

SECTION 27 11 00
COMMUNICATIONS EQUIPMENT ROOM FITTINGS

SPEC WRITER NOTES:

1. Use this section only for NCA projects. Delete text between // _____ // not applicable to project. Edit remaining text to suit project.
2. Contact Department of Veterans Affairs' (VA) AHJ, Spectrum Management and COMSEC Service (SMCS), Special Communications Team (SMCS 07A2), Telephone (202-461-5301/5311), for technical assistance.
3. When using this section, always include Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS in project specifications.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Voice and Digital TIP Cable Distribution System including, but not be limited to, equipment cabinets, interface enclosures, and relay racks, necessary combiners, traps, and filters, and necessary passive devices such as splitters, couplers, cable "patch", "punch down", and cross-connector blocks or devices, voice and data distribution sub-systems, and associated hardware.
2. System includes, but is not limited to, telecommunication rooms (TR), telecommunications outlets (TCO), copper and fiber optic // , and analog radio frequency (RF) Emergency TIP Systems coaxial // distribution cables, connectors, "patch" cables, and "break out" devices.

- B. See Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS for requirements governing work of this section.

1.2 RELATED REQUIREMENTS

- A. General electrical requirements and items common to more than one Division 27 section: Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS.
- B. Electrical Components: Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.
- C. Labeling: Section 27 10 00, STRUCTURED CABLING.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. National Fire Protection Association (NFPA):
 - 1. 70-17 - National Electrical Code.
- C. Federal Communications Commission (FCC) Publications: Standards for telephone equipment and systems.

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 - 1. Pictorial layouts of each MTC, IMTC, and RTCs; MCCA, IMCCA, VCCA, and HCCA termination cabinets, each distribution cabinet layout drawing, and TCO as each is installed and configured.
 - 2. Engineering drawings, showing calculated signal levels at EPBX output, each input and output distribution point, proposed TCO values, and signal level at each TCO multipin, fiber optic, // , and coaxial cable // jack.
- C. Environmental Requirements: Confirm environmental specifications for physical telecommunications areas. Identify requirements for initial and expanded system configurations for the following:
 - 1. Floor loading for batteries and cabinets.
 - 2. Minimum floor space and ceiling heights.
 - 3. Minimum door size for equipment passage.
 - 4. Power requirements: Voltage, amperage, phases, and circuit quantities required.
 - 5. Air conditioning, heating, and humidity requirements, including ambient temperature and relative humidity operating ranges required to prevent equipment damage.
 - 6. Air conditioning requirements expressed in BTU per hour, based on adequate dissipation of generated heat to maintain required room and equipment standards.
 - 7. Proposed floor plan, based on expanded system configuration of proposed EPBX for this FACILITY.
 - 8. Conduit size requirement among main TR, computer, and console rooms.
 - 9. Main trunk line and riser pathways, cable duct, and conduit requirements between each MTC, TR, and TCO.
- D. System Narrative Description:

1. List equipment to be provided, (a.k.a. Bill of Materials (BOM)) including quantity, manufacturer, and model number of each item. The following is minimum equipment required by system:

SPEC WRITER NOTE: Select required equipment items quantities that will satisfy system needs and edit between // - //. Add equipment required, but not listed. List equipment items not required, mark "not required" and renumber section.

QUANTITY	UNIT
// As required //	Cabinet Assemblies
// As required //	Environmental Cabinet
// As required //	Distribution/Interface Cabinet
// As required //	Equipment (Radio Relay) Rack
// As required //	Cross Connection (CCS) Systems
// As required //	Audio Alarm Panel
// As required //	Trouble Annunciator Panel
// As required //	Lightning Protection System
// As required //	Wire Management System/Equipment
// As required //	Telecommunications Outlets (TCO)
// As Required //	Distribution Cables
// As required //	TCO Connection Cables
// As required //	System Connectors

QUANTITY	UNIT
// As required //	Terminators
// As required //	Distribution Frames
// As required //	Telecommunications Closets (TR)
// As required //	Environmental Requirements
1 ea.	Installation Kit
List and itemized	Other required items
// As-required //	Separate List Containing Each Equipment Spares

