

PART 1 - GENERAL

1.01 SUMMARY

- A. Should any discrepancy become apparent between the General Conditions and conditions required by this specification, the contractor shall notify the engineer in writing, and engineer shall interpret and decide such matters in accordance with the provisions of the General Conditions.
- B. Comply with all applicable governmental regulations and with all federal, state, city, and other applicable codes and ordinances.
- C. Provide all items and work indicated on the drawings and in the specification necessary to provide a complete telecommunications cabling system.
- D. It is the intent of the drawings and specifications to provide a complete workable communications cabling system ready for the Owner's use. Any item not specifically shown on the drawings or called for in the specifications, but normally required to conform to the intent, are to be considered a part of the contract.

1.02 TERMS AND ABBREVIATIONS

- A. NEC National Electrical Code
- B. ANSI American National Standards Institute
- C. NFPA National Fire Protection Association
- D. IEEE Institute of Electrical and Electronics Engineers
- E. NEMA National Electrical Manufacturers Association
- F. UL Underwriters' Laboratories
- G. ASTM American Society of Testing Materials
- H. EIA Electronic Industries Association
- I. FCC Federal Communications Commission
- J. TIA Telecommunication Industry Association
- K. TR Telecommunications (IT) Room
- L. TSER Telecommunications Service Entrance Room
- M. MDF Main Distribution Room

1.03 DEFINITIONS

- A. Utilize the following definitions within the drawings and specifications:
 - 1. "Provide" or "furnish" means to supply, purchase, transport, install, place, erect, connect, test warranty and turn over to the Owner, complete and ready for regular operation, the work referred to.

2. "Supply" means to purchase, procure, acquire and deliver complete with related accessories.
3. "Install" means to move from property line; set in place, join, unit fasten, link attach, set up or otherwise connect together before testing, and turning over to the Owner or equipment and/or components. Installation is to be complete and ready for regular operation.
4. "Wiring" or "cabling" includes the furnishing of all fittings, conductors, grounding accessories, tape, splices and all other items for such work.
5. "Conduit", "cable tray" and "cable supports" include the furnishing of all fittings, hangers, supports, sleeves, bonding, etc.
6. "As directed" means as directed by the Owner or Owner's designated representative.
7. "Concealed" means embedded in masonry or other construction, installed behind wall furring or within double partitions, or installed within hung ceilings.
8. "Exposed" means not installed underground or "concealed" as defined above.
9. "Owner" means Ramapo College.
10. "Engineer" means Joseph R. Loring & Associates, Inc.

1.04 WORK INCLUDED

- A. The work covered by this specification includes the construction described, including all labor necessary to perform and complete such construction; all materials and equipment incorporated or to be incorporated in such construction; all services, facilities, tools and equipment necessary or used to perform and complete such construction.
- B. Provide the following:
 1. Provide a complete telecommunications wiring infrastructure.
 2. Labeling and documentation of all cables, outlets and hardware installed under this contract.
 3. All horizontal telecommunications cabling between individual work area outlet locations and the associated telecommunication room (TR).
 4. All copper and fiber backbone telecommunications cabling between TRs and MDF/TSER room or between Main Cross Connect Rooms, TRs and other buildings on campus.
 5. All cable trays within Telecom spaces and cable support hangers including all necessary mounting and installation hardware, wherever cables are installed within the ceiling plenum, as well as cable supports within the Telecommunications Room, except for those already provided for in other building contracts.

6. All necessary equipment cabinets, racks, wiring enclosures, cable supports and pathways hardware, except for those already provided for in other building contracts.
7. Testing and test documentation for all cabling.
8. Preparation and submission of shop drawings, as-built drawings and cable documentation.
9. Fire-stopping of all rated wall and floor penetrations in the TR as well as all openings created by or utilized by the contractor through rated walls and floors.
10. All connections to the telecommunications grounding system provided under the electrical specifications.
11. Adhere and comply with all requirements of the manufactures Certifications and Cable Warranty.
12. Provision of 25-year Network Cabling System Warranty.

1.05 SUBMITTALS/ QUALIFICATIONS

A. Contractors:

1. The successful bidder shall be thoroughly familiar with the cabling methods set forth in the latest release of the BICSI TDMM's (Building Industry Consulting Services International Telecommunications Distribution Methods Manuals), and unless otherwise specified, shall supervise the installation in accordance with the recommendations and practices outlined in the latest release of the BICSI Telecommunications Cabling Installation Manual.
2. Contractor shall hold a Certified Installer Status or equivalent and provide a (15) year Extended Product Warranty program for the Copper Cabling and Fiber Cabling Systems. The bidder shall submit proof of their Certified Installer status as part of the submittal process.
3. Contractor must be provide the resume of the proposed onsite project manager who has demonstrated the ability to supervise a project of this magnitude and who shall attend project meetings while the work is in progress.
4. The successful bidder shall submit in writing a list of qualified technicians assigned to this project, including relevant manufacturers training programs completed by each, and years of related experience of each.
5. The successful bidder shall maintain an office or competent technical presence with appropriate testing equipment and replacement parts within 2 hours drive time from this project.

B. Product Data:

1. Submit manufacturer's product data sheets for all materials and equipment proposed for use on the project. Material and equipment requiring shop

drawing submittals shall include, but not be limited to the following telecommunication components:

2. Faceplates

- a. Data modular inserts (Category 5e & 6A)
- b. Data & Voice horizontal cable (Category 5e & 6A)
- c. Data & Voice patch panels/termination blocks (Category 5e & 6A)
- d. Voice Backbone cable
- e. Equipment racks
- f. Work shall not proceed without the Ramapo IT Department approval of the submitted items.
- g. Submit manufacturer's product data sheets for all fire stopping materials proposed for use on the project.
- h. Mark each product data sheet to show applicable choices and options. Where product data includes information on several products, some of which are not required, mark to indicate the applicable information.

