SECTION 00 01 10

TABLE OF CONTENTS

DIVISION 27 – COMMUNICATIONS

SECTION 27 05 00
COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Contractor Responsibility and Qualification
2. Reference Standards and Codes
3. Required Contractor Training
4. Quality Assurance
5. Permits, Fees, and Certificates of Approval
6. Submittals
7. Product Assurance
8. Coordination
9. Pre-installation Conference
10. Alternates, Substitution, and Change Orders
11. Project Management
12. Delivery and Storage
13. Cleaning
14. Painting

B. This Section includes Design-Build work.

1. The intent of Division 27 Specifications and Drawings is to provide a complete and workable facility, with complete systems as required by applicable codes, as indicated and as specified.
2. Include all work specified in Division 27 and indicated on Drawings, including appurtenances, connections, fasteners, and accessories required to make a complete working system, whether indicated or not indicated.

C. The Division 27 Specifications and the accompanying Drawings are complementary, and what is called for by one shall be as binding as if called for by both.

1. Items shown on the Drawings are not necessarily included in the Specifications and vice versa.
2. In case of conflict, Specifications supersede Drawings.

1.02 RELATED SECTIONS

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

B. This Section contains the requirements and responsibilities involved in the scopes described below and all Division 27 Specification Sections.

1.03 CONTRACTOR RESPONSIBILITY AND QUALIFICATION

A. The chosen Communications Contractor (hereafter referred to as Contractor) shall provide a minimum one (1) year warranty on material, installation, and workmanship.

B. The chosen Contractor shall be certified by Accepted Manufacturers to provide a complete communications system and shall provide a Manufacturer supplied minimum 25 Year Warranty

C. Contractor shall provide all components, materials, services, and labor essential for a complete and functional structured cabling system.

D. The Contractor shall be responsible for complying with all local, state, and federal laws and regulations applicable to the work to be performed although said law, rule, or regulation is not identified herein.

E. Examination of building and site shall be the responsibility of the Contractor: Contractors shall examine site and building as required prior to installation to determine any conditions affecting the scope of work. Contact Owner representative for arrangements. All systems and cabling are assumed working and in good condition unless Contractor documents exceptions.

F. Contractor shall call for all inspections required. Final payment of this contract will not be made until final inspections have been completed and all deficient items noted have been corrected.

G. Contractor will respect and protect the privacy and confidentiality of Owner, its employees, processes, products, and intellectual property to the extent necessary, consistent with the legal responsibilities of the State of Oregon and Owner policies.

H. Use of sub-contractors: The Contractor shall inform in writing to Owner's representative and General Contractor about the intention to use sub-contractors and the scope of work for which they are being hired. Owner's representative prior to the sub-contractor's hiring and start of any work must approve the use of sub-contractors in writing.

I. Contractor will be required to provide a sufficient number of technicians for this project to stay on schedule.

J. Contractor shall have a Registered Communications Distribution Designer (hereafter referred to as RCDD) on staff and must be available as needed for design discussions and inspections. Identify the design experience of the proposed RCDD.

K. Contractor shall identify the qualifications of their technician. Vendor shall also identify the type(s) of certifications/testing that its technicians go through before and after being hired on by your company.

L. Contractor must identify plan and as-built documentation processes used by its company, such as AutoCAD, Revit, Visio, and cable records.

M. Installers: Only technicians certified by equipment manufacturer are approved.

1.04 REFERENCE STANDARDS AND CODES

A. Supervisors and lead installers shall have a working knowledge and understanding of the following documents and codes or their most recent updates and shall be familiar with the requirements that pertain to this installation. Installers shall be familiar with and have practical working knowledge of the requirements that pertain to this installation.

B. Codes: Comply with applicable sections of the most recent editions and addenda of following for interior and exterior installations. Ensure you are using the latest and most up-to-date standards regulations applicable.

1. International Building Code (IBC)
2. National Electrical Code (NEC/NFPA 70)
3. National Electrical Safety Code (NESC IEEE)

C. Standards: Comply with applicable sections of the most recent editions and addenda of the following for installations and testing of communications cabling, connectors, and related hardware: Comply with applicable sections of the following for interior and exterior installations.

1. IEEE Std 1100, Recommended Practice for Powering Grounding Sensitive Electronics

2. ANSI/EIA/TIA-455-50B, Light Launch Conditions For Long-Length Graded-Index Optical Fiber Spectral Attenuation Measurements
3. TIA/EIA TSB-140, Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems
4. ANSI/TIA/EIA-455-59A, Measurement of Fiber Point Discontinuities Using an OTDR
5. ANSI/TIA/EIA-455-60A, Measurement of Fiber or Cable Length Using an OTDR
6. ANSI/TIA/EIA-455-61A, Measurement of Fiber or Cable Attenuation Using an OTDR
7. TIA/EIA-526-7, Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant – OFSTP-7
8. TIA/EIA-526-14-A, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant – OFSTP-14
9. TIA/EIA-568-B1.1, Commercial Building Telecommunications Cabling Standard Part 1: General Requirements
10. TIA/EIA-568-B.2-4, Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components
11. TIA/EIA-568-B.3-1, Optical Fiber Cabling Components Standard
12. TIA/EIA-569-A-7, Commercial Building Standard for Telecommunications Pathways and Spaces
13. TIA/EIA-570-A-3, Residential Telecommunications Cabling Standard
14. ANSI/CEA S83-596, Fiber Optic Premises Distribution Cable
15. ANSI/TIA/EIA-526-7, Optical Power Loss Measurements of Installed Single Mode Fiber Cable Plant-OFSTP-7
16. ANSI/TIA/EIA-526-14-A, Optical Power Loss Measurements of Installed Multi Mode Fiber Cable Plant-OFSTP-14A
17. ANSI/TIA/EIA-569-A: - Commercial Building Standards for Telecommunications Pathways and Spaces.
18. ANSI/TIA-568-C.2 Category 6A
19. TIA/EIA-598-B, Optical Fiber Cable Color Coding
20. TIA-604-5-C, FOCIS-5 Fiber Optic Connector Intermateability Standard MPO
21. TIA/EIA-606-A, Administration Standard for Commercial Telecommunications Infrastructure.
22. J-STD-607, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
23. TIA/EIA 758, Customer-Outside Plant Telecommunications Cabling Standard.
24. BICSI: Comply with the most current editions of the following BICSI Design. Reference Manuals:
    a. BICSI – Telecommunications Distribution Methods Manual
    b. BICSI – Installation Transport Systems Information Manual
    c. BICSI – Outside Plant Design Reference Manual
    d. BICSI – Wireless Design Reference Manual
    e. BICSI – Electronic Safety and Security Design Reference Manual
    f. Infocomm/BICSI – AV Design Reference Manual

1.05 REQUIRED CONTRACTOR TRAINING

A. The Contractor shall be fully conversant and capable in the cabling of low voltage applications such as, but not limited to: data, voice, IP based paging systems. The Contractor shall at a minimum possess the following qualifications:

1. Personnel trained and certified in the design of the Approved Manufacturer's Cabling System.
2. Personnel trained and certified to install the Approved Manufacturer's Cabling System.
3. Proof of industry organization accepted certification.
4. The Installer shall show proof of current "Certified Installer" of the approved manufacturer's cabling system via an updated certificate given after attending the appropriate training course or an online re-certification class.
5. Provide references for the type of installation provided in this specification.
6. Personnel trained and certified in fiber optic cabling, splicing, termination and testing techniques. Personnel must have experience using an optical light source and OTDR.
7. Personnel trained in the installation of pathways and support for housing horizontal and backbone cabling.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with contract documents and governing codes and standards.

B. All personnel performing the work of this Section shall be thoroughly familiar with the cabling methods set forth in the latest release of the TDMM (Telecommunications Distribution Methods Manuals).

C. Contractor's RCDD shall review all required work prior to commencing. The Contractor's RCDD shall oversee the installation and will have the end responsibility for the quality of the installation work performed. All submitted designs and or changes to the design must be approved and signed off by the Contractor's RCDD.

D. The installed cabling systems shall not generate nor be susceptible to any harmful electromagnetic emission, radiation, or induction that degrades cabling systems.

E. Expansion Capability: Unless otherwise indicated, provide spare positions in wall fields, cross connects, and terminal strips, and space in cable pathways to accommodate twenty (20) percent future growth in distribution and riser systems.

F. Backward Compatibility: The provided solution shall be backward compatible with lower category ratings such that if higher category components are used with lower category components, the permanent link and channel measures shall meet or exceed the lower channel's specified parameters.

G. Component Compliance: The provided solution's components shall each meet the minimum transmission specifications listed herein such that no individual component will be less than specifications for permanent and channel, regardless of the fact that tests for permanent and channel ultimately meet required specifications.

H. Pre-installation inspection: Visually inspect all cables, cable reels, and shipping cartons to detect possible cable damage incurred during shipping and transport.

1. Test optical fiber cable while on reels. Use an optical time domain reflectometer (OTDR) to verify the cable length and locate cable defects, splices, and connector, including the loss value of each.

2. Test each pair of UTP cable for open and short circuits. Test results to be submitted to Owner.

I. Visibly damaged goods are to be returned to the supplier and replaced at no additional cost to the Owner.

1.07 MANUFACTURERS

A. Unless otherwise indicated, equipment in these Sections shall be the standard products of a manufacturer regularly engaged in the manufacture of such products. All components used in the system shall be commercial products that comply with these Specifications.

B. Each component of equipment shall identify the manufacturer's name, model, and applicable serial number. The Owner's authorized representative retains the right to reject products that reflect, in their opinion, sub-standard design practices, manufacturing procedures, support services, or warranty policies.

1.08 SITE VISITATION

A. The Contractor shall visit the site prior to bidding and become familiar with existing conditions and all other factors which may affect the execution of the work. Coordination of installation of equipment with prior bid packages previously issued shall be completed. Include all related costs in the initial bid proposal.

1.09 CHANGE ORDERS

A. All supplemental cost proposals by the Contractor shall be accompanied with a complete itemized breakdown of labor and materials. At the Architect's request, Contractor's estimating sheets for the supplemental cost proposals shall be made available to the Architect. Labor shall be separated and allocated for each item of work.

1.10 WARRANTY

A. Provide a written warranty covering the work of this Division.

B. Apparatus:

1. Free of defects of material and workmanship and in accord with the Contract Documents.

2. Built and installed to deliver its full rated capacity at the efficiency for which it was designed.

C. Include in Contractor's warranty for Work of Division 27 system damage caused by failures of any system component.

1.11 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state, and local requirements and conform to codes and ordinances of authorities having jurisdiction.

1.12 SUBMITTALS

A. General:

1. The guidelines set forth in this Section pertain to all Division 27 specifications included in this project.

2. The following guidelines and deliverables shall be submitted to the Owner and Design Team prior to installation commencement.

B. Informational Submittals:

1. Field Test Reports: Submit sample cable test reports showing report format and parameters tested. Submit minimum of 2 weeks prior to final punch walkthrough. Maintain test equipment on-site during punch for sample proof-of-performance tests.
2. Optical loss budget calculations for each optical fiber run.
3. Proposed test forms for fiber backbone, copper backbone, and horizontal UTP cable.
4. Certificates:
    a. Certify that field tests have been performed and that work meets or exceeds specified requirements.
    b. Certify that factory tests have been performed and that work meets or exceeds specified requirements. Certificates may be based on recent or previous test results, provided material or products tested are identical to those proposed for this Project.
    c. Optical loss budget calculations for each optical fiber run.
    d. Calibration report of test equipment for fiber and copper. Last calibration date should not be older than one (1) year from the first day of testing.
    e. Name(s) and copy of certificate of RCDDs.

C. Shop Drawings:

1. Plan views and elevations of telecommunication spaces showing cabinets, racks, termination blocks, patch panels, wire managers, and cable pathways.
    a. Vertical and horizontal offsets and transitions.
    b. Clearances for access above and to side of cable trays.
    c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
2. Plan view and elevations of all raceways (conduits, cable trays, ladder racks, floor ducts, junction boxes, pull boxes, splice boxes, manholes, and all associated supports).
3. Backbone diagram(s) for fiber and copper telecommunication cables.
4. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
5. The telecommunications drawings shall be identified as part of the Technology (T-drawings).

D. Equipment/Products:

1. Submit at one time the related submittals for the products called out in all Division 27 Specifications.
2. Two indexed sets of manufacturer's technical data for each product including product description, specifications including labeling or listing by an agency acceptable to the Owner, and storage requirements.
3. Where more than one product is called out on the same sheet, clearly highlight or mark which product is proposed for use.

E. Deferred Submittals:

1. Mounting Details:

a. Provide engineering analysis, calculations and drawing details of device restraints and supports for maximum loading in compliance with Code and coordinated with all trades. Details to show loads, connection type/materials, dimensions, etc., specific to each unique installation instance. Details to indicate both expected and maximum loads. Analysis to adhere to seismic bracing requirements in the jurisdiction specific to the project.

b. Details to be stamped and signed by an Engineer licensed for the applicable work in the project's area of jurisdiction.

F. Project Closeout:

1. Manufacturer's Installation, Start-Up, and Adjustment Instructions.

2. Operation and Maintenance Data.

3. Special Warranty: Contractor shall not offer a special warranty to Owner to supplement the standard warranty requirement covered in this Specification.

a. With respect to the installation of Approved Manufacturer's Cabling System, furnish Approved Manufacturer's Cabling System application / system standard warranty.