E. Test Equipment List:

1. Provide test equipment required to test system according to parameters specified. Unless otherwise stated, test equipment is not considered part of system. Provide test equipment of accuracy better than parameters to be tested.
2. Test equipment includes calibration tag of acceptable calibration service dated maximum 12 months before test. Minimum submittal includes manufacturer and model number of the following equipment:
 - a. Spectrum Analyzer.
 - b. Signal Level Meter.
 - c. Volt-Ohm Meter.
 - d. Time Domain Reflectometer (TDR) with strip chart recorder (Data and Optical Measuring).
 - e. Bit Error Test Set (BERT).
 - f. Camera, minimum 60 pictures, develop immediately to include appropriate test equipment adapters. Video camera in VHS format is acceptable alternative.
 - g. // Video Waveform Monitor //.
 - h. // Video Vector Scope //.
 - i. // Color Video Monitor with audio capability //.
 - j. // 100 MHz Oscilloscope with video adapters //.

F. Samples:

SPEC WRITER NOTES: See TDM, Section 3 for
TCO Wall Outlet requirements.

1. TCO Wall Outlet:
 2. Data CCS patch panel, punch block or connection device with RJ45 connectors installed.
 3. Telephone CCS system with IDC and RJ45 connectors and cable terminal equipment installed.
 4. Fiber optic CCS patch panel or breakout box with cable management equipment and "ST" connectors installed.
 5. 610 mm (2 ft.) section of each copper cable with cable sweep tags and connectors installed.
 6. // 610 mm (2 ft.) section of each fiber optic cable with cable sweep tags and connectors installed //.
- G. Surveys: Submit the following surveys that depict various system features and capacities in addition to on-site survey requirements. Each survey to be in writing and contain the following minimum information (formats are suggestions and are acceptable for initial Technical Submittal survey requirements):
1. The required EPBX connections (each CSU to be compatible with) to be compatible with the following:
 - a. Initially connect:

EQUIPPED ITEM	CAPACITY	WIRED CAPACITY
Main Station Lines		
Single Line		
Multi Line (Equipped for direct input dial [DID])		
Central Office (CO) Trunks		
Two Way		
DID		
Two-way DRTL		
Foreign Exchange (FX)		
Conference		
Radio Paging Access		
Audio Paging Access		
Off-Premise Extensions		

EQUIPPED ITEM	CAPACITY	WIRED CAPACITY
CO Trunk By-pass		
CRT w/keyboard		
Printers		
Attendant Consoles		
T-1 Access/Equipment		
Maintenance console		

- b. Projected Maximum Growth: Clearly and fully indicate this category for each item. For this purpose, the following definitions and sample connections are provided to detail system's capability:

EQUIPPED ITEM	CAPACITY	WIRED CAPACITY
Servers		
PC's		
Projected Maximum Growth		

2. Cable Distribution System Design Plan: Design plan for entire cable distribution system, including specific cable count coinciding with total growth items. Provide System's entire cable requirements and engineer a distribution system requirement plan using the following minimum format:

- a. UTP (and STP) Requirements/Column Explanation:

Column	Explanation
FROM BUILDING	Identifies the building by number, title, or location, and main signal closet or intermediate signal closet cabling is provided from.
BUILDING	Identifies the building by number, title, or location cabling is to be provided in.
TO BUILDING IMC	Identifies building main terminal signal closet, by room number or location, to which cabling is provided to, in, and from.

Column	Explanation
FLOOR	Identifies the floor by number (i.e. 1st, 2nd, etc.) cabling and TCOs are to be provided.
TR ROOM NUMBER	Identifies the floor signal closet room, by room number, which cabling is to be provided.
ROOM NUMBER	Identifies the room, by number, from which cabling and TCOs to be provided.
NUMBER OF CABLE PAIR	Identifies the number of cable pair required to be provided on each floor designated OR the number of cable pair (VA Owned) to be retained.
NUMBER OF STRANDS USED/SPARE	Identifies the number of strands provided in each run.

b. Fiber Optic Cabling Requirements/Column Explanation:

Column	Explanation
FROM BUILDING	Identifies the building by number, title, or location, and main signal closet or intermediate signal closet cabling is provided from.
TO BUILDING IMC	Identifies building, by number, title, or location, to which cabling is provided.
FLOOR	Identifies the floor by number (i.e. 1st, 2nd, etc.).
TR ROOM NUMBER	Identifies the room, by number, from which cabling to be installed.
NUMBER OF STRANDS	Identifies the number of strands in each run of fiber optic cable.
INSTALLED METHOD	Identifies the method of installation.
NOTES	Identifies a note number for a special feature or equipment.
BUILDING MTC	Identifies the building by number or title.

