

Rio Rancho Public Schools- Information Technology Services
Network Infrastructure Cabling
Requirements and Technical Specifications

CONTRACTOR REQUIREMENTS AND PROJECT PROCEDURES

A: Electrical Codes: All work shall be executed in accordance with the current **National Electrical Code**, as amended by the **New Mexico State Electrical Code**, local and state ordinances, and FCC regulations governing the particular class of work involved. The contractor shall be responsible for the final execution of the work under this heading to suit these requirements. In the event of a conflict between the various codes and standards, the more stringent shall govern. Upon completion of the various parts of the work, the installation shall be tested by the constituted authorities and approved. Upon completion of the work, this contractor shall obtain and deliver to the RRPS final certificates of acceptance. The contractor shall hold and save the Board of Education free and harmless from liability of any kind arising from his failure to comply with codes and ordinances. Contractors are required to own and maintain the most current edition of the NEC Code Book.

B: Telecommunications Standards: All work and materials shall comply with the recommendations and standards as set forth in the latest edition(s) of IEEE and ANSI/EIA/TIA Telecommunication Standards. If substitute materials, equipment or systems are installed without prior approval or are installed in a manner not in conformance with the requirements of these specifications and for which the contractor has not received written approval, removal of all the unauthorized materials plus the re-installation of those indicated or specified shall be provided at no extra cost to the owner. Unless a specific date of issue or revision is cited, the documents listed below are the current issue in effect. The requirements contained become part of the contract to the extent specified herein. Except as may be modified by the governing codes and by the Contract Documents, the contractor will comply with all District and RRPS – ITS Telecommunications Division design and installation standards.

Contractors are also required to own and maintain the most current edition of BICSI Telecommunications Distribution Methods Manual (TDMM), and the United States National CAD Standards manual.

Listing of Reference Documents:

- National Electrical Code (NEC)
- Electronics Industries Alliance / Telecommunications Industry Association (568, 569, 606, 607, TSB40)
- Institute of Electrical and Electronics Engineers, Inc. (IEEE)
- American National Standards Institute, Inc. (ANSI)
- BICSI's Telecommunications Distribution Methods Manual (TDMM)
- BICSI's Network Design Reference Manual (NDRM)
- BICSI's Wireless Design Reference Manual (WDRM)
- BICSI's Customer-owned, Outside-Plant Design Manual (CO-OSP)
- National CAD Standard (NCS)
- National Electrical Manufacturers Association (NEMA)
- American Society of Testing Materials (ASTM)

C: Licensing and Personnel Qualifications: Contractor shall be properly licensed, under the New Mexico Construction Industries Regulations, for all aspects of work requirements, including at least one New Mexico Electrical Licensee - EE98. Actual work is to be performed only by workmen properly licensed and skilled in applicable trade. No one under age 18 is to be employed on any RRPS project. Contractor must employ two (2), full-time BICSI Registered Communication Distribution Designer (RCDD) on the local payroll. The contractor's exclusive Point-of-Contact will be their RCDD(s). Contractors are not permitted to borrow, lease, sub-contract, form partnerships or establish retainers with any individuals or with other companies in order to fulfill the licensing and qualifications of this contract. Value-add preferences will be considered for contractor's RCDD/Specialty certifications, such as Network Transport Specialist (NTS), Wireless Design (WD) or Customer-Owned Outside Plant (CO-OSP).

Contractor must use Journeymen installers who have and maintain BICSI Technician certifications or Apprentice installers with a minimum of 6 months experience with a BICSI Installer Level 1 certifications at all RRPS job sites. Contractors must maintain current manufacture certifications. Contractors are required to establish and maintain a local office with sufficient and qualified personnel to support this contract.

D. Permits and Reimbursement of Fees: It is the contractor's responsibility to secure in a timely manner and pay for all necessary permits required for any particular job. RRPS will reimburse the contractor the cost of job permits. These reimbursements must be pre-approved, with no markup and must be added to invoices as a separate and documented line item. RRPS does not pay for business licenses, contractor licenses, certifications, or renewals of same, memberships in professional affiliations, and similar costs of doing business, which are the contractor's obligation to secure and maintain. Contractor will pull permits from the State of New Mexico's Construction Industry Department (CID) and will also be subject to state inspections for code compliance and/or any other relevant aspect of the job. The contractor will coordinate state inspections with the RRPS – ITS Department.