1.13 PRODUCT ASSURANCE

A. All materials shall be UL and/or ETL approved and labeled in accordance with NEC for all products where labeling service normally applies.

B. Materials and equipment requiring UL 94, 149, or 1863 listing shall be so labeled. A modification of products that nullifies UL labels is not permitted.

C. All materials and equipment provided shall be the standard Commercial-Off-The-Shelf (COTS) products of a manufacture engaged in the manufacture of such products. All materials shall be typical commercial designs that comply with the requirements specified. All materials and equipment shall be readily available through manufacturers and/or distributors. All equipment shall be supplied complete with any optional items required for proper installation.

D. Materials or Manufactures not listed in this Division 27 but are required materials to provide a complete and functioning cable infrastructure system shall have cut sheets and product data included in the material and procedures submittal package.

E. Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance and backward compatibility.

F. Contractor shall test all fiber cable while on the reel prior to installation of the cable. The Contractor shall assume liability for replacement of cable should it be found defective at this time or a later date prior to customer acceptance.

1.14 COORDINATION

A. Coordinate arrangement, mounting, and support of communications equipment with Architect, Communication Design Professional or Owner Information Technology Team:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

2. To provide for ease of disconnecting the equipment with minimum interference to other installations.

3. To allow right-of-way for piping and conduit installed at required slope.
    a. Racks and Communication Cabinets: 3-foot minimum.
    b. Open Pathways – Cable Tray, J-Hooks: 12-inch clear on working side; 3-inch clear from ceiling tiles.
    c. Closed Pathways – Conduit (Above and Below Grade):
        1) 3-inch clear from electrical pathways concrete encased.
        2) 12-inch clear in electrical pathways in dirt.
        3) 48-inch clear electrical Motors and transformers.

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

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

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

E. Contractor shall be responsible for coordination with all trades, to include required scheduling of materials and/or equipment with Owner and/or General Contractor for delivery, storage, and protection of equipment as required.

F. Finishes: Where specific device finishes have not been identified, selected by Owner or Architect, finish to match surrounding surfaces.

1.15 PRE-INSTALLATION CONFERENCE

A. Arrange and schedule pre-installation conference prior to beginning any work of this Section Division 27, Communications.

B. Agenda: Clarify questions in writing related to work to be performed, scheduling, coordination, etc., with Consultant and/or Project Manager/Owner representative.

C. All individuals, who will be in an on-site supervisory capacity, shall be required to attend the pre-installation conference. This includes project managers, site supervisor, and lead installers. Individuals who do not attend the conference will not be permitted to supervise the personnel that install, terminate, or test communications cables on the project. The Contractor’s RCDD that will oversee the installation is required to attend the pre-installation conference.

D. The manufacturer that will be providing the extended warranty is required to have a representative attend the pre-installation conference.

1.16 FIELD QUALITY CONTROL

A. The Contractor shall perform the following field inspections during installation and commissioning:

1. Visually inspect UTP and optical fiber jacket materials for NRTL certification markings.
2. Visually inspect cabling placements, pathways, and terminations in communications equipment rooms, telecommunications rooms, and work areas for compliance with standards and codes.
3. Visually inspect grounding and bonding for compliance with standards and codes.
4. Visually inspect all installed cable trays, cable pathways, and wall penetrations for compliance with standards and codes.

B. The Contractor's RCDD will be responsible for all field inspections and will submit a signed weekly inspection report to Owner.

1.17 ALTERNATES, SUBSTITUTIONS, AND CHANGE ORDERS

A. If a proposed alternate material submitted as an "or approved equal" to or exceeds specified requirements, Contractor shall provide manufacturer's specifications in writing for written approval prior to purchase and installation of proposed materials. The proposed material substitution shall not void or change manufacturer's warranty.

B. Contractor shall provide a complete cabling infrastructure according to these written specifications and drawings. If the Owner changes the scope of work to be performed by the Contractor, it shall be in writing. Contractor shall respond to these changes with a complete material list, labor, and taxes in writing presented to the Owner for approval. Contractor shall not proceed with additional scope of work without a signed approval by the Owner.

C. Additional work performed by the Contractor will not be paid by Owner without signed approval of these changes prior to implementing changes. Submit a copy of signed change order upon billing.

1.18 PROJECT MANAGEMENT

A. Contractor shall designate a project manager to act as the single point of contact. Project manager shall oversee all work performed to ensure a quality installation compliant with specifications as outlined in documents (which includes all specifications and drawings). Owner or Consulting Engineer will review a copy of the resume of the on-site project managers and each on-site team.

B. The Contractor project manager/supervisor shall attend meetings arranged by General Contractor, Architect, Owner's representatives, and/or other parties affected by work of this specification.

1.19 DELIVERY AND STORAGE

A. The Contractor shall assume custody and responsibility for the items upon delivery and determining that the contents are complete and in satisfactory condition for installation.

B. Delivery, loss, storage, and protection: All materials and equipment delivered and placed in storage shall be stored with protection from the weather, humidity, and temperature variation, dirt, and dust or other contaminants.

C. Coordinate deliveries and submittals with the General Contractor/Owner to ensure a timely scheduled installation.

D. Contractor shall be responsible for all handling and control of cabling equipment. Contractor is liable for any material loss due to delivery and storage problems.

E. No equipment or materials shall be delivered to the job site more than three weeks prior to the commencement of its installation. Coordinate with General Contractor/Owner on location of storage materials.

1.20 AS-BUILTS

A. Record copy and as-built drawings.

1. Provide record copy drawings periodically throughout the project as requested by the General Contractor or Owner, and at end of the project on CD-ROM. Record copy drawings at the end of the project shall be in CAD format and include notations reflecting the as built conditions of any additions to or variation from the drawings provided such as, but not limited to, cable paths and termination points. CAD drawings are to incorporate test data imported from the test instruments.

2. The as built drawings shall include, but are not limited to: block diagrams, frame and cable labeling, cable termination points, equipment room layouts, rack elevations, and frame installation details. The as-built drawings shall include all field changes made up to construction completion:
    a. Field directed changes to cross connect and patching schedule.
    b. Horizontal cable routing changes.
    c. Backbone cable routing or location changes, inclusive outside plant physical pathways (if within scope of this project).
    d. Associated detail drawings.

1.21 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, dust, and construction debris and repair damaged finish, including chips, scratches, and abrasions. This includes touching up paint removed for grounding.

B. Contractor shall provide a clean work environment, free from trash/rubbish accumulated during and after cabling installation.

C. Maintain construction materials and refuse within the area of work. Clean the work area at the end of each day.

D. Contractor shall keep all liquids (drinks, sodas, etc.) off finished floors, carpets, tiles, racks, and equipment. If any liquid damage to above finishes or equipment, Contractor shall provide professional services to clean or repair scratched/soiled finishes or damaged equipment at own expense.

1.22 PAINTING

A. Certain Division 27 specifications contain the requirement of painting, it is the responsibility of the Contractor to coordinate the requirements and labor involved to complete this work with the General Contractor.

B. Touch up marred and bared surfaces of primed, galvanized, and finish painted equipment, materials, and accessories installed.

C. Restore patched surfaces as close to the original condition and finish as reasonably possible. Where patching occurs in smooth painted surface, extend final paint coat over entire unbroken surface containing patch, after patched area has received two coats of primer and two coats of finished paint.

PART 2 - PRODUCTS

2.01 GENERAL

A. Where specified materials or methods conflict with applicable codes, the more stringent requirement applies.

B. Provide apparatus built and installed to deliver its full rated capacity at the efficiency for which it was designed.

C. Materials and Equipment:
    1. Use materials and equipment that are:
        a. New.
        b. Of quality meeting or exceeding specified standards.
        c. Free of faults and defects.
        d. Conforming to Contract Documents.

e. Of size, make, type, and quality specified.

f. Suitable for the installation indicated.

g. Manufactured in accordance with NEMA, ANSI, U.L. or other applicable standards.

2. Where two or more units of the same class of equipment are furnished, use products of the same manufacturer.

a. Component parts of the entire system need not be products of same manufacturer.

D. Basis of Design:

1. First listed manufacturer specified by performance or model number shall be considered the Basis of Design.

2. If other equipment is provided in lieu of the Basis of Design equipment, assume responsibility for all changes and costs which may be necessary to accommodate this equipment, including, but not limited to:

a. Different sizes and locations for connections.

b. Different dimensions.

c. Different access requirements.

d. Different configurations of connected equipment.

e. Any other differences.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General:

1. Contractor is responsible for full and complete compliance with all standards and guidelines set forth in this and all subsequent specifications.

2. Field verify all existing conditions prior to installation and make note of any conflicts and discrepancies between these specifications and construction drawings to the Owner immediately.

a. Any field discrepancies not noted to the Owner or Design Team prior to installation commencement shall be the responsibility of the Contractor and shall be repaired at no cost to the Owner.

3. Provide a complete and properly operating system for each item of equipment specified.

4. Install materials in a neat and professional manner.

5. Comply with equipment manufacturer’s written instructions, the best industry practices, and the Contract Documents.

B. Clarification:

1. Where there is a conflict among manufacturer’s instruction, best practice, and the Documents, request clarification from the project design team.

2. Work installed without clarification shall be removed and corrected by the Contractor at no cost to the Owner.

C. Existing concrete, block, or brick walls are considered not accessible and may require use of Surface Mounted Raceway (SMR) if existing concealed raceway and device boxes are not available for reuse or do not meet the intent of the design (i.e., proximity to egress path, point of use, etc.). Coordinate route and installation where SMR is required with the Architect/Engineer prior to rough-in. The Contractor will be responsible for reinstalling SMR routed without such prior approval to the Architect's satisfaction.

D. Existing stud walls (wood or metal) with or without blocking with plaster, plasterboard, or paneling finish are considered accessible with accessible ceiling, attic, tunnel, or crawl space above, below, or adjacent. Remove, patch, and repair finished surface as required to conceal rough-in for new device locations. If it is determined that a specific instance will not permit concealment of rough-in due to obstructions such as beams, headers, and other structural elements, prior approval before rough-in from the Architect is required.

3.02 INSTALLATION IN RATED CONSTRUCTION

A. Install intumescent material around ducts, conduits, and other telecommunications elements penetrating rated construction.

B. Comply with firestop materials manufacturer's written instructions to prevent spread of smoke or fire through sleeves or block-outs penetrating rated fire barriers.

C. Provide firestop materials, "Through-Penetration Firestop Systems," and as follows:

1. Capable of passing a 3-hour test per ASTM E-814 (UL 1479).
2. Consisting of material capable of expanding nominally eight times when exposed to temperatures of 250-350 degrees F.
3. An alternate method utilizing intumescent materials in caulk or putty. "Through-Penetration Firestop Systems" may be used.

3.03 EQUIPMENT SUPPORT

A. Minimum Support Capacity:

1. Provide fastening devices and supports for equipment, panels, outlets, and cabinets capable of supporting not less than four times the ultimate weight of the object or objects fastened to or suspended from the building structure.

B. Support all junction boxes, pull boxes, or other conduit terminating housings located above the suspended ceiling from the floor above, roof, or penthouse floor structure to prevent sagging or swaying.

C. Conduits:

1. Support suspended conduits one (1) inch and larger from the overhead structural system with metal ring or trapeze hangers and threaded steel rod having a safety factor of four.
2. Conduits smaller than one (1) inch installed in ceiling cavities may be supported on the mechanical system supports when available space and support capacity has been coordinated with the sub-contractor installing the supports.
3. Anchor conduit installed in poured concrete to the steel reinforcing with No. 14 black iron wire.

D. Powder actuated or similar shot-in fastening devices will not be permitted for any electrical work except by special permission from the Architect.

3.04 ALIGNMENT

A. Install panels, cabinets, and equipment level and plumb, parallel with structural building lines.

B. Install equipment and all enclosures fitted neatly, without gaps, openings, or distortion.

C. Properly and neatly close all unused openings with approved devices.

D. Fit surface panels, devices, and outlets with neat, appropriate, trims, plates, or covers without overhanging edges, protruding corners, or raw edges.

3.05 CUTTING AND PATCHING

A. General:

1. Restore to original condition new or existing work cut or damaged by installation, testing, and removal of work.
2. Patch and finish spaces around conduits passing through floors and walls to match the adjacent construction, including painting or other finishes.
3. Clean up and remove all dirt and debris.

B. Make additional required openings by drilling or cutting. Use of jackhammer is prohibited.

C. Fill holes that are cut oversize so that a tight fit is obtained around the objects passing through.

D. Where alterations disturb lawns, paving, walks, and other permanent site improvements, repair and refinish surfaces to condition existing prior to commencement of work.

3.06 PROTECTION OF WORK

A. Protect all telecommunication work and equipment installed under this Division against damage by other trades, weather conditions, or any other causes.

1. Equipment found damaged or in other than new condition will be rejected as defective.

B. Keep equipment, panels, outlets and any related telecommunication equipment covered or closed to exclude dust, dirt, and splashes of plaster, cement, paint, or other construction material spray.

1. Equipment not free of all such contamination is not acceptable.

C. Provide enclosures and trims in new condition, free of rust, scratches, and other finish defects.

3.07 UNINTERRUPTED SERVICE

A. Maintain telecommunications service to all functioning portions of the building throughout construction.

B. Pre-arrange with Owner outages necessary for new construction.

1. Apply for scheduled shut-downs minimum 4 weeks prior to time needed and reconfirm a minimum of 72 hours prior to time needed.
2. Contractor is liable for any damages resulting from unscheduled outages or for those not confined to the pre-arranged times. Damages include costs incurred by the Owner and by the Owner’s tenants.