C. Shop Drawings:

1. Submit shop drawings ten (10) business days prior to required approval.
2. Drawings shall show evidence of coordination with other trades.
3. Any work performed without prior approval shall be subject to changes without charge or penalty to the Owner if found unacceptable by the architect or engineer.

D. Test Reports:

1. Prior to testing, submit for review and approval copies of test report forms proposed for use.
2. Each test report form shall contain the following general information: date of preparation, date of test, project name, contractor(s) name(s), media type, make, model and serial number of test equipment used, dated of last calibration and names of test crew. Refer to the Test Result Section of this specification for further details.

E. As-Built Documents:

1. Keep an accurate record of all deviations between the work as shown on the document drawings and that actually installed. Provide record of these deviations to the Owner as a set of as-built documents.
2. The as-built drawing set shall consist of one (1) set of reproducible and one (1) set of electronic drawing files in accordance with the contract documents.

1.06 MATERIALS HANDLING

- A. All products and materials are to be new, manufactured within six (6) months of delivery to the site, clean free of defects and free of damage and corrosion.
- B. Contractor shall assume all risk of loss until final acceptance by the Owner.
- C. Cable shall be stored according to manufacturer's recommendations as a minimum. In addition, cable must be stored in an indoor locations protected from vandalism and weather. If air temperature at cable storage location will be below 40 degrees F., the cable shall be moved to a heated (50 degrees F. minimum) location prior to installation. If necessary, cable shall be stored off site at the contractor's expense.

1.07 ORGANIZATION OF WORK

- A. The work called for under contract shall be carried on simultaneously with the work of other trades in a manner so as not to delay the overall progress of the work. Promptly furnish all information and measurements relating to the work as required to other trades involved at the project. Cooperate with them in order to secure the harmony necessary in the interest of the project as a whole.
- B. Provide all work necessary to meet all construction schedules.
- C. All work shall remain accessible so as to permit the Owner observation of the work during the course of construction.

1.08 COORDINATION OF THE WORK

- A. Carefully check space requirements with other trades and the physical confines of the area of work to insure that all material can be installed in the allotted spaces including finished suspended ceilings. Make modifications as required and approved.
- B. The telecommunications contractor shall verify all dimensions at the site and be responsible for their accuracy.
- C. Coordinate all work with other trades and work under the direction of the General Contractor. Transmit to other trades in a timely manner all information required for work to be provided under their respective sections in ample time for installation.
- D. Attend all construction meetings, at the project site or other locations, as requested by the Owner or General Contractor.
- E. Prior to actual installation, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades or for proper compliance with the design intent.
- F. The cabling contractor is responsible for communicating all conduit requirements, core drilling requirements, and pathway requirements and block-out requirements the general contractor at the time of bid submission.

1.09 CODES, REGULATIONS AND STANDARDS

- A. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association, the local Electrical Code and present manufacturing standards.
- B. All materials shall be UL Listed and shall be marked as such. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.
- C. All modular jacks, patch cords, and patch cords performance shall be verified (not just tested) by a third party to be category 6 component and channel compliant.
- D. The cabling system described in this is derived from the recommendations made in recognized telecommunications industry standards. The following documents are incorporated by reference:
 - 1. ANSI/TIA-568-C.0-2009, Generic Telecommunications Cabling for Customer Premises, March, 2009
 - 2. ANSI/TIA-568-C.1-2009, Commercial Building Telecommunications Cabling Standard, March, 2009
 - 3. ANSI/TIA-568-C.2-2009, Balanced Twisted-Pair Telecommunications Cabling and Components Standards, August, 2009
 - 4. ANSI/TIA-568-C.3-2008, Optical Fiber Cabling Components Standard, June, 2008
 - 5. ANSI/TIA-1152-2009, Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling, September, 2009
 - 6. ANSI/TIA/EIA-526-7-1998, Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant, August, 1998
 - 7. ANSI/TIA-526-14-B-2010, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant; IEC 61280-4-1 edition 2, Fiber-Optic Communications Subsystem Test Procedure- Part 4-1: Installed cable plant- Multimode attenuation measurement, August, 2010
 - 8. ANSI/TIA-569-B-2004, Commercial Building Standard for Telecommunications Pathways and Spaces, October, 2004
 - 9. ANSI/TIA/EIA-606-A, Administration Standard for Commercial Telecommunications Infrastructure, May, 2002
 - 10. J-STD-607-A, Commercial Building Grounding (Earthing) and Bonding Requirements For Telecommunications, October, 2002
 - 11. ANSI/NECA/BICSI-607, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings, Pending, 2011

12. ANSI/TIA-758-A, Customer-owned Outside Plant Telecommunications Infrastructure Standard, August, 2004
13. National Fire Protection Agency (NFPA-70), National Electrical Code (NEC)
14. BICSI - TDMM, Telecommunications Distribution Methods Manual (TDMM) - 12th Edition

E. 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 Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.

F. This document does not replace any code, either partially or wholly. The contractor must be aware of local codes that may impact this project.

1.10 FEES AND PERMITS

A. Pay all local fees and obtain all permits and services of inspection authorities. Be present to coordinate inspections with inspection authorities. Cooperate fully with local utility companies with respect to their services.