E. Supervision: The work shall be performed under the direction of a qualified project manager experienced in the trade who shall be thoroughly familiar with the complete requirements and details of the work and shall normally be present on the site during the execution of the work. The cost of such a project manager will be considered as a part of the contractor's overhead and may not be billed as a separate charge. If the project manager should perform actual work at the site, contractor may bill at the appropriate job classification for the hours worked.

F: Project Performance: Work performed under this contract is subject to RRPS-ITS strict internal controls and industry standards. RRPS may elect to perform all or a portion of any project utilizing this contract, or to bid any project separately. Past work performance and work history may be used as a criterion to bid separate projects under this contract.

G: Project Procedures: Upon project initiation, the contractor shall coordinate all projects with RRPS – ITS Department. Contractor coordination and collaboration is also required with all other project affiliated vendors and contractors. RRPS-ITS will assign an ITS Department Designee as a primary Point of Contact (PoC) for each project. The Designee will plan, define and write the SoW and will review each quote prior to requisition submittals. Upon project initiation, contractor will coordinate project staging and scheduling with site administrators and educational technicians. Upon completion of a project, the Designee will perform a final inspection and list any punch list items to be resolved by the contractor. Contractor will provide applicable As-Builts within 10 business days and warranties within 20 business days. In cases where projects require utility spotting, contractor shall make all provisions thereof and pathways must be pre-approved prior to project initiation.

H: Work Request(s) NOT Defined in Scope of Work: Contractor shall be held accountable to NOT perform work requests which are clearly beyond the defined SoW. Contractor has the responsibility of calling such violations to the attention of the RRPS – ITS Designee. Violations may become

the personal liability of the individual requesting such work and RRPS will be under no obligation to make payment.

I. Work Scheduling: All work shall be, insofar as possible, performed during normal operating hours (7:00am to 5:00pm), Monday through Friday. However, contractors are not permitted to work during testing schedules. After hour and weekend shifts are acceptable if necessary, to complete a project in the most expeditious and feasible manner. After hour and weekend shifts must be pre-approved by the School-Site Administrator and RRPS-ITS Department.

All workmen shall sign in at the administrative office when arriving at the site, and sign out when leaving. A list of worker's name(s) and job classifications(s) shall be included. Site workers must wear distinctive clothing identifying the company e.g., shirt with company logo and a company badge. This requirement includes sub-contractors. A reasonable code of conduct must be observed. Profanity and other forms of vulgarity will not be tolerated.

J. Support Service: The contractor shall be able to provide timely service in the event of needed repairs, malfunctioning of equipment, warranty problems and similar.

- **Required Test Equipment** - Contractor shall own Cable Testers and Analyzers, Network Testers (Fluke or Wirescope), power source and light meter, Visual Fault Locators and an OTDR.
- If a **major malfunction** of the equipment occurs, the contractor shall respond onsite to the customer within four (4) hours from the time the contractor first receives the customer's request for maintenance and will complete such repairs within 48 hours. The contractor shall be able to respond to multiple major malfunction calls at any one time. Overtime hours must receive prior approval from IT Designee.
- If a **minor malfunction** occurs, the contractor shall respond to the customer during normal working hours within 24 hours from the time the contractor first receives the customer's request for maintenance and shall complete such repairs within 48 hours. The contractor shall be able to respond to multiple minor malfunction calls at any one time. Procedures defined under this Paragraph 4 are applicable.
- **Emergency Requests** - Contractor will be expected to respond immediately to a request for work to be performed.

K. Interrupting Services: Absolutely no interruption of the existing services will be permitted without prior approval of RRPS – ITS Department.

