SECTION 27 00 00
COMMUNICATIONS BASIC REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Work included in 27 00 00, Communications Basic Requirements applies to Division 27, Communications work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of communications systems for proposed project.

B. Contract Documents include, but are not limited to Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda and Owner/Contractor Agreement. Confirm requirements before commencement of work.

C. Definitions:

1. Provide: To furnish and install, complete and ready for intended use.
2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.
4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent," substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.
5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.
6. Entrance Facility (EF): Area or location that contains entrance point (demarcation) cable and associated equipment for telecommunication services entering the building.
7. Equipment Room (ER): Area or location that contains backbone cabling associated with interbuilding cable or cable that connects buildings together in a campus environment. ERs may contain Main Cross-Connects, Intermediate Cross-Connects, Horizontal Cross-Connects, and Telecommunication Rooms.
8. Main Cross-Connect (MC): Area or location that contains telecommunications equipment for connecting backbone cable to/from Intermediate Cross-Connects and Horizontal Cross-Connects. Active telecommunications equipment will often be contained in this area to serve as the telecommunications hub or headend. Backbone cable from Local Exchange Carrier's point of demarcation will connect to building backbone cable or active telecommunications equipment at this location.
9. Intermediate Cross-Connect (IC): Area or location that contains telecommunications equipment for connecting backbone cable from the MC to backbone cable distributing to one or many Horizontal Cross-Connects. This location may contain active telecommunications equipment.
10. Horizontal Cross-Connect (HC): Area or location that contains telecommunications equipment, cable terminations and cross-connect wiring. HC is the recognized connection point between backbone and horizontal pathway facilities.

11. Telecommunications Room (TR): Area or location containing telecommunications equipment, cable terminations and cross-connect wiring. Three applications serviced by TRs are horizontal cable connections, backbone system interconnection and entrance facilities. The TR provides facilities (space, power, grounding, etc.) for housing telecommunications equipment. TR may contain a MC, IC or HC and a demarcation point or an interbuilding entrance facility.
12. Interbuilding Cable: Backbone cable associated with connecting buildings together in a multibuilding or campus environment.
13. Intrabuilding Cable: Backbone cable associated with connecting Entrance Facility, Equipment Rooms, Main Cross-Connects, Intermediate Cross-Connects, Horizontal Cross-Connects, and Telecommunication Rooms together on single floor or multifloor building.

1.02 RELATED SECTIONS

A. Contents of Section applies to Division 27, Communications Contract Documents.

B. Related Work:

1. Additional conditions apply to this Division including, but not limited to:
   a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
   b. Drawings
   c. Addenda
   d. Owner/Contractor Agreement
   e. Codes, Standards, Public Ordinances and Permits

C. Scope of Work Attachment.

D. Related Products/Systems within Division 28, Electronic Security:

1. Section 28 10 00, Access Control and Intrusion Detection

1.03 REFERENCES AND STANDARDS

A. References and Standards per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, individual Division 27, Communications Sections and those listed in this Section.

B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:

1. State of Oregon:
   a. OAR - Oregon Administrative Rules
   b. OESC - Oregon Electrical Specialty Code
   c. OFC - Oregon Fire Code
   d. OMSC - Oregon Mechanical Specialty Code
   e. OPSC - Oregon Plumbing Specialty Code
   f. OSSC - Oregon Structural Specialty Code
   g. OEESC - Oregon Energy Efficiency Specialty Code
   h. Oregon Elevator Specialty Code

C. Reference standards and guidelines include but are not limited to the latest adopted editions from:

1. ABA - Architectural Barriers Act
2. ADA - Americans with Disabilities Act
3. ANSI - American National Standards Institute
   a. ANSI/TIA-568-C.0 - Generic Telecommunications Cabling for Customer Premises

b. ANSI/TIA-568-C.1 - Commercial Building Telecommunications Cabling Standard
c. ANSI/TIA-568-C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standard
d. ANSI/TIA-568-C.3 - Optical Fiber Cabling Components Standard. Commercial Building Telecommunicating Cabling Standard
e. ANSI/TIA-569-B - Commercial Building Standard for Telecommunications Pathways and Spaces
f. ANSI/TIA-570-B - Residential Telecommunications Infrastructure
g. ANSI/TIA-942 - Telecommunications Infrastructure Standard for Data Centers
h. ANSI/TIA/EIA-606-A - Administration Standard for Commercial Telecommunications Infrastructure
i. ANSI-J-STD-607-A - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

4. APWA - American Public Works Association
5. ASCE - American Society of Civil Engineers
6. ASHRAE Guideline 0, the Commissioning Process
7. ASTM - ASTM International
8. BICSI - Building Industry Consulting Service International
   a. BICSI TDMM - Telecommunications Distribution Methods Manual
   b. BICSI ESSDRM - Electronic Safety & Security Design Reference Manual
   c. BICSI AVDRM - AV Design Reference Manual
9. CFR - Code of Federal Regulations
10. EIA - Electronic Industries Association
11. EPA - Environmental Protection Agency
12. ETL - Electrical Testing Laboratories
13. FCC - Federal Communications Division
14. FM - FM Global
15. IBC - International Building Code
16. IEC - International Electrotechnical Commission
17. IEEE - Institute of Electrical and Electronics Engineers
18. ISO - International Organization for Standardization
19. MSS - Manufacturers Standardization Society
20. NEC - National Electric Code
21. NEMA - National Electrical Manufacturers Association
22. OSHA - Occupational Safety and Health Administration
23. TIA - Telecommunications Industry Association
24. UL - Underwriters Laboratories Inc.

D. See Division 27, Communications individual Sections for additional references.

E. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.

F. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

1.04 SUBMITTALS

A. See Division 01, General Requirements for Submittal Procedures.

B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.

C. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.

D. Provide product submittals in electronic format only. Electronic format must be submitted via zip file via e-mail or posted to ftp site. For electronic format, provide one zip file per specification division containing a separate file for each Specification Section. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. Copy Owner on all transmissions/submissions.

E. Product Data: Provide manufacturer's descriptive literature for products specified in Division 27, Communications Sections.

F. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the specifications and Drawings.

1. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
2. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference individual Division 27, Communications specification Sections for specific items required in product data submittal outside of these requirements.
3. See Division 27, Communications individual Sections for additional submittal requirements outside of these requirements.

G. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.

H. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer’s comments. Identify Engineer’s comments and provide an individual response to each of the Engineer’s comments. Cloud changes in the submittals and further identify changes which are in response to Engineer’s comments.

I. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-10 requirements for non-structural components. Equipment Importance Factor as specified in Division 01 and in Structural documents.

J. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.

K. Substitutions and Variation from Basis of Design:

1. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
2. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals." For any product marked "or approved equivalent," a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.

L. Resubmission Requirements:

1. Make any corrections or change in submittals when required. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Changes made for the resubmittal will be indicated in a cover letter with reference to page(s) changed and will reference response to comment. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
2. Resubmit for review until review indicates no exception taken, or "make corrections as noted."
3. When submitting Drawings for Engineers re-review, clearly indicate changes on Drawings and "cloud" any revisions. Submit a list describing each change.

M. Operation and Maintenance Manuals, Owner's Instructions:

1. Include Warranty per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Sections.
2. Include product certificates of warranties.
3. Include copy of test reports.
4. Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.
5. Copies of certificates of code authority inspections, acceptance, code required acceptance tests and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

N. Record Drawings:

1. Maintain at site at least one set of drawings for recording “as-constructed” conditions. Indicate on Drawings changes to original documents by referencing revision document, and include buried elements, location of conduit, and location of concealed communication items. Include items changed by field orders, supplemental instructions, and constructed conditions.
2. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.

3. At completion of project, input changes to original project on Revit Model and make one set of black-line Drawings created from Revit Model in version/release equal to Contract Drawings. Submit Revit disk and Drawings upon substantial completion.
4. Provide hard copy asbuilt drawings with outlet labeling and install on the back side f the door in each telecom room.
5. Provide electronic copy of asbuilt drawings with outlet labeling to district.
6. See Division 27, Communications individual Sections for additional items to include in Record Drawings.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials installed to conform with all local, state, federal and other applicable laws and regulation.

B. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., conduit) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.

C. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Owner, in writing, before starting work.

D. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.

E. Provide products that are UL listed.

F. Contractor Qualifications:

1. Minimum of five years' experience in the design, installation, testing and maintenance of communications systems.
2. Must employ at least one full time BICSI certified Registered Communications Distribution Designer (RCDD) who is involved in reviewing work performed by contractor on this project.
3. Maintain a local service facility which stocks spare devices and/or components for servicing systems.
4. Have performed successful installation and maintenance of at least three projects similar in scope and size. Be able to provide project references for these three projects, including scope of Work, project type, Owner/user contact name and telephone number.
5. The contractor selected for this project must be certified by the manufacturer of the approved products and utilize these components for completion of work.

1.06 WARRANTY

A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.

B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.07 COORDINATION DOCUMENTS

A. Prior to construction, coordinate installation and location of HVAC equipment, ductwork, grilles, diffusers, piping, plumbing equipment/fixtures, fire sprinklers, plumbing, lights, cable trays and electrical services with architectural and structural requirements, and

other trades (including ceiling suspension and tile systems), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.

B. Advise Owner in event a conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Owner of conflict.

C. Verify in field exact size, location, invert, and clearances regarding existing material, equipment and apparatus, and advise Owner of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.

D. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide like items from one manufacturer, including but not limited to jacks, patch panels, equipment connection cords and wall plates.

2.02 MATERIALS

A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL or ETL approved or have adequate approval or be acceptable by State, County, and City authorities. Equipment/fixture supplier is responsible for obtaining state, county, and city acceptance on equipment/fixture not UL approved or not listed for installation.

B. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer.

C. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.

D. Hazardous Materials:

1. Comply with local, State of Oregon, and Federal regulations relating to hazardous materials.
2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.
3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner. Hazardous materials will be removed by Owner under separate contract.