3.08 COMPLETION AND TESTING

A. Upon completion, test systems to show that installed equipment operates as designed and specified, free of faults and unintentional grounds.

1. Schedule system tests so that several occur on the same day.
2. Coordinate testing schedule with construction phasing.
3. Conduct tests in the presence of the Architect or its representative.
4. Notify owner’s representative of tests 48 hours in advance.

B. Engage a qualified telecommunications contractor with required tools to conduct equipment tests. Arrange to have the equipment factory representative present for those tests where the manufacturer's warranty could be impacted by the absence of a factory representative.

C. Perform tests per the requirements of each of the following systems:

1. Horizontal data/voice structured cabling system.

D. Provide a written record of performance tests and submit with operation and maintenance data.

END OF SECTION

SECTION 27 05 28
PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Fire rated construction wall sleeves.
4. Optical-fiber-cable pathways and fittings.
5. Nonmetallic wireways and auxiliary gutters.
6. Surface pathways.
7. Boxes, enclosures, and cabinets.
8. Handholes and boxes for exterior underground cabling.

1.02 RELATED SECTIONS

A. Section 27 05 00, Common Work Results for Communications.

B. Section 27 15 00, Communications Horizontal Cabling.

1.03 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. National Fire Protection Association (NFPA):

70-05	National Electrical Code (NEC)

C. Underwriters Laboratories, Inc. (UL):

1-03	Flexible Metal Conduit
5-01	Surface Metal Raceway and Fittings
6-03	Rigid Metal Conduit
50-03	Enclosures for Electrical Equipment
360-03	Liquid-Tight Flexible Steel Conduit
467-01	Grounding and Bonding Equipment
514A-01	Metallic Outlet Boxes
514B-02	Fittings for Cable and Conduit
514C-05	Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
651-02	Schedule 40 and 80 Rigid PVC Conduit
651A-03	Type EB and A Rigid PVC Conduit and HDPE Conduit
797-03	Electrical Metallic Tubing
1242-00	Intermediate Metal Conduit
1684	Fiberglass Conduit Above Ground

D. Building Industry Consulting Services International (BICSI):

12th Edition	Telecommunications Distribution Methods Manual
5th Edition	Customer-Owned Outside Plant Design Reference Manual

E. National Electrical Manufacturers Association (NEMA):
TC-3-04 PVC Fittings for Use with Rigid PVC Conduit and Tubing
FB1-03 Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable

1.04 SUBMITTALS

A. Submit in accordance with Section 27 05 00 submittal requirements.

B. Closeout Submittals: Submit in accordance with Section 27 05 00 submittal requirements.

C. Firestop design basis documentation that shall include each type of communication penetration, type of building construction being penetrated including the hourly resistance rating of floor, wall, or other partition of building construction into which firestop design will be installed, and firestop device or system proposed for use.

1.05 COORDINATION

A. The contractor is responsible for coordinating the arrangement, mounting and support for all communications support equipment.

1. In accordance with the requirements set forth in Section 27 05 00, Common Works for Communications, the Contractor shall provide:

a. Plan view and elevations of all raceways (conduits, cable trays, ladder racks, floor ducts, junction boxes, pull boxes, splice boxes, manholes, and all associated supports).

1) Vertical and horizontal offsets and transitions.

2) Clearances for access above and to side of cable trays.

3) Vertical elevation of cable trays above the floor or bottom of ceiling structure.

1.06 QUALITY ASSURANCE

A. Low voltage system cable supports and accessories shall be listed to Underwriter's Laboratories or other national recognized testing laboratory.

B. Low voltage system cable supports and accessories shall have the manufacturers name and part number stamped on the part for identification.

C. Pre-Installation Meetings: Contractor shall set up a pre-installation meeting to discuss low voltage cable support layout work and installation guidelines. Contractor shall organize meeting a minimum of 30 days prior to initiating cable support installation work. Attendees shall include Contractor, appropriate subcontractors, low voltage system vendors, Architect, and Owner's Representative. Purpose of meeting shall be to coordinate work between the parties to have a consistent layout for all low voltage system cables, minimize interferences, and to make cable system accessibility for future owner modifications and maintenance high priority issue for all installers.

1.07 COORDINATION

A. Coordinate layout and installation of low voltage cable bundle supports with other construction elements to ensure adequate headroom, working clearance and access. Revise locations and elevations for those indicated as required to suit field conditions and as approved by Owner's Representative.

B. Examine drawings and existing conditions above ceilings and include additional supports in bid price to avoid ducts, pipes, conduits, etc. Installation in existing ceilings can be very difficult. Contractor should include extra labor time involved in bid price.

PART 2 - PRODUCTS

2.01 CONDUIT AND OTHER CLOSED PATHWAY SYSTEMS

A. Conduit Size: In accordance with the NEC, but not less than one (1) inch unless otherwise shown in the Contract Drawings.

B. Shall be installed in accordance with the construction documents, national codes, and applicable publications designated herein.

C. Conduit:

1. Performance:

a. Shall be of the following construction types:

1) Fiberglass.

2) Electrical Metallic Tubing.

3) Rigid Galvanized Steel.

4) Flexible Non-Metallic Conduit.

b. Must be installed as recommended by the raceway manufacturer and construction documents.

c. Flexible Metallic Conduit is not permitted in this project for interior installation.

D. Conduit Supports:

1. Performance:

a. Individual Conduit Hangers: Designed for the purpose, having a preassembled closure bolt and nut, and provisions for receiving a hanger rod.

b. Conduit supports shall be installed at a maximum of 5-foot centers.

2.02 WIDE BASE CABLE SUPPORTS

A. Performance:

1. Wide base J-hooks complying with most current revision of the EIA/TIA 568 and 569 structured cabling system requirements.

2. Minimum size is 1-5/16-inch diameter loop for (50) 4-pair UTP or 2 strand fiber optic cable or inner duct. Provide larger size or multiple hooks where required.

3. Minimum one (1) inch width and flared edges where cables enter and leave support.

a. 2-inch diameter loop for (80) 4-pair UTP or 2 strand fiber optic cable or inner duct.

b. 4-inch diameter loop for (300) 4-pair UTP or 2-strand fiber optic cable or inner duct.

4. Accessories: Provide applicable accessories to independently support J-hooks from structure. This includes extender bracket for mounting multiple J-hooks on a single support, fasteners and clamps for connecting to wall, beams, rods, dedicated support wires and C and Z Purlins as required for specific construction.

5. Cable Retainers: Provide cable retainers at each J-hook.

6. See Cable Bundling instructions specified herein.

7. Finish:

a. Dry Locations, Above Lay-in Ceiling, galvanized.

b. Wet and Damp Locations: stainless steel.

B. Manufacturers:

1. ERICO Caddy CableCat series.
2. Garvin.
3. ICC.
4. Or approved equal.

2.03 CABLE TRAY

A. Performance:

1. Cable Trays and Accessories: Identified as defined in NFPA 70 and marked for intended location, application, and grounding.
   a. Source Limitations: Obtain cable trays and components from single manufacturer.
2. Sizes and Configurations: See the contract drawings for specific requirements for sizes and configurations.
3. Structural Performance: See articles for individual cable tray types for specific values for the following parameters:
   a. Uniform Load Distribution: Capable of supporting a uniformly distributed load on the indicated support span when supported as a simple span and tested according to NEMA VE 1.
   b. Concentrated Load: A load applied at midpoint of span and centerline of tray.
   c. Load and Safety Factors: Applicable to both side rails and rung capacities.
4. Seismic Performance: Cable trays and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   a. The term "withstand" means "the cable trays will remain in place without separation of any parts when subjected to the seismic forces specified."

B. Manufacturers:

1. Cooper B-Line.
2. PW Industries.
3. Or approved equal.

2.04 CABLE RUNWAYS (LADDER-TYPE) CABLE TRAYS

A. Performance:

1. Ladder rack shall be manufactured from tubular steel. Stringers (sides) will be made from 3/8-inch wide by 1-1/2-inch high tubular steel with 0.065-inch wall thickness. Cross members (rungs) will be made from one (1) inch wide by 1/2-inch high tubular steel with 0.065-inch wall thickness. Color shall be black.
2. Rung Spacing: 9 inches (225 mm) on center.
3. No portion of the rungs shall protrude below the bottom plane of side rails.
4. Straight Section Lengths: 10 feet (3 m) except where shorter lengths are required to facilitate tray assembly.
5. Width: as indicated on Drawings.
6. Splicing Assemblies: Bolted type using serrated flange locknuts.
7. Splice Plate Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.

B. Manufacturers:
   1. Chatsworth Products (CPI).
   2. B-Line Cooper, Inc.
   3. Hoffman.
   4. Cablofil/Legrand.
   5. Or approved equal.

2.05 WIRE-BASKET CABLE TRAYS

A. Provide as directed in the Contract Drawings.
   1. Performance:
      a. Configuration: Wires are formed into a standard 2-inch x 4-inch (50 mm x 100 mm) wire mesh pattern with intersecting wires welded together. Mesh sections must have at least one bottom longitudinal wire along entire length of section.
      b. Materials: High-strength-steel longitudinal wires with no bends.
      c. Safety Provisions: Wire ends along wire-basket sides (flanges) rounded during manufacturing to maintain integrity of cables and installer safety.
      d. Sizes:
         1) Straight sections shall be furnished in standard 10-foot lengths.
         2) Wire-Basket Depth: As shown in Drawings.
      e. Maximum Loads: 50 pounds per foot (74 kg/m).
      f. Connector Assemblies: Bolt welded to plate shaped to fit around adjoining tray wires and mating plate. Mechanically joins adjacent tray wires to splice sections together or to create horizontal fittings.
      g. Connector Assembly Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.
      h. Hardware and Fasteners: Zinc-plated according to ASTM B 633.
   2. Manufacturers:
      1) Chatsworth Products (CPI).
      2) B-Line Cooper, Inc.
      3) Hoffman.
      4) Cablofil/Legrand.

2.06 CABLE TRAY ACCESSORIES

A. Performance:
   1. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.
   2. Barrier Strips: Same materials and finishes as for cable tray.
   3. Cable tray supports and connectors, including bonding jumpers, 90 bends, and radius drop-outs as recommended by cable tray manufacturer.

B. Manufacturers: Compatible w/ submitted tray manufacturer.

2.07 DEVICE BACKBOXES

A. Performance:

1. Flush mounted, sheet steel construction with conduit knockout.
2. UL514A listed.
3. Unless otherwise noted, provide:
   a. 4-11/16-inch square, 2-1/8-inch deep backbox standard for Communications and Audio-Video devices.
   b. 4-inch square, 2-1/8-inch deep backbox standard for Electronic Security devices.
   c. Code minimum rated for the installed application.
4. Gang mud rings sizes as required for the applicable device.

B. Manufacturers:

1. Raco.
2. Steel City.
3. Bowers.
4. Or approved equal.

2.08 ENCLOSURES AND PULLBOXES

A. Pull Boxes:

1. Performance:
   a. Provide enclosure and pull boxes as shown in the construction documents.
   b. Any additional conduit offsets required by Contractor not shown in Drawings shall be measured and provided with properly sized pull boxes.
   c. Pull Box sizing: Contractor shall provide Pull boxes as detailed below.
2. Manufacturers:
   a. Hoffman.
   b. Cooper B-Line.
   c. Or approved equal.

Minimum Trade Size Conduit	Width	Length	Depth	Each Additional Conduit Increase (Width)
21 mm = 3/4"	100 mm - 4"	300 mm - 12"	75 mm - 3"	50 mm - 2'
27 mm = 1"	100 mm - 4"	400 mm - 16"	75 mm - 3"	50 mm - 2"
35 mm = 1-1/4"	150 mm - 6"	500 mm - 20"	75 mm - 3"	75 mm - 3"
41 mm = 1-1/2"	200 mm - 8"	675 mm - 27"	100 mm - 4"	100 mm - 4"
53 mm = 2"	200 mm - 8"	900 mm - 36"	100 mm - 4"	125 mm - 5"
63 mm = 2-1/2"	250 mm - 10"	1050 mm - 42"	125 mm - 5"	150 mm - 6"
78 mm = 3"	300 mm - 12"	1200 mm - 48"	125 mm - 5"	150 mm - 8"
91 mm = 3-1/2"	300 mm - 12"	1350 mm - 54"	150 mm - 6"	150 mm - 6"
103 mm = 4"	375 mm - 15"	1520 mm - 60"	200 mm - 8"	200 mm - 8"

2.09 FIRE RATED PATHWAYS

A. Performance:

1. Self-closing through wall penetrations for cabling pathway, without the use of sealant, putty, foam pads, or other similar sealing means.
2. Meets hourly rating for the partition penetrated.
3. Accommodates frequent cable moves, adds, and changes.
4. Permits the allowable cable load to range from 0 to 100 percent visual fill.
5. Does not require any additional action on the part of the installer to open or close the pathway device, such as, but not limited to:
   a. Opening or closing of doors.
   b. Twisting an inner liner.
6. Minimum STC rating empty or full: 45.