L. Safety: The contractor shall take all necessary precautions to protect the site occupants from hazardous conditions. The contractor shall abide by all Occupational Safety and Health Administration (OSHA) regulations and all State of New Mexico Environmental Improvements Board Occupational Health and Safety regulations that apply to this contract. The contractor shall defend, indemnify, and hold the Board of Education and its agents, officer, administrators, and employees free and harmless against all claims, loss, liability, and expense resulting from any alleged violations(s) of said judgments, court costs, and attorneys' fees. The contractor also shall be responsible for damage to persons or property that occurs as a result of his fault or negligence, or that of his employees, agents, and/or subcontractors, in connection with this contract.

M. Emergency / Lockdown Procedures: In case of a work related emergency or accident, the contractor shall immediately contact 911 as applicable. The contractor shall also contact the site administrator, RRPS - ITS Director and Facilities Director. In case of a site lockdown, contractor employees shall adhere to all RRPS procedures.

N. Guarantee: The contractor shall guarantee all materials, equipment and workmanship furnished and installed under this contract to be free from all defects and shall agree to replace at their expense,

without expense to RRPS, any and all defective equipment, parts, etc., within 12 months after service as accepted by RRPS. This excludes normal maintenance and daily servicing of equipment, which is RRPS-ITS responsibility.

O. Protection of Work, Materials and Adjacent Surfaces: The contractor is responsible for the protection and security of all materials, tools, equipment and installed work until the final acceptance of the work has been completed. RRPS will not be held responsible for lost or stolen equipment, tools or materials from job sites. The contractor shall take all measures necessary during the course of work to protect existing property including adjacent surfaces, equipment, electrical systems, piping, furnishings, and landscaping from damage during the course of the work and shall repair promptly any such damage at his own expense and to the satisfaction of RRPS.

P. Clean-up: The contractor shall keep the site reasonably clean and neat during the execution of work, remove accumulations of debris at the end of each day and leave all surfaces and areas completely clean at final completion.

Q. Final Acceptance: The contractor shall notify the RRPS-ITS Designee when project is ready for final inspection, whereas arrangements will be scheduled. The RRPS-ITS Designee will either accept the project as complete and satisfactory or provide a written list of items to be corrected and/or completed. The RRPS-ITS Designee and Contractor will sign-off on the Scope of Work as declaration of project completion.

S. Releases of Lien: If applicable, the contractor shall provide unconditional releases of lien from all subcontractors and major material suppliers when submitting his final invoice at the end of each project. When applicable, final invoice for each project shall be accompanied by all required guarantees, operations manuals, as-builds and/or other submittal required by the contract.

T. Surplus Equipment: Upon acquiring any surplus equipment from a project, the contractor will promptly deliver all surplus items to the RRPS – ITS Department.

TECHNICAL SPECIFICATIONS

A. Manufacturer Specifications: Based on in-depth, internal studies and extensive evaluations, RRPS-ITS has specified the following approved manufactures for all district cabling and infrastructure/equipment projects:

UTP – CAT 5e/6/6A, Cabling & Patch cables	CommScope – Uniprise/Systimax	Leviton/Berk-Tek or OCC Solutions
UTP – CAT 5e/6/6A, Connectivity	CommScope – Uniprise/Systimax	Leviton/Berk-Tek or OCC Solutions
UTP - High-pair count, Cabling	Superior / Essex	Belden
Fiber – 62.5/125 MM, 50/125 MM, 9/125 SM micron Cabling & Patch cables	Optical Cabling Corp./CommScope	Leviton
Fiber- Connectivity	Optical Cabling Corp./CommScope	Leviton
Fiber - OSP Enclosures	Optical Cabling Corp./CommScope	Leviton
Coaxial - Cabling	CommScope or General Cable	Leviton/Berk-Tek
Coaxial - Connectivity	T&B/Ideal/Leviton	Corning-Gilbert
Coaxial - Signal Components	Blonder-Tongue	Holland
Equipment Racks - Floor Mount	Chatsworth Products Inc.	APC-Schneider Electric
Equipment Racks - Wall Mount	Chatsworth Products Inc.	OCC - TERAX
Equipment Racks - Portables	Engineered Data Products	Great Lakes DC#09568
Media Converters	SignalMax	TBD
Lightning Protectors	Porta Systems	TBD
Battery Backups - UPS	APC –Schneider Electric	With management cards
Intercom Systems - Cabling	CommScope/General Cable	Leviton/Berk-Tek
Security Systems - Cabling	CommScope/General Cable	Leviton/Berk-Tek

B: Specification Deviations: Technical Specifications are binding. However, in instances where a major irresolvable problem of an approved manufacture has occurred, RRPS-ITS retains the right to specify an alternate manufacturer.