2.03 ACCESS PANELS

A. See Division 01, General Requirements and Division 08, Openings for products and installation requirements.

B. Confirm Access Panel requirements in Division 01, General Requirements and 08. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:

1. Provide flush mounting access panels for service of systems, equipment and individual components requiring maintenance or inspection. Where access panels are located in fire-rated assemblies of building, rate access panels accordingly.
   a. Ceiling access panels to be minimum of 24-inch by 24-inch required and approved size.
   b. Wall access panels to be minimum of 12-inch by 12-inch required and approved size.
   c. Provide screwdriver operated catch.

d. Manufacturers and Models:
   1) Drywall: Karp KDW.
   2) Plaster: Karp DSC-214PL.
   3) Masonry: Karp DSC-214M.
   4) 2 hour rated: Karp KPF-350FR.
   5) Manufacturers: Karp, Milcor, Elmdor, Acudor, or approved equivalent.

PART 3 - EXECUTION

3.01 ACCESSIBILITY AND INSTALLATION

A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.

B. Install equipment requiring access so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.

C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Engineer prior to proceeding with installation.

D. Firestopping: Comply with individual Division 27, Communications Sections and coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

E. Plenums: In plenums, provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Owner of discrepancy.

3.02 SEISMIC CONTROL

A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 27 Communications Sections.

B. Earthquake resistant designs for Communications (Division 27) equipment and distribution, i.e. cabinets and racks, ceiling assemblies, raceways, ladder racking, etc. to conform to regulations of jurisdiction having authority.

C. Provide means to prohibit excessive motion of communications equipment during earthquake.

3.03 REVIEW AND OBSERVATION

A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.

B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:
   1. Prior to ceiling cover/installation.
   2. When main systems, or portions of, are being tested and ready for inspection by AHJ.

C. Final Punch: Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.04 CUTTING AND PATCHING

A. Confirm Cutting and Patching Requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:

1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Owner. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Owner for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.
3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.
5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.05 EQUIPMENT SELECTION AND SERVICEABILITY

A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

3.06 DEMONSTRATION

A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.

B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Owner's Authorized Representative that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.

3.07 CLEANING

A. Confirm Cleaning requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.

B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.08 INSTALLATION

A. Confirm Installation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.

B. Install equipment and devices in accordance with manufacturer's installation instructions, plumb and level and firmly secured to mounting surfaces. Maintain manufacturer's recommended clearances.

C. Demonstrate compliance with requirements. Replace damaged or malfunctioning equipment.

D. Provide miscellaneous supports required for installation of equipment.

3.09 ACCESS PANELS

A. Confirm Access Panel requirements in Division 01, General Requirements. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:

1. Coordinate locations/sizes of access panels with Owner prior to work.

3.10 DEMOLITION

A. Remove existing connectors, backboxes, wall plates and other communications equipment and devices and associated wiring from walls, ceilings, floors, and other surfaces scheduled for remodeling, relocation, or demolition unless shown as retained or relocated on Drawings.

B. Remove abandoned cable to originating telecom room.

C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.

D. Remove abandoned cable to leave site clean.

3.11 ACCEPTANCE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:

1. System cannot be considered for acceptance until work is completed and demonstrated to the Owner that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:

a. Testing Reports

b. Cleaning

c. Operation and Maintenance Manuals

d. Record Drawings

e. Warranty and Guaranty Certificates, including extended manufacturer's warranties.

3.12 FIELD QUALITY CONTROL

A. Confirm Field Quality Control requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.

B. Tests:

1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in Operation and Maintenance Manuals.

2. During site evaluations by Owner, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.13 LETTER OF CONFORMANCE

A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement that Communications items were installed in accordance with

manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

END OF SECTION

SECTION 27 05 28
PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:
   1. Surface Mount Raceway
   2. Electrical Metallic Tubing and Fittings
   3. Penetration Sealing Systems
   4. Innerduct
   5. Innerduct Fittings
   6. J-Hooks

B. This Section specifies the requirements to provide communications conduit raceways, boxes, cable trays, innerduct and fittings.

1.02 RELATED SECTIONS

A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.04 QUALITY ASSURANCE

A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.05 WARRANTY

A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.06 DEFINITIONS

A. Cabinet: A modular enclosure designed to house and protect rack-mounted electronic equipment.

B. Conduit: Round raceway.

C. Conduit Body: Separate portion of a conduit or tubing system that provides access through removable cover(s) to the interior of the system at a junction of two or more sections of the system or at a terminal point of the system.

D. Pull Box Enclosure: Box with a cover installed in one or more runs of raceway to facilitate pulling conductors through the raceway system. There are no openings in the cover.

E. Surface Raceway: Surface-mounted metal channel or plastic duct with snap-in removable covers for housing and protecting electrical wires and cables. Raceway and fittings are designed so sections can be electrically and mechanically coupled together without subjecting cables to abrasion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Surface Mount Raceway: Wiremold 2800 Series and 300 Series.

B. Electrical Metallic Tubing and Fittings:
   1. Allied Tube and Conduit
   2. Or approved equivalent.

C. Penetration Sealing Systems:
   1. SEMCO
   2. Or approved equivalent.

D. Innerduct:
   1. Carlon
   2. Or approved equivalent.

E. Innerduct Fittings: Carlon.

F. J-Hooks:
   1. Erico
   2. Or approved equivalent.

2.02 SURFACE MOUNT RACEWAYS

A. Plastic latching duct, single channel raceway.

B. Metal two-piece raceway; for main pathways.

2.03 ELECTRICAL METALLIC TUBING AND FITTINGS

A. Type EMT: Electrogalvanized steel tubing.

B. Fittings and Conduit Bodies: In-line straight-through steel or malleable iron fittings and Type C conduit bodies only; do not use bends or tees, e.g. Lbs.

2.04 PENETRATION SEALING SYSTEMS

A. Firestopping: Provide fire barrier penetration sealing materials as required by code.

2.05 INNERDUCT

A. Plenum-Listed Indoor Innerduct: 1-inch inside diameter corrugated walled innerduct for use in plenum air handling spaces.

2.06 INNERDUCT FITTINGS

A. Couplings: Metallic or nonmetallic quick-connect, reverse threaded and Schedule 40 couplings for connecting sections of installed innerduct.

B. Innerduct Caps: Removable push-in caps for plugging 1-inch innerduct.

2.07 J-HOOKS

A. Constructed of galvanized steel, stainless steel or hot dipped zinc.

B. Wires or all-thread supports mounted to structure.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Workmanship:
   1. Provide, condition, apply, install, connect and test manufactured products, materials, equipment and components in accordance with the manufacturer's specifications and printed instructions.
   2. The installation of system components to be carried out under the direction of qualified personnel. Appearance to be considered as important as mechanical and electrical efficiency. Workmanship to meet or exceed industry standards.
   3. Place support for raceways, cable trays, backboards, equipment racks and cabinets.

B. Concrete Sleeves: Conduits routed perpendicular through floors, walls, or other concrete structures to pass through cast-in-place conduit sleeve openings wherever possible, or appropriate size holes to be bored to accommodate the installation of conduit sleeves. The size and location of the holes to not impair the structure's integrity.

C. Drywall/Gypsum Board Sleeves: Install insulating throat bushings on both ends of conduit sleeves placed in fire-rated walls using drywall construction.

D. Provide continuous sleeving through walls, floors and ceilings separating each telecom outlet from its respective MER/TR room, using sleeve conduit size as required per Standards. Restore penetrations through rated assemblies to original fire rating per NFPA and local codes.

E. Where sleeves are routed between rooms with floating ceilings, extend conduits horizontally 2-feet over edge of floating ceiling to avoid exposed cabling from being seen at floor level.

F. Provide removable heat-expanding pillows at fire barrier penetrations as specified in Firestopping section and described as Firestop Material Type 7 (indicated as FSM-7).

G. Provide plenum rated products, components and accessories for installation in plenums.

3.02 SURFACE MOUNT RACEWAYS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's written instructions and recommendations.

C. Provide components for raceway such as adjustable offset connectors where exiting the soffits. ceilings and splice covers.

D. Surface mount raceway is only to be used where cabling cannot route in accessible ceiling spaces, crawl spaces or mechanical rooms. Use of surface raceway that is not shown on the drawings must be approved by the district prior to installation.

3.03 ELECTRICAL METALLIC TUBING AND FITTINGS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's written instructions and recommendations.

3.04 PENETRATION SEALING SYSTEMS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's written instructions and recommendations.

3.05 INNERDUCT

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's written instructions and recommendations.

C. Provide innerduct for all fiber optic cables for the entire length of the cable run.

D. Cut innerduct square. Deburr cut ends.

E. Bring innerduct to the shoulder of fittings and couplings and fasten securely.

F. Wipe innerduct and fittings clean and dry before joining. Apply full, even coat of cement to entire area that will be inserted into fitting. Let joint cure for 20 minutes minimum.

G. Make changes in direction of communications innerduct runs with sweeps of the longest possible radius and at least 10 times the inside diameter of the innerduct.

H. During innerduct pulling, avoid excessive tension which can damage the innerduct. Inspect innerduct following placement and replace damaged sections.

I. Innerduct Pull Tape and Duct Plug Installation:

1. Following innerduct installation, install pulltape (muletape) with preprinted foot markers in innerduct sections. Tie the pulltape securely at each end.
2. Verify lengths at the time of installation and provide as-built documentation.
3. Following innerduct and pulltape installation, cap or plug innerduct with manufactured seals to prevent moisture or foreign matter from entering until cable installation starts. Seal duct openings in underground or underslab innerduct sections immediately after installation using screwtight, removable, watertight and dust-tight duct plugs.

3.06 INNERDUCT FITTINGS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's written instructions and recommendations.

C. Wipe fittings clean and dry before joining. Apply full, even coat of cement to entire area that will be inserted into the fitting. Allow joints/assembly to cure for 20 minutes, minimum.

D. Install per manufacturer's recommendations.

3.07 J-HOOKS

A. Install J-hooks rated for Category 6A cable for support of cabling from the Telecom Room to the outlet location.

B. J-hooks are to be installed on dedicated wires or all thread rods mounted to structure. J-hooks are not to attach to ceiling grid wires.

END OF SECTION

SECTION 27 11 01
COMMUNICATION EQUIPMENT ROOMS

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. Telecommunications Backboards
2. Equipment Racks
3. Wall Mount Equipment Racks
4. Vertical Wire Managers
5. Horizontal Wire Managers
6. Telecommunications Grounding
7. Ladder Rack Cable Runway

1.02 RELATED SECTIONS

A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. Use this Section in conjunction with the other Division 27, Communications Sections and related Contract Documents to establish the total general requirements for the project technology systems and equipment.

1.04 SUBMITTALS

A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.06 WARRANTY

A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Telecommunications Backboards: Reference 2.02A for requirements.