SPEC WRITER NOTE: Include requirements.
If not needed, indicate "Not Required."

c. Coaxial Cabling Requirements/Column Explanation:

Column	Explanation
FROM BUILDING	Identifies the building by number, title, or location, and main signal closet or intermediate signal closet cabling is provided from.
TO BUILDING IMC	Identifies building, by number, title, or location, to which cabling is provided.
FLOOR	Identifies the floor by number (i.e. 1st, 2nd, etc.).
TR ROOM NUMBER	Identifies the room, by number, from which cabling to be installed.
NUMBER OF STRANDS	Identifies the number of strands in each run of fiber optic cable.
INSTALLED METHOD	Identifies the method of installation.
NOTES	Identifies a note number for a special feature or equipment.
BUILDING MTC	Identifies the building by number or title.

1.5 WARRANTY

SPEC WRITER NOTE: Always retain construction warranty. FAR includes Contractor's one year labor and material warranty.

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. System Requirements:

SPEC WRITER NOTE:

Edit between the // - // and renumber the remaining paragraphs, as required.

1. System designed and supported by manufacturer, provides continuous inter and intra-Facility voice and data and analog signals with capacity sized so loss of connectivity to external systems does not affect Facilities operation in specific designated locations:
 - a. Minimum Connections: Capable of inter-connecting and functioning fully with existing Local Telephone Exchange (LEC) Networks, Federal Telephone System (FTS) Inter-city Networks, Inter-exchange Carriers, Integrated Services Digital Network (ISDN), Electronic Private Branch Exchange (EPBX) switches, asynchronous/synchronous data terminals and circuits including Automatic Transfer Mode (ATM), Frame Relay, local area networks (LAN), and other service providers as required by facility and approved by A/E.
 - b. Voice and data cable distribution system based on physical "Star" // , or "Ring" //, or "Bus" // Topology. // Provide Analog RF coaxial cable distribution system in "home run" configuration from each associated riser TR to identified locations and as shown on drawings. //
 - c. Compatible with and able to provide direct digital connection to trunk level equipment including, but not limited to, directly accessing trunk level equipment including the telephone system, audio paging, Industry Standard "T" and "DS" carrier services and external protocol converters. Also include connections to "T" and "DS" access/equipment or Customer Service Units (CSU) used in FTS and other trunk applications. Provide T-1 access/equipment (or CSU), as required for use, in FTS and other trunk applications by system design when this equipment is not included in existing telephone system and will be deactivated by the installation of the System. Provide T-1 equipment required to terminate and operate the quantity of circuits designated. Connect CSU's to System's emergency battery power supply. System to be fully capable of operating in Industry Standard "DS" protocol and provide protocol service when required.
2. Minimum Subsystem Requirements: Independent sub-systems comprise of complete and functional voice and digital telecommunications cabling

system: "Main" (MTC), "intermediate" (IMTC), and "riser" (RTC) TR's; "vertical" (or "riser") trunk cabling system; vertical cross-connection (VCC) cabling systems, and TCO's with minimum three (3) RJ-45 jacks for appropriate telephone, Data connections, and additional jacks, connectors, drop and patch cords, terminators, and adapters provided:

a. Telecommunication Toom (TR):

- 1) Minimum one for MTC, each building IMTC, and each RTC per building floor location. Provide additional TR's in large buildings, where horizontal distance to farthest voice and digital work area exceeds 90 m (295 feet). Maximum DC resistance per cable pair, 28.6 Ohms per 305 m (1,000 feet). Centrally locate each TR to cover maximum amount of local floor space. TR's house in cabinets or enclosures, on relay racks, and on backboards, various telecommunication data equipment, controllers, multiplexers, bridges, routers, LAN hubs, telephone cross-connecting, active and passive equipment.
- 2) TR's may house fire alarm, video, public address, radio entertainment, intercom, and radio paging equipment. Regardless of method of installation, terminate mounting, termination, or cross-connecting used, vertical copper and fiber optic // and analog RF coaxial // cables on appropriate cross-connection systems (CCS) containing patch panels, punch blocks, // and // or // breakout devices provided in enclosures and tested. cable or wire management system to be a part of each CCS.
 - a) Provide minimum three 110-120 Volt AC active quad outlets, each with "U" grounded receptacles at minimum of one outlet for each front, side and back wall. For larger building TR applications, provide minimum one additional quad AC outlet for every 800 sq. m (8,000 sq. ft.) of useable floor space. Equally space additional outlets along the wall.
 - b) Provide climate control in each TR 24 hours a day, seven days per week and 52 week per year to prevent failure of electronic components and for mission critical functional applications. Contracting Officer's Representative (COR)