1.11 WARRANTY

- A. Submit a single warranty from the connectivity manufacturer for a minimum of 15 years that covers all portions of the work is in accordance with contract requirements.
- B. This warranty shall cover all work against all malfunctions and faulty and improper material and workmanship for a minimum period of 15 years from the date of final acceptance by the engineer.
- C. The Warranty shall cover the failure of the wiring system to support the applications that are designed for the link/channel specifications of ANSI/TIA/EIA-568-C.I. These applications include, but are not limited to, 10BASE-T, 100BASE-T, 1000BASE-T, and 155 Mb/s ATM.
- D. Correct any deficiencies to the Owner's satisfaction, during the warranty period within 24 hours after notification by the Owner, at no additional cost. Obtain similar warranty from the sub-contractors, manufacturers, suppliers and sub-trade specialists.

1.12 ACCEPTANCE

A. Once the testing has been completed, and all as-built and testing documentation has been delivered to the Owner, and the Owner is satisfied that all work is in accordance with the contract documents, the Owner shall notify the contractor in writing of the acceptance of the work performed. The date of this acceptance shall constitute the start date of the warranty.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with technical requirements of this section and the Contract Documents, Ramapo has now standardized the communication components to be used throughout the campus to insure that all locations are consistent and identical. The following specific components represent the standards which the college has adopted. Provide cable and equipment from the following manufacturers, no other equals will be accepted:

1. 4-Pair Cable
 - a. Commscope
 - b. General
 - c. Panduit
 - d. Systimax
2. Fiber Optic Cabling and Hardware
 - a. AFL
 - b. Commscope
 - c. General
 - d. Panduit
 - e. Systimax
3. Multi-Pair Cable
 - a. Belden
 - b. Commscope
 - c. General
4. Patch Cables
 - a. Commscope
 - b. Panduit
 - c. Systimax
5. Termination Blocks
 - a. Commscope
 - b. Panduit
 - c. Systimax

6. UTP Modular Connectors/Outlets/Patch Panels
 - a. Commscope
 - b. Panduit
 - c. Systimax
7. Wire Management Hardware
 - a. Commscope
 - b. Panduit
 - c. Systimax
8. Equipment Racks/Cabinets
 - a. Chatsworth
 - b. Commscope
 - c. Panduit
9. Cable Tray/Ladder Rack
 - a. B-Line
 - b. Chatsworth (Ladder Type)
 - c. Flex tray
10. Labels
 - a. Brady USA Inc.
 - b. Panduit Corporation

2.02 PART NUMBERS

- A. Part numbers provided in this Specification have been coordinated with the manufacturer's latest available product literature. Part numbers are subject to change without notice by the manufacturers. Where a specific part number is invalid, provide product meeting component description.

2.03 MATERIALS

- A. Where specific items are called out in the specification or indicated on the drawings or a specific application, use those products or materials. Where no specific call outs are made use premium products and materials.

2.04 CABLE MEDIA

- A. 4-Pair Cable Unshielded Twisted Pair - CMP
 1. Physical Specifications: 4pr twisted pair - 23AWG (6A cable & 24AWG 5e cable) solid copper conductors, 100 ohms nominal impedance +/-15%

2. Electrical characteristics: Superior to the individual characteristics established in EIA/TIA 568-C2 for Category 5e and 6A cable performance specification.
3. Cable Construction: individually insulated conductors under a common plenum rated sheath. Confirm Color of cabling with Ramapo IT department.

Manufacturer: General Cable:

Type: GenSpeed 10MTP (Category 6A UTP Plenum Cable)
GenSpeed 5000 (Category 5e UTP Plenum Cable)

B. 25-Pair Binder Unshielded Twisted Pair Cable - CMP

1. Physical Specifications: 25 twisted pair per binder group - 24 AWG, solid copper conductors, 100 ohms nominal impedance +/- 20%. Total pair count as noted herein.
2. Electrical characteristics: Equal to or better than individual characteristics established in EIA/TIA 568-C for category 3 cable performance specification.
3. Cable Construction: individually insulated conductors in 25-pair binder groups, under a common plenum rated outer jacket.

Manufacturer: General

Type: Multi-Pair Cat. 3 voice grade riser cable.

C. Multi-Mode Optical Fiber Cable

1. Physical Specifications: Multi-mode 50micron/125 micron. Total strand count as noted herein.
2. Performance Characteristics: OM4 Fiber. Fiber attenuation shall not exceed 3.0dB/km @850nm wavelength or 1.0dB/km @1300nm. Optical Fiber shall be laser optimized and guarantee Gigabit Ethernet distances of 1100m/600m for 850nm and 1300nm respectively. Optical fiber shall guarantee a 10 Gigabit Ethernet distance of 550m at 850nm.
3. Cable Construction: Tight buffered, individually insulated conductors, reinforced with a fiber type strength member under a common plenum rated sheath, (outdoor fiber to be with an armored jacket). Refer to drawings for Strand Count.

Manufacturer: General Cable:

50/125 micron O M 4 fiber 10 Gig at 550m

Type: BLxxx1PNU

Indoor/Outdoor Plenum 10 Gig at 550m with Armor.

Type: BLxxx1ANU.BK

(xxx) = strand count

D. Single-Mode Optical Fiber Cable

1. Physical Specifications: Single-mode 8.3 micron/125 micron Fiber. Total strand count as noted herein.
2. Performance Characteristics: Fiber attenuation shall not exceed .5dB/km @1310nm wavelength or .4dB/km @1550nm.

3. Cable Construction: Tight buffered, individually insulated conductors, reinforced with a fiber type strength member under a common plenum rated sheath (outdoor fiber to be with an armored jacket). Refer to drawings for Strand Count.