B. Equipment Racks: Chatsworth; Model 46353-703.

C. Wall Mount Equipment Racks: Chatsworth; Models 11791-725 and 11970-725.

D. Vertical Wire Managers: Chatsworth; Model 35522-703.

E. Horizontal Wire Managers: 19-inches wide, two rack units high - Chatsworth; Model 35441-702.

F. Telecommunications Grounding:

1. Telecommunications Grounding Busbar (TGB): Chatsworth; Model 13622-010.
2. Telecommunications Ground Accessories:
   a. One Hole Ground Terminal Block: Chatsworth; Model 08009-001.
   b. Two Hole Grounding Lug: Chatsworth, or approved equivalent.
   c. Cable Runway Ground Strap Kit: Chatsworth; Model 40164-001.

G. Ladder Rack Cable Runway:

1. Cable Runway: Chatsworth; Model 11275-712.
2. Runway Wall Angle Support: Chatsworth; Model 11421-712.

3. Runway to Rack Mounting Bracket: Chatsworth; Model 10595-712.
4. Cable Runway Junction-Splice Kit: Chatsworth; Model 16302-701.
5. Cable Runway Butt-Splice Kit: Chatsworth; Model 16301-701.
6. Cable Runway Triangle Support Bracket: Chatsworth; Model 11312-712.
7. Cable Runway Radius Drop: Chatsworth; Model 12100-712.
8. Cable Runway Radius (Stringer): Chatsworth; Model 12101-701.

2.02 TELECOMMUNICATIONS BACKBOARDS

A. 3/4-inch minimum thickness, A/C grade or better, void-free plywood, fire treated backboard.

2.03 EQUIPMENT RACKS

A. 7-foot high, 19-inches wide, EIA free-standing rack, UL listed, black finish.

2.04 WALL MOUNT EQUIPMENT RACKS

A. 43-inches high, 24-inches deep, 19-inches wide, swing gate, UL listed, black finish.

B. 29-inches high, 24-inches deep, 19-inches wide, swing gate, UL listed, black finish.

2.05 VERTICAL WIRE MANAGERS

A. 7-feet high, 8-inches wide, 12-inches deep with front and rear doors and horizontal managers built in, black finish.

2.06 HORIZONTAL WIRE MANAGERS

A. 19-inches wide, two rack units high.

2.07 TELECOMMUNICATIONS GROUNDING

A. Telecommunications Grounding Busbar (TGB): Solid copper busbar kit, 10-inches long, 1/4-inch thick, wall-mounted with standoffs.

B. Telecommunications Ground Accessories:

1. One hole ground terminal block, holds two wires up to size #4.
2. Two hole grounding lug.
3. Cable runway ground strap kit.

2.08 LADDER RACK CABLE RUNWAY

A. Cable Runway: 12-inches wide, 10-foot lengths, steel construction.

B. Runway wall angle support.

C. Runway to rack mounting bracket.

D. Cable runway junction-splice kit.

E. Cable runway butt-splice kit.

F. Cable runway triangle support bracket.

G. Cable runway radius drop.

H. Cable runway radius (stringer).

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Provide all components of the telecommunications system from a single manufacturer.

B. Seismic installations require additional bracing of overhead cable runways to building structure, as advised by and certified by a licensed structural engineer.

C. Ladder Rack Cable Tray:

1. Provide cable tray as shown in drawing package. The locations shown may need to be adjusted slightly in the field to assure proper placement.
2. Field cut to length tray Sections with a minimum number of splice points. Make field cuts using the manufacturers recommended equipment.
3. Deburr and file rough edges on cable tray.

4. Provide seismic bracing for installed cable trays.

D. Labeling:

1. Label racks with the equipment room number and a unique identifier beginning with the telecom room number and the number one, i.e. TR1-1.
2. Label the telecommunications grounding busbar and bonding conductor with the equipment room number and a unique identifier, beginning with the number one, i.e. TGB-SVR1. The designation for the Telecommunications Main Ground Busbar begins with TMGB.
3. Submit labeling schemes to the Owner for approval prior to testing and labeling.

3.02 TELECOMMUNICATIONS BACKBOARDS

A. Mount plywood backboard vertically, 4-inches from floor, walls covered within each telecommunications space as shown in the drawings.

B. Mount backboards with the smooth "A" surface facing away from the wall. Paint the backboard with two coats of fire resistant paint prior to mounting.

C. Install boards plumb, level and secured to studs or solid concrete or masonry walls. Use a minimum of six appropriate fasteners for every 16 SF of backboard. Anchors for attaching equipment boards include:

1. Material/Substrate: Anchor type.
2. Concrete/Masonry: Expansion anchors; wedge type with washer located on the backside of the board.
3. Gypsum Wallboard: Togglebolts; use pan head type.

D. Powder drive anchors, molly bolts and tappets are not allowed.

3.03 EQUIPMENT RACKS

A. Fasten free-standing equipment racks to the telecom room floor using a minimum of four 1/2-inch anchors.

B. Position equipment racks according to drawings with a minimum of 3-feet of clearance in front and back. Field verify the dimensions of the room prior to installation of racks and report any discrepancies to the Owner.

C. Provide proper seismic bracing and wire management from backboard to freestanding equipment rack, per OSSC.

3.04 WALL MOUNT EQUIPMENT RACKS

A. Position equipment racks according to drawings with a minimum of 3-feet of clearance in front. Field verify the dimensions of the room prior to installation of racks and report any discrepancies to the Owner.

3.05 VERTICAL WIRE MANAGERS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Bolt vertical wire managers for free-standing equipment racks to the side of the rack using manufacturer's recommended hardware.

3.06 HORIZONTAL WIRE MANAGERS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

3.07 TELECOMMUNICATIONS GROUNDING

A. Bond equipment racks and ladder racking to each equipment room TGB with #6 AWG or larger, stranded copper conductor.

B. Connect each TGB to the main electrical main distribution panel and building steel using a 3/0 AWG or larger, stranded copper conductor.

C. Two hole lugs are required on all ground cable connecting to the TGB.

3.08 LADDER RACK CABLE RUNWAY

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

END OF SECTION

SECTION 27 13 00
COMMUNICATIONS BACKBONE CABLING

PART 1 - GENERAL

1.01 SUMMARY

A. Work included:

1. Copper Backbone Cable
2. Fiber Optic Backbone Cable
3. Copper Termination Hardware
4. Fiber Optic Termination Hardware
5. Fiber Patch Cords

1.02 RELATED SECTIONS

A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Procedures for cable labeling and identification, long term documentation methods and numbering scheme in accordance with ANSI/TIA/EIA- 606-A.
2. A copy of certified installer certificates and warranty certificates for products proposed.

1.05 QUALITY ASSURANCE

A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. Manufacturers to have a recognized certified installer program in place for system components proposed. Cable will be approved with manufacturer system installed.

1.06 WARRANTY

A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. Telecommunication Contractor must submit the following to Legrand:

1. Warranty Application properly completed online.
2. Test results submitted only in electronic format for the copper systems. Note: hard copies will not be accepted. The test results must be submitted in original native tester format.
3. All tests must result in a PASS. Pass* (marginal pass) and Fail are not acceptable test results.
4. Each permanent link or channel in the network must be field tested in accordance with the TIA-568 series industry standard and nCompass testing requirements in force at the time of purchase (nCompass testing requirements take precedence over TIA when differences exist). The installed permanent links and channels must have passed all applicable TIA and nCompass performance requirements. Minimum testing for copper systems Includes Wire Map, Length, Attenuation, Near End Crosstalk, Far End Crosstalk, Return Loss, PSNEXT, ELFEXT, PSELFEXT.
5. Minimum testing for Fiber Optic links Includes horizontal and backbone, Bi-Directional Dual Wavelength, Insertion Loss and Length.

C. The warranty must be submitted on the Legrand ConCert portal for review.

D. Once the materials are reviewed, the telecommunication contractor will be notified in writing of acceptance or rejection. If the project is accepted, Contractor will receive a copy of the signed warranty certificate for the owner. At that time, telecommunications contractor to forward the signed warranty registration certificate to the end user.

1.07 SYSTEM DESCRIPTION

A. Provide a standards-based cable system to serve backbone communication systems requirements as specified in these specifications and shown on Drawings. Closely follow ANSI/TIA/EIA, IEEE and ISO standards which apply to backbone communication systems.

B. Install intrabuilding backbone cables from the existing MDF to the new IDFs.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Copper Backbone Cable: Superior Essex.

B. Fiber Optic Backbone Cable: Superior Essex.

C. Copper Termination Hardware: Ortronics.

D. Fiber Optic Termination Hardware: Ortronics.

E. Fiber Patch Cords: Ortronics.

2.02 COPPER BACKBONE CABLE

A. Intrabuilding Category 6 UTP:

1. 100 ohm, 4-pair unshielded twisted pair.
2. Plenum rated, CMP rated jacket, color blue.

2.03 FIBER OPTIC BACKBONE CABLE

A. Intrabuilding Singlemode Riser: 12 strand, 8.3 micron, high performance low water peak distribution cable. Plenum rated.

2.04 COPPER TERMINATION HARDWARE

A. Category 6 Modular Patch Panels: 24 port, 8-position modular jack panel, high density, 6 port modules, Category 6, IDC terminals, T568A/B wiring scheme.

2.05 FIBER OPTIC TERMINATION HARDWARE

A. Fiber Termination Shelf:

1. 3.5-inch high shelf designed for mounting in 19-inch equipment racks and capable of accepting 6 adapter panels. The shelf will contain built-in slack management and be accessible from the front or rear with locking doors.
2. 19-inch rack mount, 19-inches deep.

B. Fiber Adapter Panels: Adapter panel for high density termination shelf with 6 LC singlemode phosphor-bronze alignment sleeves.

C. Singlemode LC Connector: Ceramic tip LC style capable of being terminated on 8.3/125 fiber with 900 micron buffer.

2.06 FIBER PATCH CORDS

A. Singlemode Fiber Optic Jumpers: Factory terminated double ended, two strand singlemode cordage with LC connectors on each end, 2-meters in length unless otherwise noted on drawings.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Miscellaneous Hardware: Provide supporting hardware, cable ties, labels, pull rope and other miscellaneous hardware for a complete and operable system.

