable strain relief bracket in the panel. Each fiber cable shall be stripped upon entering the termination panel and the individual fibers routed in the termination panel. Each cable shall be clearly labeled at the entrance to the termination panel. Cables labeled within the bundle shall not be acceptable. Dust caps shall be installed on the connectors and couplings at all times unless physically connected.

2.3 BACKBONE DISTRIBUTION SUBSYSTEM

A. Main Cross-Connect and Telecommunications Rooms: The (POP), (MDF) and each (IDF), unless otherwise noted, shall house both voice and data backbone cabling and active equipment to support networking requirements. The (POP) shall be the main point of entry for outside services. The (MDF) will be the main distribution point for all backbone cabling. Each (IDF) will receive both voice and data cabling from the (MDF). The data backbone shall consist of 50/125µm OM3 multimode cable and connectivity housed in rack-mount SC duplex fiber optic enclosures. The voice backbone shall consist of 25-pair Category 5e cabling terminated on wall-mount 110Connect XC cross-connect frames.

B. Product Specifications

1. Backbone Cross-Connect for Voice Circuits: Backbone cross-connects for voice connectivity shall be wall-mount 110Connect XC frames. Wall-mount frames shall be field-terminated 110Connect XC frame kits which include frame, blocks, bottom trough, horizontal wire troughs, connecting blocks, and designation strips. Wire management frames shall be mounted between adjacent vertical frames to provide wire management of cross-connect wire. Frames and bottom troughs shall be constructed of carbon steel, light almond in color. Wiring blocks, connecting blocks and horizontal troughs shall be constructed of polycarbonate molding compound. Wiring blocks shall be marked black every fifth pair. Connecting block terminals shall be constructed of phosphor bronze, plated with a minimum of 150µin of tin-lead over a 50µin minimum nickel underplate. Combinations of 300 and/or 900 pair frames shall be used as required by the horizontal and backbone pair counts to be terminated in the voice MC. Backbone frames shall employ 5-pair connecting blocks. Cross-connects shall meet the performance characteristics listed in Table-12-A – 12-B.

Frequency MHz	Insertion Loss dB		NEXT dB		PSNEXT dB	
	Standard	Max.	Standard	Min.	Standard	Min.
1	0.1	0.05	65.0	82.9	–	79.9
4	0.1	0.05	65.0	71.6	–	68.6
8	0.1	0.05	64.9	65.8	–	62.7
10	0.1	0.05	63.0	63.8	–	60.8
16	0.2	0.1	58.9	59.9	–	56.9
20	0.2	0.1	57.0	57.9	–	54.9
25	0.2	0.1	55.0	55.9	–	52.9

31.25	0.2	0.1	53.1	53.9	–	50.9
62.5	0.3	0.15	47.1	48.0	–	45.0
100	0.4	0.2	43.0	44.0	–	41.0

Table-12-A
Backbone Voice Cross-Connect Performance Characteristics
(or exceed TIA/EIA-568-C.2 Category 5e and ISO/IEC 11801 Class D)

Frequency MHz	FEXT dB		Return Loss dB	
	Standard	Min.	Standard	Min.
1	65.0	85.1	35.0	57.6
4	63.1	74.4	35.0	48.5
8	57.0	68.3	35.0	42.8
10	55.1	66.4	35.0	40.8
16	51.0	62.5	35.0	36.9
20	49.1	60.5	34.0	35.0
25	47.1	58.4	32.0	33.0
31.25	45.2	56.4	30.1	31.0
62.5	39.2	50.3	24.1	25.1
100	35.1	45.9	20.0	21.2

Table-12-B
Backbone Voice Cross-Connect Performance Characteristics

The backbone voice cross-connect shall be constructed using AMP NETCONNECT frame kits part number(s) [569855-1 or 569858-1] and cable management frames part number(s) [569851-1 or 569852-1] (see Table-13).

Description	Pair Count	Connecting Blocks	Part Numbers
110Connect XC Cross-Connect Frame Kits	300	5-Pair	569855-1
	900	5-Pair	569858-1
110Connect XC Cable Management Frame	300	-	569851-1
	900	-	569852-1

Table-13
Backbone Voice Cross-Connect Part Numbers

2. Backbone Cross-Connect for Data Circuits: Each fiber optic cable shall be terminated with LC simplex connectors in the Data (MDF) and each (IDF) in [2U] rack-mount enclosures providing protection for the terminated fibers. Each LC Duplex jack shall be field-installable, requiring no epoxy, no polishing, no bench tool and no crimping. Each LC simplex connector shall meet the intermateability requirements of TIA/EIA-604-3. LC simplex connector shall be AMP NETCONNECT part number TE 6754483-1 LC Style Lightcrimp Plus (see Table-14). [Bend-limiting strain relief boots are required for each jack.]

Test Description	FOTP	Requirement (dB)
Visual and Mechanical Inspection	13	TIA/EIA-604-2 or -3 Intermateability

Test Description	FOTP	Requirement (dB)
Attenuation	34	≤ 0.75
Return Loss	107	≤ -20
Low Temperature (00C for 4 days)	188	≤ 0.3 change
Temperature Life (550C for 14 days)	7	≤ 0.3 change
Humidity (90 to 95% @ 400C for 4 days)	5	≤ 0.3 change
Impact (8 drops from 1.8 meters)	2	≤ 0.75 IL, -20 RL
Durability (500 cycles)	21	≤ 0.75 IL, -20 RL
Cable Retention (00and 900)	6	≤ 0.75 IL, -20 RL
Flex (100 cycles)	1	≤ 0.75 IL, -20 RL
Twist (10 cycles)	36	≤ 0.75 IL, -20 RL

Table-14
Backbone Data performance Characteristics

Each SC connector shall be held by an LC Duplex jack snap-in adapter plate which in turn shall be installed into a rack-mount fiber optic enclosure. L Duplex jack snap-in adapter plates shall be AMP NETCONNECT part number 559596-6.

The backbone data cross-connect shall be contained in 19" x 7' rack(s). Fiber optic enclosures shall be capable of containing [18, 24, 48, or 72] MT-RJ jacks. Fiber optic enclosures shall be TE AMP NETCONNECT part number(s) RMG 4000-000B enclosure (see Table-20). Each fiber patch enclosure shall be separated vertically on the rack by a 2U rack-mount fiber management enclosure. Fiber management enclosures shall be AMP NETCONNECT part number 1435808-1. Fiber service loops shall be contained in 2U rack-mount fiber management enclosures.

Description	Fiber Count	Port Count	Rack Units	Part Numbers
Rack mount patch enclosure, holds 3 RMG adapter plates	72	36	1U	RMG-1000-000B
Rack mount patch enclosure, holds 6 RMG adapter plates	144	72	2U	RMG-2000-000B
Rack mount patch enclosure, holds 12 RMG adapter plates	288	144	4U	RMG-4000-000B

TABLE 15

FIBER ENCLOSURE PART NUMBERS

All equipment racks shall be augmented with vertical cable management hardware, both front and rear, to properly dress backbone cables and patch cords. Vertical cable management panels shall be AMP NETCONNECT part number(s) [1933534-1(6" W), 1933535-1(10" W) or 1933536-1(12" W)

C. Backbone Cross-Connect Installation: Copper termination and management hardware shall be installed in the following manner.

1. Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-C document, manufacturer's recommendations and/or best industry practices.

2. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

3. Cables shall be neatly bundled and dressed to their respective panels or blocks.

4. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

5. The cable jacket shall be maintained as close as possible to the termination point.

6. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties.

7. Cable labels shall not be obscured from view.

D. Fiber optic termination hardware shall be installed in the following manner.

1. Fiber slack shall be neatly coiled within the fiber termination enclosures or in rack-mount fiber management enclosures.

2. No slack loops shall be allowed external to the fiber enclosure(s).

3. Each cable shall be individually attached to the respective termination panel by mechanical means.

4. The cable strength member(s) shall be securely attached the cable strain relief bracket in the panel

5. Each fiber cable shall be stripped upon entering the termination panel and the individual fibers routed in the termination panel.

6. Each cable shall be clearly labeled at the entrance to the termination panel.

7. Cable labels shall not be obscured from view.

8. Dust caps shall be installed on the connectors and couplings at all times unless physically connected.

E. Backbone Cabling Product Specifications

1. Backbone Cabling for Voice Circuits: Backbone voice cabling shall be 24 AWG, 25-pair UTP, NEC/NFPA [CMP] rated and be independently verified for compliance. Cable jacketing shall be [blue] and shall be lead-free. [Individual conductors shall be 100% FEP insulated]. Cable shall be independently verified by ETL and shall exceed all TIA/EIA Enhanced Category 5 requirements as well as meet the performance requirements listed in Table-16A – B.

Frequency	Insertion Loss (dB)		NEXT (dB)		PSNEXT (dB)	
MHz	Standard	Max.	Standard	Min.	Standard	Min.

.772	1.8	1.8	67.0	67.0	64.0	64.0
1	2.0	2.0	65.3	65.3	62.3	62.3
4	4.1	4.1	56.3	56.3	53.3	53.3
8	5.8	5.8	51.8	51.8	48.8	48.8
10	6.5	6.5	50.3	50.3	47.3	47.3
16	8.2	8.2	47.2	47.2	44.2	44.3
20	9.3	9.3	45.8	45.8	42.8	42.8
25	10.4	10.4	44.3	44.3	41.3	41.3
31.25	11.7	11.7	42.9	42.9	39.9	39.9
62.5	17.0	17.0	38.4	38.4	35.4	35.4
100	22.0	22.0	35.3	35.3	32.3	32.3

Table-16-A
Backbone Voice Cable Performance Characteristics
(meet or exceed TIA/EIA-568-B.2 Category 5e)

Frequency MHz	ELFEXT (dB)		PSELFEXT (dB)		Return Loss (dB)	
	Standard	Min.	Standard	Min.	Standard	Min.
.772	–	–	–	–	–	–
1	63.8	63.8	60.8	60.8	20.0	20.0
4	51.8	51.8	48.8	48.8	23.1	23.0
8	45.7	45.7	42.7	42.7	24.5	24.5
10	43.8	43.8	40.8	40.8	25.0	25.0
16	39.7	39.7	36.7	36.7	25.0	25.0
20	37.8	37.8	34.8	34.8	25.0	25.0
25	35.8	35.8	32.8	32.8	24.3	24.3
31.25	33.9	33.9	30.9	30.9	23.6	23.6
62.5	27.9	27.9	24.9	24.9	21.5	21.5
100	23.8	23.8	20.8	20.8	20.1	20.1

Table 16-B
Backbone Voice Cable Performance Characteristics
(continued)

Cable performance shall be independently verified and characterized to 100MHz. Cable shall be supplied on wooden reels. Cable shall be independently verified for flammability by Intertek ETL SEMKO and shall comply with NEC article 800 and NFPA 70; [CMP (NFPA 262, UL 910)]. Backbone cable shall be [blue] AMP NETCONNECT part number [1499419-3].

2. Backbone Cabling for Data Circuits: Backbone data cable shall be all-dielectric and shall consist of [twelve] 900µm tight-buffered OM3 50/125µm fibers surrounded by aramid strength members and a PVC outer jacket. Cables with fiber counts more than 12 shall have two or more subunits and may have a central member. The cable shall have a UL rating of Non-Plenum. The nominal cable dimensions shall be as listed in Table-23.

   a. Backbone data cable shall be all-dielectric and shall consist of 900µm tight-buffered 850nm laser-optimized OM3 50/125µm multimode fibers surrounded by aramid strength members and a PVC outer jacket.

   b. Cable shall be tested to comply with the most recent revision of TIA/EIA-568-C.3 and ISO/IEC 11801 standards, and their published addenda. The minimum bandwidth and maximum cable attenuation of the cable shall meet the requirements of table **[1]**. The fibers shall support 10 Gigabit Ethernet to a minimum distance as listed in Table **[1]**. Cables with fiber counts more than 12 shall have two or more

subunits and may have a central member. The cable shall have a UL rating of **[OFNR (Riser) or OFNP (Plenum)]**.

	OM3 50/125µm (850/1300nm)
Maximum Attenuation	3.2/1.2 dB/km
OFL Bandwidth	1500/500 MHz·km
850 nm LASER Bandwidth	2000 MHz-km
1000BASE-SX Distance	800m
1000BASE-LX Distance	550m
10GBASE-S Distance	300m
10GBASE-LX4 Distance	300m

TABLE [17]
FIBER BACKBONE CABLE PERFORMANCE CHARACTERISTICS

c. Backbone fiber cabling shall meet the mechanical and temperature requirements listed in tables **[2 and 3]**.