B. Manufacturers:

1. STI EZ-path.
2. 3M.
3. Hilti Speed Sleeve.
4. Or approved equal.

2.10 CABLE STRAPS

A. Performance:

1. Cable Straps shall be used within telecommunications rooms and open cable pathways (cable tray) and shall be provided for strapping groups of cables to raceway and for controlling/managing patch cables.
2. The use of plastic tie wraps for this purpose is not acceptable.
   a. Cable straps shall be self-gripping, reusable, constructed of Velcro, and hook-and-loop style. Cable straps to be used in plenum air handling spaces shall be plenum rated.
3. Quantity:
   a. Cable Straps shall be provided in sufficient quantity to strap cable bundles at intervals specific to the type of cable bundle. For the purposes of determining the quantity of straps to provide, the number of cables in a cable bundle and the intervals at which straps shall be applied are as follows:
      1) Bundle size (use to determine strap quantity):
         (a) For Patch Cables: Maximum of 25 patch cables per cable bundle with straps applied at one (1) foot intervals.
         (b) For horizontal cabling: Maximum of 25 station cables per cable bundle with straps applied at 3-foot intervals.
         (c) For Backbone Cables: Maximum of 4 backbone cables per cable bundle with straps applied at 3-foot intervals.
4. Bundling (use to determine strap quantity):
   a. Cables shall be bundled by application (patch, horizontal, backbone) and by cable type (Category “X”, MM Fiber, SM Fiber, etc.). Cable applications and types shall not be intermixed within a bundle.
5. Color: All cable straps shall be colored black.

B. Manufacturers:

1. Panduit.
2. Velcro.
3. Or approved equal.

PART 3 - EXECUTION

3.01 CONDUIT INSTALLATION

A. Penetrations:

1. Cutting or Holes:

a. Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the Structural Engineer prior to drilling through structural sections.

b. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Owner's Information Technology as required by limited working space.

B. Fire Stop: Where conduits, wire ways, and other communications raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke, and gases as specified in Section 07 84 00, Firestopping, with rock wool fiber or silicone foam sealant only. Completely fill and seal clearances between raceways and openings with the fire stop material.

C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Section 07 92 00, Joint Sealants.

3.02 INSTALLATION, GENERAL

A. Install conduit as follows:

1. In complete runs before pulling in cables or wires.
2. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.
3. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
4. Cut square with a hacksaw, ream, remove burrs, and draw up tight.
5. Mechanically continuous.
6. Independently support conduit at 5'-0" on center. Do not use other supports (i.e., suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts).
7. Support within 300 mm (one foot) of changes of direction, and within 300 mm (one foot) of each enclosure to which connected.
8. Close ends of empty conduit with plugs or caps at the rough-in stage to prevent entry of debris, until wires are pulled in.
9. Conduit installations under fume and vent hoods are prohibited.
10. Secure conduits to cabinets, junction boxes, pull boxes, and outlet boxes with bonding type locknuts. Do not use aluminum conduits in wet locations.

11. Unless otherwise indicated on the drawings or specified herein, all conduits shall be installed concealed within finished walls, floors, and ceilings.

B. Conduit Bends:

1. Make bends with only with fiberglass manufacturer approved bends and elbows.
2. Do not use standard conduit bending machines.
3. Conduit hickey may be used for slight offsets, and for straightening stubbed out conduits.
4. Bending of conduits with a pipe tee or vise is prohibited.

C. Layout and Homeruns:

1. Deviations: Make only where necessary to avoid interferences and only after Drawings showing the proposed deviations have been submitted approved by the Owner Information Technology Team.

3.03 CONCEALED WORK INSTALLATION

A. In Concrete:

1. Conduit: Rigid steel, IMC or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel, or vapor barriers.
2. Align and run conduit in direct lines.
3. Install conduit through concrete beams only when the following occurs:
   a. Where shown on the Structural Drawings.
   b. As approved by the Resident Engineer prior to construction, and after submittal of Drawing showing location, size, and position of each penetration.
4. Installation of conduit in concrete that is less than 75 mm (3 inches) thick is prohibited.
   a. Conduit outside diameter larger than 1/3 of the slab thickness is prohibited.
   b. Space between conduits in slabs: Approximately six conduit diameters apart, except one conduit diameter at conduit crossings.
   c. Install conduits approximately in the center of the slab so that there will be a minimum of 19 mm (3/4 inch) of concrete around the conduits.
5. Conduit for conductors 600 volts and below:
   a. Fiberglass; different type conduits mixed indiscriminately in the same system is prohibited.
6. Align and run conduit parallel or perpendicular to the building lines.
7. Connect recessed lighting fixtures to conduit runs with maximum 1800 mm (6 feet) of flexible metal conduit extending from a junction box to the fixture.
8. Tightening set screws with pliers is prohibited.

3.04 EXPOSED WORK INSTALLATION

A. Unless otherwise indicated on the Drawings, exposed conduit is only permitted in mechanical and electrical rooms.

B. Align and run conduit parallel or perpendicular to the building lines.

C. Install horizontal runs close to the ceiling or beams and secure with conduit straps.

D. Support horizontal or vertical runs at not over 2400 mm (8-foot) intervals.

E. Surface metal raceways: Use only where shown.

F. Painting:

1. Paint exposed conduit as specified in Section 09 91 00, Painting.

2. Paint all conduits containing cables rated over 600 volts safety orange. Refer to Section 09 91 00, Painting for preparation, paint type, and exact color. In addition, paint legends, using 50 mm (2-inch) high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 6000 mm (20-foot) intervals in between.

3.05 EXPANSION JOINTS

A. Conduits 75 mm (3 inches) and larger secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.

B. Provide conduits smaller than 75 mm (3 inches) with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible non-metallic conduit to produce 125 mm (5-inch) vertical drop midway between the ends.

C. Seismic Areas: In seismic areas, provide conduits rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on both sides of the joint. Connect conduits to junction boxes with 375 mm (15 inches) of slack flexible conduit. Flexible conduit shall have a copper green ground bonding jumper installed.

3.06 CONDUIT SUPPORTS, INSTALLATION

A. Safe working load shall not exceed 1/4 of proof test load of fastening devices.

B. Use pipe straps or individual conduit hangers for supporting individual conduits. Maximum distance between supports is 2.5 m (8-foot) on center.

C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 90 kg (200 pounds). Attach each conduit with U-bolts or other approved fasteners.

D. Support conduit independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.

E. Fasteners and Supports in Solid Masonry and Concrete:

1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.

2. Existing Construction:

a. Steel expansion anchors not less than 6 mm (1/4-inch) bolt size and not less than 28 mm (1-1/8-inch) embedment.

b. Power set fasteners not less than 6 mm (1/4-inch) diameter with depth of penetration not less than 75 mm (3 inches).

c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.

F. Hollow Masonry: Toggle bolts are permitted.

G. Bolts supported only by plaster or gypsum wallboard are not acceptable.

H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

I. Attachment by wood plugs, raw plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.

J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.

K. Spring steel type supports or fasteners are prohibited for all uses except: horizontal and vertical supports/fasteners within walls.

L. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.07 BOX INSTALLATION

A. Boxes for Concealed Conduits:

1. Flush mounted.

2. Provide raised covers for boxes to suit the wall or ceiling, construction, and finish.

B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.

C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

3.08 COMMUNICATION SYSTEM CONDUIT

A. Install the communication raceway system as shown on Drawings.

B. Minimum conduit size of 27 mm (one inch), but not less than the size shown on the Drawings.

C. All conduit ends shall be equipped with insulated bushings.

D. All 100 mm (4-inch) conduits within buildings shall include pull boxes after every two 90-degree bends. Size boxes per the NEC.

E. Vertical conduits/sleeves through closets floors shall terminate not less than 75 mm (3 inches) below the floor and not less than 304.8 mm (12 inches) below the ceiling of the floor below.

F. Terminate conduit runs to/from a backboard in a closet or interstitial space at the top or bottom of the backboard. Conduits shall enter communication closets next to the wall and be flush with the backboard.

G. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.

3.09 COMMUNICATION SYSTEM CONDUIT

A. Install the communication raceway system as shown on Drawings.

B. Minimum conduit size of 27 mm (one inch), but not less than the size shown on the Drawings.

C. All conduit ends shall be equipped with insulated bushings.

D. All 100 mm (four inch) conduits within buildings shall include pull boxes after every two 90 degree bends. Size boxes per the NEC.

E. Vertical conduits/sleeves through closets floors shall terminate not less than 75 mm (3 inches) below the floor and not less than 304.8 mm (12 inches) below the ceiling of the floor below.

F. Terminate conduit runs to/from a backboard in a closet or interstitial space at the top or bottom of the backboard. Conduits shall enter communication closets next to the wall and be flush with the backboard.

G. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.

H. All empty conduits located in communication closets or on backboards shall be sealed with a standard non-hardening duct seal compound to prevent the entrance of moisture and gases and to meet fire resistance requirements.

1. Conduit runs shall contain no more than 2 quarter turns (90 degree bends) between pull boxes/backboards. Minimum radius of communication conduit bends shall be as follows (special long radius):

Sizes of Conduit Trade Size	Radius of Conduit Bends mm, inches
3/4	152 (6)
1	156 (6)
1-1/4	190 (7.5)
1-1/2	228 (9)
2	304 (12)
2-1/2	635 (25)
3	775 (30)
3-1/2	900 (36)
4	1125 (40)

3.10 CABLE INSTALLATION

A. Install cables only when each cable tray run has been completed and inspected.

B. Fasten cables on vertical runs to cable trays every 18 inches, using specified Velcro cable straps. Plastic wire-ties are not permitted for communications use.

C. Fasten and support cables that pass from one cable tray to another or drop from cable trays to equipment enclosures. Fasten cables to the cable tray at the point of exit and support cables independent of the enclosure. The cable length between cable trays or between cable tray and enclosure shall be no more than 72 inches.

D. Pathway cabling fill to not exceed a maximum of 40%, or per manufacturer's recommendations. Provide multiple support and pathway systems where required cable count exceeds 40% fill.

E. Unless otherwise noted, group cabling in separate supports and pathways by the following systems:

3.11 CONNECTIONS

A. Connect pathways to cable trays according to requirements in NEMA VE 2-2000 and NEMA FG 1-1993 where applicable.

3.12 FIELD QUALITY CONTROL

A. Perform the following tests and inspections, with the assistance of a factory-authorized service representative if necessary:

1. After installing cable trays and after cabling has been energized, survey for compliance with requirements.

2. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.

3. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by physical barriers or are installed in separate cable trays. Barriers are required between all different voltage types.

4. Verify that there are no intruding items such as pipes, hangers, or other equipment in the cable tray.
5. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and re-torque in suspect areas.
7. Check for improperly sized or installed bonding jumpers.
8. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
9. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is one (1) ohm.

B. Provide test and inspection reports.

3.13 PROTECTION

A. Protect installed cables.

1. Install temporary protection for cables to safeguard exposed cables against falling objects or debris during construction.

END OF SECTION

SECTION 27 08 00
COMMISSIONING OF COMMUNICATIONS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:

1. Optical Fiber Cable Testers
2. 100 Ohm Balanced Twisted Pair Tester/Certifier
3. Labels

B. The intent of this Section is to establish complete service requirements for inspection, testing, verification, and documentation of telecommunications infrastructure, cabling, and equipment, upon request of the Owner, in accordance with these specifications and applicable nationally recognized codes and standards.

C. This Specification includes requirements for types of labeling, administration, and testing for communications systems. It includes the commissioning of portions of telecommunications infrastructure work including but not limited to structured cabling systems, optical fiber cabling systems, coaxial cabling systems, outside plant cable, duct banks, trenches, maintenance holes, and aerial pole line distribution.

1.02 RELATED SECTIONS

1. Division 01, General Requirements
2. Division 27, Communications
3. Section 27 05 00, Common Works for Communications Systems
4. Section 27 15 00, Communications Horizontal Cabling

1.03 REFERENCES

A. References, Codes and Standards as required by Section 27 05 00, Common Work Results for Communications and Division 01, General Requirements.

B. In addition, meet the following:

1.	ANSI/TIA-568-C.2	Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted- Pair Cabling Components
2.	ANSI/TIA-1152	Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
3.	ANSI/TIA-568-C.3	Optical Fiber Cabling Component Standard
4.	ANSI/TIA-526-7	Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
5.	ANSI/TIA-526-14C	Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant
6.	ANSI/TIA-758-B	Customer-Owned Outside Plant Telecommunications Infrastructure Standard
7.	ANSI/TIA-569-D	Telecommunications Pathways and Spaces
8.	ANSI/TIA-568-C	Commercial Building Telecommunications Standard
9.	ANSI/TIA-607-B	Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

10. BICSI Wireless Design Manual, 3rd Edition
11. BICSI Outside Plant Design Reference Manual, 5th Edition
12. BICSI Telecommunications Distribution Methods Manual, 13th Edition
13. Per the systems manufacturer’s specifications, installation and warranty requirements.

14. National Electrical Code National Electrical Safety Code and other related NFPA Codes and Standards.
15. Underwriters Laboratories or other NRTL.
16. Manufacturer's instructions.

1.04 QUALITY ASSURANCE

A. Conform to the quality assurance requirements of Section 27 05 00, Common Work Results for Communications and Division 01, General Requirements.

B. Testing procedures and testers comply with applicable requirements of the listed standards in the references.

C. Identification and administration work specified herein complies with the applicable requirements of the standards listed in the references.

D. Pre-installation inspection: Visually inspect cables, cable reels, and shipping cartons to detect possible cable damage incurred during shipping and transport.

1. Test optical fiber cable while on reels. Use an optical time domain reflectometer (OTDR) to verify the cable length and locate cable defects, splices, and connector, including the loss value of each.
2. Test each pair of UTP cable for open and short circuits. Submit test results to Owner.