B. Provide like items from one manufacturer, such as cable, patch panels, connectors, and equipment connection cords.

C. Communications Backbone Cabling includes cables, connectors, patch panels and patch cords, as well as the necessary support systems, such as cable managers, tie wraps and D-rings.

D. Furnish and install materials necessary for a complete and working system.

E. Contractor must be a Certified Installer for Ortronics, prior to, during, and through completion of the system installation and must be able to provide the manufacturer's extended warranty.

F. Perform work in a neat and workmanlike manner.

G. Firestopping: Install all firestop systems in accordance with manufacturer's recommendations. Firestop systems to be completely installed and available for inspection by local inspection authorities prior to cable system acceptance.

H. Install cable after interior of building has been physically protected from the weather and mechanical work likely to damage cabling has been completed.

I. Before installing cabling, ensure cable pathways are completely and thoroughly cleaned:

1. Inspect conduit, wireway, cable trays and innerduct systems prior to installation.
2. Swab any additional enclosed raceway and innerduct systems.

J. Provide protection for exposed cables where subject to damage. Provide abrasion protection for any cable or wire bundles, which pass through holes or across edges of sheet metal.

K. Install cable ties and other cable management clamps via hand so they fit snugly. Do not over tighten or use mechanical tools which could compress, crimp, or otherwise change the physical characteristics of the cable jacket or distort the placement of twisted-pair components. Replace any cable exhibiting stresses due to over tightening of cable management devices.

L. Where possible, route cables in overhead cable trays and inside wire management systems attached to the equipment cabinets and racks. Use Velcro ties or ducts to restrain cabling installed outside of wire management systems on racks or in cabinets.

M. Limit cable raceway fill to less than the TIA/EIA-569-B maximum fill for the particular raceway type.

N. If a J-hook or trapeze system is used to support cable bundles, support cables at a maximum of 48 to 60-inch intervals. Cables are prohibited to rest on acoustic ceiling grids or panels.

O. Install cable above fire-sprinkler systems and ensure the cable does not attach to the system or any ancillary equipment or hardware. Install cable system and support hardware so it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

P. Do not attach cables to ceiling grid or lighting fixture wires. Where support for cable is required, install appropriate carriers to support the cabling.

Q. Any cable damaged or exceeding recommended installation parameters during installation will be replaced by the contractor prior to final acceptance at no cost to the Owner.

R. Unshielded Twisted Pair Cable Installation Practices:

1. Install cable in accordance with manufacturer's recommendations and best industry practices.
2. Do not exceed the cable's minimum bend radius and maximum pulling tension.
3. Install unshielded twisted pair cable so there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.

S. Provide the following minimum separation distances between pathways for copper communications cables and power wiring of 480 volts or less:

1. Open or Nonmetal Communications Pathways:
   a. 12-inches from electric motors, fluorescent light fixtures and unshielded power lines carrying up to 3 kVA.
   b. 36-inches from electrical equipment and unshielded power lines carrying more than 5 kVA.
   c. 48-inches from large electrical motors or transformers.
2. Grounded Metal Conduit Communications Pathways:
   a. 2-1/2-inches from electrical equipment and unshielded power lines carrying up to 2 kVA.
   b. 6-inches from electrical equipment and unshielded power lines carrying from 2 kVA to 5 kVA.
   c. 12-inches from electrical equipment and unshielded power lines carrying more than 5 kVA.
   d. 3-inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying from 2 kVA to 5 kVA.
   e. 6-inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying more than 5 kVA.

T. Determine requirements for plenum rated cable and devices. When doubt exists, seek prior determination in writing by AHJ.

U. Seal conduits entering from outside the building and install listed firestop material in conduits and sleeves to satisfy NEC and local codes.

V. Unshielded Twisted Pair Termination:
1. Dress and terminate cables in accordance with the recommendations made in the ANSI/TIA/EIA-568-C.1 document, manufacturer's recommendations and best industry practices.
2. Maintain the cable jacket within 1-inch of the termination point.
3. Do not exceed 0.5-inch of pair untwist at the termination point.
4. Do not exceed 4 times the outside diameter of the cable in the termination area for bend radiance compliance.
5. Neatly bundle and dress cables to their respective panels or blocks. Feed each panel or block by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

W. Testing Procedures:
1. Test cables and termination hardware for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-C. Verify pairs of each installed cable prior to system acceptance. Repair or replace any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels and connector blocks in order to ensure 100 percent useable conductors in cables installed.
2. Test cables in accordance with this document, the ANSI/TIA/EIA standards, the manufacturer's procedures and best industry practice. If any of these are in conflict, bring any discrepancies to the attention of the project team for clarification and resolution.
3. Test Unshielded Twisted Pair cables as follows:
   a. Test twisted-pair copper cable links for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance. Test cabling using a Level IV test unit for Category 6 performance compliance as specified in ANSI/TIA/EIA-568-C.

b. Continuity: Test each pair of each installed cable using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Test shielded/screened cables with a device that verifies shield continuity in addition to the above stated tests. Record the test as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures and referenced to the appropriate cable identification number and circuit or pair number. Correct or repair any faults in the wiring and re-test the cable prior to final acceptance.

c. Length: Test each installed cable link for installed length using a TDR type device. Test the cables from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length will conform to the maximum distances set forth in the ANSI/TIA/EIA-568-C standard. Record cable lengths, referencing the cable identification number and circuit or pair number. For multi-pair cables, record the shortest pair length as the length for the cable.

4. Follow the Standards requirements established in ANSI/TIA/EIA-568-C.

5. Perform testing with a Level IV tester The basic tests required are:
   a. Wire Map
   b. Length
   c. Attenuation

6. Provide test results in electronic format, with the following minimum information per cable:
   a. Circuit ID
   b. Test result, “Pass” or “Fail”
   c. Date and Time of test
   d. Project Name

7. Fiber Test Documentation: Provide electronic CD disk and hard copy test reports from ANSI/TIA/EIA-526-14A Method B Standards. Calculate a “Loss Budget” for each cable length based on cable length and connectors. Provide as a minimum, OTDR test results in the form of a printed waveform and text table for both 850 nm and 1300 nm for multimode fiber and 1350 nm and 1510 nm for singlemode fiber. Test fibers and connector systems for end-to-end attenuation. Provide a power meter test on fiber optic strands at both wavelengths A to B, B to A and OSPL (OSPL is as defined as La + Lb). Include the results of unsatisfactory tests, with an explanation of how the problem was corrected. Clearly label connector and fiber loss on test waveforms.

8. Provide an electronic copy of the test results, in the native tester software format, to the Owner along with the printed test results.

9. Provide a fully functional version of the tester software for use by the Owner in reviewing the test results.

3.02 COPPER BACKBONE CABLE

A. Install per manufacturer's instructions and recommendations.

B. Reference 3.01, General Installation Requirements.

C. Labeling:

1. Label cables using a machine printed label at each end of the cable at approximately 6-inches of the termination point. Do not use handwritten labels.

2. Labels to denote to and from with room names and numbers.

3. Provide the final cable ID matrix to the Owner for approval one week prior to cable installation.

4. Note labeling information on the As-Built Drawings.

3.03 FIBER OPTIC BACKBONE CABLE

A. Install per manufacturer's instructions and recommendations.

B. Reference 3.01, General Installation Requirements.

C. Place fiber optic cable so as to maintain the minimum cable bend radius limits specified by the manufacturer or ten times the cable diameter, whichever is larger.

D. Place fiber optic cable runs in innerduct. Use care when handling fiber optic cable. Carefully monitor pulling tension so as not to exceed the limits specified by the manufacturer.

E. Terminate fiber optic cable in rack-mounted fiber optic termination units at each end using standard LC style bulkhead connectors.

F. Splicing of fiber optic cable is prohibited.

G. Labeling:

1. Label cables using a machine printed label at each end of the cable at approximately 6-inches of the termination point. Do not use handwritten labels.
2. Labels to denote to and from with room names and numbers.
3. Provide the final cable ID matrix to the Owner one week prior to cable installation.
4. Note labeling information on the As-Built Drawings.

3.04 COPPER TERMINATION HARDWARE

A. Install per manufacturer's instructions and recommendations.

B. Reference 3.01, General Installation Requirements.

C. Dress and terminate cables in accordance with the recommendations made in the ANSI/TIA/EIA-568-B standard, manufacturer's recommendations and best industry practices.

D. Pair untwist at the termination is not to exceed 0.125-inch.

E. Bend radius of the cable in the termination area is not to exceed four times the outside diameter of the cable.

F. Dress cables to their respective panels. Feed each panel by an individual bundle, separated and dressed back to the point of cable entrance into the rack or frame.

G. Maintain the cable jacket to the termination point.

3.05 FIBER OPTIC TERMINATION HARDWARE

A. Install per manufacturer's instructions and recommendations.

B. Reference 3.01, General Installation Requirements.

C. Neatly coil fiber slack within the enclosure.

D. Individually attach each cable to its respective fiber enclosure by mechanical means.

E. Clearly label each cable at the entrance to the enclosure. Cables labeled within the bundle will not be accepted.

3.06 FIBER PATCH CORDS

A. Install per manufacturer's instructions and recommendations.

B. Reference 3.01, General Installation Requirements.

C. Provide sufficient duplex fiber optic patch cords at each fiber termination point to cross-connect one-half the number and type of fibers terminated there, Assume a minimum of two duplex fiber optic jumpers per termination point for a 6-strand optical fiber.

D. Field terminated patch cords are not allowed.

END OF SECTION

SECTION 27 15 00
COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:
   1. Station Cabling
   2. Modular Jacks
   3. Work Area Outlets
   4. Patch Panels
   5. Patch Cords

1.02 RELATED SECTIONS

A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.

B. Use this Section in conjunction with other Division 27, Communications specifications and related Contract Documents to establish the total general requirements for the project communications systems and equipment.

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. In addition, provide:
   1. Procedures for cable labeling and identification, long term documentation methods and numbering scheme in accordance with ANSI/TIA/EIA-606A.
   2. A copy of certified installer certificates and warranty certificates for products proposed.

1.05 QUALITY ASSURANCE

A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. Manufacturers to have a recognized certified installer program in place for system components proposed. Cable will be approved with manufacturer system installed.