Cable Type	Fiber count	UL/NEC Rating	Nominal O.D. mm(in.)	Nominal Weight kg/km(lbs/1000ft)	Rated Tensile Load		Minimum Bend Radius	
					Installation N (lbf)	Long Term N (lbf)	Installation mm(in)	Long Term mm(in)
Distribution	6	OFNR	5.2(0.20)	29 (19)	660 (150)	198 (45)	114 (4.5)	57 (2.2)
	6	OFNP	4.8 (0.19)	24 (16)	440 (100)	132 (30)	110 (4.3)	55 (2.2)
	8	OFNR	5.7 (0.22)	24 (16)	660 (150)	198 (45)	136 (5.4)	68 (2.7)
	8	OFNP	5.0 (0.20)	26 (17)	440 (100)	132 (30)	110 (4.3)	55 (2.2)
	12	OFNR	6.0 (0.24)	37 (25)	660 (150)	198 (45)	128 (5)	64 (2.5)
	12	OFNP	5.7 (0.23)	46 (31)	440 (100)	132 (30)	128 (5)	64 (2.5)
	24 2(12)	OFNR	7.4 x 13.0 (0.29 x 0.51)	87 (58)	1320 (300)	396 (90)	284 (11.2)	142 (5.6)
	24 2(12)	OFNP	7.0 x 12.4 (0.28 x0.49)	92 (62)	660 (150)	198 (45)	264 (10.4)	132 (5.2)
	36	OFNR	16.4 (0.65)	220 (148)	1320 (300)	396 (90)	342 (13.5)	171 (6.7)
	36	OFNP	16.0 (0.63)	255 (171)	660 (150)	198 (45)	327 (12.9)	164 (6.4)
	48	OFNR	16.0 (0.63)	250 (168)	1320 (300)	396 (90)	350 (13.8)	175 (6.9)
	48	OFNP	15.2 (0.60)	202 (136)	660 (150)	198 (45)	312 (12.3)	156 (6.1)
	72	OFNR	18.9 (0.75)	301 (202)	1320 (300)	396 (90)	386 (15.2)	193 (7.6)
	72	OFNP	18.5 (0.73)	316 (212)	660 (150)	198 (45)	386 (15.2)	193 (7.6)
	96	OFNR	22.8 (0.90)	433 (291)	1320 (300)	396 (90)	462 (18.2)	231 (9.1)
	96	OFNP	22.0 (0.86)	466 (313)	660 (150)	198 (45)	448 (17.6)	224 (8.8)
	144	OFNR	24.8 (0.98)	461 (310)	1320 (300)	396 (90)	514 (20.2)	257 (10.1)
	144	OFNP	24.2 (0.95)	474 (319)	660 (150)	198 (45)	514 (20.2)	257 (10.1)

TABLE [18]
FIBER BACKBONE CABLE MECHANICAL SPECIFICATIONS

Operation (Riser)	Installation (Riser)	Storage (Riser)
-20ºC to +70ºC (-4ºF to +158ºF)	-10ºC to +60ºC (14ºF to +140ºF)	-40ºC to +70ºC (-40ºF to +158ºF)

Operation (Plenum)	Installation (Plenum)	Storage (Plenum)
0ºC to +70ºC (32ºF to +158ºF)	0ºC to +60ºC (32ºF to +140ºF)	-40ºC to +70ºC (-40ºF to +158ºF)

TABLE [19]
FIBER BACKBONE CABLE TEMPERATURE RATINGS

d. Backbone fiber cabling shall be TE Connectivity product part number **[**see Table **[4]**. The cable jacket shall be Aqua.

OM3 50/125um (Aqua Jacket)			
Fiber Count	Construction	UL/NEC Rating	Part Numbers
6	1x6	Riser (OFNR)	3-1553307-9
		Plenum (OFNP)	3-1553308-9
8	1x8	Riser (OFNR)	3-1553309-9
		Plenum (OFNP)	3-1553310-9
12	1x12	Riser (OFNR)	3-1553311-9
		Plenum (OFNP)	3-1553312-9
24	1x24	Riser (OFNR)	3-1553313-9
		Plenum (OFNP)	3-1553314-9
24	2x12	Riser (OFNR)	3-1553315-9
		Plenum (OFNP)	3-1553316-9
36	6x6	Riser (OFNR)	3-1553319-9
		Plenum (OFNP)	3-1553320-9
48	4x12	Riser (OFNR)	3-1553321-9
		Plenum (OFNP)	3-1553322-9
72	6x12	Riser (OFNR)	3-1553323-9
		Plenum (OFNP)	3-1553324-9

TABLE [20]
FIBER BACKBONE CABLE PART NUMBERS

3. Backbone Cable Installation: All backbone cables shall be installed in the following manner. Backbone cables shall be installed separately from horizontal distribution cables. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits or in separate innerduct(s) within conduits. Where cables are installed in an air return plenum, the cable shall be installed in conduit, or plenum cable shall be installed in a plenum innerduct to provide protection to the cable. Where backbone cables and distribution cables are installed in a cable tray or wire-way, backbone cables shall be installed first and bundled separately from the horizontal distribution cables

2.4 WORK AREA AND CROSS-CONNECT CABLE ASSEMBLES:

A. Cable Assemblies: Data cable assemblies used for horizontal cross-connect and at the workstation shall be Category 6, 4-pair assemblies. Twisted pair data cable assemblies shall be

factory-assembled by the manufacturer of the cabling system. Each (MDF/IDF) shall require 2-foot cable assemblies to cross-connect between the horizontal data patch panels and network equipment. The total quantity of cable assemblies required in each (MDF/IDF) shall be a 2 foot cable for each port in Patch Panel and (1) Box of 3fts (TCPC-6RUVB-RD03F). and (1) Box of 5fts (TCPC-6RUVB-RD05F). and (1) box of 7 foot (TCPC-6RUVB-RD07F). Each workstation shall require one 10-foot Category 6 cable assembly. One patch cord per user outlet shall be provided. The phone cords shall be provided by the owner. Voice cable assemblies at each workstation shall be provided by the Owner. Voice cable assemblies used at the voice cross connect shall be factory-assembled by the manufacturer of the cabling system. In the (POP), (MDF) and in each (IDF), fiber optic cable assemblies shall be provided to cross-connect between the backbone data fiber LIU enclosures and network equipment. Optical fiber cable assemblies shall be 3 meters in length. [LC duplex or Hybrid] fiber optic cable assemblies shall be provided depending upon LAN electronic interface.

B. Product Specifications

1. Cable Assemblies for Horizontal Data Circuits: Workstation data cable assemblies shall be Category 6 patch cable assemblies, constructed using modular plugs with 50µm gold-plated contacts, and shall be wired to the T568B wiring pattern. Data cable assemblies shall utilize colored cable and "snagless" cable boots that match the color of the cable. Cable assemblies shall be 10ft in length, orange in color and shall be AMP NETCONNECT part number 1-1933123-01.

2. Cable Assemblies for Backbone Data Circuits: Backbone data cable assemblies shall be optical fiber assemblies, factory-terminated using duplex OM3 50/125µm multimode cable. The duplex cables shall utilize SC Duplex plugs [at both ends, or on one end and a LC duplex connectors on the other]. Optical fiber patch cables shall be 3m in length and shall be AMP NETCONNECT part number 6828151-3, 1907438-3.

2.5 TELECOMMUNICATIONS SPACES

A. The telecommunication closets shall house racks, voice termination fields and required cable routing hardware. Racks shall be placed in a manner that will allow a minimum of 3 feet of clearance from the front and rear mounting surfaces and on one side. If one mounting rail of the rack is placed against a wall, the mounting rail shall be no closer than 6” to the wall to allow room for vertical management. Where there is more than one rack, the racks shall be ganged with vertical management hardware to provide interbay management. Ganged rack frames will be placed in a manner that will allow a minimum of 3 feet of clearance from the front and rear mounting surfaces and on one side of the ganged assembly. In all closets the racks shall be on the opposite side of the room from the voice termination fields. Voice termination fields shall be mounted on 4’ x 8’ x .75” virgin fire retardant plywood, unless otherwise noted in drawings, and shall be on the opposite side of the room from the room entrance. Backbone termination fields shall be mounted to the left of the horizontal voice fields. Conduits with 4” minimum diameter shall be used in all closets. Conduits for data backbone shall be located adjacent to the racks and conduits for voice shall be located adjacent to the voice termination fields. The Contractor shall provide innerduct for all backbone fiber runs. Contractor shall provide required ladder and wall-mount management rings to properly support and dress cables from conduits to racks and frames.

B. Installation Specifications: Racks shall be installed in the following manner. Racks shall be securely attached to the concrete floor using 3/8” hardware. All racks shall be grounded to the telecommunications ground bus bar in accordance with Section 9.0 of this document. Rack mount screws (#12-24) not used for installing fiber panels and other hardware shall be bagged and left with the rack upon completion of the installation. Voice backbone termination fields

shall be mounted on 4’ x 8’ x .75” virgin plywood, painted “BLACK” that is mounted vertically at 12” A.F.F.

C. Cabling System Testing: All cables and termination hardware shall be 100% tested for defects in installation and to verify cable performance under installed conditions. All conductors and fibers of each installed cable shall be verified useable by the Contractor prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed-through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all installed cables. All cables shall be tested in accordance with this document, the ND&I Contract agreement, and best industry practices. If any of these are in conflict, the Contractor shall be responsible to bring any discrepancies to the attention of the project team for clarification and/or resolution.

1. The Pass or Fail condition for the cabling run under test is determined by the results of the required individual tests. Any Fail or Fail* result yields a Fail for the cabling run under test. In order to achieve an overall Pass condition, the results for each individual test parameter must be a Pass or Pass*.

   A Pass or Fail result for each parameter is determined by comparing he measured values with the specified test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester

   Test results shall be printed directly from the test unit or from a download file using an application from the test equipment manufacturer. The printed test results shall include all tests performed, the expected test result and the actual test result achieved.

D. Fiber Optic Testing: Each fiber strand shall be tested for attenuation with an optical power meter and light source. Cable length shall be verified using sheath markings. If splices are used, splice attenuation shall be verified with an OTDR. The guidelines and procedures established for Tier 1 testing in TIA/TSB-140 shall apply.

E. Attenuation: Horizontal distribution multimode optical fiber attenuation shall be measured in one direction at either 850 nanometers (nm) or 1300 nm using an LED light source and power meter. This measurement is consistent with the loss which network equipment will see under normal installation and use. Backbone multimode fiber shall be tested at both 850 nm and 1300 nm in one direction. Test set-up and performance shall be conducted in accordance with ANSI/TIA/EIA-526-14 Standard, Method B. The MT-RJ system shall be tested in accordance with the AMP testing procedures established in the MT-RJ Optical Fiber Systems Testing white paper (literature #1307540). Test results evaluation for the panel to panel (backbone) or panel to outlet (horizontal) shall be based on the values set forth in ANSI/TIA/EIA-568-B.1. Attenuation testing shall be performed with a stable launch condition using two-meter jumpers to attach the test equipment to the cable plant. The light source shall be left in place after calibration and the power meter moved to the far end to take measurements. Maximum attenuation for installed cables shall be evaluated based on the following formula: manufacturer’s maximum attenuation per kilometer divided by 1000 and then multiplied by the installed cable length in meters (the length based on cable length measurements marked on the jacket is suitable, but if OTDR testing is performed in accordance with 8.2.2, then the actual measured length shall be used). Conversion from metric to US Standard measurement shall use 3.2808 as a constant with the result rounded to the next highest whole number. The adjusted cable attenuation value shall be added to the manufacturers mean loss per mated pair of connectors multiplied by the number of mated pairs under test (the testing for this project measures the loss over the installed cable plus two jumpers which accounts for three mated pairs of connectors - subtract one mated pair for the

equipment interface to arrive at a total of two mated pairs under test). The expected results for each cable (or group of cables of the same nominal length) shall be calculated before the start of testing and recorded in a space provided on the Contractor's test matrix. Each strand of fiber in the respective cable shall be evaluated against this target number. Any fibers that exceed this value shall be repaired or replaced at no cost to the Owner.

*For this application, the length based on cable length measurements marked on the jacket, will be suitable. If OTDR testing is performed in accordance with 8.2.2, then the actual measured length shall be used. Conversion from metric to US Standard measurement shall use 3.2808 as a constant with the result rounded to the next highest whole number.

**The testing for this project is measuring the loss over the installed cable plus two jumpers which accounts for three mated pairs of connectors. Subtract one mated pair for the equipment interface to arrive at a total of two mated pairs under test.

Where concatenated links are installed to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. After the link performance test has been successfully completed, each link shall be concatenated and tested. The test method shall be the same used for the test described above. The evaluation criteria shall be established between the Owner and the Contractor prior to the start of the test.

F. Length and Splice Loss: Each cable shall be verified for length using sheath markings, a length-capable power meter or an Optical Time Domain Reflectometer (OTDR). Splices, if used, shall be verified for loss using an OTDR. The OTDR measurements for length, if taken, shall be performed in accordance with ANSI/TIA/EIA-455-60 (FOTP-60). The measurements to determine splice loss shall be performed in accordance with manufacturer's recommendations and best industry practices. Refer to TIA/TSB-140 for additional guidelines. OTDR traces shall be taken if one or more of the following conditions exist. OTDR testing is specifically requested by the Owner (refer to Tier 2 testing in TIA/TSB-140). Each strand of all outside plant cables. Each optical fiber splice (fusion or mechanical). A representative strand of each fiber cable over 300m in length. Where abnormal or unexpected results are obtained during attenuation testing. Where the cable has been subjected to extreme conditions or stresses during installation.

2.6 FIRESTOP SYSTEMS

A. Composition: A firestop system is comprised of the item or items penetrating the fire-rated structure, the opening in the structure and the materials and assembly used to seal the penetrated structure. Firestop systems comprise an effective block for fire, heat, vapor and a pressurized water stream. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to "through" penetrations (complete penetration) and "membrane" penetrations (through one side of a hollow, fire-rated structure). Any penetrating items (i.e., riser slots and sleeves, cables, conduit, cable tray, raceways, etc.) shall be properly firestopped.

B. Product Specifications: Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed firestopped system, stamped by the cognizant PE, shall be provided to the owner's technical representative prior to installing the firestop system(s).

C. Firestop System Installation: All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cabling system acceptance.

D. Provide Specified Technologies, Inc (STI) EZ Path Cable Pathway sleeves at all cable penetrations through walls in the telecommunications rooms (MDF and IDF rooms). Provide multiple Series 33 and Series 44 as needed to serve cabling being installed plus 100% spare capacity.