will provide minimum climate control requirements.
 // Provide minimum two individual and properly sized self-contained climate controlled equipment cabinet enclosures; one designated for voice, // and // one designated for data service, in each TR location identified on drawings and determined by COR, in lieu of providing additional required TR air handling capability. //.

2.2 SYSTEM PERFORMANCE

SPEC WRITER NOTE: The use of Category 6 must be specifically approved during project design due to increased project cost.

- A. Minimum System support for the following voice and data // and analog RF // operations for minimum Category 5e // 6 // Certified Telecommunication Service:
1. Interchange (or interface) capabilities:
 - a. Basic Rate (BRI).
 - b. Primary Rate (PRI).
 2. ISDN measured at // _____ //:
 - a. Narrow Band BRI:
 - 1) B Channel: 64 kilo-Bits per second (kBps), minimum.
 - 2) D Channel: 16 kBps, minimum.
 - 3) H Channel: 384 kBps, minimum.
 - b. Narrow Band PRI:
 - 1) B Channel: 64 kBps, minimum.
 - 2) D Channel: 64 kBps, minimum.
 - 3) H Channel: 1,920 kBps, minimum.
 - c. Wide (or Broad) Band Channels: 140 mega (m)-Bps, minimum, capable to 565 mBps at "T" reference.
 3. ATM operation and interface: ATM 155 mBps measured at // _____ . //
 4. Frame Relay: Stated compliances measured at // _____ . //
 5. Integrated Data Communications Utility (IDCU) operation and interface: Measured at // _____ . //
 6. Government Open Systems Interconnection Profile (GOSSIP) compliant: Measured at // _____ . //

7. Fiber optic Distributed Data Interface (FDDI): Minimum 100 mBps to maximum 1.8 giga(g)-Bps data bit stream speed measured at // _____ // (to be Synchronous Optical Network [SONET] compliant).
 8. // Coaxial Distribution, provide specific approved information here. //
 9. // RF Distribution, provide specific approved information here. //
 10. System Sensitivity: Provide satisfactory service for minimum 915 m (3,000 feet) for each voice and data // and analog RF // location.
 11. // Other _____. //
- B. Minimum System support for the following operating parameters:
1. EPBX connection:
 - a. System speed: Minimum 1.0 gBps per second.
 - b. Impedance: 600 Ohms.
 - c. Cross Modulation: -60 deci-Bel (dB).
 - d. Hum Modulation: -55 dB.
 - e. System data error: Minimum 10 to the -10 Bps.
 - f. Loss: Measured at frame output with reference Zero (0) decibel measured (dBm) at 1,000 Hertz (Hz) applied to frame input.
 - 1) Trunk to station: Maximum 1.5 dB.
 - 2) Station to station: Maximum 3.0 dB.
 - 3) Internal switch crosstalk: -60 dB when signal of + 10 decibel measured (dBm), 500-2,500 Hz range is applied to primary path.
 - 4) Idle channel noise: 25 dBm "C" or 3.0 dBm "O" above reference (terminated) ground noise, whichever is greater.
 - 5) Traffic Grade of Service for Voice and Data:
 - 6) Minimum service grade of P-01 with average traffic load of 7.0 CCS per station per hour and traffic overload in data circuits will not interfere with, nor degrade, voice service.
 - 7) Average CCS per voice station: Maintain average CCS capacity per voice station at 7.0 CCS when EPBX is expanded up to projected maximum growth as stated herein.

SPEC WRITER NOTE: Verify with A/E for required information.

2. Coaxial Connection:

SPEC WRITER NOTE: Verify with A/E for required information.

3. RF Connection:
4. Telecommunications Outlet (TCO):

SPEC WRITER NOTE: Confirm each characteristics with TDM, Section 3 Guidelines.