1.06 WARRANTY

A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. All projects will be installed and tested to fulfill the requirements for a nCompass Limited Lifetime Product and Application Assurance Warranty. This warranty will be required as described below for the following systems or system components.
   1. Superior Essex Communications LP and Legrand warrant to the end user that the nCompass CAT 6A U/UTP, Copper certified network cabling system installations will meet the defined TIA-568 series industry specifications in effect at the time of product purchase for the lifetime of the infrastructure not to exceed 40 years from date of product installation
   2. The nCompass Limited Lifetime Product and Application Assurance Warranty will be extended to include the entire channel provided that the applicable Legrand patch cords and Legrand equipment cords are utilized, and all products are installed within areas protected from outside elements. Channel warranties will support current or future applications that are approved by industry recognized organizations (IEEE, ANSI/TIA) for transmission over structured cabling systems

defined by the TIA-568 standard in effect at the time of the installation. Channel warranties will perform to the specifications listed in the nCompass system data sheets in effect at the start of the installation. Legrand will honor claims on the nCompass Limited Lifetime Product and Application Assurance Warranty for 40 years from the installation of the nCompass cabling System.

C. Telecommunication Contractor must submit the following to Legrand:
   1. Warranty Application properly completed online.
   2. Test results submitted only in electronic format for the copper systems. Note: hard copies will not be accepted. The test results must be submitted in original native tester format.
   3. All tests must result in a PASS. Pass* (marginal pass) and Fail are not acceptable test results.
   4. Each permanent link or channel in the network must be field tested in accordance with the TIA-568 series industry standard and nCompass testing requirements in force at the time of purchase (nCompass testing requirements take precedence over TIA when differences exist). The installed permanent links and channels must have passed all applicable TIA and nCompass performance requirements. Minimum testing for copper systems Includes Wire Map, Length, Attenuation, Near End Crosstalk, Far End Crosstalk, Return Loss, PSNEXT, ELFEXT, PSELFEXT.
   5. Minimum testing for Fiber Optic links Includes horizontal and backbone, Bi-Directional Dual Wavelength, Insertion Loss and Length.

D. The warranty must be submitted on the Legrand ConCert portal for review.

E. Once the materials are reviewed, the telecommunication contractor will be notified in writing of acceptance or rejection. If the project is accepted, Contractor will receive a copy of the signed warranty certificate for the owner. At that time, telecommunications contractor to forward the signed warranty registration certificate to the end user.

1.07 SYSTEM DESCRIPTION

A. Provide a standards-based cable system to serve horizontal communication systems requirements as specified and as shown on Drawings. Closely follow ANSI/TIA/EIA, IEEE and ISO standards.

B. The horizontal distribution subsystem refers to intrabuilding twisted-pair communications cabling connecting telecommunications rooms to the wireless outlets located at individual work areas and consists of the following:
   1. Category 6A, 100 ohm, 4-pair, unshielded twisted pair cables from the telecom rooms to the outlets.
   2. The horizontal system includes cables, jacks, patch panels and patch cords, as well as the necessary support systems, such as cable managers and faceplates.
   3. Cables are routed through conduit, spaces below raised floors, open ceiling areas, non-ventilated spaces above ceiling tile and through plenum air-handling spaces above ceiling tile.
   4. Furnish and install materials necessary for a complete and working system.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Station Cabling: Superior Essex; 10 Gain XP.

B. Modular Jacks: Ortronics; Models OR-HDJ6A, OR-HDJ6A-00, and OR-403HDJ14.

C. Work Area Outlets: Ortronics; Models OR-404HDJ14 and OR-403HDJ11.

D. Patch Panels: Ortronics; Model OR-PSDHJU48.

E. Patch Cords: Ortronics; Model OR-MC6A03-XX.

2.02 STATION CABLING

A. Category 6A Unshielded Twisted Pair:
   1. 100 ohm, Category 6A, 23 AWG, 4-pair unshielded twisted pair, CMP rated jacket.
   2. Cable Colors:
      a. Yellow for wireless.
      b. Blue for voice/data.
      c. White for paging.
      d. Green for AV.
      e. Gray for video surveillance.

2.03 MODULAR JACKS

A. Category 6A Modular Jacks:
   1. Eight-position modular jack, Category 6A, IDC terminals, T568A/B wiring scheme
   2. Each jack must be stamped or have icons to identify it as CAT 6A.
   3. Colors: Fog white for outlet end and black for patch panel end.

2.04 WORK AREA OUTLETS

A. Flush Mounted Faceplate:
   1. One-port faceplate, constructed from high impact thermo-plastic, with recessed label fields, mounts within a single-gang wall box.
   2. One port biscuit block for surface mounted areas.
   3. Four-port faceplate, constructed from high impact thermo-plastic, with recessed label fields, mounts within a single-gang wall box.

B. Dust Covers: Single port dust cover for modular openings, color to match faceplate.

C. Category 6A, RJ45, 8-position, UTP, modular plug. Wireless and IP paging only.

2.05 PATCH PANELS

A. Category 6A Modular Patch Panels: 48 port, modular, high density, Category 6A, black jacks.

2.06 PATCH CORDS

A. Category 6A Modular Patch Cords: Factory terminated double ended, eight-position to eight-position, modular, stranded conductors, 4 pair, 3-foot cords for telecom room end and 7-foot for outlet end. Color to match cable color.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Miscellaneous Hardware: Provide supporting hardware, cable ties, labels, pull string and other miscellaneous hardware for a complete and operable system.

B. Provide like items from one manufacturer, such as jacks, patch panels, equipment connection cords and wall plates.

C. Horizontal cabling includes cables, jacks, patch panels and patch cords, as well as the necessary support systems, such as cable managers and faceplates.

D. Furnish and install materials necessary for a complete and working system.

E. Contractor must be a Certified Installer for selected manufacturer prior to, during and through completion of the system installation and must be able to provide the manufacturer's extended warranty.

F. Perform work in a neat and workmanlike manner.

G. Install cable after interior of building has been physically protected from the weather and mechanical work likely to damage cabling has been completed.

H. Before installing cabling, ensure cable pathways are completely and thoroughly cleaned.

1. Inspect conduit, wireway, cable trays and innerduct systems prior to installation.
2. Swab any additional enclosed raceway and innerduct systems.

I. Provide protection for exposed cables where subject to damage. Provide abrasion protection for any cable or wire bundles, which pass through holes or across edges of sheet metal.

J. Install cable ties and other cable management clamps via hand so it fits snugly. Do not over tighten or use mechanical tools which could compress, crimp, or otherwise change the physical characteristics of the cable jacket or distort the placement of twisted-pair components. Replace any cable exhibiting stresses due to over tightening of cable management devices.

K. Where possible, route cables in overhead cable trays and inside wire management systems attached to the equipment cabinets and racks. Use Velcro ties or ducts to restrain cabling installed outside of wire management systems on racks or in cabinets.

L. Co-install a pull cord (nylon; 1/8-inch minimum) with cable installed in conduit.

M. Limit cable raceway fill to less than the TIA/EIA-569-B maximum fill for the particular raceway type.

N. Support horizontal cables at a maximum of 48- to 60-inch intervals. Cables are prohibited to rest on acoustic ceiling grids or panels.

O. Bundle horizontal distribution cables in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.

P. Install cable above fire-sprinkler systems and ensure that the cable does not attach to the system or any ancillary equipment or hardware. Install cable system and support hardware such that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

Q. Do not attach cables to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, install appropriate carriers to support the cabling.

R. Any cable damaged or exceeding recommended installation parameters during installation will be replaced by the contractor prior to final acceptance at no cost to the Owner.

S. Determine requirements for plenum rated cable and devices. When in doubt, seek determination in writing by Authority Having Jurisdiction (AHJ) prior to ordering. Without written confirmation from the AHJ, Contractor to assume that a plenum rating is required.

T. Unshielded Twisted Pair Cable Installation Practices:

1. Install cable in accordance with manufacturer's recommendations and best industry practices.
2. Install cables in continuous lengths from origin to destination (no splices).
3. Do not exceed the cable's minimum bend radius and maximum pulling tension.
4. Install unshielded twisted pair cable so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.
5. Do not exceed 25-lbf pulling tension on 4-pair UTP cable.

U. Provide the following minimum separation distances between pathways for copper communications cables and power wiring of 480 volts or less:

1. Open or Nonmetal Communications Pathways:
   a. 12-inches from electric motors, fluorescent light fixtures and unshielded power lines carrying up to 3 kVA.
   b. 36-inches from electrical equipment and unshielded power lines carrying more than 5 kVA.
   c. 48-inches from large electrical motors or transformers.

2. Grounded Metal Conduit Communications Pathways:
    a. 2-1/2-inches from electrical equipment and unshielded power lines carrying up to 2 kVA.
    b. 6-inches from electrical equipment and unshielded power lines carrying from 2 kVA to 5 kVA.
    c. 12-inches from electrical equipment and unshielded power lines carrying more than 5 kVA.
    d. 3-inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying from 2 kVA to 5 kVA.
    e. 6-inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying more than 5 kVA.

V. Unshielded Twisted Pair Termination:
1. Provide a 10-foot service loop on the outlet end of the cabling.
2. Dress and terminate cables in accordance with the recommendations made in the ANSI/TIA/EIA-568-C.1 document.
3. Terminate four pair cables on the jack and patch panels using T568B wiring scheme.
4. Maintain the cable jacket within 1-inch of the termination point.
5. Do not exceed 0.5-inch of pair untwist at the termination point.
6. Do not exceed four times the outside diameter of the cable in the termination area for bend radiance compliance.
7. Neatly bundle and dress cables to their respective panels. Feed each panel by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
8. Terminate voice/data, wireless, AV, paging and video surveillance on separate patch panels.

W. Testing Procedures:
1. Test cables and termination hardware for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-C. Verify pairs of each installed cable prior to system acceptance. Repair or replace any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels and connector blocks in order to ensure 100 percent useable conductors in cables installed.
2. Test cables in accordance with this document, the ANSI/TIA/EIA standards, the manufacturer's procedures and best industry practice. If any of these are in conflict, bring any discrepancies to the attention of the project team for clarification and resolution.
3. Test Unshielded Twisted Pair Cables as Follows:
    a. Test twisted-pair copper cable links for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance. Test horizontal cabling using a Level IV test unit for Category 6A performance compliance as specified in ANSI/TIA/EIA-568 C.
    b. Continuity: Test each pair of each installed cable using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Test shielded/screened cables with a device that verifies shield continuity in addition to the above stated tests. Record the test as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures and referenced to the appropriate cable identification number and circuit or pair number.