C: Cabling Warranties: Contractors are required to provide a Manufacture Warranty Certification for all completed cabling installation projects. This warranty shall be hand-delivered to the RRPS–ITS Department no later than one month after project completion.

D. Materials, Delivery, Storage and Handling: The contractor shall be responsible for the receipt, safe storage, and delivery of materials and equipment to the job site. All products and materials will be shipped and stored in a manner that will protect from damage, weather and entry of debris. Damaged items will not be installed and contractor will take immediate action to obtain replacement. Materials (except bulk materials) shall be delivered in the manufacturer's unopened container, fully identified with the manufacturer's name, trade name, type, class, grade, size and color.

Any materials required to be stored shall be suitably sheltered from the elements. Items subject to moisture damage kept in dry storage. On-site secure storage area may or may not be available. The contractor shall not store or place materials on RRPS floors in excess of the floors' designed load limits.

E. Procurement of Other Materials: RRPS-ITS reserves the right to procure any material through normal procurement channels and to furnish such materials to contractor for installation. Any such materials shall not be marked up by the contractor in any manner. RRPS-ITS may from time to time order parts or other materials only from this contract as a convenience or because of the nature of a particular work order, but the general intent is for the contractor to supply all materials and labor for a given job. Contractor and RRPS-ITS shall be in agreement as to exact parts/materials to be used prior to commencement of any work.

F. General Installation Requirements: Contractor will adhere to any and all District Standards for RRPS-ITS – Cabling Installations. The locations of telecommunications outlets (TO), enclosures, panels, equipment racks and other related products as indicated on project drawings will be understood to be approximately correct and will be subject to such revision as may be found necessary or desirable at the time of installation. Particular caution will be exercised with reference to location of surface raceways, power poles, floor boxes, TO's, etc., with precise locations accepted by the owner before proceeding with the installation. The contractor shall ensure that the maximum pulling tensions of the specified distribution cables are not exceeded and that cable bends maintain the proper radius during the placement of facilities. Failure to follow the appropriate guidelines will require the Contractor to provide in a timely fashion the additional material and labor necessary to properly rectify the situation. This shall also apply to any and all damages sustained to the cables by the contractor during the implementation.

Installers must be qualified to perform the work and be knowledgeable in the following activities:

- Cable installations and terminations for specified copper, fiber optic and coaxial cables.
- ANSI/EIA/TIA 606A Administration labeling and documentation.
- Bonding and grounding where required.
- Testing of copper and fiber cabling for performance compliance.

Industry Cable Installation Standards as well as manufacturer's instructions will be used for in-process quality control and final acceptance of the work installation. Installers will be required to provide and use the proper tools in the performance of each activity. The tools must be in good working order. The owner reserves the right to review the tool lists and tool maintenance procedure for the contractor. RRPS-ITS reserves the right to bring in the manufactures representative to inspect the workplace and quality of workmanship.

G. Horizontal Cabling:

- Contractor shall supply horizontal cables to connect each Telecommunication Outlet to the backbone subsystem on the same floor.

- The minimum type of horizontal cabling shall be rated as Category 5e/6/6A UTP.
- Voice drops shall have "White" jacketed cable and wall jacks.
- Data drops shall have "Blue" jacketed cable and wall jacks.
- The Category 5e/6/6A UTP cables shall be run using a star topology format from Telecommunications Room on each floor or classroom wing, to each individual Telecommunication Outlet.
- All cable routes shall be approved by RRPS – ITS Designee prior to installation of the cabling.
- The maximum length of each permanent link from the Telecommunication Closet on each floor to the Telecommunication Outlet shall not exceed 295 ft (90 m).
- Contractor shall observe the bending radius and pulling strength requirements of the Category 5e/6/6A UTP cable during handling and installation.
- Each cable between the termination block and the information outlet shall be continuous without splices.
- Plenum rated cable will be used in all appropriate areas.
- The Category 5e/6/6A UTP cable shall be Underwriters Laboratories (UL) listed type MPR, MPP, CMR, or CMP.
- Conduit runs installed by the contractor shall not exceed 100 feet or contain more than two 90 degree bends without utilizing appropriately sized pull boxes.
- All cabling terminations will comply with ANSI/EIA/TIA 568A/568B Standard and utilize 66/110 blocks and IDC type jacks.
- All voice (analog/digital cabling-66 blocks) and data (data cabling-110 blocks) cabling shall be terminated using 66/110 blocks and IDC type jacks and patch panels.
- All face plates shall be stainless steel type.
- Avoid drop locations near any heat and water sources and cubbies and coat rack areas.