2.7 GROUNDING AND BONDING

A. The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential for acting as a current-carrying conductor. The TBB shall be installed independently of the building electrical ground and of the building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA/EIA-607-A Telecommunications Bonding and Grounding Standard.

B. The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding bus bar (TMGB). Each telecommunications closet shall be provided with a telecommunications grounding bus bar (TGB). The TMGB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.

C. Product Specifications: All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the TC or ER shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors. Where metallic panels attached to the rack to not have sufficient metal to metal contact to provide an adequate path to ground, they shall be bonded to the rack using a minimum #14 AWG copper conductor. The copper conductor size shall be upgraded based on the largest power conductor feeding any rack-mount equipment. The conductor shall be continuous, attaching all isolated components in a daisy chain fashion from top to bottom and bonded to the rack using an appropriate compression connector. All wires used for telecommunications grounding purposes shall be identified with green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables and busbars shall be identified and labeled in accordance with the System Documentation Section of this specification.

D. Ground System Installation: The TBB shall be designed and/or approved by a qualified professional Engineer (PE), licensed (actual or reciprocal) in the state that the work is to be performed. The TBB shall adhere to the recommendations of the ANSI/TIA/EIA-607-A standard, and shall be installed in accordance with best industry practices. Installation and termination of the main bonding conductor to the building service entrance ground, at a minimum, shall be performed by a licensed electrical contractor.

2.8. UNINTERRUPTABLE POWER SUPPLY

A. Provide one (1) UPS unit in each IDF data equipment rack, and any equipment rack not connected to the central UPS described below. The UPS System shall be line interactive design

with a maximum transfer time of 4 milliseconds. The UPS shall be a single conversion modular UPS System with SNMP Management.

1. The UPS System shall provide a minimum of 2000 VA of output power with 120 Volt input. UPS shall connect to a NEMA L5-30 Receptacle.

2. The UPS System shall provide a minimum battery runtime of 20 minutes at full load.

3. The output waveform of UPS shall be true sine-wave.

4. The UPS System shall be provided with a minimum of six NEMA 5-15R output receptacles.

5. The system shall be covered by a two-year on-site warranty.

6. The front panel display shall indicate load level, battery charge level, and replacement battery indication.

7. The UPS System shall be rack-mounted in the bottom of each 19" equipment rack.

8. The UPS shall be APC Smart UPS XL Series Model SU2200RMXLNET with SU48RMXLBP external battery pack, and SNMP Card AP9619 with environmental monitoring, or approved equal.

9. Provide grounding per EIA/TIA 607 requirements.

B. Provide Factory assisted startup of all UPS units. Perform visual, mechanical and electrical inspections of UPS installation. Provide complete UPS on-site testing. Provide complete on-site operation training and demonstration of each UPS system, including providing and installing software setup, and operation.

C. Provide manufactuer field services and maintenance services for a period of 2 years on all UPS units from date of final acceptance of UPS system.

2.9 VIDEO OUTLETS, CABLES AND MISCELLANEOUS EQUIPMENT

A. Provide input cable from Utilities Demarq to MDF. Input cable shall be Time Fiber TX Series Flexible Feeder model # 02852V TX15AQ-VBV Flame Retardant Quad Shield terminated with Amphenol ACC-15BAFFT10U or Gilbert G-15Q-BAFF TX Quad connectors specific to this cable. Coil twenty (20) feet slack cable at CATV/telephone backboard for connect to cable television service by Cable Utility Company.

B. Video Drop Cable shall be a non-plenum rated quad shielded RG-6 coaxial cable with an 18 AWG solid copper center conductor, a 100% Bifoil shield and a 65% aluminum braid shield. Video drop cable shall be West Penn or approved equal. Video (RF) Jacks shall be standard "F" connector feed through type jacks, Ortronics 6090017 or approved equal. Video System RG-6 Connector shall be a two piece crimp on type. Provide Blonder Tongue BTF-561 or approved equal.

C. Coaxial cable for system trunk line distribution from the MDF shall be Commscope RG-11 (Series 11) Quad Shield Non-Plenum Series #2287K. Commscope is specified due to its construction characteristics of a copper clad steel center conductor and aluminum braid over

aluminum tape shielding. Coaxial cable for drop cable from system tap offs shall be Commscope RG-6 (Series 6) Quad Shield Non-Plenum Series #2227V and K.

D. Trunk lines of RG-11(Series 11) coaxial cable shall not exceed 500 feet. Distribution lines (drop cables) of RG-6 (Series 6) shall not exceed 150 feet.

E. System Tap offs shall be Toner Model TGT four (4) and/or eight (8) port Tap offs or Blonder-Tongue Model SRT-4A four (4) and SRT-8A eight (8) port Tap offs.

F. All terminators shall be Blonder-Tongue stock #4670 BTF-TP, Gilbert GTR-59A or equivalent and be installed on all unused ports throughout the plant.

G. CATV system outlets shall be configured into the designated Technology wall plate by providing, one (1) CATV system outlet with one (1) AMP part # 1339121-1 "F" Series Coupler Insert, color TBD. Hubbell also approved.

H. CATV Amplifier: Provide a minimum of one (1) Blonder-Tongue model #5800P-73 BIDA 75A-30P 5-36,49- 750MHz WITH Integrated Active Return Broadband Indoor Distribution Amplifier as required to provide a fully functional catv system. Provide necessary internal pads and equalizers to balance the installed system.

I. CATV System Acceptance Tests:

1. Coaxial Cable Plant Testing shall consist of a sweep test of the cable plant provided under this Contract to verify installed cable bandwidth and distortions.

2. A Cumulative Leakage Index (CLI) survey shall be made to verify system integrity. Section 76.605(a)(h) of the FCC states that signal leakage must not exceed 20 micro-volts/meter from 54 MHz to 216 MHz at 3 meters and 15 micro-volts/meter at all other frequencies.

3. The Contractor shall test and for the following:
   a. Test all specialty video cables for open, short, and ground.
   b. Test all specialty video cables for end to end signal performance.
   c. Test picture quality at each specialty outlet.
   d. Test cables for frequency response and insertion loss at 5-1000 MHZ.

2.10 VIDEO PROJECTOR– CABLING AND CEILING PLATE MOUNTS

A. Provide ceiling-mounted projector plate mounts at all locations as indicated on the drawings. Approved grid-mounted 24” x 24”projector drop-in tile (lightweight suspended ceiling kit) plates are Peerless Model# CMJ455. Projector ceiling plates shall be mounted in accordance with all of the Manufacturer’s installation requirements. Contractor shall coordinate installation of Projector ceiling plate’s AC outlet and communication outlet with the power and communication drops and the various ceiling fixtures as indicated on project drawings. Coordinate installation of the projector ceiling plate’s location with the center of the room’s projection screen and coordinate the throw distance(s) (the distance from ceiling mounted projector plate to the screen surface) with the Owner. Provide a minimum of 6' of above ceiling slack in the flexible metallic power cable to accommodate future minor relocation of ceiling mounted projector plates. Contractor shall likewise provide a minimum of 6' of above ceiling slack of in-room HI-Low audio/video/VGA cabling to the projector plates. Provide as indicated on the drawings, at the High Projector outlet, 36” of slack with connectors to extend to the Owner’s projectors. Provide

extension column, length as needed, Peerless model EXT series, for each projector plate installation. Provide universal adapter plate projector mountm Peerless model PRS-UNV for each projector plate installation. Projector mounting kits shall be located 9’-4” from the teaching wall and centered on the projection screen, unless otherwise noted.

B. Projector/monitor High-Low Outlets shall include the following:
   1. These “A/V” jacks allow the user to connect a VCR, a Digital Video Disk (DVD) player, or a computer at the low system outlet location (18" AFF) and feed the Audio/Video input jack of a ceiling-mounted data projector and/or monitor. The low outlet location will also allow the user to connect into the Streaming Video System. Provide three RCA type A/V jacks (RED/WHITE/YELLOW). Refer to contract drawings for specific configurations and locations of high/low outlets.
   2. VGA jack and cabling shall match detail indicated on contract drawings. VGA Jack will be Molex MSY-00007; (Ortronics, or approved equal): Provide VGA interconnection cable between high VGA jack and low VGA jack. VGA cable shall be 75 Ohm coaxial cable Mogami Model #WV2947, Helix/HiTemp#C027C0022110, or approved equal system. Mount the VGA video and audio jacks in faceplates and install in the same back-boxes used for the A/V connectors installed under this specification.

PART 3 – EXECUTION

3.1 EXAMINATION:

A. Examine pathway elements to receive cable. Check raceways and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

A. Wiring Methods:

   1. Install station cables to individual outlets in raceway within walls.

   2. Install horizontal runs of station cables exposed above finished ceilings. Provide “J” hooks or other suitable cable management devices at intervals not to exceed 5'-0" on center.

B. Install components as indicated, according to manufacturers' written instructions. Use techniques, practices, and methods that are consistent with the Category 6 rating of the components and that assure Category 6 performance of completed and linked signal paths, end-to-end.

C. Install cable without damaging conductors, shield, or jacket.

D. Do not bend cable in handling or installation to smaller radii than minimums recommended by manufacturers.

E. Pull cables without exceeding cable manufacturer's recommended pulling tensions.

1. Pull cables simultaneously where more than one is being installed in the same raceway or cable run.
2. Use pulling compound or lubricant where necessary. Use compounds that will not damage conductor or insulation.
3. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage media or raceway.

F. Install exposed cable parallel and perpendicular to surfaces or exposed structural members, and follow surface contours where possible.

G. Secure and support exposed cable at intervals not exceeding 30 inches and not more than 6 inches from boxes, cable trays, fittings, racks, frames, and terminals.

H. Separation of Wires: Comply with EIA/TIA-569 rules for separation of unshielded copper voice and data system cables from potential EMI sources, including electrical power lines and equipment.

I. Make splices, taps, and terminations only at outlets, terminals, and cross-connect and patch panels.

J. Use splice and tap connectors compatible with media types.

K. Termination of station cables at voice and data jacks shall be in accordance with EIA/TIA 568A, Designation T568B for Category 6 cable. Verify jack termination scheme with Owner prior to termination.

3.3 CABLE ROUTING

A. Wiring for the voice/data/video system shall be installed in cable tray and supported by J hooks, installed four (4) feet apart. Exposed wiring run in the, mechanical rooms, and other rooms where there is no drop ceiling shall be installed in EMT conduit above 10’-0” AFF and in surface metal raceway below 10-0” AFF. EMT conduit in mechanical rooms may be installed in EMT conduit below 10’-0” AFF.

B. All voice and data horizontal cables shall not exceed 90 m (295 ft) from the telecommunications outlet in the work area to the horizontal cross connect. The combined length of jumpers, or patch cords and equipment cables in the telecommunications closet and the work area should not exceed 10m (33 feet) total, including 3 m(10 feet) at the station and 6 m (20 feet) at the closet. Every effort will be made to route cables so as not to exceed 90 meters in length. Contractor will identify any cable runs exceeding 90 meters from proposed MDF/IDF location and shall provide solution to meet the 90-meter requirement.

C. Horizontal pathways shall be installed or selected such that the minimum bend radius of horizontal cables is kept within manufacturer specifications both during and after installation. Cable bends shall be no less than four (4) times the cable outer diameter or 1.00".

D. In open ceiling cabling, cable supports shall be provided by means that are structurally independent of the suspended ceiling, its framework, or supports. These supports shall be spaced no more than 1.2 m (4 feet) apart.

E. Telecommunications pathways, spaces and metallic cables which run parallel with electric power cables or lighting cables shall be installed with a minimum clearance of 300 mm (12 inches).

Communication cables shall not be run parallel with electric power cables for more than 10 m (33 feet) if their separation is less than 300 m (12 inches).

F. Cables routed in a suspended ceiling shall not be draped across the ceiling tiles. Cable supports shall be mounted a minimum of 75 mm (3 in) above the ceiling grid supporting the tiles.

G. Cables run exposed above accessible ceilings shall be run in bundles of a size for installation. Bundle by use of cable ties, taking care not to cinch cables. Cable shall be supported from roof structures, joists and other appropriate structural members by means of J hooks. J hooks shall not exceed spacing of four (4) feet. In no case shall any cable be supported from below by contact with the ceiling system. The data, telecommunication and video cabling systems shall be separated into bundles and separated by a minimum of 12". Provide cable ties to secure cables to each “J” hook. Avoid cinching cables.

1. All voice and data telecommunications cable installed above suspended ceilings shall be supported by 2" “J” hooks spaced at a maximum of 48". For support of high density (>50 cables) bulk cable where 48" spacing results in the bowing of cable, the Contractor shall divide bulk cable into smaller parallel streams or decrease the spacing of the “J” hooks sufficiently to adequately support the cable.

2. Where voice and data telecommunication wiring is supported by “J” hooks, wire shall be run neatly bundled with tie wraps. Tie wraps shall be spaced randomly between 6" and 10" apart, 8" on the average. Tie wraps shall be snug, but capable of being easily rotated about the cable bundle so as to secure the cable without binding, deforming or damaging it. Cable deflection shall be less than 5" between “J” hooks.

3. Fiber optic and Category 6 UTP backbone cable shall be run separately from the horizontal distribution cable. This shall be accomplished by running said cable parallel to horizontal distribution cabling supported on the back-side of the “J” hooks used for the horizontal cabling or by supporting the backbone cable separately from the horizontal. In either case, the backbone cabling shall not be tie wrapped together with the horizontal distribution cable.