Manufacturer: General Cable

Type: APxxx1PNU

Indoor/Outdoor Plenum with Armor

APxxx1ANU-ILPA

(xxx) = strand count

Type: Indoor/Outdoor Plenum with Armor

E. 8-Pin Modular Patch Cables

1. Physical Specifications: 4 twisted pair - 23 AWG, stranded copper conductors, 100 ohms nominal impedance +/-15%, 8-pin modular plugs
2. Electrical characteristics: Equal to or better than individual characteristics established in EIA/TIA 568-C for category 6A and category 5e cable performance specification.
3. Cable Construction: 4-pair cables, individually insulated conductors under a common sheath with 8-pin modular plug at each end.

Manufacturer: Panduit

Type: Cat. 6A to Cat 6A modular patch Cords, Lengths vary

Type: Cat. 5e to Cat 5e modular patch cords, Lengths vary

2.05 TERMINATION HARDWARE

A. Termination Blocks

1. 110-type termination blocks, with legs, 300-pair capacity, and field terminated, with rack mounting brackets. Complies with EIA/TIA-568B Category 5e performance specification. Complete with designation strips and all connector blocks.

Manufacturer: Panduit

P110KB3005Y

Type: 300pr 110 w/legs

110C5 (5 pair connector blocks)

Or Approved Equivalent

2. Rack mount 8-pin modular patch panel. Complies with EIA/TIA-568B Category 6A and Category 5e performance specification. Patch Panels are complete with label holders and are preloaded with 110-style terminations and female 8-pin, modular openings.

Manufacturer: Panduit

Type: DPA486X88TGY Category 6A - Angled

Type: DPA485E88TGY Category 5e- Angled

Or Approved Equivalent

3. Optical Fiber Patch Panel

19-inch rack mounted patch panel with hinged front door, with slide out shelf, mounting guides and designation panels. Populate panels complete with coupler panels and LC couplers required for a complete installation.

Manufacturer: Panduit

Type: FRME1U-48-Port/Strand
Or Approved Equivalent

B. Modular Connectors/Outlets

1. 8-pin modular outlet, non-keyed. Complies with EIA/TIA –568B Category 6A and 5e performance specifications. Outlet wired with standards compliant T568B pinning. Confirm color of jacks and faceplates with Architect.

Manufacturer: Panduit

Type: Minicom Cat. 6A Jack for standard wall-mounted faceplate.
CJ6X88TGxx
Minicom Cat 5e Jack for standard wall-mounted faceplate
CJ5E88TGxx

Type: Keystone Style Cat. 6A jack for surface raceway, floor boxes and poke-thru.
Keystone Style Cat 5e jack for surface raceway, floor boxes and poke-thru.
Or Approved Equivalent

2. Wall mounted 8-conductor outlet and faceplate, mounted over a standard electrical j-box. Faceplate with two mounting studs to support wall mounted type telephones.

Manufacturer: Panduit

Type: KWP6PY
Or Approved Equivalent

3. Optical Fiber Connectors

Duplex LC connectors, ceramic tip, with strain relief boot, low insertion loss, suitable for use with specified and supplied optical fiber cables.

Manufacturer: Panduit

Type: Panduit OptiCAM's, LC Connectors
Type: Single Mode. Panduit OptiCAM, LC's
Or Approved Equivalent

C. Faceplate/Mounting Plate

1. Outlet faceplate suitable to be installed in a standard NEMA electrical junction box, capable of mounting a minimum of four approved 8-pin modular outlets complete with "106" mounting frame (for poke-thurs, surface raceway and/or floor boxes). Provide blanks and colored icons as required.

Manufacturer: Panduit
Type: Executive series
Or Approved Equivalent

D. Building Entrance Protectors

1. 100 pair capacity, 110-type terminations for input and output connections, wall mount and stackable. Unit shall be fitted with a protector module for each pair served. A ground lug for the cable shield and for the ground cable shall be provided.
2. Protector modules must be suitable for use of unit specified.

Manufacturer: Circa

Type: 1 890ECT-I/NSC-50-110 BLKS Circa 50 Pair
1890ECT - INSC- I 00-110 BLKS Circa 100 Pair
3BIE Circa Fuse

2.06 EQUIPMENT RACKING

A. Equipment Racks

1. 19-inch double-sided wire-management equipment rack, 84-inch high, vertical wire management panels attached to each side of the racks and shall have a 23.75" OD width with standard EIA spacing. Waterfall cable management shall be provided at the top of the rack for patch cords and for horizontal cables entering the rack channels for protection and to maintain proper bend radius and cable support. Wire management shall also be mounted above each patch panel and/or piece of equipment on the rack as needed. Velcro cable ties shall be provided inside the rack channels to support the horizontal cable. Rack shall be black in color to match the patch panels and cable management.

Manufacturer: Chatsworth

Type: 55053-703

Narrow Vertical Wire Management Panel CPI # 30161-703

Wide Vertical Management Panel CPI 30162-703

B. Wire Management Hardware

1. Wall mounted, lightweight, self-extinguishing molded, polycarbonate, split front, distribution (D) rings.

Manufacturer: Panduit

Part Number: D-rings

2. Rack mounted, patch cord wire management panel.

Manufacturer: Chatsworth

Type: Horizontal cable management panel: CPI# 30130-719 1U or 2U

3. Cable support split mesh grip, with double support eyes, suitable for support of vertically installed backbone cables.

Manufacturer: Daniel Woodhead Company

Part Number: SSUD

C. J- Hooks

1. Ceiling mounted J- Hook/ hanger/ brackets with fasteners.

Manufacturer: Erico Fastening Products

Part Number: CAT 21

Or Approved Equivalent

2. Ceiling mounted Loop/ hangers with fasteners.

Manufacturer: Arlington Industries, Inc

Part Number: LT20

LT25

LT50

Or Approved Equivalent

D. Cable Tray (IDF Rooms/ MDF Room only)

1. Open rung ladder type cable tray with runway radius drop outs, 8-inch cable retaining post and end cap, complete with heavy duty butt-splice hardware, junction splice hardware, end feet hardware, protective end caps and 5/8-inch ceiling support hardware. Constructed of steel tubing with 12-inch rung spacing.