Correct or repair any faults in the wiring and retest the cable prior to final acceptance.

c. Length: Test each installed cable link for installed length using a TDR type device. Test the cables from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length will conform to the maximum distances set forth in the ANSI/TIA/EIA-568-C Standard. Record cable lengths, referencing the cable identification number and circuit or pair number. For multipair cables, record the shortest pair length as the length for the cable.

4. Follow the Standards requirements established in ANSI/TIA/EIA-568-C.
5. Perform testing with a Level IV tester. The basic tests required are:
   a. Wire Map
   b. Length
   c. Attenuation
   d. NEXT (Near-end Crosstalk)
   e. Return Loss
   f. ELFEXT Loss
   g. Propagation Delay
   h. Delay Skew
   i. PSNEXT (Power Sum Near-end Crosstalk Loss)
   j. PSELFEXT (Power Sum Equal Level Far-end Crosstalk Loss)
6. Provide test results in electronic format, with the following minimum information per cable:
   a. Circuit ID
   b. Test Result, “Pass” or “Fail”
   c. Date and Time of Test
   d. Project Name
7. Provide an electronic copy of the test results, in the native tester software format, to the Owner along with the printed test results.
8. Provide a fully functional version of the tester software for use by the Owner in reviewing the test results.

X. Labeling:
1. Label horizontal cables using a machine printed label at each end of the cable at approximately 6-inches of the termination point. Do not use handwritten labels.
2. Label patch panel ports and TO ports with the cable identifier.
3. Labels to be Telecom Room number, patch panel number and patch panel port number. Provide the final cable ID matrix to the Owner for approval one week prior to cable installation.
4. Note labeling information at each outlet on the record drawings. Provide final hard copy of record drawings with outlet labeling and place on the back of the door in each telecom room.
5. Camera and speaker labeling to be by location/room number.

Y. Coordination of Conditions: Structured cabling for wireless access points of a given description may be used in more than one type of ceiling or wall structure. Coordinate ceiling construction, wall types, recessing depth and other construction details prior to ordering special components indicated in the details for shipment. Where materials supplied do not match ceiling construction replace them at no cost to Owner.

3.02 STATION CABLING

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

3.03 MODULAR JACKS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

3.04 WORK AREA OUTLETS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

3.05 PATCH PANELS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

3.06 PATCH CORDS

A. Provide a 3-foot patch cord and a 7-foot patch cord for all voice, data and AV terminations. Provide 3-foot patch cords for the telecom room end for all wireless and paging terminations. Field terminated patch cords are not allowed.

B. Install patch cords from the patch panels to the OFOI switches. Based on the number of switches, data (blue patch cables), IP cameras (gray), IP speakers (white), and wifi (yellow). Wifi cables should always go in the last set of ports on the switch (ports 37-48). IP cameras and IP cables should go on the last switch. IP cameras should go in the first set of ports if available (1-12) and then IP speakers should go in ports if available (13-36). Create port patching matrix for approval by district IT. Obtain final approval prior to installation.

END OF SECTION

SECTION 27 41 16.51
INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT FOR CLASSROOMS

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:
   1. Audio Amplification and Distribution Equipment
   2. Loudspeakers
   3. Wire and Cable

1.02 RELATED SECTIONS

A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:
   1. Contractor Qualifications: Minimum of five years experience in the design, installation, testing and maintenance of commercial audio-video systems.
   2. Must employ at least one full-time InfoCOMM Certified Technology Specialist (CTS) who is involved in reviewing work performed by Contractor on this project.
   3. Maintain a local service facility which stocks spare devices and/or components for servicing systems.

1.06 WARRANTY

A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.07 MANUFACTURER APPROVALS AND SUBSTITUTIONS

A. Provide products as specified without exception, unless approved in writing prior to bidding.

B. Remove and replace non-compliant products installed as part of this Contract. Contractor to bear costs associated with removal and replacement of products

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Audio Amplification and Distribution Equipment: Lightspeed Technologies, Incorporated; Model CAT 955-FM.

B. Loudspeakers;
   1. Flush, Ceiling-Mounted Loudspeaker:
      a. Lightspeed Technologies, Incorporated; Model 4JCS.
   2. Surface-Mount Loudspeaker:
      a. Lightspeed Technologies, Incorporated; Model WMQ.

C. Wire and Cable:
   1. West Penn Wire
   2. Or approved equivalent.

2.02 AUDIO AMPLIFICATION AND DISTRIBUTION

A. Audio Mixer/Amplifier/FM Microphone Receiver:
   1. Power output: 24-W (12-W per channel).
   2. Frequency response: 60-Hz to 20-kHz.
   3. Signal-to-noise ratio: >73-dB.
   4. Total harmonic distortion: <1 percent at 20-W (10-W per channel).
   5. Loudspeaker load impedance: 4-ohm, each output.
   6. Four stereo audio inputs: Two RCA and two 3.5-mm.
   7. Paging system override input.
   8. 4-band equalizer on front panel.
   9. Include Flexmike.

2.03 LOUDSPEAKERS

A. Flush, Ceiling-Mounted Loudspeaker:
   1. Two-way speaker system.
   2. Frequency response: 40-Hz to 20-kHz.
   3. 8-ohm impedance.
   4. 30-W power handling.

B. Surface-Mount Loudspeaker:
   1. Mini 2-way speaker system with built-in crossover.
   2. 3-inch driver, 1-inch horn.
   3. Frequency response: 110-Hz to 20-kHz.
   4. 8-ohm impedance.
   5. 30-W power handling.
   6. Weather-resistant enclosure.

2.04 WIRE AND CABLE

A. Cable and Adapter Types: Loudspeaker-level cable, 18 AWG, stranded, two conductors, plenum rated.

B. 3.55mm Stereo Audio Cable.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Examination: Examine areas and conditions under which audio-video equipment will be installed. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not begin installation until unacceptable conditions are corrected.

B. Equipment Racks:
   1. Fasten free-standing equipment racks to the floor using a minimum of four 3/8-inch concrete anchors. In raised floor areas, secure equipment racks to the concrete floor below.
   2. Position free-standing equipment racks according to the Drawings with a minimum of 3-feet clearance in front. Report any discrepancies to the Architect.
   3. Mount equipment within rack as shown in rack elevations on Drawings.
   4. Fill unused rack space with blank rack panels.

C. Power Distribution:
   1. Mount power distribution in rack as shown in rack elevations on Drawings.
   2. Connect equipment cords from rack-mounted equipment to the power distribution unit.

D. Performance Requirements:

1. Conceal wiring in walls and ceiling spaces during construction.
2. Determine requirements for plenum-rated cable. When doubt exists, seek determination in writing by AHJ prior to ordering.

E. Install complete system in strict accordance with manufacturer's recommendations. Complete electrical connections to all system components.

F. Install equipment so it is held firmly in place.

G. Do not install electronic equipment in any space until other work within the space has been completed, to prevent dust, dirt, debris, etc. from damaging equipment.

H. Store loose devices and cables in rack-mounted drawers, cabinets, or Owner-approved location. Notify Owner of location of loose devices and cables during training.

I. Inspection and Testing Upon Completion:
1. Warranty materials and installation to be free of defects in material and workmanship after final acceptance of installation and test per Division 01, General Requirements.
2. Upon completion of the installation, furnish copies of complete operational instructions, complete with record drawings. Include part numbers and names, addresses and telephone numbers of parts source. One hard copy and two digital copies on CD required for materials.
3. Nothing contained in this Section to be construed to relieve the Contractor from furnishing a complete and acceptable system in all its categories. Architect will reject any materials or labor that are or may become detrimental to the accomplishment of the intents of these Specifications.

J. Training: Provide Owner with manufacturer's operating instructions.

K. Clean-Up:
1. Remove unused materials and debris from the work and storage areas. Leave areas in an undamaged and acceptable condition.
2. Save the shipping boxes for the Owner in case of need to return product for service.

3.02 AUDIO AMPLIFICATION AND DISTRIBUTION EQUIPMENT

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Audio Amplification:
1. Audio Signal Routing: Provide and install required signal routing mixers, equalizers, or processors such that the user can produce and route an audio signal to any location or equipment within the system.
2. Speakers: Provide and install flush mounted speakers of professional commercial grade. Locate speakers as noted on drawings.

3.03 LOUDSPEAKERS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

3.04 WIRE AND CABLE

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Provide system wiring in accordance with good engineering practices as established by Telecommunications Industry Association (TIA), Electronic Industries Alliance (EIA) and NEC. Meet established state and local electrical codes.

D. Install wiring in raceways where routed through inaccessible areas. Use J-hooks for cable installed in areas with accessible ceilings.

E. Provide 3.5mm stereo audio cable from the amplifier to the flat screen in each space.

END OF SECTION

SECTION 27 51 13
INTERCOM, PAGING AND CLOCK SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Furnish all labor, project management, materials, tools, equipment and resources necessary for the installation of a new AtlasIED GCK Intercom System and master clock scheduling functions as shown on the plans and as specified.

1.02 RELATED SECTIONS

A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.

B. In addition, reference Division 26, Electrical when power clocks are required.

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. Install system in compliance with local and state authorities having jurisdiction.

1.04 SUBMITTALS

A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Product Data: Submit complete catalog data for each component, describing physical characteristics and method of installation. Submit brochure showing available colors and finishes of clocks.
2. Samples: Submit one clock for approval. Tag and install approved sample at location directed.
3. Manufacturer's Instructions: Submit complete installation, set-up and maintenance instructions.
4. Documentation of the network requirements that are needed for proper installation and distribution.
5. A complete list of materials with model and part numbers and reference to the Specification paragraph number.
6. A complete set of detailed manufacturer's specifications and product data describing and illustrating all standard and special components and materials.
7. A copy of the intercom contractor’s valid state contractor's license and written confirmation from the factory that he is an authorized distributor/installer of the submitted equipment.
8. Shop drawings showing components and relative connections and terminations.
9. The following information shall be submitted at the end of the project and included in Operations and Maintenance (O&M) Manuals:
    a. Copy of product data cut sheets as submitted for review as noted above.
    b. Complete as-built drawings on scaled floor plans depicting the final location of all equipment, each device, and cable routing as installed.
    c. Certificate of Completion, identifying the installation is complete, programming is complete, training of the Owner and appropriate staff is complete. Certificate to be signed by the Contractor and the Owner, and dated.
10. Submit at the end of the project and provide the following during Owner training: System specific customized user manuals, including step-by-step instructions for use by office administrative staff, teachers, and programming staff.