4. “J” hooks shall be supported directly by the building structure. “J” hooks shall be supported on minimum 3/8" threaded rod anchored to the side hallway walk, or to the slab above. “J” hooks shall ***not*** be attached to or supported by ceiling supports, piping or piping supports, or duct work or duct work supports.

5. Install cabling below or to the side of the duct work, just above the suspended ceiling. Extend “J” hooks down to support the cabling at that level.

H. Where wire and cable penetrate walls or other structural elements or pass above inaccessible areas of the building, install EMT sleeves sized to accept sizes of run, as follows (in no case shall sleeves exceed 40% fill ratio):

IPS/TRADE SIZE	NUMBER OF CABLES
0.75-inch	2
1.00-inch	4

IPS/TRADE SIZE	NUMBER OF CABLES
1.25-inch	8
1.50-inch	11
2.00-inch	18
2.50-inch	27
3.00-inch	41
3.50-inch	55
4.00-inch	71

3.4 INSTALLATION AT EQUIPMENT ROOMS AND WIRING CLOSETS

A. Provide adequate length of conductors and cables. Train the conductors to terminal points with no excess. Provide ten (10) foot service loop for each copper cable within Equipment Room. Use cable management system to restrain cables, to prevent straining connections, and to prevent bending cables to radii smaller than allowed.

B. Mount voice backbone punchblocks, terminal strips, and other connecting hardware on plywood backboards, except as otherwise indicated. Provide additional 3/4-inch fire retardant treated plywood backboards where required for mounting of equipment.

C. Mount data patch panels in floor or wall mounted electronic racks, with cable management. Do not fill racks to more than 50% capacity to allow spare room for Owner furnished equipment. Provide additional racks, to match existing, where required to maintain rack space.

D. Group connecting hardware for cables into separate logical fields.

E. Communication grounding / earthing and bonding shall be in accordance with applicable codes and regulations. It is recommended that the requirements of IEC 1000-5-2, ANSI/TIA/EIA-607, or both, be observed throughout the entire cabling system. Provide 12" ground bus bars and #6 solid copper ground wires from the ground bus bars to the building ground. Provide #6 ground from the ladder cable rack to the ground bus bars.

F. Provide a minimum of one 4' w x 8' h x 3/4" fire-retardant-treated plywood backboard, painted white, two feet off the floor to top. Secure backboard with a minimum of eight (8) screws. Plywood backboard shall conform to Product Standard PS1, Grade B-D, with exterior glue and one side finished.

3.5 SLACK

A. In the work area, a minimum of 300 mm (12 in) should be left at outlets, while 1 m (3 ft) should be left at the backboard or rack, and 6 m (20 feet) in the closet area.

B. In telecommunications rooms a minimum of 6 m (20 ft) of slack should be left for all cable types. This slack must be neatly managed on trays or other support types. “All cable types” includes all voice/data/video backbone cables and fiber optic backbone cables.

C. All unused cables shall be properly terminated, as specified, with 10 m (33 feet) extra cable neatly coiled and tie-wrapped at the workstation end of cable in the ceiling space.

D. Where wireless access point devices are installed, provide a minimum of 3 m (10 feet) of cable coiled,tie-wrapped, and supported in the ceiling space.

3.6 SYSTEM DOCUMENTATION

A. The following section describes the installation, administration, testing, and as-built documentation required to be produced and/or maintained by the Contractor during the course of the installation.

B. Cabling System Labeling: The Contractor shall develop and submit for approval a labeling scheme for the cable installation. Voice and Data outlets and cables shall be labeled the using the same labeling scheme. Customer will negotiate an appropriate labeling scheme with the successful Contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cable origin and destination and a unique identifier for each cable within the system. Racks and patch panels shall be labeled to identify the location within the cabling system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

C. Product Specifications: The labeling shall be machine-generated and affixed to the cable, faceplate, patch panel, rack or other hardware.

D. Labeling Software: Labeling software shall be easily useable and run on Microsoft Windows® 95, 98, ME, NT, 2000 and XP operating systems. Labeling software shall be compliant with TIA/EIA-606-A and shall be able to produce complex unique identifiers of up to 12 independent segments. Labeling software shall be capable of inserting symbols as well as use any standard True Type Font as well as capable of saving individual build information and of fine tuning print adjustments. Labeling software shall be compatible with AMP NETCONNECT products and shall be [Microsoft Word®, Microsoft Excel® or purchased directly from Silver Fox, Ltd. at: http://www.silfox.com/eshop/viewproduct.php?id=149].

E. Faceplate Labeling: Labeling for faceplates at each work station shall be white [perforated card stock compatible with inkjet and laser printers or pre-cut self-adhesive polyester compatible with laser printers]. Labels shall be 1.98” x 0.373” in size and be divided 72 labels per sheet with each sheet being 8.5” x 11”. Work area outlet labels shall be AMP NETCONNECT part number [1375356-X or 1375357-X (X denotes packaging, see Table-30)].

Description	Labels per Sheet	Sheets per Pack	Labels per Pack	Part Number
Card Stock	72	5	360	1375356-1
	72	100	7200	5-375356-1
Self-adhesive Polyester	72	5	360	1375357-1
	72	100	7200	5-1375357-1

Table-30
Faceplate Label Part Numbers

F. Patch Panel Labels: Patch Panel labels shall be white [perforated card stock compatible with inkjet and laser printers or pre-cut self-adhesive polyester compatible with laser printers]. Labels shall be [3.10" x 0.50" (for patch panels without icons) or 3.30" x 0.25" (for patch panels with icons)] in size and be divided [36 or 72] labels per sheet with each sheet being 8.5" x 11". Patch panel labels shall be AMP NETCONNECT part number [1375351-X, 1375352-X or 1375353- X (X denotes packaging, see Table-31)].

Description	Labels per Sheet	Sheets per Pack	Labels per Pack	Part Number
Card Stock	36	5	180	1375351-1
	36	100	3600	5-1375351-1
Self-adhesive Polyester	36	5	180	1375352-1
	36	100	3600	5-1375352-1
	72	5	360	1375353-1
	72	100	7200	5-1375353-1

Table-31
Data Patch Panel Label Part Numbers

G. Cross-Connect Labels: Cross-connect labels shall be [perforated card stock compatible with inkjet and laser printers or pre-cut self-adhesive polyester compatible with laser printers] [and be color coded per the labeling scheme in paragraph 10 (card stock)]. Labels shall be 7.90" x 0.48" in size and be divided 18 labels per sheet with each sheet being 8.5" x 11". Cross-connect labels shall be AMP NETCONNECT part number [1375354-X or 1375355-X (X denotes color and packaging, see Table-32)].

Description	Labels per Sheet	Sheets per Pack	Labels per Pack	Color	Part Number
Card Stock	18	5	90	White	1375354-1
				Blue	1375354-2
				Green	1375354-3
				Purple	1375354-4
				Red	1375354-5
				Brown	1375354-6
				Yellow	1375354-7
				Orange	1375354-8
				Gray	1375354-9
		100	1800	White	5-1375354-1
				Blue	5-1375354-2
				Green	5-1375354-3
				Purple	5-1375354-4
				Red	5-1375354-5
				Brown	5-1375354-6
				Yellow	5-1375354-7
				Orange	5-1375354-8
				Gray	5-1375354-9
Self-adhesive Polyester	18	5	90	White	1375355-1
		100	1800	White	5-1375355-1

Table-32
Voice Cross-Connect Label Part Numbers

H. Cable Labels: Cable labels shall be self-adhesive, self-laminating, pre-cut and laser-printer compatible. Labels shall be used with [4-pair horizontal UTP cable and/or 25-Pair backbone UTP], be [0.984" x 1.496" (4-Pair) and/or 0.984" x 2.480" (25-Pair)] in size and be divided [48 (4-Pair) and/or 24 (25-Pair)] labels per sheet with each sheet being 8.5" x 11". Cable labels shall be AMP NETCONNECT part number [1479002-X and/or 1479003-X (X denotes packaging, see Table-33)].

Description	Labels per Sheet	Sheets per Pack	Labels per Pack	Part Number
Card Stock	18	5	90	1479002-1
		100	1800	5-1479002-1
Self-adhesive Polyester	18	5	90	1479003-1
		100	1800	5-1479003-1

Table-33
Twisted Pair Cable Label Part Numbers

I. Icons: Icons shall be used to indicate the function of each port on a work area outlet. Icons shall be provided with each faceplate kit and be colored to match the faceplate. If icons are to be used in each TR for horizontal or backbone patch panels and enclosures, AMP NETCONNECT part number [558176-X, 1375092-X, 558198-X, 558199-X or 558821-X (X denotes color, see Table-34)] shall be used.

	Description				
Part Number	4-Data, 4-Blank, 2-Phone, 3-Cat5, 1-Fax, 1-Modem, 1-Printer	4-Blank, 2-Cat 5e, 2-Cat 6, 1-Each: V1, V2, V3, V4, D1, D2, D3, D4	16-Data	16-Phone	16-Blank
Almond	558176-1	1375092-1	558198-1	558199-1	558821-1
Red	558176-2	1375092-2	558198-2	558199-2	558821-2
Green	558176-3	1375092-3	558198-3	558199-3	558821-3
Blue	558176-4	1375092-4	558198-4	558199-4	558821-4
Yellow	558176-5	1375092-5	558198-5	558199-5	558821-5
Black	558176-6	1375092-6	558198-6	558199-6	558821-6
Orange	558176-7	1375092-7	558198-7	558199-7	558821-7
White	558176-8	1375092-8	558198-8	558199-8	558821-8
Violet	558176-9	1375092-9	558198-9	558199-9	558821-9
Gray	1-558176-0	1-1375092-0	1-558198-0	1-558199-0	1-558821-0
Electrical Ivory	1-558176-1	1-1375092-1	1-558198-1	1-558199-1	1-558821-1

Table-34
Icon Part Numbers

3.7 AS-BUILT DRAWINGS

A. The installation Contractor will be provided with 2 sets of D or E-size drawings at the start of the project. One set will be designated as the central location to document all as-built information as it occurs throughout the project. The central set will be maintained by the Contractor's foreman on a daily basis, and will be available to the technical representative upon request during the course of the project. Anticipated variations from the build-to drawings may include such things as cable routing and actual outlet placement. No variations will be allowed to the planned termination positions of horizontal and backbone cables or grounding conductors unless approved in writing by the Owner.

B. The Contractor shall provide the central drawing set to the Owner at the conclusion of the project. The marked up drawing set will accurately depict the as-built status of the system including termination locations, cable routing, and all administration labeling for the cabling system. In addition, a narrative will be provided that describes any areas of difficulty encountered during the installation that could potentially cause problems to the telecommunications system.

C. A comprehensive installation, operation, programming and instruction manual shall be supplied as part of the system. The manual shall provide complete service information, including schematics, layout drawings, and interconnecting diagrams showing the location of all the outlets, cable taps, cable routes, and other installed components. Include final revised one-line system drawings. Include for this particular project parts lists to permit quick and efficient maintenance and repair of the equipment by qualified technicians. Manuals shall include 8 2" x 11" device location/cabling route drawings provided in CADD format Autodesk -AutoCadd Release 2005 or later (.dwg/.dxf) on CD disk. Manuals shall include a copy of the operations manuals listed below. Manuals shall be indexed and placed in a hard-cover three ring binder. Three (3) copies of this manual shall be provided to the Owner upon project completion. Contractor shall retain a minimum of one (1) copy for their permanent records. Provide one copy of Manual and disk(s) in the Main Equipment Rack. Refer to "General Provisions" in the contract for additional or documentation requirements.

3.8 TEST DOCUMENTATION

A. Test documentation shall be provided in a three-ring binder(s) within three weeks after the completion of the project. The binder(s) shall be clearly marked on the outside front cover and spine with the words "Test Results", the project name, and the date of completion (month and year). The binder shall be divided by major heading tabs: Horizontal and Backbone. Each major heading shall be further sectioned by test type. Within the horizontal and backbone sections, scanner test results (Enhanced Category 5 or Category 6), fiber optic attenuation test results, OTDR traces (if any), and green light test results shall be segregated by tab. Test data within each section shall be presented in the sequence listed in the administration records. The test equipment name, manufacturer, model number and last calibration date will also be provided at the end of the document. The test document shall detail the test method used and the specific settings of the equipment during the test.

B. Scanner tests shall be printed on 8-1/2" x 11" paper. Hand written test results (attenuation results and green light results) shall be documented on the attached test form (Appendix C). OTDR test results shall be printed or attached and copied on 8-1/2" x 11" paper for inclusion in the test documentation binder. Hand written test results shall no be acceptable.

C. When repairs and re-tests are performed, the problem and corrective action taken shall be noted, and both the failed and passed test data shall be collocated in the binder.

3.4 WARRANTY AND SERVICES

A. The Contractor shall provide a system warranty covering the installed cabling system against defects in workmanship, components, and performance, and covering follow-on support after project completion. The Owner shall be provided full access to the manufacturer's warranty services and registered by the Contractor as an authorized user of the manufacturer's warranty support services.

B. Installation Warranty: The Contractor shall warrant the cabling system against defects in workmanship for a period of two (2) years from the date of system acceptance. The warranty shall cover all labor and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after repairs are accomplished. This warranty shall be provided at no additional cost to the Owner.