Manufacturer: Chatsworth Products Inc.

Type: 10250-7xx (refer to floor plans for size of cable tray)

10506-706 (elevation kit)

10596-712 (runway mounting plate)

10595-712 (cable retaining posts)

12100-712 (runway radius drops)

Or Approved Equivalent

E. Labels

1. Pre-printed or machine printed, self-adhesive smudge resistant labels for cables and face-plates. Labels shall be appropriately sized for cable diameter. Labels shall be appropriately colored for faceplate contrast.

Manufacturer: Brady Labeling System

Type: Contractors option meeting specification.

Or Approved Equivalent

Submit sample labels for approval.

PART 3 - EXECUTION

3.01 GENERAL

- A. Installation: Follow manufacturers' instructions for installing, connecting, and adjusting all equipment and communications cabling. Where no instructions are included or available, follow industry standards.

- B. Examine and compare the communications cabling drawings and specifications with the drawings and specifications of other trades; report any discrepancies between them to the engineer, and obtain from him written instructions for changes necessary in the work. The most stringent requirements shall be included in the bid.
- C. The contractor shall assume responsibility for the protection of any finished work during installation of the cabling system set forth in this specification and its associated plans and documents, and remedy any such injury or damages as required.
- D. Exercise particular caution with reference to the location of patch panels, termination blocks, outlets, etc. Have precise and definite locations of all outlets accepted by the architect before proceeding with the installation.
- E. Keep all items protected before and after installation, with dust and moisture proof barrier materials. It shall be the contractor's responsibility to ensure the integrity of these protective measures throughout the life of the project.
- F. Clean up all debris generated by installation activities. Transport all debris to a pickup location designated by the General Contractor or Commissioner. Ensure that safe ingress and egress from all work sites is maintained during movement and installation of materials.
- G. Maintain a current copy of this bid specification at the job site at all times.

3.02 CABLE DISTRIBUTION

- A. Follow room boundaries when pulling cables through ceilings for distribution into walls, conduits, wiring channels, outlets, etc.
- B. Horizontal distribution cables shall be bundled in groups of no more than 50 cables.
- C. The cable's minimum bend radius and maximum pulling tension shall not be exceeded.
- D. Where a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of 4-foot inch intervals.
- E. J-hooks shall be dedicated for data communications cabling only.
- F. Cables shall not be attached to the ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the contractor shall install appropriate carriers to support the cabling.
- G. Cabling installed in cable trays shall not contain, nor be fastened with Velcro or plastic ty-wraps.

3.03 EMI/RFI AVOIDANCE

- A. To avoid electromagnetic interference (EMI), cables shall be routed in such a way as to maintain the following minimum distance from possible sources of EMI:
 - 1. Three inches from power lines of 2 kVA or less installed in conduits.
 - 2. Five inches from fluorescent fixtures with remotely installed ballasts.

3. Twelve inches from power lines of between 2 to 5kVA.
 4. Thirty-six inches from power lines of 5kVA or greater.
 5. Twelve inches from high voltage lighting, including fluorescent lighting.
 6. Forty inches from transformers or motors.
- B. Telecommunication cables which must cross electrical cables/conduits shall do so only at 90° angles.

3.04 STAFFING

- A. Keep a qualified foreman in charge of the work at all times. The foreman shall be present in the field at all times during the performance of the work. Such foreman shall be replaced if unsatisfactory to the owner, architect or engineer.
- B. Use only skilled, experienced and reliable work force. Discontinue the services of anyone employed on this project upon written request of the Owner, architect or engineer.
- C. Craft personnel shall be qualified with 30% approved Certified installers (at minimum) to perform the work activities and be knowledgeable of the following:
1. Color coding of American Standard Telephone cables.
 2. Bonding and grounding of communication wiring, pathways and equipment.
 3. Testing conductors for electrical continuity.
 4. Testing conductor insulation.
 5. Installation, termination, connectorization, and testing of unshielded twisted pair cable, connectors, and terminal blocks.
 6. Other testing, as set forth in this specification.
- D. Craft personnel shall be required to provide and use the proper tools in the performance of each activity. The tools must be in good working order. The engineer reserves the right to review the tools and tool maintenance procedures of the contractor and require replacements to be obtained.
- E. Telephone and data industry cable installation standards, EIA/TIA standards, and manufacturer's instructions shall be used for in-process quality control and final acceptance of the work installation.

3.05 INSTALLATION

- A. Equipment Racks/Cabinets
1. Provide 19-inch wide, 84-inch high equipment racks in the IDF, and MDF/TSER room as shown on the Telecommunications Room Details

Drawings. Racks are to be used for the mounting of UTP workstation termination blocks, optical fiber backbone cable patch panels and owner provided equipment.

2. Provide (6") vertical management channels between racks. Utilize rear rings for routing of horizontal cabling.
3. Provide Chatsworth cable runway radius drop cross member or stringer with 3 – 1 1/2" cable spools installed for each Global Vertical Cable Manager and cable drop locations (cross member product # 12100-712).
4. Provide vertical manager attached to each side of a relay rack (qty: 2), when two racks are installed, there shall be three vertical manger attached, one between the two.
5. Ground each rack and cable tray section to the telecom grounding busbar located within the room.