- a. Voice:
 - 1) Isolation (outlet-outlet): 24 dB.
 - 2) Impedance: 600 Ohms, balanced (BAL).
 - 3) Signal Level: 0 decibel per mili-Volt (dBmV) + 0.1 dBmV.
 - 4) System speed: Minimum 100 mBps.
 - 5) System data error: Minimum 10 to the -6 Bps.
- b. Data:
 - 1) Isolation (outlet-outlet): 24 dB.
 - 2) Impedance: 600 Ohms, BAL.
 - 3) Signal Level: 0 dBmV + 0.1 dBmV.
 - 4) System speed: Minimum 120 mBps.
 - 5) System data error: Minimum 10 to the -8 Bps.
- c. Fiber optic:
 - 1) Isolation (outlet-outlet): 36 dB.
 - 2) Signal Level: 0 dBmV + 0.1 dBmV.
 - 3) System speed: Minimum 540 mBps.
 - 4) System data error: Minimum 10 to the -6 bps.

2.3 PRODUCTS - GENERAL

- A. Provide system components from one manufacturer.
 1. Equipment: New and manufacturer's current model of standard products, meet or exceed specifications.
 2. Provide proper size and type of cable duct and conduit and wiring.
 3. Provide interfacing cable connections for telephone, // PA //, // Radio Paging, // // and _____ // systems with System.
 4. Telephone equipment and // PA interface equipment // Radio interface equipment // to be interface points for connection of // PA // Radio // interface cabling from telephone switch via system telephone interface unit.

5. Active Electronic Component Equipment: Solid state components, rated for continuous duty service, and comply with FCC standards for telephone equipment, systems, and service.
6. Passive Distribution Equipment: Meet or exceed minus 80 dB radiation shielding specifications.
7. Telephone Cable Systems without Adapters: Terminate interconnecting twisted pair, fiber-optic // or coaxial // cables on equipment terminal boards, punch blocks, breakout boxes, splice blocks, and unused equipment ports/taps according to manufacturer's instructions. Do not leave unused or spare cable unterminated, unconnected, loose or unsecured.
8. Color Code Distribution Wiring: Conform to Telephone Industry standard, EIA/TIA, and this specification, whichever is most stringent. Legibly and permanently label equipment, cable duct and conduit, enclosures, wiring, terminals, and cables, as shown on record drawings, to facilitate installation and maintenance. Refer to Section 27 10 00, STRUCTURED CABLING.
9. Connectors:
 - a. Plug-in Connectors: Connect equipment, except coaxial cables and interface points. Coaxial cable distribution points and RF transmission lines to use coaxial cable connections recommended by cable manufacturer and approved by System manufacturer.
 - b. Barrier Terminal Screw Type Connectors: Use Base- band cable systems, at a minimum.
 - c. Acceptable Alternative:
 - 1) Crimp Type Connectors: Installed with ratchet type installation tool, as long as cable dress, pairs, shielding, grounding, and connections and labeling are provided same as barrier terminal strip connectors. No tape, wire nuts, or solder type connections are permitted.
10. Equipment Faceplates: Stainless steel, anodized aluminum, or UL approved cycolac plastic.
11. Provide noise filters and surge protectors for each equipment interface cabinet, switch equipment cabinet, control console, local, and remote active equipment locations.

SPEC WRITER NOTES: Use non-detectable
type at cemeteries only.

12. Underground Warning Tape: Standard, 0.1 mm (4 mil polyethylene), 76 mm (3 inch) wide non-detectable type, color as follows:
- a. Red with black letters imprinted "CAUTION BURIED ELECTRIC LINE BELOW".
 - b. Orange with black letters imprinted "CAUTION BURIED TELEPHONE LINE BELOW".
 - c. Orange with black letters imprinted "CAUTION BURIED FIBER OPTIC LINE BELOW".

B. Equipment Functional Characteristics:

FUNCTIONS	CHARACTERISTICS
Input Voltage	105 to 130 VAC
Power Line Frequency	60 Hz \pm 2.0 Hz
Operating Temperature	0 to 50 degrees Centigrade (C)
Humidity	80 percent minimum rating

C. Equipment Standards and Testing:

1. Supplies and materials, listed, labeled or certified by UL or a nationally recognized testing laboratory. Refer to Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS.
2. Active and passive equipment required by System design and approved technical submittal, comply with each UL standard bearing UL seal in effect as of technical submittal date (or date when COR approved system equipment necessary to be replaced) was technically reviewed and approved by VA.
3. NRTL listed with seal or seal of testing laboratory that warrants complicity with required NRTL Standards.