C. Cabling System Warranty: The Contractor shall facilitate a 25-year system performance warranty between the Manufacturer and the Owner. An extended component warranty shall be provided which warrants functionality of all components used in the system for 25 years from the date of acceptance. The performance warranty shall warrant the installed 250 MHz horizontal copper, and both the horizontal and the backbone optical fiber portions of the cabling system. Copper links shall be warranted to the link performance minimum expected results defined in ANSI/TIA/EIA-568-C.2. Fiber optic links shall be warranted to the link and segment performance minimum expected results defined in ANSI/TIA/EIA-568-C.0..

D. Post Installation Maintenance: The Contractor shall furnish an hourly rate with the proposal submittal which shall be valid for a period of two years from the date of acceptance. This rate will be used when cabling support is required to affect moves, adds, and changes (MACs) to the system. MACs shall not void the Contractor's nor Manufacturer's warranty.

E. Project Management / General: The Contractor shall establish a single point of contact (POC) with the Customer who will be responsible for reporting progress and updating the Customer's technical representative with issues that the Owner must address to facilitate the cabling system installation. The Contractor's POC shall provide daily written reports to the Customer's technical representative detailing progress. Requests for access to limited access or restricted areas (ie main campus data center) shall be made 14 days prior to the required access. Information critical to the completion of the task or project shall be communicated to the Customer's technical representative as the requirement becomes known. Casual information shall be passed during the scheduled progress report. The Contractor shall maintain the Customer's facility in a neat and orderly manner during the installation of the communications cabling system. The Customer's facilities shall be maintained in broom clean condition at the completion of work each day. At the completion of work in each area, the Contractor will perform a final cleaning of debris prior to moving the installation crew to the next work area.

3.9 CABLING SYSTEM ACCEPTANCE

A. The Customer's technical representative will make periodic inspection of the project in progress. One inspection will be performed at the conclusion of cable pulling, prior to closing of the false ceiling, to inspect the method of cable routing and support, and the firestopping of penetrations. A second inspection will be performed at completion of cable termination to validate that cables were dressed and terminated in accordance with ANSI/TIA/EIA specifications for jacket removal and pair untwist, compliance with Manufacturer's minimum bend radius, and that cable ends are dressed neatly and orderly.

B. Final Inspection: Upon completion of the project, the Customer's technical representative will perform a final inspection of the installed cabling system with the Contractor's project foreman.

The final inspection will be performed to validate that all horizontal and backbone cables were installed as defined in the drawing package, and that the installation meets the aesthetic expectations of the Customer.

C. Test Verification: Upon receipt of the test documentation, the Customer reserves the right to perform spot testing of a representative sample of the cabling system to validate test results provided in the test document. Customer testing will use the same method employed by the Contractor, and minor variations will be allowed to account for differences in test equipment and test variability. If significant discrepancies are found, the Contractor will be notified for resolution.

D. System Performance: During the three week period between final inspection and delivery of the test and as-built documentation, the Contractor shall activate the cabling system. The Contractor shall validate operation of the cabling system during this period with the performance requirements of the specifications.

E. Final Acceptance: Completion of the installation, in-progress and final inspections, receipt of the test, receipt of the as-built documentation, and successful performance of the system for a two week period will constitute acceptance of the system.

3.10 TRAINING:

A. The Contractor shall include (4) four-hour on-site training sessions, or as required, of startup and training assistance during substantial completion and equipment to ensure a fully functional system. This training may also be used for system configuration during initial system startup or other services as required at the Owner's request.

B. Training shall include a "walk-through" of the system for location and labeling orientation, a discussion of overall system concepts and configuration, specific instruction in system reconfiguration using patch cords in the wiring closets, a review of the as-built drawings, a review of the system testing and acceptance documentation, and guidelines for basic trouble-shooting of the structured cabling system. The contractor shall supply personnel who are thoroughly familiar with the installation to present the instruction in an organized and professional manner. Contractor to schedule the inspection and walk-through at a mutually agreeable time.

C. The Contractor shall provide key personnel at each training session, as required by the Owner, at no additional cost to the Owner. Key personnel include Contractor's site-foreman, project manager and service manager.

3.11 LABELING REQUIREMENTS

A. Cable Designation Explanation – Following is a description of the Cable Labeling and Designating System adopted for Washington County Government.

B. The Cable Labeling and Designating System is based on three principles:

1. A cable is uniquely identified by its end termination points, therefore these identifiers can be used as the cable identifier.

2. The information a person standing at a cable termination is most interested in is the far end termination of the cable. (i.e.; If you are standing in the Comm. Room you would want to be able to determine where the other end or far end terminates.)

3. Only far end location information different from the near end is necessary to describe the far end termination.

C. To fully identify a cable termination location it is necessary to identify the site, building, floor, room, main terminating device, and subsidiary terminating device. To further specify cable ports the basic information must be supplemented with port and sub-port identifiers.

D. The cable termination location identifiers down to the subsidiary terminating device are universal for all types of cable, in all configurations and at all locations. The supplemental port and sub-port information, however, varies by type of cable because of the variety of cables used for communications. To make the identifiers easy to understand the universal identifiers are separated from the variable data by a "dash".

E. The various identifiers are a mixture of characters and digits that have been selected to allow identifiers to meet most needs while being easily understood.

Cable Identification		
Type of Identifier	Identifier(s)	Comments
Site	WC	Washington Co.: Not posted on labels since both ends of all cables are in Washington Co.
Building	CO= Central Office	Not posted on labels since both ends of all cables are in the Central Office
Floor	1 or 2 A or D	Has one floor but is divided into 3 areas: A, B, or C.
Communication Room	01-3122	See Floor Plan
Main Terminating Unit	A to Z	Equipment Rack
Subsidiary Terminating Unit	A to Z	Patch Panel
Port	1-48	Jack 1 on Mod Jack Panel and Com Outlet.

Several examples clarify the system.
FO-P-1-68-BC-05:
FO-R-1-60-D-2

F. This is the full cable identifier for a LATERAL DISTRIBUTION CABLE. It identifies a cable, both ends of which are at the C site, in the KH building. It further identifies the cable as running from the first floor Room 68, Equipment Rack B, Modular Patch Panel C, Position 5, to the Kent Humanities Building, first floor, Room 60, Communication Outlet D, Jack 2.

G. This full information exists only in a cable management database. The unnecessary site and building identifiers are not used on cable labels and designation strips. Designation strips for the cable are:

1-68-BC-5 Termination information in Room 60
(Identifies far end)

1-60-D-2 Termination information in Room 68
(Identifies far end)

1-68-BC-5:
1-60-D-2: Cable label attached to both ends of the cable.

H. Placing of Labels:

1. Every Communications Open Relay Rack, 4-Post, Wall mount rack will be labeled A-Z.

2. Every Patch Panel will be labeled A-Z.

3. Every Port on the Patch Panel will be labeled with far end information (i.e.; floor-room-face plate (outlet)-jack 1-60-D-2).

4. Every Face plate in each room, starting with the first outlet on the left upon entering the room and continuing around the room, will be labeled. Far end information will be attached securely to each face plate that clearly identifies each separate jack (i.e.; For a two port outlet floor-comm. room-rack-patch panel-port: 1-68-BC-5, 1-68-BC-6).

5. Every Cable will be labeled with far end information approx. 1 foot back from termination. This will ensure that in case of damage at the termination point the cable is still identifiable.

3.12 SYSTEM DOCUMENTATION

A. The following section describes the installation, administration, testing, and as-built documentation required to be produced and/or maintained by the Contractor during the course of the installation.

B. Cabling System Labeling: The Contractor shall develop and submit for approval a labeling scheme for the cable installation. Customer will negotiate an appropriate labeling scheme with the successful Contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cable origin and destination and a unique identifier for each cable within the system. Racks and patch panels shall be labeled to identify the location within the cabling system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme. (See appendix A for Washington County labeling scheme)

C. Product Specifications: The labeling shall be machine-generated and affixed to the cable, faceplate, patch panel, rack or other hardware.

D. Labeling Software: Labeling software shall be easily useable and run on Microsoft Windows® 95, 98, ME, NT, 2000 and XP operating systems. Labeling software shall be compliant with TIA/EIA-606-A and shall be able to produce complex unique identifiers of up to 12 independent segments. Labeling software shall be capable of inserting symbols as well as use any standard True Type Font as well as capable of saving individual build information and of fine tuning print adjustments. Labeling software shall be compatible with AMP NETCONNECT products and shall be [Microsoft Word®, Microsoft Excel® or purchased directly from Silver Fox, Ltd. at: http://www.silfox.com/eshop/viewproduct.php?id=149].

E. Faceplate Labeling: Labeling for faceplates at each work station shall be white [perforated card stock compatible with inkjet and laser printers or pre-cut self-adhesive polyester compatible with laser printers]. Labels shall be 1.98” x 0.373” in size and be divided 72 labels per sheet with each

sheet being 8.5” x 11”. Work area outlet labels shall be AMP NETCONNECT part number [1375356-X or 1375357-X (X denotes packaging, see Table-30)].

Description	Labels per Sheet	Sheets per Pack	Labels per Pack	Part Number
Card Stock	72	5	360	1375356-1
	72	100	7200	5-1375356-1
Self-adhesive Polyester	72	5	360	1375357-1
	72	100	7200	5-1375357-1

Table-30
Faceplate Label Part Numbers

F. Patch Panel Labels: Patch Panel labels shall be white [perforated card stock compatible with inkjet and laser printers or pre-cut self-adhesive polyester compatible with laser printers]. Labels shall be [3.10” x 0.50” (for patch panels without icons) or 3.30” x 0.25” (for patch panels with icons)] in size and be divided [36 or 72] labels per sheet with each sheet being 8.5” x 11”. Patch panel labels shall be AMP NETCONNECT part number [1375351-X, 1375352-X or 1375353- X (X denotes packaging, see Table-31)].

Description	Labels per Sheet	Sheets per Pack	Labels per Pack	Part Number
Card Stock	36	5	180	1375351-1
	36	100	3600	5-1375351-1
Self-adhesive Polyester	36	5	180	1375352-1
	36	100	3600	5-1375352-1
	72	5	360	1375353-1
	72	100	7200	5-1375353-1

Table-31
Data Patch Panel Label Part Numbers

G. Cross-Connect Labels: Cross-connect labels shall be [perforated card stock compatible with inkjet and laser printers or pre-cut self-adhesive polyester compatible with laser printers] [and be color coded per the labeling scheme in paragraph 10 (card stock)]. Labels shall be 7.90” x 0.48” in size and be divided 18 labels per sheet with each sheet being 8.5” x 11”. Cross-connect labels shall be AMP NETCONNECT part number [1375354-X or 1375355-X (X denotes color and packaging, see Table-32)].

Description	Labels per Sheet	Sheets per Pack	Labels per Pack	Color	Part Number
Card Stock	18	5	90	White	1375354-1
				Blue	1375354-2
				Green	1375354-3
				Purple	1375354-4
				Red	1375354-5
				Brown	1375354-6
				Yellow	1375354-7

Description	Labels per Sheet	Sheets per Pack	Labels per Pack	Color	Part Number
				Orange	1375354-8
				Gray	1375354-9
		100	1800	White	5-1375354-1
				Blue	5-1375354-2
				Green	5-1375354-3
				Purple	5-1375354-4
				Red	5-1375354-5
				Brown	5-1375354-6
				Yellow	5-1375354-7
				Orange	5-1375354-8
				Gray	5-1375354-9
Self-adhesive Polyester	18	5	90	White	1375355-1
		100	1800	White	5-1375355-1

Table-32
Voice Cross-Connect Label Part Numbers

H. Cable Labels: Cable labels shall be self-adhesive, self-laminating, pre-cut and laser-printer compatible. Labels shall be used with [4-pair horizontal UTP cable and/or 25-Pair backbone UTP], be [0.984" x 1.496" (4-Pair) and/or 0.984" x 2.480" (25-Pair)] in size and be divided [48 (4-Pair) and/or 24 (25-Pair)] labels per sheet with each sheet being 8.5" x 11". Cable labels shall be AMP NETCONNECT part number [1479002-X and/or 1479003-X (X denotes packaging, see Table-33)].

Description	Labels per Sheet	Sheets per Pack	Labels per Pack	Part Number
Card Stock	18	5	90	1479002-1
		100	1800	5-1479002-1
Self-adhesive Polyester	18	5	90	1479003-1
		100	1800	5-1479003-1

Table-33
Twisted Pair Cable Label Part Numbers

I. Icons: Icons shall be used to indicate the function of each port on a work area outlet. Icons shall be provided with each faceplate kit and be colored to match the faceplate. If icons are to be used in each TR for horizontal or backbone patch panels and enclosures, AMP NETCONNECT part number [558176-X, 1375092-X, 558198-X, 558199-X or 558821-X (X denotes color, see Table-34)] shall be used.

Part Number	Description				
	4-Data, 4-Blank, 2-Phone, 3-Cat5, 1-Fax, 1-Modem, 1-Printer	4-Blank, 2-Cat 5e, 2-Cat 6, 1-Each: V1, V2, V3, V4, D1, D2, D3, D4	16-Data	16-Phone	16-Blank
Almond	558176-1	1375092-1	558198-1	558199-1	558821-1
Red	558176-2	1375092-2	558198-2	558199-2	558821-2
Green	558176-3	1375092-3	558198-3	558199-3	558821-3
Blue	558176-4	1375092-4	558198-4	558199-4	558821-4
Yellow	558176-5	1375092-5	558198-5	558199-5	558821-5
Black	558176-6	1375092-6	558198-6	558199-6	558821-6
Orange	558176-7	1375092-7	558198-7	558199-7	558821-7
White	558176-8	1375092-8	558198-8	558199-8	558821-8
Violet	558176-9	1375092-9	558198-9	558199-9	558821-9
Gray	1-558176-0	1-1375092-0	1-558198-0	1-558199-0	1-558821-0
Electrical Ivory	1-558176-1	1-1375092-1	1-558198-1	1-558199-1	1-558821-1

Table-34
Icon Part Numbers

3.13 AS-BUILT DRAWINGS

A. The installation Contractor will be provided with 2 sets of D or E-size drawings at the start of the project. One set will be designated as the central location to document all as-built information as it occurs throughout the project. The central set will be maintained by the Contractor's foreman on a daily basis, and will be available to the technical representative upon request during the course of the project. Anticipated variations from the build-to drawings may include such things as cable routing and actual outlet placement. No variations will be allowed to the planned termination positions of horizontal and backbone cables or grounding conductors unless approved in writing by the Owner.