B. Termination Blocks

1. Provide 24/48-Port 8-pin modular patch panels in the IDF and MDF/TSER room for the termination of all UTP 4-pair Category- 5e and 6A workstation cables in the Telecommunications Room. Mount the termination panels on the equipment racks as shown on the Drawings. All blocks to be provided complete with designation strips. Provide patch panels in quantities as required for a complete installation.
2. Provide wall-mount 110-blocks for all voice backbone cable terminations.
3. Provide wire management panels in the IDF/MDF rooms. Mount the panels onto the equipment racks alternating between termination blocks and/or patch panels as shown on the IT/Telecom Room Detail Drawings. Provide wire management panels in quantities as required for a complete installation.

C. Cable Media

1. Install workstation and backbone cables in accordance with these Specifications, the manufacturer's recommendations, and the Telecommunications Distribution Plan Drawings.
2. After dressing the cable to its final location the sheath shall be removed to a point that allows the conductor to be splayed and terminated in a neat and uniform fashion. Every effort will be made to maintain sheath integrity by removing only as much sheath as is practical, to accomplish termination. For UTP cables, maintain the manufacturers twisting of the wire pairs through to the point of termination.
3. There shall be no splices or mechanical couplers installed between the cable points of origin and termination for the intra-building cable.
4. When routing cables in the IDF and Server/MDF rooms, cables are to transition from the conduit sleeves to the cable tray within the room via vertical ladder rack. When cables enter racks from the horizontal cable tray mounted above, they are to be run in an approved "waterfall" bracket that attaches to the ladder rack. Do not use plastic tie-wraps. If tie-wraps are to

be used, provide Velcro-type, and ensure that the tie-wraps can be able to be twisted around the cable bundle with no stress.

5. 4-Pair Cables

- a. Provide 4-pair Category 5e & 6A cable from the telecommunications outlet location shown on the IT Distribution plan Drawings in quantities shown on the telecommunications drawings, to the respective serving Telecom Rooms. Terminate all cables onto 8-pin modular connectors at the outlet location and onto rack-mounted modular patch panel for all Category 5e & 6A cables in the IT/Telecom Room as shown on the IT/Telecom Room Detail Drawings. Provide different cable jacket coloring for Category 5e and Category 6a cabling.
- b. Provide an allowance for an additional (5) 4-Pair Category 6A cables to support Wireless Local Area Network Access points in addition to what is shown on the drawings. Terminate all cables on 8-pin connectors at the Access Point and on Modular Patch Panels in the Telecom Rooms. Exact location of Wireless Access Points shall be determined during the RF survey. Allow 200' run from the Telecom Room to the Access Point. The wireless data jack shall:
 - 1) Hold one (1) modular jack.
 - 2) Utilize a single gang box.
 - 3) Be located a minimum of six (6) inches above ceilings and mounted to the nearest wall in relation to supplied drawings depicting wireless access point locations.
 - 4) Be located exactly per supplied drawings in areas without ceilings.

6. RG6 Quad-Shield Cable

- a. Provide Commscope Part # 2275 RG6 Quad Shield cable to locations shown on the drawings and terminate with F-type connectors at both ends. Refer to the A/V drawings for termination requirements in the IT/Telecom Room and terminate in single-gang faceplates at the outlet locations.

7. 25 pair Binder Category 3 Riser/Tie Cables:

- a. Provide 25pr Category 3 voice riser cables from the MDF to the IDF. Cables shall be terminated on wall-mount 110 blocks at both ends. Support all cables with split mess-pulling grips in the vertical backbone pathway segments.
- b. Provide 100pr cabling from the MDF rooms in each building to main telecom room in the Core 6 building and terminate on electrical protector blocks at both ends for the cabling from Adler to the Core 6 building (OSP copper cable will be required for this run, whereas only plenum rated copper cabling is required for the connection to the G-Wing from the Core 6 building Main Telecom Room. Refer to the electrical drawings for routing details to the Core 6 building. The pathway from the Adler building will be done via an underground duct bank to the Core 6 building, The pathway from

the G-Wing to the Core 6 building Main Telecom Room will be done via j-hooks on the 3rd floor of G-Wing down to the 1st floor ceiling to the existing "bridge" to Academic the Building. Utilize existing cable tray within the E-Wing down a conduit sleeve to the basement Main Telecom Room.

8. Optical Fiber OFNP Backbone Fiber Cables:

- a. Provide 50-Micron multi-mode and Single-Mode optical fiber cable from the TSER/MDF room to the telecommunications/IDF room as shown as shown on IT/Telecom drawings. Terminate all cables with the appropriate fiber connectors and mount in optical fiber patch panels. Utilize the inter-floor sleeves for the routing of cables. Support all cables with split mess-pulling grips in the vertical backbone pathway segments.
- b. Provide indoor/outdoor plenum rated armored fiber optic tie cabling from the MDF rooms in each building to main telecom room in the Core 6 building and terminate fiber cabling with LC connectors and mount in fiber optic patch panels at both ends. Refer to the electrical drawings for routing details to the Core 6 building. The pathway from the Adler building will be done via an underground duct bank to the Core 6 building, The pathway from the G-Wing to the Core 6 building Main Telecom Room will be done via j-hooks on the 3rd floor of G-Wing down to the 1st floor ceiling to the existing "bridge" to Academic the Building. Utilize existing cable tray within the E-Wing down a conduit sleeve to the basement Main Telecom Room.

9. Connectors

- a. Dry Wall, Wall Mounted/Furniture Mounted Telecommunications Outlet:

Provide Category 6 8-pin modular connectors for all Category 5e & 6A cables installed under this work. Provide an accompanying faceplate and/or furniture mounting plate at the appropriate outlet location as shown on the Telecom Distribution plan Drawings. Install faceplates level and align to adjacent outlet faceplates. Coordinate the color of the connectors with the corresponding cable, and be consistent throughout. Coordinate the color of the wall plate with the Architects.
- b. Fiber Connectors:

Provide LC connectors for Single-Mode and Multi-Mode optical fiber cabling.