1.05 QUALITY ASSURANCE

A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. In addition, meet following:

1. Warranty: Two year warranty on all components excluding batteries.
2. Qualifications: Contractor must be a local certified Atlas GlobalCom IP Integrator at time of bidding and during installation.
3. Coordinate the installation of equipment with the other contractors on site and the Owner.
4. All systems specified to be provided by a single source and installed under the direct supervision of an authorized factory distributor for the submitted equipment. This distributor to stock spare parts and maintain a staff of trained, certified technicians with full warranty privileges.

1.06 WARRANTY

A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.07 SYSTEM DESCRIPTION

A. Furnish and install a system complete in every respect and ready to operate. Furnish and install all miscellaneous items and accessories required for such installation, whether or not each such item or accessory is shown on the plans or mentioned in these specifications.

B. Components of the Intercom Notification System to provide a complete system IP Based solution for a fully functioning Intercom System, Public Address System and Master Clock System for distribution of schedules, emergency tones, and messages via intercom system speakers. System to include software from a single manufacturer for complete control and monitoring of the system for a fully supported system. System to be digital and operate over the school Local Area Network and Wide Area Network, with redundancy as shown on contract documents.

C. System to be connected at the head-end, to the Owner’s phone system, to allow integration of the two systems. Coordinate with the Owner to ensure compatibility of intercom and phone system prior to any procurement of intercom system components. Provide all necessary interconnecting equipment. Coordinate with Owner to determine exact configuration of phone system.

D. Complete all tie-in and testing of the phone/intercom system tie-ins to allow paging by any phone, and answering of the assigned phones to call switch call-ins and main entry door switch activation.

E. Furnish and install all necessary equipment, including but not limited to backboxes, specialty boxes, speakers, wall plates, supports and enclosures.

F. Furnish all programming of the system (initial and final) and audio level adjustments (initial and final).

G. All materials, equipment and apparatus provided to be new and of the latest design or model offered for sale by the manufacturer.

H. Provide all system programming for configuration and interfaces.

I. System to be capable of being configured and controlled remotely via Owner provided connectivity (e.g. via a smart phone, VPN, etc.).

J. System to include General Purpose Input and Output trigger points for interfacing to other systems including Emergency and Security Systems, to provide event driven configuration scenarios for the system.

K. Each classroom to be a “zone” on the system capable of individual intercom use or as part of a “zone group” or “all call” during Public Address System use. Classroom end device to be a PoE device attached to the school network.

L. Provide all common areas, including but not limited to: Corridors, Commons (cafeteria), Gymnasium, Student Center, Media Center, and Restrooms, with coverage from the system for general and emergency announcements.

M. System to provide multicast or hybrid unicast/multicast for configuration of LAN and WAN with standard Ethernet protocols.

N. System to interface with any telephone system utilizing either Enhanced/SIP, FXS or FXO Port type integration thus allowing the school(s) to upgrade or replace their telephone system without suffering a requirement to replace, or lose any feature of, their internal communications (intercom) system.

O. System to provide opening tones and messages for announcements to speakers.

P. System to be common alert protocol compliant, capable of incorporating automatic weather and amber alerts as directed by the Owner's Representative.

Q. All common area loudspeakers to operate on a 24Vdc distributed system. Group loudspeakers in modular zones, allowing maximum flexibility for paging area assignment.

R. Server, Software and Operating System to be provided and connected to a separate Owner LAN. Provide all necessary hardware for support of system software.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Intercom equipment specified is that of GlobalControlKom 2.0 by AtlasIED. System to include GlobalContolKom 2.0 control software by AtlasIED. Equipment of this manufacturer constitutes the quality of design and construction, operational characteristics, appearance standards, space requirements and field service staffing levels required to comply with the requirements of this specification.

B. Substitutions will not be considered.

2.02 SYSTEM OPERATION

A. The following functional capabilities are required for the Intercom notification system:

1. System operation to allow administrator to define user privileges, define loudspeaker zones, pre-recorded messages, bell schedules, bell designations, event logs, background music streams, system configuration and end point status.
2. Automatically send visual messages or sound a tone or play a pre-page .WAV file over any loudspeaker connected for two-way communication to alert the classroom teacher that this two-way call has been established. This is intended to prevent unauthorized monitoring. The privacy tone must repeat every 15 seconds.
3. Distribution of emergency announcement(s) from any authorized telephone to all areas furnished with a loudspeaker. Emergency announcements to have highest system priority.
4. Distribution of general announcements from any administrative telephone, staff telephone, or classroom telephone. System to be capable of providing all-call, group call, and multiple group calls. Classroom speakers to be software assignable to an unlimited amount of paging groups.
5. Provide the ability to define and archive unlimited amount of time schedules. Each schedule to be capable of controlling an unlimited amount of events. An event is defined as but not limited to, pre-defined audio .WAV files, relay controls, streaming music, etc. System to be capable of uploading and storing .WAV files, text-to-speech and recording on the fly. System to allow for an unlimited amount of audio sources that are programmable to play over an unlimited amount of audio groups. System to be capable of supplying an unlimited amount of relays for building control. Each scheduled audio event to be distributable to an unlimited amount of audio groups. System to feature the ability to automatically initiate up to an unlimited amount of schedules per day, based upon the day of

the week or calendar dates up to five years in advance. Schedule administration, modification and creation functions must be available through a browser-based system. Systems that do not allow the school to manage their own schedules with browser-based software and do not offer calendar based scheduling up to five years in advance or require separate page and time groups are not acceptable.

6. Provides one to 11 digits numbering plan, thus allowing the classroom speaker and the classroom telephone to be the same architectural number.
7. Place call buttons in each classroom and talkback area; these will trigger caller ID information to the Main Office.
8. System to be capable of operation with multiple Telephone Systems to place intercoms call on hold in order to perform other administrative functions.
9. System to offer a test room mask to minimize audio distributions during tests. Emergency audio is not to be encumbered by this test room mask.
10. Programmable features to be stored in non-volatile memory and will not be lost due to power failures.
11. Classroom initiated intercom calls must be able to be assigned to ring at specific administrative ports. Administrative ports to have the flexibility to be forwarded to other administrative ports, should a call go unanswered or should the assigned administrative port be busy.
12. Facilities to annunciate incoming intercom calls at multiple administrative phones simultaneously. Calls may be answered from any of the administrative telephones by simply lifting handset, dialing the room number or pressing a button on telephone. Once answered, the call will automatically be cancelled for other administrative phones.
13. System functionality must include the capability to manually distribute an unlimited amount of chained events via browser based device, pushbuttons, contact closure, or dial up tones from any administrative telephone. These events to be customizable with respect to volume levels, cadence, priority, type and duration. Browser access and dial up events to only be accessible by authorized users.
14. System to be capable of providing an unlimited amount of ports to be connected to the telephone system via Enhanced/SIP, FXS or FXO Port integration from the intercom system. These ports to provide built-in Enhanced Caller Line Identification which will visually announce the name of the teacher or location, the classroom number.
15. System to have the ability to control all system relays. Relays to be controlled through any computer on the LAN/WAN, DTMF controlled, automatically cycle at a programmed time of day, follow time schedule events. All relays must be software programmable with the flexibility to change as required.
16. System to tie to AV systems with analog line and one relay closure for each type of page: local page, page all and emergency page.
17. System to provide an unlimited amount of user administration and system operation access. Audio program material to be controlled and distributed by way of a browser-based device such as a computer allowing simple and easy changes. Systems that require manual operated switch-banks or cumbersome DTMF telephone codes for distribution are not acceptable.
18. System to have the ability to store a minimum of 25000 seconds of .WAV files; these will not be lost due to power outage.
19. The .WAV files to be activated via any computer on the LAN/WAN, Telephone and/or Telephone system, and/or pushbuttons.

20. .WAV files to be programmable as to what level of priority they can be broadcast. They are to be programmable as to override any class change tones, normal all call, music, and intercom in the event of an emergency.
21. .WAV files to have the ability to be broadcast into an unlimited number of audio groups.
22. .WAV files to have the ability to be broadcast via a schedule for any day of the week or time of the day. .WAV files to have the ability to be broadcast for any duration of time and repeat number of plays with the ability to select how long the duration is between each repeated broadcast.
23. .WAV files to be able to be broadcast via a pushbutton. When this pushbutton is activated it will be programmable to select which .WAV file is broadcast, the priority level, where it is broadcast, and how many times it will play.
24. .WAV files to have the ability to be a part of the class change tones within the system. These files to be able to replace any tone within the class change schedules as to offer the flexibility of customizable tones and or phrases in this class change mode.

2.03 NETWORK REQUIREMENTS FOR MANAGED VOIP PRODUCTS

A. Hardware Requirements: 10/100 Ethernet.

B. Bandwidth Requirements:
   1. 64 kbps per active One Way Broadcast.
   2. 128 kbps per active Two Way Broadcast/Talkback.

C. TCP Requirements:
   1. HTTP (80).
   2. SIP (5060).

D. UDP Requirements:
   1. SIP (5060).
   2. RTP (20480-32767).

E. Optional Multicast Requirements:
   1. IGMPv2 enabled network.
   2. IGMP Snooping disabled.

F. Requirements:
   1. VLAN for optimal performance.
   2. 802.3af PoE compatible switches.

2.04 INTERCOM SYSTEM CONTROL UNIT

A. System appliance to be AtlasIED GLOBALCOM.IP. Server to provide automated emergency messaging, event scheduling and clock control capability. It allows distribution of .WAV formatted audio out to 25 simultaneous groups of speakers. Browser-based interface facilitates easily accessible manipulation of custom audio files for use as class change tones or emergency notification alerts. System control software features audio and visual messaging or text-to-speech conversion and provides on demand access of pre-loaded audio files via web browser or contact closure. Schedules may be automated based upon day of the week, calendar date up to one year in advance, or may be manually controlled.

2.05 SYSTEM EQUIPMENT

A. Speakers: System speakers to be capable of utilizing standard Category 6A infrastructure for installation from the MDF or IDF's as applicable, to the classroom and/or zone, thus allowing for only one type of wiring infrastructure within the school.