2.4 EQUIPMENT

- A. Cabinet with Internal Equipment Mounting Rack: Refer to Section 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS.
- B. Cross-Connection System (CCS) Equipment Breakout, Termination Connector (or Bulkhead), and Patch Panels:
 1. Connector Panels: Solid aluminum, custom designed, flat smooth, 3.175 mm (1/8 inches) thick,. Mount bulkhead equipment connectors on panel to connect cabinet equipment's signal, control, and coaxial cables through panel. Panel color to match cabinet installed.

a. Voice (or Telephone):

- 1) CSS, minimum Industry Standard type 110 punch blocks for voice or telephone, and control wiring in lieu of patch panels, certified for Category six service. IDC punch blocks (with internal RJ45 jacks) are acceptable for use in CCS, design for Category six telecommunications service; size and type of UTP cable used as specified. Secure punch block strips according to manufacturer-designed physical anchoring unit on wall location in MTC, IMTC, RTC, and TR. Console, cabinet, rail, panel, etc. mounting is allowed according to manufacturer's instructions and as approved by COR. Punch blocks may not be used for Class II or 120 Volt AC power wiring.
- 2) Technical Characteristics:

Number of horizontal rows	100, minimum
Number of terminals per row	4, minimum
Terminal protector	required for each used or unused terminal
Insulation splicing	required between each row of terminals

b. Digital or High Speed Data:

- 1) CSS, patch panel with modular female RJ45 jacks installed in rows, designed for Category six telecommunications service and size and type of UTP or STP cable used. Each panel to be 480 mm (19 inches) horizontal EIA rack mountable dimensions with EIA standard spaced vertical mounting holes.
- 2) Technical Characteristics:

Number of horizontal rows	2, minimum
Number of jacks per row	24, minimum
Type of jacks	RJ45
Terminal protector	required for each used or unused jack
Insulation	required between each row of jacks

c. Fiber Optic // and Analog Audio //:

SPEC WRITER NOTES: Panel below is acceptable for fiber optic, audio, control cable, and Class II Low Voltage Wiring installations when provided with the proper connectors but not acceptable for 120 Volt AC power connections.

- 1) Use Interface Cabinet or Panel with pre-punched chassis mounting holes arranged in two horizontal rows.
- 2) Technical Characteristics:

Height	Two rack units (RUs), 88 mm (3 1/2 inches) minimum
Width	484 mm (19 1/16 inches), EIA minimum
Number of connections	12 pairs, minimum
Connectors	
Audio Service	Use RCA 6.35 mm (1/4 inch) Phono, XL or Barrier Strips, surface mounted with spade lugs (punch block or wire wrap type strips are acceptable alternatives for barrier strips when system design is maintained and approved by COR)
Control Signal Service	Barrier strips surface mounted with spade lugs (punch block or wire wrap type strips are acceptable alternates for barrier strips when system design is maintained and approved by COR)
Low Voltage power (class II)	Barrier strips with spade lugs and clear full length plastic cover, surfaced mounted
Fiber optic	"ST" Stainless steel, female

d. Mounting Strips and Blocks:

- 1) Barrier Strips: Approved for AC power, data, voice, and control cable or wires.
 - a) Accommodate size and type of audio spade (or fork type) lugs used with insulating and separating strips between terminals, for securing separate wires.

- b) Provide each cable or wire end with audio spade lug connected to individual screw terminal on barrier strip.
- c) Surface secure barrier strips to console, cabinet, rail, panel, etc.
- d) Do not connect signal barrier strips to 120 Volt AC power wires.

2) Technical Characteristics:

Terminal size	6-32, minimum
Terminal Count	Any combination
Wire size	.52 sq. mm (20 AWG), minimum
Voltage handling	100 V, minimum
Protective connector cover	Required for Class II and 120 Volt AC power connections

- 2. Solderless Connectors (or Fork Connectors): Crimp-on insulated lug to fit 6-32 minimum screw terminal. Install fork connector using standard lug-crimping tool.
- 3. Punch Blocks: Minimum Industry Standard 110 type punch blocks, approved for data, voice, and control wiring, designed for size and type of wire used. Secure punch block strips to console, cabinet, rail, panel, etc. Punch blocks may not be used for Class II or 120 Volt AC power wiring.
- 4. Wire Wrap Strips: Industry Standard wire wrap strips minimum 16.5 mm (0.065 inch), approved for data, voice and control wiring. Secure wire wrap strips to cabinet, rail, panel, etc. Wire wrap strips are not acceptable for Class II or 120 Volt AC power wiring.