H. Patch Cables:

- All patch cords shall exceed ANSI/TIA/EIA and ISO/IEC Category 5e/6/6A Specifications
- Patch cords shall be UL listed and UL-C certified.
- Patch cables for Voice drops shall have "White" jacketed cable.
- Patch cables for Data drops shall have "Blue" jacketed cable.
- Patch cables for WAP drops shall have "Black" jacketed cable.
- Patch cables for CCTV IP Cameras shall have "Yellow" jacketed cable.
- All fiber patch cables shall be labeled to identify associated link designation.

I. Backbone Cabling:

- Minimum, 6 – strand, tight-buffer fiber backbones between Distribution Frames.
- Aerial, OSP cables shall be made of an indoor/outdoor/plenum rated cabling.
- Contractor shall supply and install the transmission media and terminating hardware to provide interconnection between the MDF and each IDF in a star topology.
- All cable routes to be approved by RRPS-ITS project manager prior to installation.
- Contractor shall observe the bending radius and pulling strength requirements of all backbone cables during handling and installation.
- All cable routes to be approved by project manager prior to installation.
- Contractor shall install electrical protection devices for OSP copper trunk cabling.
- Contractor shall install a tracer wire in all applicable UG conduits.
- Use self supporting cable rather than lashed cable if: (1) It is available in the required size, (2) there is no existing strand for voice and data, (3) new cable cannot be lashed to existing cable unless approved by an RRPS-ITS representative, and (4) adequate space exists for growth.
- Aerial connecting hardware and enclosures must be UV and NEMA4 rated.

- All clearances and separations must meet NEC and local codes. NO contractor will install any cable on the roof/s of any RRPS facilities, or make any roof penetrations unless given written permission by RRPS – ITS Department.
- Backbone fiber cable runs will include a minimum, 30-foot service loop at MDF and minimum, 10' service loop at each IDF.

J. Fiber Specifications:

Multi-mode - 50 micron Fiber

Minimum 10 Gigabit bandwidth capacities
 300 meters (984') maximum distance
 LC type terminations and connectors
 "Aqua" colored patch cables

Single-mode Fiber

Minimum 10 Gigabit bandwidth capacities
 40 kilometers (~25 miles) maximum distance
 LC type terminations and connectors
 "Yellow" colored patch cables

K. Coaxial Distribution Overview:

The typical A/V distribution cabling standard for RRPS-ITS is based on a hybrid design, which combines the "MDF/IDF" star topology with the "Trunk and Tap" daisy-chain design. Homerun trunks and backbones are specified between the MDF and each IDF and are typically rated as Series 11 coaxial cable. Feeder cables are specified from the IDF and tapped or split to each TV outlet. Feeder cables are typically rated as Series 6 coaxial cabling. Fiber optic cabling is specified when distribution distances have exceeded the coaxial cabling limitations. Plenum and OSP rated cabling shall be used in all applicable areas. Coaxial connectors shall be compression type.

L. Intercom and Security Distribution Overview: The typical distribution cabling standard for RRPS-ITS intercom and security systems are primarily based on manufactures requirements. Contractor is required to coordinate each intercom and security cabling installation project with associated manufactures and their product resellers for cabling specification requirements.

M. Wireless Specifications: Physical plant design locations of a wireless network will be provided by the RRPS-ITS Designee. Drop locations for access points are typically installed at 96" AFF or at RRPS-ITS desired location/height. Contractors shall install wireless access enclosures in gym environments. These enclosures must be non-metallic.