B. The Contractor shall provide the central drawing set to the Owner at the conclusion of the project. The marked up drawing set will accurately depict the as-built status of the system including termination locations, cable routing, and all administration labeling for the cabling system. In addition, a narrative will be provided that describes any areas of difficulty encountered during the installation that could potentially cause problems to the telecommunications system.

3.14 TEST DOCUMENTATION

A. Test documentation shall be provided in a three-ring binder(s) within three weeks after the completion of the project. The binder(s) shall be clearly marked on the outside front cover and

spine with the words “Test Results”, the project name, and the date of completion (month and year). The binder shall be divided by major heading tabs: Horizontal and Backbone. Each major heading shall be further sectioned by test type. Within the horizontal and backbone sections, scanner test results (Enhanced Category 5 or Category 6), fiber optic attenuation test results, OTDR traces (if any), and green light test results shall be segregated by tab. Test data within each section shall be presented in the sequence listed in the administration records. The test equipment name, manufacturer, model number and last calibration date will also be provided at the end of the document. The test document shall detail the test method used and the specific settings of the equipment during the test.

B. Scanner tests shall be printed on 8-1/2” x 11” paper. Hand written test results (attenuation results and green light results) shall be documented on the attached test form (Appendix C). OTDR test results shall be printed or attached and copied on 8-1/2” x 11” paper for inclusion in the test documentation binder.

C. When repairs and re-tests are performed, the problem and corrective action taken shall be noted, and both the failed and passed test data shall be collocated in the binder.

3.15 WARRANTY AND SERVICES

A. The Contractor shall provide a system warranty covering the installed cabling system against defects in workmanship, components, and performance, and covering follow-on support after project completion.

B. Installation Warranty: The Contractor shall warrant the cabling system against defects in workmanship for a period of two years from the date of system acceptance. The warranty shall cover all labor and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after repairs are accomplished. This warranty shall be provided at no additional cost to the Owner.

C. Cabling System Warranty: The Contractor shall facilitate a 25-year system performance warranty between the Manufacturer and the Owner. An extended component warranty shall be provided which warrants functionality of all components used in the system for 25 years from the date of acceptance. The performance warranty shall warrant the installed 250 MHz horizontal copper, and both the horizontal and the backbone optical fiber portions of the cabling system. Copper links shall be warranted to the link performance minimum expected results defined in ANSI/TIA/EIA-568-B.2-1. Fiber optic links shall be warranted to the link and segment performance minimum expected results defined in ANSI/TIA/EIA-568-B.1.

D. Post Installation Maintenance: The Contractor shall furnish an hourly rate with the proposal submittal which shall be valid for a period of one year from the date of acceptance. This rate will be used when cabling support is required to affect moves, adds, and changes (MACs) to the system. MACs shall not void the Contractor’s nor Manufacturer’s warranty.

E. Project Management / General: The Contractor shall establish a single point of contact (POC) with the Customer who will be responsible for reporting progress and updating the Customer’s technical representative with issues that the Owner must address to facilitate the cabling system installation. The Contractor’s POC shall provide [daily, weekly] written reports to the Customer’s technical representative detailing progress. Requests for access to limited access or restricted areas shall be made [number of days] prior to the required access. Information critical to the completion of the task or project shall be communicated to the Customer’s technical representative as the requirement becomes known. Casual information shall be passed during the scheduled progress report. The Contractor shall maintain the Customer’s facility in a neat and

orderly manner during the installation of the communications cabling system. The Customer's facilities shall be maintained in broom clean condition at the completion of work each day. At the completion of work in each area, the Contractor will perform a final cleaning of debris prior to moving the installation crew to the next work area.

3.16 CABLING SYSTEM ACCEPTANCE

A. The Customer's technical representative will make periodic inspection of the project in progress. One inspection will be performed at the conclusion of cable pulling, prior to closing of the false ceiling, to inspect the method of cable routing and support, and the firestopping of penetrations. A second inspection will be performed at completion of cable termination to validate that cables were dressed and terminated in accordance with ANSI/TIA/EIA specifications for jacket removal and pair untwist, compliance with Manufacturer's minimum bend radius, and that cable ends are dressed neatly and orderly.

B. Final Inspection: Upon completion of the project, the Customer's technical representative will perform a final inspection of the installed cabling system with the Contractor's project foreman. The final inspection will be performed to validate that all horizontal and backbone cables were installed as defined in the drawing package, and that the installation meets the aesthetic expectations of the Customer.

C. Test Verification: Upon receipt of the test documentation, the Customer reserves the right to perform spot testing of a representative sample of the cabling system to validate test results provided in the test document. Customer testing will use the same method employed by the Contractor, and minor variations will be allowed to account for differences in test equipment and test variability. If significant discrepancies are found, the Contractor will be notified for resolution.

D. System Performance: During the three week period between final inspection and delivery of the test and as-built documentation, the Customer will activate the cabling system. The Customer will validate operation of the cabling system during this period.

E. Final Acceptance: Completion of the installation, in-progress and final inspections, receipt of the test, receipt of the as-built documentation, and successful performance of the system for a two week period will constitute acceptance of the system.

END OF SECTION

SECTION 17850 – COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Electronic safety and security equipment coordination and installation.
   2. Sleeves for raceways and cables.
   3. Sleeve seals.
   4. Grout.
   5. Common electronic safety and security installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For sleeve seals.

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of electronic safety and security equipment:
   1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
   2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
   3. To allow right of way for piping and conduit installed at required slope.
   4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electronic safety and security items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."."

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.
   1. Minimum Metal Thickness:
      a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
      b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Advance Products & Systems, Inc.
      b. Calpico, Inc.
      c. Metraflex Co.
      d. Pipeline Seal and Insulator, Inc.
   2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
   3. Pressure Plates: Carbon steel. Include two for each sealing element.
   4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electronic safety and security equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRONIC SAFETY AND SECURITY PENETRATIONS

A. Electronic safety and security penetrations occur when raceways, pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors **2 inches (50 mm** above finished floor level.

G. Size pipe sleeves to provide **1/4-inch (6.4-mm)** annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
   1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.".

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using **steel** pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electronic safety and security installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. The work covered by this Section shall include all labor, equipment, materials, ancillary materials and services to furnish, install, test, and turnover components establishing a complete and operational microprocessor-based Access Control System (ACS), as described herein and in the contract drawings. This section includes specifications for an electronic access control system, which shall perform the following general services:
   1. Access Control

B. Related Sections include the following:
   1. Common Work Results for Electronic Safety and Security: Section 178500.
   2. Division 08 Section "Door Hardware" for any door hardware items that interface with electronic safety and security systems.

1.2 REFERENCES

A. Abbreviations and Acronyms
   1. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.
   2. UPS: Uninterruptible power supply.
   3. WAN: Wide area network.
   4. RF: Radio frequency.
   5. I/O: Input/Output.
   6. LAN: Local area network.
   7. LED: Light-emitting diode.
   8. CPU: Central processing unit.
   9. ACS: Access control system.
   10. CCTV: Closed-circuit television.

B. Definitions
   1. ABA Track: Magnetic stripe that is encoded on track 2, at 75-bpi density in binary-coded decimal format; for example, 5-bit, 16-character set.
   2. Central Station: A PC with software designated as the main controlling PC of the security access system. Where this term is presented with initial capital letters, this definition applies.
   3. Controller: An intelligent reader control panel that uses a computer for controlling its operation. Where this term is presented with an initial capital letter, this definition applies.
   4. Credential: Data assigned to an entity and used to identify that entity.
   5. DTS: Digital Termination Service: A microwave-based, line-of-sight communications provided directly to the end user.
   6. File Server: A PC in a network that stores the programs and data files shared by users.
   7. Identifier: A credential card, keypad personal identification number or code, biometric characteristic, or other unique identification entered as data into the entry-control database for the purpose of identifying an individual. Where this term is presented with an initial capital letter, this definition applies.
   8. Location: A Location on the network having a PC-to-Controller communications link. Where this term is presented with an initial capital letter, this definition applies.

9. PCI Bus: Peripheral Component Interconnect; a peripheral bus providing a high-speed data path between the CPU and peripheral devices (such as monitor, disk drive, or network).
10. ROM: Read-only memory. ROM data is maintained through losses of power.
11. RS-232: A TIA/EIA standard for asynchronous serial data communications between terminal devices. This standard defines a 25-pin connector and certain signal characteristics for interfacing computer equipment.
12. RS-485: A TIA/EIA standard for multipoint communications.
13. WAV: The digital audio format used in Microsoft Windows.
14. Wiegand: Patented magnetic principle that uses specially treated wires embedded in the credential card.
15. Workstation: A PC with software that is configured for specific limited security system functions.

C. Reference Standards
1. FCC: All assemblies shall be in compliance with FCC emission standards.
   a. Microprocessor based controller: Part 15, Subpart F, Class A.
   b. Proximity Card Reading Sensors: Part 15, Subpart F (field disturbance sensors).
   c. Dial-up modems: Part 68
2. 2000 International Fire Code
3. American National Standards Institute (ANSI)
4. NFPA 70 (1999) National Electric Code International Organization for Standardization (ISO)
5. NEMA: Electrical equipment shall comply with applicable portions of NEMA.
6. Underwriters Laboratories (UL)
   a. UL-1012 and CSA: All power supplies shall be in compliance with Underwriters Laboratories standard UL1012 and CSA standards for power supplies.
   b. UL-294: The system shall comply with Underwriter Laboratories standard UL294 for Access Control Systems.
7. All applicable state and local codes

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination: The ACS contractor is required to coordinate with all required trades work that is required by and for “others”.

B. Pre-installation Meetings: Pre-installation meetings shall be held outlining requirements of all trades involved in the successful installation of this ACS.

C. Sequencing: The work shall be performed in the following sequence:
1. Installation of Access Controllers & Modules.
2. Installation of devices and readers.
3. Installation of site control equipment.
4. Commissioning of the new system components.

D. Scheduling: The ACS contractor shall schedule work in order to complete the ACS in accordance with the project timeline.

1.4 ACTION SUBMITTALS

A. Submit evidence of compliance for Security Contractor and equipment manufacturer prior to Bid, and as indicated under the quality assurance section(s) of Division 28 Specification Sections and this section.

B. Submit data consisting of shop drawings and catalog datasheets complete with technical data necessary to evaluate the material and equipment. Include dimension, wiring and block diagrams, performance data, ratings, control sequences, and other descriptive data necessary to describe the item proposed and its operating characteristics. Include a compete technical specification for the submitted equipment, noting differences and adherence to all Division 28 Sections.

C. Submit shop drawings and product data in accordance with Division 1 and this Section.
   1. Coordinate with other trades in submittal of shop drawings.
   2. Shop drawings shall detail space conditions and shall be subject to final review by the Architect.
   3. Provide an operational narrative of each component/system.
   4. Submit to Owner a complete listing of proposed devices, indicating interconnection equipment locations and specifying terminal/connecter termination locations. Submit a complete set of proposed drawings, identifying equipment locations, types of cabling, numbers of conductors, raceway locations, and termination points of each conductor.
   5. The approval of shop drawings or samples does not relieve the Security Contractor of responsibility for any deviation from the requirements of the Contract Documents, unless the Security Contractor has informed the Architect in writing of such deviation at the time of submission, has noted the deviation on the shop drawings, and the Architect has given written approval of the specific deviation. The Architect's approval also does not relieve the Security Contractor from responsibility for errors or omissions in the shop drawings or samples.
   6. Coordinate equipment submittals with construction schedules.
   7. Do not purchase or install equipment requiring submittal until the review process is complete.

1.5 INFORMATION SUBMITTALS

A. Coordinate with, and Submit for Owner approval a listing of all system components with recommended labeling for identification within the system.

B. Coordinate with, and Submit for Owner approval a listing of doors recommended for time zone unlocking/alarm shunting.

C. Coordinate with, and Submit for Owner approval a listing of operator privileges recommended for system segregation.

D. Project Record Documents:
   1. As-Built Drawings: Security Contractor shall maintain record of "as-built" drawings. Upon Security Contractor completion of the final punch list, a full size set of drawings and one set of CAD disks shall be submitted for review and record.
   2. The Security Contractor shall provide documentation of all final components showing the following information.
      a. System Label
      b. Physical Location
      c. System address
      d. Functional description

1.6 CLOSEOUT SUBMITTALS

A. Warranty Documentation: Provide copies of manufacturers warranties for all system components and applicable equipment. Include statement of labor warranty from the manufacturer, Security Contractor, and/or 3rd party entity.

B. Record Documentation

1. Submit a copy of a signed agreement between the Security Contractor and the Owner stipulation that the license of all software and operation systems residing on the server and workstations shall become the sole property of the Owner
2. Submit to Owner upon completion of Work, all passwords used to access all aspects of the operating system software and database utilized by the ACS. Documentation shall include the name and position of anyone who has knowledge or record of these passwords.