1.05 SUBMITTALS

A. Including, but not limited to: Product Data Sheets, Shop Drawings, etc.

B. General: Submit in accordance with Section 27 05 00, Common Work Results for Communications submittal requirements.

C. Closeout Submittals: Submit in accordance with Section 27 05 00, Common Work Results for Communications submittal requirements.

D. Additional requirements specific to this section:

1. Test reports: Submit minimum of two weeks prior to final punch walkthrough. Maintain test equipment on-site during punch for sample proof-of-performance tests.
2. Cabling Administration Drawings:
   a. Show building floor plans with cabling administration-point labeling.
   b. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Optical Fiber Cable Testers:

1. Multimode Optical Fiber Light Source:
   a. Fluke
   b. JDSU
   c. Corning
   d. Or approved equal.
2. Single-Mode Optical Fiber Light Source:
   a. Fluke
   b. JDSU
   c. Corning

d. Or approved equal.

3. Power Meter:
   a. Fluke
   b. JDSU
   c. Corning
   d. Or approved equal.
4. Optical Time Domain Reflectometer (OTDR):
   a. Fluke
   b. JDSU
   c. Corning
   d. Or approved equal.

B. 100 Ohm Balanced Twisted Pair Tester/Certifier:
1. Fluke
2. JDSU
3. Ideal
4. Or approved equal.

C. Labels:
1. Brother
2. Panduit
3. Brady
4. Or approved equal.

2.02 OPTICAL FIBER CABLE TESTERS

A. Multimode Optical Fiber Light Source:
1. Capable of testing to ANSI/TIA-568-C.3 and ANSI/TIA-526-14C criteria.
2. Meet launch requirements of TIA-455-78-B.
3. Provide test results for applicable multimode center wavelengths via LED light sources.
4. Output of light source, 8 MW for 50um core optical fiber.
5. Output Stability +/- 0.40 dB from 0 to 50 degrees C.
6. Long-term output stability +/- 0.10 dB at 25 degrees C.
7. Connector types include, MPO and LC.

B. Single-Mode Optical Fiber Light Source:
1. Capable of testing to ANSI/TIA 568-C.3 criteria.
2. Meet requirements of ANSI/TIA-526-7.
3. Provide test results for applicable multimode center wavelengths via laser light sources.
4. Output Stability +/- 0.40 dB from 0 to 50 degrees C.
5. Long Term output stability +/- 0.10 dB at 25 degrees C.
6. Connector types include: MTRJ, LC, ST, and SC.

C. Power Meter:
1. Capable of testing to TIA 568-C.3 criteria.
2. Provide 850 nm, 1300 nm, and 1500 nm +/- 20 nm wavelength test capability.

3. Measurement range from 10 to -60 dBm.
4. Resolution: 0.1 dB
5. Connector types include: LC and SC.

D. Optical Time Domain Reflectometer (OTDR):
1. Capable of testing to ANSI/TIA 568-C.3 criteria.
2. Connector types include, MPO, LC, and SC.

2.03 100 OHM BALANCED TWISTED PAIR TESTER/CERTIFIER

A. Capable of testing to ANSI/TIA-568-C.2 and ANSI/TIA-1152 criteria.

B. Third party (Intertek/ETL) approved TIA Level IIIe (ISO Level IV) field tester.

C. Physical Interface: Modular 8P8C connector and a serial port with DB-9 connector or USB connector.

D. Auto-testing to determine if cable meets the requirements of ANSI/TIA-568-C.2, ISO Class F, 10GBase-T.

E. Tests include:
1. Wire Map
2. Propagation Delay
3. Delay Skew
4. Cable Length
5. Insertion Loss (IL)
6. Return Loss (RL)
7. Near-End Crosstalk (NEXT)
8. Power Sum NEXT (PS-NEXT)
9. Attenuation to Crosstalk Ratio Near-End (ACR-N)
10. Power Sum ACR-N (PS-ACR-N)
11. Far End Crosstalk (FEXT)
12. Attenuation to Crosstalk Ratio Far-End (ACR-F) (formerly called ELFEXT)
13. Power Sum ACR-F (PS-ACR-F) (formally called PS-ELFEXT)
14. The following tests only apply to CAT6A cabling:
a. Power Sum Alien Near End Cross Talk (PSANEXT)
b. Power Sum Alien Attention to Cross Talk Ratio Far-End (PSAACRF)

2.04 LABELS

A. Meet the legibility, defacement, exposure, and adhesion requirements of UL 969 Marking and Labeling Systems.

B. Machine print labels. Preprinted or laser printed type.

C. Handwritten labels are not permitted in this project.

D. Where used for cable marking provide vinyl substrate with a white printing area and a clear tail that self laminates the printed area when wrapped around the cable. If cable jacket is white, provide cable label with printing area orange or yellow, so that the labels are easily distinguishable.

E. Where insert type labels are used provide clear plastic cover over label.

F. Provide plastic warning tape 6-inches wide, continuously printed, bright colored, and 18 inches above direct buried services, underground conduits, and duct-banks.

PART 3 EXECUTION

3.01 OPTICAL FIBER CABLE TESTING

A. Test fibers with launch and far end cable of sufficient length for the MOTDR to be able to see through installed connectors.

B. Localized attenuation not to exceed 0.50 dB.

C. Backbone multimode fiber tested at both 850nm and 1300 nm in accordance with ANSI/TIA-526-14C Method B.

D. Backbone single mode fiber tested in at both 1310nm and 1550 nm in accordance with ANSI/EIA/TIA-526-14C Method A.1.

E. Multimode fiber conforms to the following:

850 nm:
Length (meters) Attenuation (dB)
500 - 3.25
1000 - 5.0
1500 - 6.5
2000 - 8.5
1300 nm:
Length (meters) Attenuation (dB)
500 - 2.2
1000 - 3.0
1500 - 3.8
2000 - 4.5

F. Single Mode Fiber conforms to the following:

Inside: at 1550 nm
Length (meters) Attenuation (dB)
500 - 2.0
1000 - 2.5
1500 - 3.0
2000 - 3.5
2500 - 4.0
3000 - 4.5
Outside: at 1550 nm
Length (meters) Attenuation (dB)
500 - 1.8
1000 - 2.0
1500 - 2.2
2000 - 2.5
2500 - 2.8
3000 - 3.0

3.02 100 OHM BALANCED TWISTED PAIR CABLE TESTING

A. Testing parameters called for in this Section include the permanent link and horizontal channel for installed cabling locations.

B. Test cable with test set to match the Nominal Velocity Propagation for the cable as stated by the cable manufacturer of the cable being installed.

C. Performed meeting the requirements of ANSI/TIA 1152 and ANSI/TIA-568-C.2:

1. Wire Map
2. Propagation Delay
3. Delay Skew
4. Cable Length

5. Insertion Loss (IL)
6. Return Loss (RL)
7. Near-End Crosstalk (NEXT)
8. Power Sum NEXT (PS-NEXT)
9. Attenuation to Crosstalk Ratio Near-End (ACR-N)
10. Power Sum ACR-N (PS-ACR-N)
11. Far End Crosstalk (FEXT)
12. Attenuation to Crosstalk Ratio Far-End (ACR-F) (formerly called ELFEXT)
13. Power Sum ACR-F (PS-ACR-F) (formally called PS-ELFEXT)
14. The following tests only to apply to CAT6A cabling:
    a. Power Sum Alien Near End Cross Talk (PSANEXT)
    b. Power Sum Alien Attention to Cross Talk Ratio Far-End (PSAACRF)

3.03 IDENTIFICATION AND LABELING

A. Verify specific labeling requirements with Owner prior cable installation or termination.

B. Cables:
1. Backbone Cables: Mark at each endpoint and at intermediate pull/access points or junction boxes. Indicate origination and destination Telecommunications Room ID sheath ID and strand/pair range.
2. Horizontal Cables: Mark at each end, on the sheath indicating the TR, patch panel, and panel port to which the cable is wired.
3. Patch Panels: Label as detailed later in this Section.
4. Horizontal Cable faceplates – Faceplates are numbered left to right, top to bottom.
    a. Include telecommunications room number and faceplate number.
    b. Rooms with more than one faceplate are numbered clockwise from the first faceplate on the wall to the left of the entry door.
    c. Faceplates on the ceiling of the room or located in floor boxes are numbered after the faceplates on the wall.

C. Optical Fiber Patch Panels:
1. Fiber patch panels marked using adhesive labels indicating the range of circuits installed to it.
2. Label each port with the origination and destination with the individual strand ID.

3.04 LABELING EXAMPLES

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A.
1. Label horizontal and backbone cables at each end. Mark the cable or its label with its identifier.
2. Use a unique identifier marked on each faceplate to identify it as connecting hardware.
3. Use a unique identifier marked on each piece of connecting hardware to identify it as connecting hardware.
4. Label each port on the connecting hardware with its identifier.
    a. Backbone cables only:
        1) Exposed Cables and Cables in Cable Trays and assorted open pathways: Label each cable at intervals not exceeding 15 feet.

3.05 RECORD COPY AND AS-BUILT DRAWINGS

A. Provide record copy drawings periodically throughout the project as required by Division 01, General Requirements or as requested by the Project Manager, and at end of the project.

B. Record copy drawings include notations reflecting the as-built conditions of additions to or variation from the drawings provided.

3.06 TEST RESULTS

A. Horizontal Copper Cabling:

1. Test cables and submit horizontal copper cable test result data in electronic format, with the resulting file formatted with one test result per 8-1/2-inch by 11-inch page.
2. To provide the test results in an acceptable format: Export or Download the test results from the cable tester to a PDF format.

B. Fiber Optic Cables:

1. Test fiber optic cables and submit fiber test result data in an electronic format and provide one hardcopy of the test results showing graphically, the entire length of the fiber.
2. Show cable ID, cursor marks, total attenuation, date of installation and test used.
3. Submit one copy of software capable of viewing the electronic test result files.

C. High Pair Count Copper Cables:

1. Test high pair count copper cables and submit test result information in an electronic format.
2. Minimal acceptable formats are PDF.
3. Refer to Project Coordinator for required format for test report documentation.

END OF SECTION

SECTION 27 15 00
COMMUNICATIONS HORIZONTAL CABLING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Horizontal Cable
   2. Audio Cabling
   3. Work Area Outlet Jacks
   4. Faceplates
   5. Wall Phone Wall Jack Assembly
   6. Equipment/Patch Cables

B. Horizontal cabling is the portion of the cabling system that extends from the work area to the Telecommunications Room Cross-connect.

C. Configure horizontal cabling in a star topology. The horizontal cabling includes the horizontal cables, mechanically connected jacks, outlets, and faceplates.

D. Minimum requirements for the following:
   1. Category 6A Cable, Jacks and Patch Cables.
   2. Installation and Termination Methods

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 27, Communications

C. Section 27 05 00, Common Work Results for Communications

D. Section 27 05 28, Pathways for Communications Systems

E. Section 27 08 00, Commissioning of Communications

1.03 REFERENCES

A. References, Codes and Standards as required by Section 27 05 00, Common Work Results for Communications and Division 01, General Requirements.

B. In addition, meet the following:

1.	ANSI/TIA/EIA - 568-B	Commercial Building Telecommunications Cabling Standard
2.	ANSI/TIA/EIA - 569-A	Commercial Building Standard for Telecommunications Pathway and Spaces
3.	EIA/TIA-606-A	Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
4.	EIA/TIA-607	Commercial Building Grounding and Bonding requirements for Telecommunications
5.	NEMA - 250	
6.	Federal Communications Commission 47 CFR 68.	
7.	BICSI Telecommunications Distribution Design Manual	
8.	BICSI Telecommunications Cabling Installation Manual	
9.	ANSI/NECA/BICSI 568-2001	Standard for Installing Commercial Building Telecommunications Cabling
10.	ADA - Americans with Disabilities Act	

11. NFPA 70 - 2002, including:
    a. NEC - Article 770
    b. NEC - Article 800
12. Underwriters Laboratory

1.04 QUALITY ASSURANCE

A. Conform to the quality assurance requirements of Section 27 05 00, Common Work Results for Communications and Division 01, General Requirements.

B. Install cabling and connectivity components in a neat and workmanlike manner. Methods of construction that are not specifically described or indicated in the Contract Documents and subject to the control and approval of the owner's Information technology Department.

C. Equipment and materials quality and manufacture indicated. Equipment specified is based upon the manufacturers listed.

D. Equipment new and free of defects.

E. Strictly adhere to Telecommunications Industry Alliance standard installation practices when installing UTP data cabling.

F. Materials and work specified herein comply with the most current version of the publications listed in the References section of this document.

1.05 SUBMITTALS

A. Including, but not limited to: Product Data Sheets, Shop Drawings, etc.

B. General:
    1. Submit in accordance with Section 27 05 00, Common Work Results for Communications submittal requirements.

C. Closeout Submittals:
    1. Submit in accordance with Section 27 05 00, Common Work Results for Communications submittal requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Horizontal Cable:
    1. CommScope Media 6 U/UTP (Color Pink)
    2. Superior Essex
    3. General
    4. Or approved equal.