C. Wire Management System and Equipment:

- 1. Wire Management System: Management center of cable system, CCS, and TR; performs as platform to house peripheral equipment in standard relay rack or equipment cabinet. Install cables and connections at rear of each system interface to IDC and patch panels, punch blocks, wire wrap strips, and barrier strip.
- 2. Wire Management Equipment: Focal point of each wire management system, providing orderly interface between outside and inside wires and cables (where used), distribution and interface wires and

cables, interconnection wires and cables and associated equipment, jumper cables, and providing uniform connection media for system fire retardant wires and cables and other subsystems; compatible and interface with cable tray, duct, wireway, or conduit used in system; interconnection or distribution wires and cables to enter system at top (or from wireway in floor) via overhead protection system and uniformly routed down either side (or both at same time) of frame's side protection system then laterally via anchoring or routing shelf for termination on rear of each respective terminating assembly. Each system to be custom configured to meet System design and user needs.

PART 3 - EXECUTION

3.1 INSTALLATION

A. System Installation:

1. Comply with accepted industry standards, manufacturer's instructions, requirements of this section, and in manner that does not constitute a safety hazard. Ensure installation personnel understands and comply requirements.
2. Install suitable filters, traps, directional couplers, splitters, TR's, and pads for minimizing interference and balancing System. Items used for balancing and minimizing interference to pass telephone and data // , and light wave //, and analog // signals in frequency bands selected, in direction specified, with low loss, and high isolation, and minimal delay of specified frequencies and signals. Provide equipment necessary to meet the requirements of System performance standards.
3. Connect passive equipment according to manufacturer's instructions.
4. Where TCOs are installed adjacent to each other, install one outlet for each instrument.
5. Terminate lines to facilitate future System expansion. Provide minimum one spare 25 pair cable at each distribution point on each floor.
6. Terminate vertical copper and fiber optic // , and coaxial // cables so future changes only require modifications of // existing // EPBX or signal closet equipment.
7. Provide terminating resistors or devices to terminate unused system branches, outlets, equipment ports.

8. Install outdoor equipment, weatherproof or in weatherproof enclosures with hinged doors and locks with two keys.
 9. Install indoor equipment in metal cabinets with hinged doors and locks with two keys.
- B. Conduit and Signal Ducts: Raceway Installation; See Section 27 05 33, CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS.
1. Conduit:
 - a. Install with latest installation practices and materials. Provide conduit, junction boxes, connectors, sleeves, weatherheads, pitch pockets, and associated sealing materials not specifically identified in this section as GFE. Sleeve and seal conduit penetrations of walls, ceilings, floors, interstitial space, fire barriers, etc. Minimum conduit size, 19 mm (3/4 inch).
 - b. Install cables in separate conduit and signal ducts (exception to separate conduit requirement to allow telephone cables to be installed in partitioned cable tray with data cables may be granted in writing by COR, if requested). Provide conduits according to Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and NFPA 70 Article 800 for Communications systems, at a minimum.
 - c. Conduit (including GFE) fill maximum 40 percent. Equip each conduit end during installation with protective insulator or sleeve, connection nut or clamp. Install electrical power conduit according to NFPA 70. Run AC power conduit separate from signal conduit.
 - d. Ensure PA and Radio Paging Systems (as identified by NFPA 70 Section 517) are completely separated and protected from other systems.
 2. Signal Duct, Cable Duct, or Cable Tray:
 - a. Use existing signal duct, cable duct, and/or cable tray, when identified and approved by COR.
 - b. Approved signal and cable duct, minimum 100 mm by 100 mm (4 inches by 4 inches) inside diameter with removable tops or sides, as required. Provide protective sleeves, guides or barriers on sharp corners, openings, anchors, bolts or screw ends, junction, interface and connection points.