C. Extra Stock Materials: Furnish materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Fuses of all kinds, power and electronic, equal to 10 percent of amount installed for each size used, but no fewer than three units.

D. Substantial Design Closeout Documentation
1. Operation and Maintenance Manual Data: Submit data in accordance with Division 1 and this Section for all equipment specified in this Section. Include complete set of supplier's operating instructions, installation instructions, and troubleshooting guide. Include final listing of doors, locations and normal status.
2. Prior to Substantial Completion, provide schematic drawings depicting type and location of interface equipment/components, number of cables and conductors, raceway locations, types of connectors, circuit requirements and type and dimensions of enclosures.

E. Tools
1. The Security Contractor shall provide documentation of any specialized tools required by the End User in order to perform routine maintenance.

F. Commissioning Reports: Security Contractor shall provide documentation of both the Final Test Acceptance and Start Up Testing as per Part 3, 3.12.

1.7 QUALITY ASSURANCE

A. Qualifications
1. Manufacturer:
   a. Manufacturer of products defined in this section shall have at least 10 years experience in manufacturing and servicing access control and management systems.
2. Supplier:
   a. Obtain Workstations, Controllers, Identifier readers, and all software through one source from a single manufacturer.
3. Installer / Systems Integrator Qualifications:
   a. Company must employ workers trained and certified by manufacturer.
   b. Company must have a minimum of 5 (five) years system design, engineering supervision, and installation experience in the alarm or access control industry.
   c. Company must employ personnel that are trained, authorized, and hold current certification to install the specified products.
   d. Company has local coverage for all sites included in this section qualified to service the products being installed.
   e. Service facility: Systems Integrator shall have service facilities within 50 miles of the installation.
4. Testing Agency
   a. Electrical Components, Devices, and Accessories: Must be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Acceptance: Upon delivery to the site, Contractor shall inspect all products and materials for any damage. Acceptance of the units constitutes that the inspection has occurred and no damaged or unacceptable products were found, and any damage or unacceptable products would be the responsibility of the Contractor.

B. Product Storage and Handling Requirements
   1. Central Station, Workstations, and Controllers:
      a. Store in temperature and humidity controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 50 and 85 deg F (10 and 30 deg C), and not more than 80 percent relative humidity, non-condensing.
      b. Open each container; verify contents against packing list, and file copy of packing list, complete with container identification for inclusion in operation and maintenance data.
      c. Mark packing list with designations that have been assigned to materials and equipment for recording in the system labeling schedules that are generated by cable and asset management system specified in Part 2.
      d. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.9 SITE CONDITIONS

A. Ambient Environmental Requirements: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
   1. Control Station: Rated for continuous operation in ambient conditions of 60 to 85 deg F (16 to 30 deg C) and a relative humidity of 20 to 80 percent, non-condensing.
   2. Interior, Controlled Environment: System components, except central-station control unit, installed in temperature-controlled interior environments shall be rated for continuous operation in ambient conditions of 36 to 122 deg F (2 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, non-condensing. NEMA 250, Type 1 enclosure.
   3. Interior, Uncontrolled Environment: System components installed in non-temperature-controlled interior environments shall be rated for continuous operation in ambient conditions of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, non-condensing.
   4. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient conditions of minus 30 to plus 122 deg F (minus 34 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation where exposed to rain as specified in NEMA 250, winds up to 85 mph (137 km/h). NEMA 250, Type 3R enclosures.
   5. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.
   6. Corrosive Environment: For system components subjected to corrosive fumes, vapors, and wind-driven salt spray in coastal zones, provide NEMA 250, Type 4X enclosures.
   7. Begin installation of electronic components only when the following is met, in each installation area:
      a. All wet work is completed.
      b. Area is dust free.
      c. Painting work is completed.

1.10 WARRANTY

A. Special Warranty
   1. Proximity Access Readers: Proximity readers shall provide a lifetime warranty against workmanship and defects.
   2. System Components: One (1) year from date of Substantial Completion.
   3. Labor: One (1) year from date of Substantial Completion.

B. Extended Correction Period: On system components that require an extended correction period after Substantial Completion, the above Warranty shall commence at the end of the extended correction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
   1. Access Control System Hardware/Firmware/Software:
      a. Genetec
      b. No Substitutions
   2. Power Supplies:
      a. Lifesafety Power
      b. No Substitutions
   3. Credentials & Readers:
      a. HID Prox Proxpoint Plus Mini
      b. No Substitutions

2.2 ACCESS CONTOL SYSTEM REQUIREMENTS

A. General Access Control System Description:
   1. Provide complete additions to the existing Genetec Access Control System.

2.3 MATERIALS, GENERAL

A. Power: All ACS equipment shall operate on 120-VAC. Any special power treatment required, such as filtering or spike elimination that may be required for proper operation and protection of the ACS, shall be provided with the system.

B. Backup Power: ACS equipment shall be supplied from a UPS system, which shall be tied to emergency building power circuits. The UPS shall power the equipment including, but not limited to, access control processors, modules, electronic locks and lock power supplies for a minimum of 4 hours. Access control system PC Servers and Workstations shall be equipped with a local Uninterruptible Power Supply (UPS). The UPS shall provide a minimum of 600VA.

C. Hardware: Provide a distributed access control system as required for a complete operating system as described herein and as shown on the Contract Drawings.

2.4 ACCESS CONTROL SYSTEM HARDWARE / FIRMWARE

A. All hardware shall be provided with enclosures, with hinged doors and locks. All the enclosures shall also be equipped with tamper switches.

B. Reader Control Panels
   1. The Reader control panels shall be independently programmed, intelligent devices, which shall be able to process transactions at the local level.
   2. Provide Genetec Small Enclosures for 4 HID Modules (part # Sy-19x16ENC-KIT).

C. Reader Interface
   1. Each reader in the system shall be HID Prox Proxpoint Plus Mini Mullion Reader (color = Gray).
   2. Provide Master Controller (1 HID VertX V1000 Master Controller part # SY-71000AEPONO).

D. Door Interface Modules
   1. Provide 1 HID VertX V100 Door Interface Module (part # SY-70100AEPON) per every 2 Proxpoint readers.

E. Power Supply: Provide Lifesafety Power 12/24 V DC 250 W , dual volt 16 doors E4 Cabinet (part # FPO250/250-2C82D8).

F. Accessories
   1. Request-to-Exit Motion Detectors:
      a. Motion detectors shall be used to shunt alarm signals when exiting. Detectors shall not be used to unlock the access door.
      b. 12/24VDC Request-to-Exit (REX) sensors:
         1) Field adjustable for coverage.
         2) Form C relay output for signaling to Controller.
   2. Door Position Switches/Contacts:
      a. Hermetically sealed magnetic reed switch.
      b. Contact & magnet housing shall snap-lock into a ¾" hole.
      c. Provide 45-degree condolettes to enclose and protect cabling from door contacts/switches. Condolettes shall be placed as close to the contact/switch as possible.

G. Hardware Specifications
      a. Reader Controller
         1) Power input - 16VAC or 24VDC 4-amps
         2) Power consumption – 600mA
         3) Ambient temperature – 0º to 49º C or 32º to 120º F
         4) Humidity – 10% to 85%
         5) Maximum distance to PC – RS-232 communication - 50 feet
      b. Reader Interfaces
         1) Power input - 12-24 VDC
         2) Power consumption – 350mA
         3) Ambient temperature – 0º to 49º C or 32º to 120º F
         4) Humidity – 10% to 85%

2.5 ACCESS CONTROL SYSTEM SOFTWARE

A. System Communication: System shall provide an interface (Communication Interface Module or CIM) to issue all database changes to the Reader Controllers.

   1. Each door requires a Genetec SMA Pro-Reader Support for 5 years (part# SMA-RDR-P-5Y)

2.6 INTEGRATED VIDEO ENTRY SYSTEM

A. Provide an integrated Video Entry System in accordance with manufacturer's instructions at locations indicated on the Drawings and Riser Diagrams.

B. The Video Entry System shall be the Aiphone Corporation "IS Series" integrated security and communication system.

The following Aiphone IS Series components shall be installed:

One (1) AIPHONE IS-CCU Central Control Unit (rack mount)

One (1) AIPHONE IS-PS-UL Power Supply

One (1) AIPHONE IS-RACK power supply rack

One (1) APC SMT1500RM2U Uninterrupted Power Supply

Two (2) AIPHONE SBX-IS-DVF Video Intercom Door Station Back Box

Two (2) HONEYWELL HNVE1 Video Encoders (for NVR recording of CCU analog outputs)

Four (4) HONEYWELL HUTP214TM Passive Transceivers (2 per CCU output)

Four (4) AIPHONE IS-MV Master Stations

(1) Reception #1201

(1) Reception #1102

(1)Security Post #1002

(1) EDC Lobby (programmed for independent operation)

Two (2) AIPHONE IS-DVF Video Intercom Door Stations ***(mount as required to suit field conditions)***

(1) Lobby #1101

(1) EDC Lobby #1401

Two (2) AIPHONE SBX-IS-DVF Video Intercom Door Station Back Box

(*) Integrate with access control system for release of controlled doors

(*) Integrate with IP camera surveillance system for recording of analog video outputs

(*) Necessary CAT-6 cable per manufacturer's specifications

(*) Installation in accordance with manufacturer's requirements.

(*) Necessary programming for proper operation and in accordance with Owner's requirements

2.7 PANIC ALARM SYSTEM

A. Provide an integrated Panic Alarm System in accordance with manufacturer's instructions at locations indicated on the Drawings and Riser Diagrams. Provide hardwired panic alarm stations and connect to the access control system.

B. Provide panic alarm stations to alarm courthouse security. System and functions shall match those of the existing county office building panic alarm system.

C. Provide panic alarms stations as indicated on drawings and as follows:

(1) Reception #1201

(1) Reception #1102

(1)Security Post #1002

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions

1. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.
2. Examine roughing-in for LAN and control cable conduit systems to PCs, Controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Furnish any inserts required for building into concrete, masonry, and other work, to support and attach work of this section. Furnish in ample time to comply with schedule of work into which inserts are built.

B. Verify that power and outlets are in correct locations.

C. Verify that building structure is properly prepared for mounting, attachment and support of equipment.

D. Prior to installation of systems components and devices, verify all required preparations have been properly performed and that substrates are acceptable for installation.

1. Verify all rough-ins and field dimensions.

E. Report in writing to the Architect any prevailing conditions that will adversely affect satisfactory execution of Work in this Section.

1. Security Consultant reserves the right to review proposed methods of construction/installation, reject proposed methods, and have the installation done in a satisfactory method at the Contractor's cost.

3.3 INSTALLATION, GENERAL

A. Install work in accordance with manufacturer's recommendations, instructions and final Shop Drawings.

B. Anchor components securely in place, plumb, level, and accurately aligned. Provide separators and isolators to prevent corrosion and electrolytic deterioration.

C. For card readers that are located in equipment traffic areas, and that are exposed to damage due to collision or impact from forklifts, or manually moved carts, carriers, or other equipment used by the Owner, provide protective bollards, railings, coverings etc. to ensure that all card readers installed are properly protected from such damage.

D. Provide fastenings, plates, and other incidental items required for complete and operational installation.

E. Provide required electrical work in accordance with National and Local code requirements.

3.4 WIRING

A. General: Comply with provisions of Section 28 05 13 – Conductors and Cables for Electronic Safety and Security.

B. Install all wiring connecting all system components and controlled and monitored devices.

C. Install all transformers, relays and other accessories.

D. Install all cable, and perform all cable splicing and equipment terminations.

E. Use 45-degree condolettes to enclose and protect cabling from door contacts/switches. Condolettes shall be placed as close to the contact/switch as possible.

F. Pull continuously between connections where possible.

G. Install electronic systems wiring and cabling in conduit or raceway, as noted on Drawings and as specified in Section 28 05 28.

H. Pulling cables and wires:
   1. Do not force or pressure in a manner, which will stretch, break or damage jacket.
   2. Use an inert anti-friction material to assist in pulling wire.
   3. Pull all cables and wires to be installed in a raceway all at one time.

3.5 GROUNDING

A. Comply with Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Comply with IEEE 1100, "Power and Grounding Sensitive Electronic Equipment."

C. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

D. Bond shields and drain conductors to ground at only one point in each circuit.

E. Signal Ground:
   1. Terminal: Locate in each equipment room and wiring closet; isolate from power system and equipment grounding.
   2. Bus: Mount on wall of main equipment room with standoff insulators.
   3. Backbone Cable: Extend from signal ground bus to signal ground terminal in each equipment room and wiring closet.

3.6 IDENTIFICATION

A. In addition to requirements in this Article, comply with applicable requirements in Division 26 Section "Identification for Electrical Systems" and with TIA/EIA-606.

B. Using cable and asset management software specified in Part 2, develop Cable Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable, and label cable and jacks, connectors, and terminals to which it connects with same designation. Use logical and systematic designations for facility's architectural arrangement.

C. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

D. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the particular device as shown.

1. Each wire connected to building-mounted devices is not required to be numbered at the device if the color of the wire is consistent with the associated wire connected and numbered within the panel or cabinet.

3.7 SYSTEM SOFTWARE

A. Install and test software and databases for the complete and proper operation of systems involved. Assign software license to Owner.

3.8 SYSTEM PROGRAMMING

A. The Contractor shall work with the Owner to ensure that the new components will be properly programmed into the existing system.