B. Speaker Cabling:
    1. Windy City Wire Model 4423280 (Color Pink)
    2. Or approved equal.

C. Work Area Outlet Jacks:
    1. Leviton
    2. Legrand (Ortronics)
    3. Panduit
    4. Or approved equal.

D. Faceplates:
    1. Leviton
    2. Legrand (Ortronics)

3. Panduit
4. Or approved equal.

E. Wall Phone Wall Jack Assembly:
1. Leviton
2. Legrand (Ortronics)
3. Panduit
4. Or approved equal.

F. Equipment/Patch Cables:
1. Commscope
2. Superior Essex
3. General
4. Or approved equal.

2.02 HORIZONTAL CABLE

A. Performance: Transmission Characteristics: ANSI/TIA/EIA-568-B.2-10 standard for Category 6 UTP cable.

B. Meet applicable requirements of ANSI/ICEA S-80-576.

C. Four 24 AWG Twisted pairs.

D. The overall diameter of the cable less than 0.28 inches.

E. The ultimate breaking strength measured in accordance with ASTM D 4565 400 N minimum.

F. Lead free cable jackets and rated for its installed environment.

G. Withstand a bend radius of 1-inch at -20 degrees C without jacket or insulation cracking.

H. Cable jacket color blue, unless otherwise noted.

I. The cabling used in this project manufacturer compatible with other parts of the component system for a full 20-year warranty. In order to qualify for the warranty, the structured cabling system must be installed per the following:
1. Meet TIA/EIA commercial building wiring standards.
2. Use products purchased from authorized distributors.
3. Install installed in accordance with the manufacturer's warranty guidelines.

2.03 COAXIAL CABLING

A. Provide coaxial cabling as specified on the contract drawings, from the Telecommunications Room/Telecommunications Enclosure to the designated Work Area Outlet.

B. RG-6QS (Radio Grade – Series 6 Quad shield).

C. Color: Black

D. Sweep tested for up to 3GHz operation.

2.04 WORK AREA OUTLET JACKS

A. Performance:
1. Physical Characteristics:
a. Keystone style.
b. Functional from -10 degrees F to 140 degrees F.
c. Test in accordance with ANSI/EIA/TIA-568-B.2-1 for Category 6A
d. Modular RJ45 jacks that snap into user configurable faceplates meeting durability requirements specified in IEC 603-7.

e. 110 IDC, RJ45 type suitable for eight 22-26 AWG wires and be certified Category 6 compliant.

f. Construct jacks of high-impact plastic.

g. Separate and align conductors internally by separate compartments within the jack.

h. Wired in accordance with EIA/TIA T568B polarization sequence.

B. Provide high-impact plastic faceplates with labels, label faceplates according to the guidelines set forth in Section 27 08 00, Commissioning of Communications.

C. Single gang faceplates, 2-3/4-inch by 4-1/2-inch

D. Double-gang faceplates, 4-1/2-inch by 4-1/2-inch

E. Keystone style.

F. 4 port standard.

G. Provide blank inserts for unfilled outlet locations.

H. UL Listed

2.05 WALL PHONE WALL JACK ASSEMBLY

A. Stainless steel construction

B. Mounting lugs designed to mate with corresponding telephone base plate or adapter.

C. Mount to single gang outlet box.

D. Wired to TIA-568B Standards.

2.06 EQUIPMENT / PATCH CABLES

A. Equipment and Patch cables are part of the horizontal channel and tested as specified in Section 27 08 00, Commissioning for Communications Systems.

B. Provide 20-foot equipment cables for WAP locations shown on contract drawings.

C. Physical Characteristics:

1. Verify lengths with authorized representative prior to procurement.

2. Stranded conductors and meet Category 6A performance criteria as defined by TIA 568-B.2-1.

3. Lengths required will range from 3 to 15 feet as required by Owner's authorized representative.

a. 15-foot workstation cords for 80 percent of the installed faceplates.

b. 4-foot patch cords for 40 percent of the installed faceplates.

c. 6-foot patch cords for 40 percent of the installed faceplates.

d. 4-foot patch cords for 20 percent of the installed faceplates.

e. 6-foot patch cords for 20 percent of the installed faceplates.

PART 3 EXECUTION

3.01 INSTALLATION

A. UTP Cable:

1. Conceal wiring in walls or soffits. Install in metal conduits.

2. Install exposed wiring in surface raceway.

3. Install wiring above ceilings in cable tray or open top cable hangers.

4. Support cable above accessible ceilings 3-foot on center from cable support attached to building structure.

5. Do not untwist cable pairs more than 1/2-inch when terminating.

6. Responsible for replacing cables that do not pass testing and administration requirements laid out in Section 27 08 00, Commissioning of Communications.
7. Maximum length, 90 meters.
8. No physical defects such as cuts, tears, or bulges in the outer jacket. Replace defective cables.
9. Install cable in neat and workmanlike manner. Neatly bundle and tie cable in closets. Leave sufficient cable for 90 degree sweeps at vertical drops.
10. Maintain the following clearances from EMI sources.
    a. Power Cable: 6-inches
    b. Fluorescent Lights: 12-inches
    c. Transformers: 48-inches
11. Do not install Category 6A cable with more than 25 pounds pull force, as specified in EIA/TIA and BICSI installation practices. Utilize appropriate cable lubricant in sufficient quantity to reduce pulling friction to acceptable levels on:
    a. Long pulls inside conduit, pulls of multiple cables into a single small bore conduit, on conduit runs greater than 100 lineal feet with bends of opposing directions, and in conduit runs that exceed 180 degrees of accumulated bends.
    b. Use of tensile rated cords (i.e., fishing line) should be used for difficult or questionable pulls – to judge to go/no-go condition of the conduit and pulling setup. Utilize thin-coat lubricants when feasible.
12. Replace cables jackets that are chaffed or burned exposing internal conductor insulation or have bare copper, shiners.
13. Firestop openings where cable is installed through a fire rated wall or enclosure.

B. Inserts and Faceplates:
1. Terminate cables with high density modular jacks that snap into a faceplate mounted on a wall outlet box, surface raceways, or power pole.
2. Secure outlet boxes to building with mechanical fasteners. Adhesive fasteners are not allowed.
3. Fill extra openings with blank inserts.
4. Terminate cable per EIA/TIA T568B standard pin assignments.
5. Locate so that combined length of cables and cords from panel to phone or computer does not exceed 3m.

END OF SECTION

SECTION 27 51 23
INTEGRATED ELECTRONIC COMMUNICATIONS NETWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The drawings and general provisions of the Contract Documents apply to this Section.

1.02 SUMMARY

A. This section includes a fully operational IP platform for a district-wide internal and school Critical Communications Solution, incorporating school safety notifications and general communications including but not limited to the following:

1. The platform shall provide complete internal communications and employ state of the art IP Technology including the minimum functions listed.
    a. Communications between staff locations and classrooms.
    b. Scheduled bell events.
    c. Emergency announcements that will override any pre-programmed audio, assuring that all Emergency/Lockdown etc., are heard at each and every speaker location.
    d. Capability of prerecording emergency announcements that can be activated by a Soft Key on an administrative console, panic button, dial string, or web browser.
    e. District-wide, Emergency, Group, All School and Zone live voice paging.
    f. District-wide, Emergency, Group, All School and Zone paging for pre-recorded audio – tones, music and voice.
    g. Web-based user interface.
2. The system shall support a minimum of 1000 level priorities which shall be user-definable, allowing each end point to place a minimum of 5 different priority calls at the same time.
3. Any authorized administrator shall be able to call from outside the school into any classroom, zone, or entire school directly via the School District supplied SIP enabled Telephone Network. This shall allow remote monitoring, call-in annunciation, and two-way conversation from outside the facility as well as paging into the system. (Compliance with NEMA Standard SB-40 for emergency communications in K-12 Schools).
4. Authorized system users shall be able to create a minimum of 100 automated sequences with voice instructions, tones, emails, program distribution, and relay activations and replay them.
5. Automated message strings shall be manually initiated from a single-button access on the console, on a SIP connected telephone, a panic button, from the web-based user interface or via interface with third party systems.
6. Paging features shall be accessible from any system console or SIP connected telephone for each campus.
7. The platform shall synchronize its system time to the network timeserver or a web-based time server.
8. Each single campus installation shall be locally survivable for paging, bells, and emergencies such as lockdown, even when the district connection is unavailable.
9. This specification establishes a minimum level of quality, features, and performance for individual components as well as the integrated system.

10. Systems that do not comply with the feature-sets highlighted in this Specification will not be considered.

1.03 DEFINITION OF TERMS

A. Installer(s): Shall refer to the person, persons, or company who or which actually contracts to perform the work specified herein.

1.04 SUBMITTALS

A. Product data for each component.

B. Shop Drawings: Prior to proceeding with the work: Provide detailed equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, location of each field connection, and a complete schedule of all equipment and materials with associated manufacturer's cuts sheets which are to be used.

1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring. Identify terminals to facilitate installation, operation, and maintenance. Include a single-line diagram showing cabling interconnection of components and levels throughout system and impedances.
2. Each drawing shall have a descriptive title and all sub-parts of each drawing shall be labeled. All drawings shall have the name and locations of the project, Systems Contractor's name in the title block.
3. Details and descriptions of any other aspect of the system, which must differ from the contract documents due to field conditions or equipment, furnished.
4.

C. FCC Approval: The system shall be approved for direct interconnection to the telephone utility under Part 68 of FCC rules and regulations. Systems, which are not FCC approved or utilize an intermediary device for connection, will not be considered. Provide the FCC registration number of the system being proposed as part of the submittal process.

D. Product Certificates: Signed by manufacturers certifying that products furnished comply with specified requirements.

E. Installer Certificates: Signed by manufacturers certifying that Installers comply with specified requirements.

F. Manufacturer Certificates: Signed by manufacturers certifying that they comply with specified requirements.

G. Field Test Reports: Indicate and interpret test results for compliance with performance requirements. Include record of final matching transformer-tap settings, and signal ground-resistance measurement certified by Installer.

H. Maintenance Data: For equipment to be included in maintenance manuals specified in Division 1.

1. Record of Owners equipment-programming option decisions.2. All instructions necessary for proper operation and manufacturer's instructions.
2. Proof of Performance" information.
3. Manufacturer's maintenance information.
4. Copies of non-proprietary computer programs and system set up disks documenting all programmable features of the installed system.

I. Record Drawings: Prior to final acceptance, provide three (3) complete sets of drawings indicating all cable numbers and construction details in accordance with the actual system installation. Revise all shop drawings to represent actual installation conditions. These Record Drawings will be used during “Final Acceptance Testing”.

J. System Training: Submit the following information describing the training programs and system trainers as outlined in paragraph 1.6 of this specification and in accordance with Division 1 specifications.

1. Include with the submittal a preliminary staff development training program in outline form for review and approval by the owner’s representative.
2. Include with the submittal a current copy of the trainer’s certification from the manufacturer that certifies and identifies the trainer(s) who are eligible to provide training and support for the project.
3. Include with the submittal a current copy of trainer’s needs assessment form which will be reviewed with the owner’s designated representative for the system’s preliminary system programming and configuration.
4. Include with the submittal copies of all documentation used to identify for the owner those participants attending and completing the training programs.

K. A copy of the manufacturer’s standard statement of warranty proving all equipment provided for the school communications network is covered with the required five-year warranty shall be included with the project submittal. This statement of warranty shall be provided on the manufacturer’s stationary.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An experienced Installer who is an authorized representative of equipment manufacturer for both installation and maintenance of equipment required for this Section. Provide the following within thirty (30) days after notification to proceed:

1. Provide a list of installations that the Installer has specifically installed for verification by the Owner. Random installations from other vendors and/or Installers shall not be accepted. The Installer, not its employees, must meet these qualifications.
2. The Installer shall be bondable.
3. The Installer shall demonstrate to the satisfaction of the Owner or his representative that he has:
    a. Adequate plant and equipment to pursue the work properly and expeditiously.
    b. Adequate staff and technical experience to implement the work.
    c. Suitable financial status to meet the obligations of the work.
    d. Technically capable and factory trained service personnel at a local service facility to provide routine and emergency service for all products used in this project.

B. Any Contractor, who intends to bid on this work and does not meet the requirements of the “Quality Assurance” paragraph(s), shall employ the services of an “Installer” who does meet the requirements and who shall provide the equipment, make all connections and continuously supervise the installation. A subcontractor so employed as the “Installer” must be acceptable to the Architect/Engineer. The “Installer” shall be identified within thirty (30) days of notification to proceed for acceptance by the Architect/Engineer.

C. Because the life expectancy of this type of communications structure normally exceeds 10 years, the owner expects continuity from the service provider. If the installing/servicing company has not been an authorized provider of the manufacturers product for it least (10) years, the following is required:

1. A list of (2) systems manufacturers of which they currently are authorized service providers where the relationship exceeds (10) years.
2. A letter from the manufacturer outlining the details of changes in service providers over the last (5) years and what actions they will take to ensure continuity of service to the customer.

D. Each major component of equipment shall have the manufacturers name, address and model number on a plate securely affixed in a conspicuous place. NEMA code ratings, UL Label, or other data that is die-stamped into the surface of the equipment shall be easily visible.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

F. Comply with NFPA 70

G. Comply with NEMA Standard SB-40 for Emergency Communications in K-12 schools.

H. Comply with UL 60950.

1.06 IN-SERVICE TRAINING

A. The contractor shall provide and implement a complete and comprehensive staff training program for all administrators, facility staff members, and teachers. This mandatory training program will provide school staff a complete understanding of how to utilize and properly operate all functions.

B. The training program shall be implemented by a staff member/trainer employed by the contractor. The trainer must be factory certified to provide training on their product.

C. All staff development training is to be coordinated through the owner's designated representative. As training sessions are completed, the trainer will provide the school's administrative staff and school district's staff a document listing all of the staff and faculty members who attended, received, and completed the training program.