N. Pathways: In suspended ceiling and raised floor areas where duct, cable trays or conduit are not available, the contractor shall bundle, 50 cables or less, with cabling Velcro. Cable bundles shall be supported via "J" hooks attached to the existing building structure and framework at a maximum of five foot (5') intervals. The contractor shall adhere to the manufacturer's requirements for bending radius and pulling tension of all data cables. Cables shall not be attached to or supported by fire sprinkler heads or delivery systems or any environmental sensor located in the ceiling air space. Cables shall not be attached to ceiling grid supports or laid directly on the ceiling grid. OSP aerial pathways shall consist of rigid conduit masts and 30' utility poles, not to exceed a span of 75,' and wedge clamps as secure attachments to aerial messengers. OSP - Riser racks must comply with RRPS – ITS standards. Contractor shall coordinate riser rack design and installation with RRPS – ITS Designee for project specifications and approvals.

O. Portable Buildings: Connections to portable buildings shall be made via aerial or underground cabling. Contractor shall coordinate portable building projects with the RRPS – ITS Designee for design and installation specifications. The following is a list of aerial specifications for a Quick-Disconnect Industrial connector for fiber backbones installations:

Part#	Manufacturer w/ Description
TBD	OCC, LC, MM Industrial plug
TBD	OCC, LC, MM Industrial outlet
TBD	OCC, Outlet Dust Cap
TBD	OCC, Plug Dust Cap
OC-040818-01	OCC, 2 strand, 62.5 Multimode Fig. 8, w/ Blue jacket
BX__-WLS-900-OFNR	OCC, Multi-strand, Indoor/Outdoor/Plenum rated

P. Equipment Racks and Enclosures: The equipment racks shall be made of lightweight steel and include mounting hardware. Enclosures shall be lockable, vented, include fan kits (50 cfm max per fan), and mounted in compliance with NEC clearance codes and ANSI/EIA/TIA mounting standards. Ladder rack is required for any applicable floor-mounted racks. All racks shall be grounded to the isolated ground bar within the TR / ER using a standard ground lug and #6 jacketed green cable. Contractor shall install Surge Protected Device (SPD), electrical receptacles as required to power up equipment in MDF and IDF racks and enclosures.

Q. Battery Backups / UPS: For projects requiring battery backups, contractor shall coordinate with RRPS – ITS Designee for size and type specifications. Typical UPS installations will be mounted at the bottom of a 4-post rack and serve power to rack mounted, vertical and horizontal power strips. Electrical receptacles for UPS's shall be installed on the ladder rack and/or on adjacent walls at 84" AFF, below ladder rack. UPS's shall have installed an SNMP network card, which will monitor input power and ambient temperature.

R. Administration

Identification

All cables and conduits shall be labeled by the contractor at each exposed point or end with a unique identifier and a description of the cable function to ease individual cable tracing based on ANSI/EIA/TIA 606A and District standards. Labels shall be permanent, waterproof, and shall not be removable by normal cable handling or normal operations.

As-Builts Requirements

Contractor is required to provide As-Built drawings at the completion of each project. They must be of professional quality, capable of being reproduced and with reasonable archival standards. As-Builts shall be delivered within 10 working days after project completion. Hand-drawn As-Builts are not acceptable. Upon completion of the project, paper and electronic copies of the As-Builts are to be provided to the RRPS – ITS Department, as well as a hard copy to the site Educational Technologist. As-Builts are required to be drawn in the latest version of Autodesk's AutoCAD software and comply with the United States National CAD Standard as follows:

- ES - Electrical Site Plan
- TN-DATA, Telecommunications Network Layer
- TT-PHON, Telecommunications Voice Layer
- TA-CATV, Telecommunications Audio/Visual Layer
- TI-INT, Telecommunications Intercom Layer
- TY-SEC, Telecommunications Security Layer

- Labeling compliance with ANSI/EIA/TIA 606A standards and District standards
- Electronic As-Builts will be sent as a complete set which include both the .dwg and .dwf formatted files

S. Electrical, Grounding and Bonding Requirements: The contractor shall be responsible for providing an approved ground at all newly installed distribution frames, and or insuring proper bonding to any existing facilities. The contractor shall also be responsible for ensuring ground continuity by properly bonding all appropriate cabling, closures, cabinets, service boxes and framework. All grounds shall consist of #6 AWG copper wire and shall be supplied from an approved building ground and bonded to the main electrical ground. Bonding and grounding shall be in compliance with the NEC and ANSI/EIA/TIA 607 standards.