3.9 SITE QUALITY CONTROL

A. The Contractor shall develop a Final Test and Acceptance (FTA) Plan. The plan shall identify each new system component provided in the work, intent of test, method or methods of test and expected results. Each component listed in the plan shall include space for test part signatures, brief comments, time of test and pass/fail check boxes. The FTA plan shall be submitted to the owner’s representative 30 days prior to the scheduled final test.

B. Provide manufacturer's supervision of final testing of each system.

1. On-Site Testing: Manufacturer trained and authorized Systems Integrator shall functionally test each component in the system after installation to verify proper operation and confirm that the wiring and dressing conform to the wiring documentation.

C. Each system shall test free from interference, opens, grounds, and short circuits.

D. START-UP TEST (BURN-IN)

1. Following completion of the Final Test, the system shall undergo a thirty (30) day Operational Demonstration Test (ODT) or Burn-In period. This operational demonstration period shall start when all specified systems and equipment have been installed and Substantial Completion is reached, with only a moderate number of punch list items remaining.
2. During this period, the system shall be operated under a normal facility traffic load for no less than 30 days. If any item or system fails during the ODT, the 30-day burn-in period shall be suspended for that item until repaired or replaced. Once repaired or replaced, the burn-in period shall recommence.
3. Final system acceptance of the entire project will be withheld until after successful completion of this operational demonstration period for all systems and components.

4. System will not be considered substantially complete until the following activities have been successfully completed:
    a. Acceptance of all submittals.
    b. Delivery of final documentation.
    c. Successful Final Test and Inspection
    d. Successful Operational Demonstration Test
    e. Successful training and demonstration, including operation of systems using the manuals.
    f. Purging of Contractor User privileges and return of all key card media.

3.10 CLEANING AND WASTE MANAGEMENT

A. Cleaning and Touchup: Immediately after installation, including the completion of wiring and testing, clean all work and touchup all damaged factory finishes.

3.11 Protection

A. Maintain strict security during the installation of equipment and software. Rooms housing the control station, and workstations that have been powered up shall be locked and secured, with an activated burglar alarm and access-control system reporting to a Central Station complying with UL 1610, Central-Station Burglar-Alarm Units, during periods when a qualified operator in the employ of Contractor is not present.

B. Protection: Provide protective covers, fenders, and barriers as necessary to maintain Work of this Section in same condition as installed until time of Substantial Completion.

3.12 Closeout Activities

A. DEMONSTRATION
1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain security access system. Refer to Division 01 Section Demonstration and Training.
2. Develop separate training modules for the following:
    a. Computer system administration personnel to manage and repair the LAN and databases and to update and maintain software.
    b. Operators who prepare and input credentials to man the control station and workstations and to enroll personnel.
    c. Security personnel.
    d. Hardware maintenance personnel.
    e. Corporate management.

B. Training
1. Operator Training: Instruct operating staff in proper operation, including hands-on training.
    a. Minimum of twenty-four (24) man-hours covering the operations for each system installed.
    b. Training sessions shall be provided to supervisors, staff, maintenance personnel and any other personnel designated by the Owner. Contractor should prepare to provide operator training for up to ten (10) personnel.
    c. Contractor shall be prepared to provide training sessions on all work shifts, including day, evening and night shifts.
2. Review in detail all information in the Operations and Maintenance Manuals for each system provided.

3. Prior to administering the above training, the Contractor(s) shall prepare an outline of the training, identifying the goals and expectations of the course and detailing what students are expected to learn.

3.13 LIFE CYCLE ACTIVITIES

A. Commissioning: All system components shall be commissioned as to conform to the manufacturer's recommendations for maximum life cycle.

B. Operation and Use: Provide, in writing, Operation and Use procedures for each system component. Such procedures shall be written in order to conform to the manufacturer's recommendations for maximum life cycle.

C. Maintenance: Provide, in writing, Maintenance procedures for each system component. Such procedures shall be written in order to conform to the manufacturer's recommendations for maximum life cycle.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division I Specification Sections of the Contract, apply to this Section.

1.2 SUMMARY

A. This Section includes furnishing of equipment and installation of a CCTV. Contractor shall be responsible for installation and programming of any cameras to this system. Contractor is responsible for the supply and installation of any video input/output, or any other head end equipment required for a complete system and provide a fully operational CCTV system. The contractor shall provide all wiring, fiber and electrical power, to provide control of pan/tilt/zoom cameras and all CCTV equipment.

B. Camera network cabling shall be green Plenum Category 6 homerun to IT closet and terminated with the rest of the network cabling on patch panel.

1.3 SUBMITTALS

A. Product Data: Include detailed manufacturer's specifications for each component specified. Include data sheets reflecting the model numbers, features, ratings, performance, power requirements, and dimensions.

B. Shop Drawings: For CCTV equipment to include plans, elevations, sections, details, and attachments to other Work.

1. Include dimensioned plan and elevation views of components and enclosures. Show access and workspace requirements. Shop drawings shall include mounting details for all wall and pole mounted equipment. Such details shall include all mounting brackets, hardware, and connections to the building and pole structures.
2. Wiring Diagrams: Power, signal, and control wiring point-to-point diagrams. Differentiate between manufacturer-installed and field-installed wiring.
3. It is the Contractors responsibility to submit for approval the complete designed system configuration and layout showing all devices, wiring, conduit, and locations along with other required information as specified herein for the completely integrated system proposed for installation.

C. Coordination Drawings: Plans drawn to scale and coordinating locations of CCTV equipment. Show the following:

1. Method of attaching hangers to building structure.
2. Location of items requiring installation coordination including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and other architectural features.

D. Samples: Provide full size samples of each outlet; finish plate, for colors and textures required.

E. Product Certificates: Signed by manufacturer of CCTV equipment and components certifying that products furnished to the Contractor comply with requirements.

F. Installer Certificates: Signed by manufacturer certifying that installers comply with manufacturers requirements.

G. Field Test Reports: Indicate and interpret test results for compliance with performance requirements of installed systems.

H. Maintenance Data: Maintenance Data for CCTV equipment and components shall be a part of the maintenance manuals specified in Division 1. In addition to requirements specified, to be provided include the following:

1. Detailed operating instructions covering operation under both normal and abnormal conditions.
2. Routine maintenance requirements for system components.
3. Lists of spare parts and replacement components recommended are to be stored at the site for ready access.

I. Warranties: Special warranties specified in this Section.

J. Calculations and Parameters; Contractor shall submit for approval, the calculations used and plans and diagrams for the Field of View calculations for the CCTV system. Submission as a minimum shall include and address Low Level Lighting. Backlight compensation, and Lens conformance with this Specification.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: This project requires an experienced installer with a minimum of five (5) years experience installing CCTV equipment and possess manufacturers certification, for both installation and maintenance of equipment required for this Project.

B. Product Options: Drawings shall indicate size, profiles, and dimensional requirements of surveillance equipment and are based on the specific system indicated. Other manufacturers' products complying with requirements may be considered. Refer to Division I Section "Substitutions."

C. Electrical Components: Devices, and Accessories; Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NFPA 70.

E. Comply with 47 CFR 15, 17, and 76.

F. UL Compliance. Comply with applicable requirements of UL safety standards pertaining to television equipment and accessories. Provide TV equipment and accessories, which are UL-listed and labeled.

1.5 PROJECT COND1TIONS

A. Environmental Limitations: System components shall be equipped and rated for the environments where installed

1. Service Conditions for Outdoor Equipment: Rate equipment for continuous operation under the following environmental conditions, unless otherwise indicated:
   a. Temperature: Minus 15 deg F to plus 122 deg F.
   b. Relative Humidity: 5 to 100 percent.
   c. Weather: Enclosure housings to prevent entry of moisture due to melting ice build-up or driven rain or snow.

2. Service Conditions for Indoor Equipment: Rate equipment for continuous operation under the following environmental conditions, unless otherwise indicated:
   a. Temperature: 32 deg F to 140 deg F.
   b. Relative Humidity: 0 to 95 percent.

1.6 COORDINATION

A. Coordinate layout and installation of CCTV surveillance equipment and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

1.7 WARRANTY

A. Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

1. Special Warranty for Surveillance System and Components: Written warranty, signed by manufacturer and Installer agreeing to correct system deficiencies and replace components that fail in materials or workmanship within specified warranty period when installed and used according to manufacturer's written instructions. This warranty shall be in addition to, and not limiting, other rights Owner may have under other provisions of the Contract Documents.
2. Special Warranty Period: Two years from date of Substantial Completion.
3. Technical Assistance: CCTV equipment manufacturer shall provide a 24-hour technical telephone assistance program, allowing for the communications directly with manufacture employees to answer any questions and resolve problems over the telephone on a 24-hour basis.
4. Repairs: Manufacturer shall provide 24-hour repair and turn around service on all CCTV equipment.

This section applies to security cameras accessories and equipment.

1.8 GENERAL REQUIREMENTS

A. Design, furnish and install the camera system equipment and layout in conformance with IES recommended procedures. All CCTV system components are to be new, unused products provided with complete Manufacturer's and Contractor's warranty of no less than two years Parts and Labor service. All of the equipment to be furnished is to interface and directly connect to the existing Genetec software and CCTV equipment in place. Code converter boxes or translator equipment will not be acceptable.

B. Lighting: Contractor will assure that adequate area lighting exists to allow for the proper viewing of the video images in the viewing area. This may be accomplished by use of the appropriate

combination of cameras, lenses, environmental enclosures, and mounts, as well as, the possible addition of exterior lights. Metal Halide is the preferred exterior lighting source.

1.9 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of each camera with the switching arrangements and provide the Owner with accurate As-built plans within 30 days of contract closeout.

1.10 REFERENCES

A. Building exterior shall be a mountable surface capable of bearing a shear weight of 100 lbs.

1.11 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years experience.

PART 2 - PRODUCTS

2.1 MANUFACTURER EQUIPMENT AND VENDORS

A. Equipment supplied shall be compatible with existing Genetec CCTV equipment, boxes or translator equipment will not be acceptable.

2.2 CAMERA EQUIPMENT AND ACCESSORIES

A. Fixed Color IP PoE Dome Cameras :

1. Interior: Each interior color camera shall be recessed and secured to the beam structure of the building or the Owner may opt for corner-mounted or wall-mounted units. All cameras that are recessed will be required to have the domes at ceiling level. It is the Contractor's responsibility to coordinate the camera type and lens requirements with the Owner before the purchase of the cameras as stated in submittals above. The Contractor shall refer to the Drawings for installation location and type. Provide software licenses for each camera. The cameras shall be Axis IP PoE (no exceptions).

2. Exterior : Each exterior color camera shall be surface mounted on wall bracket and secured to the structure of the building or the Owner may opt for corner-mounted or wall-mounted units. It is the Contractor's responsibility to coordinate the camera type and lens requirements with the Owner before the purchase of the cameras as stated in submittals above. The Contractor shall refer to the Drawings for installation location and type. Provide software licenses for each camera. The cameras shall be Axis IP PoE (no exceptions).

B. Mounts: An appropriate mounting device will be provided at all camera locations to provide a stable and accessible means of access to the camera site. The specifics of each site location will be determined by local considerations at the indicated mounting location during the site walk-through. Other mounts are to be applied where required.

C. Provide 1 Genetec Omnicast Enterprise Camera Connection (part #GSC-Om-E-1C)

D. Provide 1 Genetec SMA 5 year Enterprise Camera License (part # SMA-CAM-E-5Y)

E. Network Video Recorder: Provide one Genetec SV-Pro v2 server by Dell, QC, 4GBRAM, RAID5, 12TB (part# SV-PRO v2 9TB RAID) pre-loaded with Genetec software. Include all software licenses.. Mount in new server rack.

F. Provide security equipment floor mounted server rack.

G. Provide Camera network green Plenum Category 6 cabling homerun to IT closet and terminated with the rest of the network cabling on patch panel.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Examine adjacent surfaces to determine that surfaces are ready to receive work.

B. Examine each piece of equipment to determine suitability for location specified.

3.2 INSTALLATION

A. Install camera equipment and accessories in accordance with manufacturers' instructions.
   1. Install equipment in consoles and EIA Standard 19" Equipment Racks.
   2. Connect equipment to the branch circuits and cables provided by Contractor.
   3. Bond products and metal accessories to the branch circuit equipment-grounding conductor.

B. Equipment shall be located clear of equipment that will affect the field of view of the cameras. The Owner reserves the right to relocate any camera within 15 feet from locations shown on drawings at no cost to the Owner.

C. Camera network cabling must be green Plenum Category 6 homerun to IT closet and terminated with the rest of the network cabling on patch panel.

3.3 ADJUSTING AND CLEANING

A. Adjust equipment as directed by the Owner.

B. Clean paint splatters, dirt, and debris from installed equipment.

C. Touch up enclosures, buildings, and interior finish at completion of work.

D. Replace equipment and mounts, which have failed at completion of work.

3.4 COORDINATION

A. Confirm compatibility and interface of other materials with CCTV system. Report discrepancies to the Owner.

B. Supply trim rings, back boxes, etc. to other trades as necessary.

C. Coordinate with the Mechanical, and Structural Contractors to avoid conflicts between cameras, supports, fittings, and mechanical equipment.

D. Before ordering, confirm construction details and architectural finish for each area with the Owner.

3.5 ACCEPTANCE

A. Contractor shall demonstrate to the satisfaction of the Owner that all equipment is operating properly. Any faulty equipment shall be replaced at the Contractor's expense. The Contractor shall demonstrate operation of all installed equipment.

END OF SECTION