1.07 WARRANTY

A. Provide a manufacturer's five-year warranty of the school communications network equipment against defects in material and workmanship. This warranty will cover all electronic system components. Additional warranties cover speakers, and call in switches. If any defects are found within the warranty period, the defective equipment shall be replaced at no cost (equipment only); a one year warranty shall be provided for labor.

B. A copy of the manufacturer's standard statement of warranty proving all equipment provided for the school communications network is covered with the required five-year warranty shall be included with the project submittal. This statement of warranty shall be provided on the manufacturer's stationary. The standard five-year warranty is an important element in establishing a standard in quality. Manufacturers who circumvent the five-year warranty by offering special "extended warranties" that are not part of their normal published warranty will not be accepted.

C. Contractor shall respond, excluding weekends and holidays, within 24 hours to any warranty service calls. If equipment cannot be repaired within 24 hours of service visit, the contractor shall provide "loaner" equipment to the facility at no charge.

D. Make available a service contract offering continuing factory authorized service of the system after the initial warranty period.

1.08 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide the following system:

1. Telecenter manufactured by Rauland

a. Authorized Rauland Distributor contact:

b. GB Manchester, Inc.

c. 6000 NE 88th Street, Suite B103

d. Vancouver, WA 98665

e. Contact: Dale Williamson

f. Email: dale.w@gbmanchester.com

B. Source Limitations: Obtain paging system from single source/single manufacturer.

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

D. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 SYSTEM REQUIREMENTS

A. Functional Description of the System:

1. Selectively connect any zone to any available signal channel. Includes programming of zones shown on drawings into functional groups as determined by the Owner.

2. "All-call" feature shall connect the all-call sound signal simultaneously to all zones regardless of zone or channel switch settings.

3. VoIP paging interface shall allow paging by dialing an extension from any local telephone instrument and speaking into the telephone.

4. Produce a program-signal tone that is amplified and sounded over all speakers, overriding signals currently being distributed.

5. Reproduce high-quality sound that is free of noise and distortion at all loudspeakers at all times during equipment operation including standby mode with inputs off; output free of non-uniform coverage of amplified sound.

6. Reproduce school bell tones as defined by a schedule determined by the Owner. Includes programming of up to 12 standard schedules.

B. The platform shall utilize state of the art IP Technology for Call-in Notification, School Safety Paging and Evacuation tones, Atomic Time Synchronization, Class Change Tones utilizing multiple, programmable schedules for each zone, Two-way hands-free Internal Communications and Paging, and Program Distribution. The system shall be easy to learn and operate. All standard programming shall be web-based and user friendly to allow the system administrator the ability to easily program system features.

C. Provide complete and satisfactorily operating district/school communications and district/school safety as described herein, using materials and equipment of types, sizes, ratings, and performances as indicated. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction, in accordance with published product information. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions.

D. The platform shall be a single electronic system consisting of a minimum of 4 audio channels, IP Zone Modules connecting corridor speakers, inside and outside horns, IP Administrative Consoles, SIP enabled PBX integration and district-wide integration for paging, emergency notifications, calendar scheduling and configuration.

E. Each Classroom shall be provided with a 25v Speaker with integrated volume control.

F. Call-ins may automatically annunciate (display of priority and location) to administrative consoles, SIP enabled phones, and outside phones.

G. Call-ins shall be programmed to automatically change priority and annunciation route based on age of call-in and original priority.

H. Call-ins may have priority (and annunciation route) changed by user action from a console or SIP enabled phone.

I. Call-in annunciation route shall include playing pre-recorded audio over speakers, sending a pre-configured email, and activating relays.

J. The platform shall lend itself to expansion by simple addition of hardware modules.

K. The platform shall connect directly to an existing, standard protocol WAN/LAN network, without the need for a separate server at each school location. Configuration, including bell schedules, calendars, and emergency sequences can be remotely created, changed, stored and downloaded to the system by an authorized user from a web-based user interface.

L. The platform shall provide the ability to initiate school safety paging announcements, evacuation tones and take cover tones from any telephone or connected web browser within the facility or outside the facility to any other location within the facility or district.

M. The platform shall allow users to configure multiple schedules per school, with a minimum of 500 unique events per schedule, and automatic Daylight Savings time correction. Schedules can be programmed to occur once, daily, weekly, monthly, or in any combination of the preceding recurrences. Each school may have a minimum of 20 unique bell schedules, with a minimum of 5 active schedules on any given day for each campus. User shall be able to select from 25 standard included tones as well additional user created and uploaded audio files for class change signaling and messaging. In addition, scheduled events shall include relay actions, email notifications, and paging exclusions as system configuration changes. The platform shall allow control of the bell schedules via the district WAN/LAN without the need for a separate server at each school location. Bell schedules can be remotely created, changed, stored and assigned to calendar days for the local school by an authorized user from a web-based user interface.

N. The platform shall be able to integrate with an existing PA system or operate as a fully independent IP solution. The platform shall be able to function in combination of said configurations, and allow for seamless communication within a school or district-wide, regardless of the type of configuration used. The platform shall be scalable, with the ability to easily add, install, and configure additional equipment to a system.

O. The platform allows for customization of preprogrammed sequences, used for emergencies, events, and everyday communications. Preprogrammed sequences can be activated from the push of a relay button, soft key of an administrative console, a dial string of a SIP phone, or a web browser configured to the district network. Sequences can be initiated automatically as part of a schedule or on the fly. Preprogrammed sequences can be customized to utilize any combination of audio tones, emails, relays, tone exclusions, swings, delays, duples, SIP phone notifications, and program distribution. Audio tones can include customized audio files and voice messages, recorded in any language. Uploaded audio tones and messages can be preprogrammed to annunciate repeatedly or individually, as part of a scheduled sequence or on the fly. Each school in a district can have its own customized sequences, and can be activated individually, in groups, or district-wide.

2.02 EQUIPMENT AND MATERIAL

A. Master Controller: Rauland TCC2000 — Telecenter U Campus Control

B. Amplifiers: Ashly NX 1504

C. Zone Paging Module: Rauland RCC2022

D. POE Auxilery Input/Output Module: Rauland TCC2033

2.03 OFOI NETWORK EQUIPMENT

A. The Owner will provide network switches. Their standard manufacturer is Brocade.

B. Contractor is required to submit a list of IP devices requiring IP addresses and associated information required for programming purposes, in a spreadsheet or table format, such that Owner's IT staff can provide all necessary information in a timely manner with minimal effort. Contractor to indicate devices that require Power-over-Ethernet and power consumption characteristics of each device.

2.04 OUTDOOR PAGING SPEAKERS

A. Rauland speaker inside Rauland Enclosure with Volume Control.

B. Approved Equivalent

C. Multi-tap 2 through 15-watt mini-horn mounted inside of recessed enclosure specified.

D. Enclosure must be weather and vandal resistant.

2.05 CLASSROOM SPEAKERS:

A. Model Rauland ACC1403

1. Description: Assembly; speaker with matching transformer; speaker to be permanent magnet cone-type with viscous-damped cone; speaker shall be equipped with dual winding line matching transformer.
2. Integrated volume control.
3. Speaker Specifications: Nominal Size: Maximum size 8" With a 12" grill
4. Frequency range: 65 HZ to 17,000 HZ
5. Power rating: Normal 8 watts, Peak 15 watts
6. Voice coil impedance: 8 ohms
7. Axial sensitivity: 93 db at 1w/1m/1KHz
8. Depth: 2.75"

2.06 PATHWAYS

A. Conduit and Boxes: Comply with Section 270528 "Pathways for Communications Systems."

2.07 WIRE AND CABLE

A. Speaker Cable:
   1. Windy City Wire Part Number 4423280 Type CMP Multi-Conductor Shielded Plenum Cable.
   2. Cable Color is to be Pink.

B. Category Cable:
   1. Commscope Part Number 8774414/10 | 6504+ PINK CPK
   2. Category 6 U/UTP Plenum Rate
   3. Cable color to be Pink.

C. IP wiring: Comply with Section 271500 “Communications Horizontal Cabling”

D. Server Software
   1. Provides district-wide paging, bell event scheduling, emergency notification and configuration for entire district.
   2. Ability to configure system and initiate system features, per school and district-wide via web-based user interface.
   3. The software has the ability to sync system time to the Atomic Clock Signal or to the school’s or district’s network time server.
   4. The software will provide a web browser to deliver district-wide emergency paging, pre-recorded messages and tones from any authorized computer in the facility or the district. The software must be capable of automatically notifying district personnel via the WAN/LAN of an alarm condition.
   5. The software can automatically broadcast emergency instructions via associated system hardware throughout an entire district when an alarm (e.g. lockdown, lockout, security, fire) is initiated via the web-based user interface. The emergency instructions are preprogrammed and require no user intervention. Bell tones are able to be halted during an emergency. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.
   6. The software allows for user-uploaded pre-recorded messages and tones. Software supports the upload of MP3 and WAV file types. User-uploaded pre-recorded messages and tones can be part of emergencies, sequences, and bell schedules.
   7. The software can be installed in cloud, virtual or physical server environments.
   8. The web-based user interface supports secure HTTP browsing.
   9. The software supports encryption to ensure secure access.
   10. The system shall monitor itself if devices go offline and system actions are not received. Specified users shall receive email notifications when devices go offline. The software shall be able to keep a log and report on system activity within a school or all schools district-wide for a minimum of one year. These reports can be exported to excel spreadsheets.
   11. The software will support a minimum of 20 bell schedules per school, with 5 schedules assignable to a specific school day. Bell schedules can be programmed to annunciate tones, activate relays, send emails, activate program distribution, and notify SIP phones.

12. The system allows programmable end points to be automatically included or excluded for live paging, bell tones, or prerecorded audio, depending on the time or day or day of the week. These inclusions/exclusions can be applied manually or automatically depending on their schedule.
13. The software can automatically send an email, as part of a programmed sequence of events, to district administrators alerting them of an emergency within the district.
14. The software provides the ability to view schools that are in an emergency status, using any web browser on the district's network. The software shall identify the name of the school in an emergency as well the type of emergency that school is in.
15. The software provides the ability to view individual classrooms that are not checked-in during an emergency, using any web browser on the district's network. The software shall identify the name, extension, and description of the classroom that is not checked-in during the emergency.
16. The system has a minimum of 5 customizable emergencies, one of them being an All-Clear – with the ability to return the system from an emergency to normal status. Each emergency shall have a minimum of 500 unique events.
17. As a district-wide communications solution, the system shall be able to provide simultaneous communications to all schools or groups of schools within a district. The system shall allow a user to initiate district-wide communications to individual schools, all schools or groups of schools, from a web-based user interface. The system shall allow a user to initiate prerecorded audio, live paging, or programmed sequences to individual schools, all schools or groups of schools, from the web-based user interface. Programmed sequences shall be customizable per school, and the system shall be able to activate them simultaneously to individual schools, all schools or groups of schools, from the web-based user interface.
18. The communications software must allow upgrade from an individual school system to multiple schools, or an entire school district, using the same web-based user interface. The communications software from an individual school system must be identical in typical user operation to the multiple schools or entire school district communications system software.

E. Campus Controller

1. Provides call routing for paging and intercom for a single facility.
2. System shall connect to the district provided Telephone Network via a SIP connection.
3. Support a flexible numbering plan allowing two, three, four, five, or six digit extensions.
4. SIP interface to a district provided Telephone Network shall be capable of allowing connected phones to display classroom call-ins, answer internal intercom call-ins, make pages and change priorities of call-ins in progress.
5. Direct dialing, two-way amplified voice intercom between any provided telephone or admin console and speaker without the use of a press-to-talk or talk-listen switch.
6. Ability to upgrade priority level from individual call switch.
7. The ability to answer intercom call-ins registered at administrative consoles and pre-selected telephones.

8. The ability to automatically escalate incoming call-ins to an alternate telephone or group of telephones if they remain unanswered for a predetermined amount of time.
9. The ability to manually upgrade an intercom call-in to an alternate telephone or group of telephones.
10. The ability for classrooms to “check-in” via push button when they have successfully secured their location during emergency.
11. Administrative console shall display locations that have not checked in to confirm their secured location and provide hands-free audio monitoring and communication to unsecured locations.
12. The controller shall not need direct connection to any classroom via home run or distributed wiring. It shall communicate solely through the IP network.
13. Single button access from any console on the system to distribute emergency announcements within the facility to all or select locations equipped with speakers. Emergency announcements originating from any assigned administrative console shall have priority over all regular system functions.
14. Ability for administrative consoles and connected phones to selectively monitor audio at any two way speaker during an emergency.
15. Stores a minimum of 48 hours’ worth of Bell Event Schedules, all emergency notification sequences as well as facility wide configuration.
16. System has the ability to sync system time to the Atomic Clock Signal or to the school’s or districts network time server.
17. System’s SIP Interface shall provide:
    a. Audio paging access from any telephone to any single intercom speaker, zone (group) of intercom/paging speakers, or all speakers/paging horns throughout the entire facility.
    b. Ability to answer a call-in directed to that SIP extension.
    c. Ability to upgrade a call-in directed to that SIP extension.
    d. Single button access from any telephone on the system to initiate alarm signals within the facility to all or select locations equipped with speakers. A minimum of 25 separate distinct alarm signals shall be provided. Alarm signals originating from any assigned administrative telephone shall have priority over all regular system functions.
    e. Ability to initiate a school-wide emergency including lockdown and evacuate sequences.
    f. SIP device shall display call-in information from call in switch. Information will include a minimum of Classroom Name, Number, and Priority Level.
18. The system will have the ability to utilize a web browser and a USB microphone connected to the PC to deliver district-wide live emergency paging, pre-recorded messages and tones from any authorized computer in the facility or the district. The system must be capable of automatically notifying district personnel via the WAN of an alarm condition.
19. The system can automatically broadcast emergency instructions throughout an entire campus when an alarm (e.g. lockdown, lockout, security, fire) is tripped or manually activated. The emergency instructions are preprogrammed and require no user intervention. Bell tones are able to be halted during an emergency. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.