When required by local code, provide a Telecommunications Bonding Backbone utilizing a #6-AWG or larger bonding conductor that provides direct bonding between equipment rooms and telecommunications closets. This is part of the grounding and bonding infrastructure (part of the telecommunications pathways and spaces in the building structure), and is independent of equipment or cable.

As applicable to an RRPS-ITS project SoW, contractor shall install electrical receptacles for computer, network, phones, intercom, security, audio/visual equipment and other IT end-devices.

T. Fire stopping and Penetration Sealants: Sealing of openings between floors, through rated fire and smoke walls, existing or created by contractor for cable pass through shall be the responsibility of the contractor. Any openings created by or for the contractor and left unused shall also be sealed as part of this work. All sealant materials will be installed according to manufacturer's directions and recommendations. No foam sealants are to be used. Contractor is required to provide UL and ATSM approved fire stopping systems to restore fire ratings to all wall or floor or ceiling penetrations. Contractor must provide certification of such fire stopping along with as-built indicating the locations of such penetrations.

The fire rating of the penetration seal shall be at least that of the floor or wall into which it is installed, so that the original fire rating of the floor or wall will be maintained as required by Article 300-21 & 22 of the NEC. Sealing of annular space of conduits is also required.

The sealant shall remain resilient and pliable to allow for the removal and/or addition of cable without the necessity of drilling holes. It shall adhere to itself in order to allow any and all repairs to be made with the same material. It shall allow for vibration, expansion and/or contraction without affecting the seal, cracking or crumbling.

U. Cable Testing and Signal Certifications: Contractor will provide a cable certification from the manufacture based on their warranty period, as proof that the system is fully operational. If at any time during this period, cable or workmanship should be defective, the contractor will repair or replace in a timely manner at no charge. The above-referenced certifications must be delivered to RRPS-ITS no later than 30 days after completion of the project. Test equipment manufacturers may include only Fluke or WireScope. The contractor shall perform the cable tests for all cables specified as follows unless otherwise noted or approved by the owner:

UTP CAT5e/6/6A, Cabling

- All installed cable will be Channel and Permanent Link tested determining continuity, shorts, reversed pairs, split pairs, attenuation, and return loss, NEXT, PSNEXT, ACR, PSACR, ELFEXT and PSELFEXT. The continuity of all grounds and bonds will also be tested.
- All of the installed station cables shall be tested for attenuation loss at 100 MHz and results reported in dB.

- Test 100% of all the station cable runs and provided patch cables for the correct jack pin terminations as specified.

Fiber Optic Cabling

- All multi-mode fiber optic tests will be performed at the 850nm and 1300nm windows in both directions. All single-mode fiber optic tests will be performed at the 1310nm and 1550nm windows in both directions.
- All connectors will be tested and the loss measured in dB, connectors will have a loss of 0.5 dB or less to be accepted.
- All fiber optic links will be tested and the loss measured in dB/KM.
- All fiber optic links will be tested with an Optical Time Domain Reflectometer.
- The length of each fiber optic link shall be recorded.
- End to end testing is considered to be from the equipment end through the cross-connect to the terminal end.

Coaxial Cabling

- A/V cabling systems shall support frequencies between 1Mhz to 1Ghz
- Each TV outlet must be tested for acceptable signal strength of 0-10 db minimum
- Contractor shall install all necessary components to acquire acceptable signal strength

V. Reports and Certifications: The contractor shall be responsible for recording and providing all test data. Copies of all test results are to be submitted to the RRPS – ITS Department in an electronic format and delivered via email. For all fiber optic cables within the required distance, a printout from an Optical Time Domain Reflectometer will be provided and correspond to a labeled fiber cable. All UTP CAT5e/6/6A cable must have an output of the test results with the station ID assigned.