- c. Fully cover approved cable tray, mechanically and physically partitioned for multiple electronic circuit use, and UL certified and labeled for use with telecommunication circuits and/or systems. COR will approve width and height dimensions.
- C. Connectors: Circuits, transmission lines, and signal extensions to have continuity, correct connection and polarity. Maintain uniform polarity between points in system.
1. Wires:
 - a. Neatly form wire ends and secure insulation on each wire with heat shrink tubing, where insulation has been cut. No tape will be permitted.
 - b. Install audio spade lugs on each wire end (including spare or unused) and connect to screw terminals of appropriate size barrier strips. Provide AC barrier strips with protective cover to prevent accidental contact with wires carrying live AC current. Punch blocks are approved for signal, not AC wires. Wire Nut or "Scotch Lock" connectors are not acceptable for signal wire installation.
 2. Cables: Design each connector for specific size cable being used and install with manufacturer's approved installation tool.
 3. Line or Microphone Audio: Install each connector according to cable or connector manufacturer's instructions using manufacturer's approved installation tool. Install connectors to provide and maintain the following audio signal polarity:
 - a. XLR type connectors Signal or positive conductor is pin 3; common or neutral conductor is pin 2; ground conductor is pin 1.
 - b. Two and three conductor 6 mm (1/4 inch) Signal or positive conductor is tip; neutral or 3 mm (1/8 inch) phono plugs conductor is ring and ground or shield and jacks conductor is sleeve.
 - c. RCA Phono Plugs the Signal or positive conductor is tip; and Jacks neutral or shield conductor is sleeve.
 4. Speaker Line Audio:
 - a. Install connector according to cable, transformer or speaker manufacturer's instructions using manufacturer's approved installation tool. Ensure each speaker is properly phased and connected in same manner throughout System using two conductor type wires.

- b. Color code one of the conductors to aid in establishing speaker signal polarity. Solder permanently each speaker line or audio spade lug connected to each appropriate speaker or line matching transformer connection terminal. Speaker line connection to each audio amplifier to use audio spade lugs.
- D. AC Power: Run AC power wiring separately from signal cable.
- E. Grounding:
- 1. Grounding and Bonding: See Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.
 - 2. General: Ground all Contractor Installed Equipment and identified Government Furnished Equipment (GFE). Total ground resistance, 0.1 Ohm or less.
 - a. Install lightning arrestors and grounding according to NFPA 70 and as specified.
 - b. Provide gas protection devices on circuits and cable pairs serving building distribution frames located in buildings other than building in which // _____ // is located or in any area served by an unprotected distribution system (manhole, aerial, etc.). Install gas protection devices at nearest point of entrance in buildings where protection is required and on same circuits on MDF in telephone switch room.
 - c. Do not AC neutral in power panel or receptacle outlet for communication system ground.
- F. Equipment Assembly:
- 1. Cabinets:
 - a. Install rack (including freestanding radio relay) mounted equipment requiring adjustment or observation, in enclosure's equipment adjustable mounting racks. Mount heavy equipment with rack slides or rails allowing servicing from front of enclosure. Heavy equipment support should not be dependent from front panel mounting screws. Provide equipment with sufficient cable slack to permit servicing by removal of installed equipment from front of enclosure. Install 44 mm (1 3/4 inch) high color matched blank panel (spacer) between each piece of equipment (active or passive). Equip each console or cabinet with quiet fan and non-disposable air filter.
 - b. Install enclosures and racks plumb and square, permanently attached to building structure and held firmly in place. Provide

380 mm (15 inches) of front vertical space opening for additional equipment.

- c. Connect signal connector, patch, and bulkhead panels (audio, data, control, analog video, etc.) so that outputs from each source, device or system component enters panel at top row of jacks, beginning left to right as viewed from front, and called "inputs". Each connection to a load, device or system component to exit panel at bottom row of jacks, beginning left to right as viewed the front, and called "outputs".
 - 1) Install equipment located indoors in metal racks or enclosures with hinged doors to allow access for maintenance without causing interference to other nearby equipment.
 - 2) Cables to enter equipment racks or enclosures to allow doors or access panels to open and close without disturbing or damaging cables.
 - 3) Securely mount distribution hardware to allow access to connections for testing and provide sufficient room for doors or access panels to open and close without disturbing cables.

3.2 FIELD QUALITY CONTROL

SPEC WRITER NOTE: Section 01 45 29, TESTING LABORATORY SERVICES includes VA provided testing for large projects and contractor provided testing for small projects. Coordinate testing responsibility.

- A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.

SPEC WRITER NOTE: When this section is used as "Stand Alone" cable plant installation, include the following testing guidelines.

- B. See Section 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS.

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