F. IP Addressable Modules:

1. System shall provide multiple IP Addressable Modules for intercom, paging and relay activation.
    a. All Modules are POE 802.3af compliant
    b. All Modules support DHCP.
    c. All Modules connect to network with a single RJ45 connector
2. IP Addressable Speaker Module
    a. a. Shall interface to school's data network, a classroom speaker, and multiple call switches.
    b. b. A minimum of 5 levels of call-in can be placed from an IP Speaker Module. The call-ins are routed to administrative consoles and select SIP connected telephones and can only be cleared from the system once answered. If a call-in is not answered within a preprogrammed time the call-in may reroute to other telephones, consoles, and speakers.
    c. c. An option for Privacy call in switches is supported. When the Privacy switch is activated it prevents administrative or classroom telephones from monitoring the specific classroom/location intercom speaker.
    d. d. The ability to belong to one or more of a minimum of 100 independent zones for zone paging, program/music distribution zones and class change tone zones; this assignment is a programmable function, changeable by time of day. Each IP Speaker Module's location shall be programmed in software to belong to any combination of software zones. IP Speaker Modules shall be designed to mount near ceiling and wall speakers and in the plenum space.
    e. Intercom and paging volume adjustable from Software interface.
3. IP Addressable Zone Paging Module
    a. Zone Paging Module shall connect multiple speakers for district all page, all page, zone paging, bells, audio events and, emergency notification.
    b. Zone Paging Modules shall be rack and wall mountable.
    c. Zone Paging Modules shall be able to belong to one or more of 100 independent zones for live paging, bells, pre-recorded audio and emergency notification.
4. IP Addressable Aux I/O Module
    a. Aux I/O Module shall have two input contacts and two output contacts.
    b. Input and output contacts are individually addressable.
    c. Aux I/O Module shall be wall and rack mountable.
    d. User can program relays to be activated manually, through an event/bell schedule, or during emergency notification.
    e. Aux I/O Module can perform school lockdown from a single press of a panic button.
5. IP Addressable Program Line Input Module
    a. Program Line Input Module shall provide line level audio program distribution into system.
    b. Program Line Input Module shall have a 3.5mm cable jack.

c. Program Line Input Module shall be configured via web-based user interface.

d. User can configure program distribution to be activated manually or automatically through an event/bell schedule.

e. Program Line Input Module will have a system priority level such that emergency communications override program distribution.

G. IP Addressable Analog Gateway

1. IP Addressable Gateway provides integration with existing analog wiring infrastructure – consisting of shielded two-pair classroom field wiring. The Gateway provides the ability to reuse speaker wiring, speakers, and punch blocks to integrate analog infrastructure with IP platform.
2. Each Gateway will have 5 watts of power per port and 25 watts total per device.
3. Supports 24 classrooms that utilize 25 Volt speakers and all current Telecenter call switches for front office notification.
4. Supports minimum of 5 call switch priorities per classroom, capable of lockdown check-in functionality, while reusing existing shielded two-pair classroom field wiring.
5. Classroom intercom volume adjustable from Software interface.
6. Classroom paging volume adjustable from Software interface.
7. Configured to the school network and can be used in conjunction with IP Addressable Modules.

H. IP Addressable Administrative Console

1. A full color screen with 64 soft keys, 3 line select, volume control, push to talk, speakerphone mode and left/right and up/down scrolling.
2. Audio paging access from any Console to any single intercom speaker, zone (group) of intercom/paging speakers, or all speakers/paging horns throughout the entire school.
3. Programmable soft key access from any console on the system to initiate alarm signals within the school to all or select locations equipped with speakers. A minimum of 25 separate distinct alarm signals shall be provided. Alarm signals originating from any assigned administrative console shall have priority over all regular system functions.
4. Programmable soft key access from any console to automatically broadcast page emergency instructions throughout an entire school when an alarm (e.g. lockdown, lockout, security, fire) is tripped or manually activated. The emergency instructions are preprogrammed and require no user intervention. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.
5. Ability to perform intercom to any single IP Addressable Speaker Module.
6. Ability to display 3 call-ins at a time on the screen while other call-ins are annunciating and the ability to scroll to view all call-ins.
7. Ability to upgrade a call-in via soft key.
8. Programmable soft key access from any console for activating relays, campus wide.
9. Ability to maintain, along with controller and other IP Modules system functions, including intercom, bells and paging for the local campus in the event of district-wide connection loss.

10. Classrooms that have not ‘checked-in’ during an emergency are listed on the Administrative Console’s screen.

11. The time duration of an emergency is shown on the screen of the administrative console. The check-in timer is shown on the screen of the administrative console.

I. Audio Paging/Program Amplifiers

1. Power amplifier(s) shall be provided to provide a minimum of 2 watts of power to all paging speakers, and 15 watts of power to all paging horns.

2. The maximum load on the paging/program amplifiers shall be 80% of the rated maximum output of the amplifiers.

J. Equipment Racks

1. All equipment racks shall provide 44 spaces (77”) minimum for mounted system equipment.

2. All equipment racks shall be multi-rack format (“gangable”) style, bolted together, and open cavity.

3. All equipment racks will be provided with lockable rear doors.

4. Equipment rack(s) shall be located in climate-controlled areas/rooms as shown on drawings.

5. All head-end, distribution, and source equipment, including data and power, shall be located in racks configured as approved by the Engineer.

6. Rack mounted equipment shall be accessible from front and rear.

7. All unused rack spaces will be covered with appropriate blank/vent panels.

K. Classroom Interior Ceiling or Wall Speakers

1. Provide Ceiling Speaker Assembly consisting of 8 Ohm, 8” speaker mounted in a 2 foot by 2 foot, or 2 foot by 1 foot, lay-in baffle, with an integrated back box that covers the full area of the baffle.

2. The speaker shall be connected by inserting an 8-pin RJ45 terminated CAT 5e or Cat 6 cable.

3. The speaker shall include provisions to allow attachment of a safety cable if required.

L. Wall Mounted Horns

1. Provide double re-entrant type horn loudspeakers with integral driver. The horn loudspeaker shall be impervious to weather and vandalism. Horn shall be constructed of heavy-duty ABS plastic. Horn loudspeaker drivers shall be rated at 15 watts with a frequency response of 480 Hz to 14 KHz. Sensitivity shall be 106 dB 1 watt, 1 meter. Transformer assembly shall be dual voltage multi-tap type suitable for 25 or 70-volt installations. Dispersion pattern shall be 180 degrees conical. The horn loudspeaker shall be constructed of treated heavy gauge aluminum, with all exposed parts potted and a sealed driver. Wiring terminal shall be fully enclosed. The speaker flange and mounting surface shall have a cork-rubber gasket. The horn loudspeakers finish shall be gray baked on enamel.

2. The recessed back box shall be of heavy gauge cold-rolled steel, spot welded for stability with a rust-retardant gray primer finish. Acoustically treat the interior to eliminate mechanical resonance. The back box shall be 10-3/4”x10-3/4”x6” deep.

3. The baffle shall be vandal proof, the faceplate constructed of 14-gauge carbon steel with a minimum tensile strength of 55,000 PSI. A lattice grid sub-plate shall deny access to the horn but be acoustically transparent for sound projection. Provide tamper proof, stainless steel mounting hardware. The baffle shall a mar/scratch baked epoxy rust inhibitive finish.

M. Uninterruptible Power Supplies (UPS)

1. UPS equipment provided for this system will include Power Conditioning to smooth current and voltage fluctuations.
2. UPS equipment will be sized in accordance with the system manufacturer's recommendations.
3. Provide an individual UPS for EACH SYSTEM CONTROLLER (Gateway) furnished with the system.
4. UPS equipment shall be rack mounted.
5. Cat6 patch cord color for IP paging system devices to be pink.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the School Communications and School Safety Network.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Cable Installation Requirements:

1. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
2. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
3. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
5. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend speaker cable not in a wireway or pathway a minimum of 8 inches above ceiling by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.

D. Separation of Wires: Separate speaker, line-level, speaker-level, and power wiring runs. Install in separate pathways or, where exposed or in same enclosure, separate conductors at least 12 inches apart for speakers and adjacent parallel power and telephone wiring. Separate other communication equipment conductors as recommended by equipment manufacturer.

E. IP wiring: Comply with Section 271500 “Communications Horizontal Cabling”

3.03 INSTALLATION

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

B. Equipment Cabinets and Racks:

1. Group items of same function together, either vertically or side by side, and arrange controls symmetrically. Mount monitor panel above the amplifiers.

2. Arrange all inputs, outputs, interconnections, and test points so they are accessible at rear of rack for maintenance and testing, with each item removable from rack without disturbing other items or connections.

3. Blank Panels: Cover empty space in equipment racks so entire front of rack is occupied by panels.

C. Conductor Sizing: Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker not smaller than No. 18 AWG.

D. Connect wiring according to Section 271500 "Communications Horizontal Cabling".

E. General: Install system in accordance with NFPA 70 and other applicable codes. Install equipment in accordance with manufacturer's written instructions.

F. Furnish and install all material, devices, components and equipment for a complete operational system.

G. Impedance and Level Matching: Carefully match input and output impedance’s and signal levels at signal interfaces. Provide matching networks where required.

H. Control Circuit Wiring: Install control circuits in accordance with NFPA 70 and as indicated. Provide number of conductors as recommended by system manufacturer to provide control functions indicated or specified.

I. The contractor shall provide necessary transient protection on the AC power feed, all copper station lines leaving or entering the building, and all central office trunks. All protection shall be as recommended by the equipment supplier and referenced to earth ground.

J. Wiring within Enclosures: Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars.

K. Provide physical isolation from speaker-microphone, telephone, line-level wiring, and power wiring. Run in separate raceways, or where exposed or in same enclosure, provide 12 inch minimum separation between conductors to speaker-microphones, telephone wiring and adjacent parallel power. Provide physical separation as recommended by equipment manufacturer for other system conductors.

L. Identification of Conductors and Cables: Use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams.

M. Weatherproofing: Provide weatherproof enclosures for items to be mounted outdoors or exposed to weather.

3.04 GROUNDING

A. Provide equipment grounding connections for Integrated Electronic Communications Network systems as indicated. Tighten connections to comply with tightening torques per manufacturer requirements to assure permanent and effective grounds.

B. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments..

C. Provide all necessary transient protection on the AC power feed and on all copper station lines leaving or entering the building. Note in system drawings, the type and location of these protection devices as well as all wiring information.

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

B. Inspection: Make observations to verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Provide a list of final tap settings of paging speaker line matching transformers.

C. Testing: Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

D. Tests and Inspections:

1. Schedule tests with at least seven days' advance notice of test performance.
2. After installing paging system and after electrical circuitry has been energized, test for compliance with requirements.
3. Operational Test: Perform tests that include originating program and page messages at program inputs, and other inputs. Verify proper routing and volume levels and that system is free of noise and distortion.
4. Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with A-weighted scale to measure level in each zone.

E. Prepare test and inspection reports.

1. Include a record of final speaker-line matching transformer-tap settings and signal ground resistance measurement certified by Installer.

3.06 FINAL ACCEPTANCE TESTING

A. The Final Acceptance Testing shall be provided to the Owner or the Owners designated representative only. Final acceptance testing to any other trade or service provider for the project will not comply with the requirements of this section.

B. The contractor will provide a Final Acceptance Test record document signed by both the contractor and the Owner or designated Owner’s Representative establishing the “In Warranty” date. The warranty period will not commence until the Final Acceptance Test is completed.

C. Be prepared to verify the performance of any portion of the installation by demonstration, listening and viewing test, and instrumented measurements. Make additional adjustments within the scope of work and which are deemed necessary by the Owner because of the acceptance test.

3.07 COMMISSIONING

A. The contractor shall train the Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventative maintenance of the system. This training will be in accordance with the training as outlined in Section 1.6 of these specifications. In addition to the Training Materials provided, the contractor will also furnish Operators Manuals and Users Guides at the time of this training.

B. Schedule training with Owner through the owners representative, with at least seven days advance notice.

3.08 STARTUP SERVICE

A. Perform startup service.

1. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.
2. Complete installation and startup checks according to manufacturer's written instructions.

3.09 OCCUPANCY ADJUSTMENTS

A. The contractor shall provide Occupancy Adjustments in accordance with Section 1.6 of these specifications. A response scenario amenable to both the owner and the contractor will be established and followed for the first year of service.

B. When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

C. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.

3.10 CLEANING AND PROTECTION

A. Prior to final acceptance, the contractor shall vacuum and clean all system components and protect them from damage and deterioration. All blank spaces in equipment cabinets will be covered with blank panels. Top and side panels, and all cabinet doors will be installed. All general areas within and around all equipment rack/cabinets in the facility will be swept, vacuumed, and cleaned up. No cabinets will be left unlocked and all cabinet keys will be turned over to the owner or designated owner’s representative.

END OF SECTION