D. Ladder Rack Cable Tray

1. Provide ladder type cable tray in the IDF and IDF/MDF rooms to support cabling entering the IDF and MDF rooms. Mount cable trays overhead as described on the IT Distribution Drawings. Coordinate with mechanical and electrical trades. Follow manufacturer installation instructions. Provide heavy-duty butt-splice-kits where cable tray lengths require the joining of two sections. Provide threaded-rod-ceiling-kits, spaced 5-feet on center, and/or end-foot-kits to support the cable tray overhead. Provide extension horns/retaining post for the ladder type tray, spaced at every two feet.

Ground each cable tray section to the next where butt splice kits are required. Ground each cable tray to the nearest grounding busbar located with the respective room. Coordinate exact dimensions to be determined during the shop drawing process.

2. Ladder rack shall be attached to all data racks installed in the TR using Chatsworth cable runway elevation kit up to 15cm high black (product # 10506-706) and Chatsworth cable runway mounting plate (product # 10595-712.)
3. Provide ladder type cable tray vertically on the main wall, in all IDF and MDF/TSER rooms, which cables "waterfall down". Use cable tray to support cables between wall mounted termination blocks and the ceiling and from the ceiling to the horizontal cable tray. When supporting cables on the wall use VELCRO tie wraps only.

E. Patch Cords:

1. Furnish for the Owners use, provide (2) patch cords per each cable installed in the following lengths:
 - a. 25% 3-foot, 50% 7-foot and 25% 14-foot 4pr Category 6A & 5e UTP RJ45 to RJ45 patch cords. Exact color and length to be determined by Ramapo College +/- 1-2 feet.

3.06 GROUNDING

- A. In addition to the normal electrical ground system, a Telecommunications Main Ground Busbar (TMGB) and a Telecommunications Ground Busbar (TGB) system are required per ANSI/EIA-STD-J-607-A. These grounding systems shall be installed to support the telecommunication infrastructure only.
- B. A TMGB shall be located in the Main Telecommunication Room (MTR/DF). The TMGB is to be bonded to the Main Building Grounding System and to building steel or ground rod by conventional welds, exothermic welds clamp-and-braze method, or UL approved compression type connectors where practical. TMGB shall be bonded to both building steel and ground rod if Main Building Grounding System does not have a sufficient ground rod. The connection between the TMGB and the bonding point shall be 6 AWG copper ground wire, or larger as required. Exothermic welds are the preferred method.
- C. In each TR, a TGB shall be installed. The TGB's shall be bonded to the electrical panel serving the rooms where the TGB is installed, bonded to building steel, and bonded in series to the main TMGB.
- D. All TMGB and TGB's shall be labeled in accordance with TIA/EIA 606-A.
- E. Communications bonding relies on short direct paths that have minimum resistive and inductive impedance:
- F. Bonding conductors shall be routed with minimum bends or changes in direction.
- G. Bonding connectors shall be made directly to the points being bonded, avoiding unnecessary connections or splices.

- H. All ground attachments shall be properly tagged and labeled in accordance with TIA/EIA-606-A. Do Not Disconnect tags shall be attached to each ground attachment.

3.07 FIRESTOP

- A. 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 of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.
- B. 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 hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.
- C. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, ladder racks, etc. entering or residing in the TR shall be grounded to the respective TGB or TMGB using a minimum #6 A WG stranded copper bonding conductor and compression connectors.
- D. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape.

3.08 CABLE TESTING

A. Testing Equipment

- 1. Ramapo College requires the installation contractor to purchase two types of testing tools for this project. A copper Level 3 tester and a fiber testing kit. Both tools will be used to do the testing on the project. The Installer (The telecommunications contractor) will confirm that tester is flashed with the most recent software. At the conclusion of the project, the Installer will provide and turn testers over to Ramapo College. Specifications for the testers are listed below.
- 2. Copper Tester:
 - a. JDSU Certifier 40G, JDSU part # NGC-4500 Copper Tester to be utilized and provided to the college upon completion of the project.
 - b. The tester must have a 1,600Mhz frequency range to support future cabling standards.
 - c. The tester must have the ability to view full results at both the remote and local ends.
 - d. The tester must allow for modification of cable names at both the remote and local ends.
 - e. The remote and local unit must both be touch screen.
 - f. The tester must be able to support Class FA Cabling.
 - g. The tester must be able to test while plugged into AC power.

- h. The tester must have 8+ hours of battery life without changing the battery with the remote.
 - i. The tester must have on board test storage of 2000+ Cat 6 tests.
 - j. The tester must have a USB port for easy file transfer.
 - k. The tester must allow for software and firmware upgrades via USB.
 - l. The tester must allow for replaceable permanent link test cables.
 - m. The tester must have a Cat-6A test time of 9 seconds or less.
 - n. The tester must have a Tier I fiber test time of 8 seconds or less.
 - o. The tester must have road-mapped the future Capability to accept digital fiber inspection probe via USB with automatic pass/fail to IEC-61300-3035 criteria.
3. Provide and Utilize Fiber test kit FIT-S205-PRO Fiber Inspection and Cleaning: All-In-One Fiber Inspection, Cleaning, and Test Kit:
- a. The kit must have a power meter, scope, display, visual fault locator (VFL), and cleaning tools in an all in one hands-free device to improve workflow.
 - b. The kit must come with a hands-free designed bag to ensure efficient, fast and seamless operation.
 - c. The kit must include 1.25mm and 2.50mm cleaning tools for both the patch-cord and bulkhead.
 - d. The kit must include both a probe scope and a patch-cord viewer.
 - e. The kit must include a VFL with both 2.50mm and 1.25mm adapters.
 - f. The tool must have inspection tips available for any military connector application including 38999, TFOCA, Ribbon, and ARINC.
- B. Pre-Installation Testing:
- 1. Visually inspect all cables, cable reels and shipping cartons to detect any damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.
 - 2. When post-manufacture test data has been provided by the manufacturer on the reel or shipping carton, submit copies to the engineer prior to installing the cables.
 - 3. Mark reels as tested/inspected and submit associated test results to engineer.
 - 4. Coordinate cable terminations, hardware, and testing with the Ramapo Telecommunications project management team and their contractors.
- C. Post-Installation Testing:

1. Conduct cable testing as described below upon completion of installation. Fully test completed systems. Partial or statistically sampled testing is not acceptable.
 2. For 4-pair UTP cabling, in addition to the end-to-end test for continuity, ground fault proper cross connection, shorts and crossed pairs for each cable pair/conductor, test for length, capacitance, attenuation, noise, resistance, and next with injected standard signals. Utilize automated test equipment (see below) for all 4-pair UTP cable testing to allow for single-pass testing of all measured parameters. Test all horizontal, 4-pair cables bi-directionally, in accordance with the requirements of EIA/TIA 568B.1,B2-1 for Level III testing.
 3. All 4-pair Category 5e & 6A UTP cabling shall be tested as a basic (permanent) link with the following minimum tests required:
 - a. Wire Map
 - b. Length
 - c. Attenuation
 - d. NEXT (Near end crosstalk)
 - e. Return Loss
 - f. ELFEXT Loss
 - g. Propagation Delay
 - h. Delay skew
 - i. PSNEXT (Power sum near-end crosstalk loss)
 - j. PSELFEXT (Power sum equal level far-end crosstalk loss)
 - k. Remove all defective cables from the cable pathways. Do not abandon cables in place.
 - l. The Owner reserves the right to observe the conduct of any or all portions of the testing process.
 4. The Owner further reserves the right to conduct using contractor equipment and labor, a random re-test of up to five (5) percent of the cable plant to confirm documented test results.
 5. All test results and corrective procedures are to be documented and submitted to the Owner within ten (10) working days of test completion.
 6. Be prepared to conduct on-the-spot cable tests and effect cable plant repairs, as necessary. Successful equipment performance tests do not relieve the Contractor from the specified testing, repair, and documentation requirements.
- D. All UTP cables. Provide test reports created by automated cable tester for each tested cable.
- E. Fiber Testing shall be in conformance with the following:

1. All fiber testing shall be performed on all fibers in the completed end to end system. There shall be no splices unless clearly defined in the specifications. Testing shall consist of an end to end power meter test performed per EIA-TIA-455-53A. The system loss measurements shall be provided at 850 and/or 1300 nanometers for multimode fibers and 1310 and/or 1550 nanometers for single mode fibers. These tests also include continuity checking of each fiber.
2. Backbone and Outside Plant fiber cabling shall be tested at 850 nm and 1300 nm for multimode and or 1310 and 1550 nm for single-mode in both directions.
3. Test set-up and performance shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, Method B.
4. Where links are combined to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. ONLY LINK TEST IS REQUIRED. The contractor can optionally install patch cords to complete the circuit and then test the entire channel. The test method shall be the same used for the test described above. The values for calculating loss shall be those defined in the ANSI/TIA/EIA Standard.
5. Attenuation testing shall be performed with an approved hand held tester described above.

3.09 SYSTEM DOCUMENTATION

- A. Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to Ramapo College for approval. Documentation shall include the items detailed in the sub-sections below.
- B. Documentation shall be submitted within ten (10) working days of the completion of each testing phase (e.g. subsystem, cable type, area, floor, etc.). This is inclusive of all test result and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 working days of the completion of each testing phase. At the request of Ramapo College, the telecommunications contractor shall provide copies of the original test results.
- C. Ramapo College may request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by Ramapo College, including a 100% re-test. This re-test shall be at no additional cost.

3.10 TEST RESULTS

- A. Test documentation shall be provided on disk within 30 days after the completion of the project. The disk shall be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) J.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model

number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.

- B. The field test equipment shall meet the requirements of ANSI/EIA-568-B including applicable TSB's and amendments. The appropriate Level III tester shall be used to verify Category 5e & 6 cabling systems.
- C. Printouts generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. The telecommunications contractor must furnish this information in electronic form (CD or DVD).
- D. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.
- E. Marginal (PASS*) test results will not be accepted.

3.11 CABLE IDENTIFICATION SYSTEM

- A. Use color coding in accordance with the EIA-606 standards.
- B. All horizontal cabling shall be labeled with machine generated black uppercase lettering printed on three (3) rows on a permanent self-laminating adhesive label stock.
- C. Labels shall be placed on both ends of the cable within 12 inches from the point at which the cable jacket is opened to expose individual copper pairs or fiber strands, or from the connector, outlet boxes or terminal block. All labels shall be visually and physically accessible at work locations, and when cables are mounted to frames, blocks, racks, etc. where the proper mounting procedure allows ready access to individual cables.
- D. The cable identification numbers will be developed and will be related to the termination location within the Telecom Room (TR). Each cable number indicates the floor, the block or panel and the termination sequence or port number. This number will be the cable ID.
- E. After pulling and testing cables, place the appropriate cable label. Temporary tags are acceptable for use during construction. All temporary tags must be removed and replaced with permanent machine generated labels prior to acceptance.

If at any time during the job of permanent cable label becomes illegible or is defaced or removed, immediately replace it with a duplicate pre-printed cable label.

END OF SECTION