B. IP Loudspeaker with Microphone and Clock:

1. IP loudspeaker system with microphone, LED flashers, and clock to provide two-way communication, live, pre-recorded messages, bells, streaming music or ad hoc messages to individual rooms or classrooms. Loudspeaker to be surface mounted and connected via PoE (802.3af).
2. Speaker Qualities:
   a. IP Loudspeaker with Microphone and Clock part #IP-SDMF-72.
   b. ETL Certified to Safety Listed to UL60950-1.
   c. 8-inch dual cone speaker with 10 oz. magnet motor.
   d. Frequency response of 86Hz to 8kHz (+/-5dB).
   e. 94 dB average SPL sensitivity @1W/1M.
   f. 103dB @1M via rated power using internal IP addressable amplifier, 9 watts maximum.
   g. 105-degree dispersion 2kHz octave band (-6dB).
   h. Internal electret condenser microphone for full duplex operation and room monitoring for emergencies only. Monitoring to be disabled by administration set up.
   i. Include two configurable contact closures for Class room call and Emergency call buttons.
   j. Network controlled internal digital clock with bright five-element LED creating 2.75-inch high x 1.25-inch wide characters for clock or scrolling text.
   k. Have an all metal baffle in neutral white color.
   l. Include internal RJ-45 connection.
   m. Include internal relays for muting external systems as required.
   n. Include all mounting hardware and backcan.

C. IP Loudspeaker with Clock:
1. IP loudspeaker system with LED flashers and clock to provide one-way communication, live, pre-recorded messages bells or streaming music to individual rooms or classrooms. Loudspeaker to be surface mounted and connected via PoE (802.3af).
2. Speaker Qualities:
   a. IP Loudspeaker with Clock part #IP-SDMF.
   b. ETL Certified to Safety Listed to UL60950-1.
   c. 8-inch dual cone speaker with 10 oz. magnet motor.
   d. Frequency response of 86Hz to 8kHz (+/-5dB).
   e. 94 dB average SPL sensitivity @1W/1M.
   f. 103dB @1M via rated power using internal IP addressable amplifier, 9 watts maximum.
   g. 105-degree dispersion 2kHz octave band (-6dB).
   h. Network controlled internal digital clock with bright five-element LED creating 2.75-inch high x 1.25-inch wide characters for clock or scrolling text.
   i. Have an all metal baffle in neutral white color.
   j. Include internal RJ-45 connection.
   k. Include all mounting hardware and backcan.

D. IP Zone Controller:

1. IP zone controller to provide interface to send live, pre-recorded or Ad hoc messages with control data to single zoned speaker end points over multicast or unicast enabled LAN/WAN.
2. Zone Controller Qualities:
    a. IP Zone Controller part #ZC1PRO+.
    b. Analog output, transformer balanced.
    c. ETL Certified to Safety Listed to UL60950-1.
    d. Remote volume control.
    e. Maximum level +23 dB @1 kHz, 2k ohm load.
    f. Crosstalk of 100dB typical 1kHz bandpass.
    g. 24 bit audio converter with 24bit or higher audio processing.
    h. 10 Base T on RJ45 Ethernet connection compatible with SIP VoIP systems.
    i. Power requirement 12VDC - 18VDC PoE compliant IEEE 802.3af.
    j. Be rack mountable, 1/2 space, 1RU.
    k. Connectivity to zone amplifier.
    l. Limiter, inrush.
    m. Input sensitivity per channel, 1V or 2V.
    n. Any combination of modules allowed.

E. Interior Common Loudspeaker Type 1:
1. The Type 1, 1-foot x 2-foot, lay-in loudspeaker to provide one-way communication, live, pre-recorded messages bells or streaming music to interior common Areas. Loudspeaker to be flush mounted with speaker, grill and backcan.
2. Speaker Qualities:
    a. Interior 1-foot x 2-foot, Lay-in Loudspeaker, Type 1, part #DT12.
    b. ETL Certified to Safety Listed to UL1480.
    c. 8-inch dual cone speaker with 10 oz. magnet motor.
    d. Frequency response of 85Hz to 8kHz (+/-5dB).
    e. 97 dB average SPL sensitivity @1W/1M.
    f. 105-degree dispersion 2kHz octave band (-6dB).
    g. Integral E.O. box for conduit or plenum wire termination.
    h. Complete with all mounting hardware and backcan.

F. Exterior and Wall Mount Common Loudspeaker:
1. IP loudspeaker system to provide one-way communication, live, pre-recorded messages bells or streaming music to exterior common Areas. Loudspeaker to be surface mounted in Vandal resistant enclosure and connected via PoE (802.3af).
2. 8-inch speaker with 4-watt 25V/70V transformer.
3. Vandal resistant baffle.
4. Atlas VP161-APF.

G. Speaker Back Boxes:
1. IP Speaker Backbox: Angled enclosure constructed of 20-gauge CRS with white epoxy finish. Atlas IP-SEA-SD.
2. Analog Speaker Backbox: Heavy-duty 18-gauge stainless steel construction with white powder coat finish. Atlas 161SES.

H. Power Amplifier:

1. Speaker power amplifier to provide amplification for analog speakers.
2. Power Amplifier Qualities:
    a. ETL Certified to Safety Listed to UL1480.
    b. A single channel amplifier of 5 watts into 8 ohm loads.
    c. Single balanced Line Input.
    d. 24VDC input, and 4 - 8 ohm output.
    e. Include all mounting hardware.
    f. Size as needed to support paging zones.

I. PoE Switches:
1. Switches to be rack mountable to meet district standard as noted below:
    a. Cisco Catalyst 3850, 48 Port (12mGig+36 Gig) UPoE LAN Base. Part Number: WS-C3850-12X48U-L.
    b. 1100W AC Config 1 Power Supply. Part Number: PWR-C1-1100WAC.
    c. Universal. Part Number: S3850UK9-163.
    d. 1100W AC Config 1 Secondary Power Supply. Part Number: PWR-C1-1100WAC/2.
    e. Cisco Catalyst 3850 2 X 10GE Network Module. Part Number: C3850-NM-2-10G.
    f. North America AC Type A Power Supply. Part Number: CAB-TA-NA.
    g. 50CM Type 1 Stacking Cable. Part Number: STACK-T1-50CM.
    h. Catalyst Stack Power Cable 30 CM; Part Number: CAB-SPWR-30CM.
    i. POE switches to be managed and rack mounted.
    j. Number as required to power speakers and other intercom components.
    k. Alternates are not acceptable.

J. Power Supplies:
1. Provide as required for all system components and all rack locations.
2. Power supplies to be nominal 115V, 60Hz input, 24Vdc output.

K. UPS Units: Provide as required to support all system components in order to maintain intercom system functionality during power outages.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Mount all equipment firmly in place. Clearly, logically and permanently mark all switches, jacks and receptacles. Provide for adequate ventilation in all equipment racks; take precautions to prevent electromagnetic or electrostatic hum. All installations to be neat and of professional quality. Cooperate with other trades in order to achieve well-coordinated progress and satisfactory final results. Execute without claim for extra payment minor moves or changes in equipment locations to accommodate equipment of other trades or the architectural symmetry of the facility.

B. Install all head end equipment in rack space furnished in the Main Server room and IDF rooms. Supplement rack, if necessary, to accommodate all equipment.

3.02 WIRING

A. Provide and install all cabling, clips, hangers, j-hooks, etc. as required.

B. Wiring to be in accordance with the Manufacturer’s specifications. Wiring to meet all local and state codes. All wiring to be ground and short tested.

C. All wiring to be listed for the intended purpose. Cabling to be Category 6A for all connections from the IDF or MDF to the classroom and or zone origination point. All IP speakers to be homerun to each local IDF that serves that area, or MDF as noted on plans. There is no additional cabling required from the IDF to the MDF; this is

accomplished through the shared fiber network devices and infrastructure. All interior wiring to be in accordance with new construction guidelines suggested by the Manufacturer; including the speaker and the call-in switch. Terminate cabling on 48 port patch panels separate from other systems. Refer to Section 27 15 00, Communications Horizontal Cabling, for cabling requirements.

3.03 TESTING

A. Upon completion of the installation, all systems to be completely tested by the respective manufacturer's representative. Make all necessary modifications and/or adjustments to ensure compliance with this specification. Testing to be performed in the presence of the Owner's representative at a time mutually agreed upon by the Contractor and Owner's representative.

B. Testing to include functionality of interface between the Intercom systems and Owner's phone system. Do not conduct testing until phone system is operational and able to be tested in this manner.

3.04 CERTIFICATION

A. Upon completion of the testing, the manufacturer or representative to issue to the Owner, a letter of certification attesting to the fact that he has tested and adjusted the system, that all components are properly installed according to the manufacturer's recommendations and are free of defects, and that the system is in compliance with this specification.

3.05 INSTRUCTION

A. Work to include supplying the services of a field service representative who is to be a full-time employee. The field service representative is to have specialized experience in the operation and maintenance of the systems and will instruct Owner's personnel in the techniques involved in the operation of the systems.

B. Provide up to eight hours' training in the use and operation of the Intercom Notification System, and all associated components and parts.

C. Sessions to facilitate the training of personnel in operating classroom equipment, administrative equipment, program distribution, and user programming functions.

3.06 DIAGRAMS, DRAWINGS AND INSTRUCTION MANUALS

A. Provide documentation materials in sufficient detail to enable the Owner's personnel to operate and maintain all systems. Provide a minimum of two manuals.

B. The two sets of documentation to be as follows:

1. The first set is to be the operations manual. This manual will provide operators with sufficient information to operate each system and network, assist in trouble identification, configure system hardware for adds, moves, and changes, and to identify individual hardware items.

2. The second set is to be the maintenance and operations manual and will contain all of the manufacturer’s maintenance and operations manuals, system as-built drawings, proof of performance test results, and any other maintenance and operational information required to properly troubleshoot or maintain the systems installed.

3.07 WARRANTY, SERVICE AND MAINTENANCE

A. Provide a one year warranty of the installed systems, against defects in material and workmanship. If any defects are found within the warranty period, replace all defective at no extra charge to the Owner for parts or labor. Perform all warranty work during normal working hours, within 48 hours (or by the next business day close, if encompassing a weekend).

B. Intercom Notification System Supplier to employ factory trained technical service personnel for service and maintenance of the system. Systems supplier to also instruct the Owner's technical personnel in the operation, care and maintenance of the system, as described above.

END OF SECTION