PART 1 - GENERAL

1.01 FILED SUB-BID REQUIREMENTS
   A. Filed Sub-Sub Bids Required:
      1. SUB-SUB-BID REQUIRING A PARAGRAPH "E" LISTING on the FORM FOR
         SUB-BID required per M.G.L. Chapter 149 Section 44A to 44L, as amended to
         date. The Electrical Subcontractor shall be responsible for all related building
         preparation and coordination as required, see specification for additional
         Paragraph “E” Listing requirements of the Listed Contractor, and coordination of
         responsibilities. Failure to meet or exceed the requirements of the Contractor, as
         detailed in this specification, shall be grounds to reject the applicable bidder.
      2. It is the sole intent of this Paragraph “E” Listing to ensure to the end-user,
         single source responsibility from a single qualified Contractor.
      3. Bidders listing themselves must provide documentation that they
         themselves are factory-authorized representatives of all systems
         specified. Bidders listing themselves may NOT sub-contract any portion of
         this specification.
      4. This Section shall be provided/installed, in its entirety, and as follows by a
         single firm/company that is a qualified Contractor.
            a. The Contractor must be DCAM Certified by the state of Massachusetts
               Division of Capital Asset Management, in the category of:
               TELECOMMUNICATION SYSTEMS.
            b. The Contractor must customarily furnish the size, scope and
               nature of this section IN ITS ENTIRETY WITH LABOR
               CONSISTING OF EMPLOYEES WITH WHOM ARE ON THEIR
               PAYROLL and must be an authorized manufacturers
               representative, certified, experienced and qualified to provide,
               install, program, troubleshoot, train, warrant and service all the
               systems in this section in their entirety.
   B. Examine all Project Specifications and Drawings for requirements that affect this
      SECTION, whether or not such work is specifically mentioned in this SECTION.

1.02 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and
      Supplementary Conditions and Division 1 Specification Sections, apply to this
      Section.
1.03 **SECTION INCLUDES**

A. Public Address and Intercom Systems.
   1. Preamplifiers.
   2. Power amplifiers.
   3. Transfer to standby amplifier.
   5. Volume limiter/compressors.
   6. Control console.
   7. Equipment cabinet.
   8. Equipment rack.
   10. Tone generator.
   11. Monitor panel.
   12. Loudspeakers.
   13. Volume Control Units.
   15. Microphone and headphone outlets.
   17. Program Distribution System.
   18. Administrative Intercom LCD Display Console.
   19. UPS Battery Backup System.
   20. Modem.

B. Interface to Other Systems
   1. Interface to Local Sound Systems.
   2. Interface to Master Clock System.
   3. Interface to Voice/Telephone system provided by others.
   4. Interface to Fire Alarm System.

C. Speaker and/or speaker backbox installer shall coordinate with the Architect's reflected ceiling lighting plan for proper location of all speakers installed in suspended ceilings.

D. Provide and maintain in safe adequate condition all staging and scaffolding required for the proper execution of the work of this Section.

E. The contractor shall remove and re-install all ceiling tiles as required for the work of this section.
   1. Replace all ceiling tiles damaged as a result of the work of this section at no cost to the owner.

F. Removal of all trash from site and clean up of all areas of work under this SECTION
G. Each Contractor shall perform daily clean-up of areas of work under this section and removal of all trash from the site.

H. Coordinate work with that of all other trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.04 RELATED SECTIONS

A. Related Sections include the following:

1. SECTION 260001-ELECTRICAL for “Pathways for Communication Systems,” and “Raceways and Boxes.”

B. Except for coordination, or unless otherwise indicated, the following work is not included as part of the technology Contractor’s responsibilities in this SECTION, and is to be performed by others as indicated:

1. Power Requirements provided by Electrical Contractor.
2. Cutting, channeling and core drilling up to five inches in diameter, shall be provided by Electrical Contractor.
3. Cable tray, ladder rack, and snake tray shall be provided by the Electrical Contractor.
4. Sleeves and empty conduits to accessible point above ceiling or below floor shall be provided by the Electrical Contractor.
5. Standard device boxes with plaster rings shall be provided by the Electrical Contractor.
6. All required specialty boxes shall be furnished by this Contractor and installed by the Electrical Contractor.

C. The installation, operating cost, and maintenance of the controlled environmental conditions for equipment located on site, as required by the manufacturer, NFPA 70B, or as specified in these specifications, shall be the responsibility of the General Contractor.

1.05 DEFINITIONS

A. Furnish: The term "furnish" is used to mean "supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, and similar operations."

B. Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, rigging in place, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."
C. **Provide:** The term "provide" means to "furnish and install, complete and ready for the intended use".

D. **SECTION, Section, and Contract:** "SECTION," "Section," and "Contract" refer to the requirements of the work to be performed as specified herein.

E. **Channels:** Separate parallel signal paths, from sources to loudspeakers or loudspeaker zones, with separate amplification and switching that permit selection between paths for speaker alternative program signals.

F. **UPS:** Uninterruptible Power Supply.

G. **VC:** Volume Control Unit.

H. **Zone:** Separate group of loudspeakers and associated supply wiring that may be arranged for selective switching between different channels.

1.06 **PERFORMANCE REQUIREMENTS**

A. Include **GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS** and Division 1 as part of this Section.

B. Examine all Project Specifications and Drawings for requirements that affect work of this Section, whether or not such work is specifically mentioned in this Section.

C. **Delegated Design:** Design supports and seismic restraints for control consoles, equipment cabinets and racks, and components, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.07 **SUBMITTALS**

A. Submit complete shop drawings, data, schedule of values, and samples in accordance with **SECTION 013300 - SUBMITTALS**

B. Submit all related Submittal information at one time.

1. **SUBMIT ALL ITEMS IN A SPECIFICATION SECTION AT THE SAME TIME.** An incomplete submittal will be held until a complete submittal is accumulated, or may be rejected without further review and returned to the applicable parties. Include a copy of the Specification Paragraphs pertaining to each item submitted.

C. Submit Contractor Qualifications.
D. Schedule of Values: Provide a schedule of values itemizing costs for labor and materials with additional breakdowns for rough and finish work. As a minimum, provide the following breakdown, by phase where applicable:

1. Each major piece of equipment
2. Other equipment by category
3. Material and labor for each item.
4. Equipment installation by category and each major piece of equipment.
   a. Rough work.
   b. Finish work.
5. Testing.
6. Owner training.
7. Operation and Maintenance Manuals.
8. Record drawings.

E. Submit for review, within thirty days after signing the Contract and prior to the submission of any Submittal, an itemized list of manufacturers of material and equipment and of Contractors proposed to be used under this Contract. Include a schedule of anticipated submittal and anticipated lead times after release of reviewed Submittal.

F. Provide a Submittal Bill of Materials, with column headings that clearly identify the information requested herein for each and every item submitted.

1. Each and every specification sheet submitted shall include a page number in the lower outside corner of the sheet. Double-sided specification sheets shall be identified by two (2) separate page numbers.
2. On each and every specification sheet submitted, indicate the applicable part numbers(s) on the sheet(s) by one of the following methods:
   a. Circling the applicable part number(s)
   b. Putting an arrow next to the applicable part number(s)
   c. Highlighting the applicable part number(s)

G. The Submittal Bill of Materials Index/Equipment List column headings shall identify the following minimum information. Submittals must be submitted using the following “headings” in the order indicated from left-to-right on the Bill of Materials Index/Equipment List:

1. All Bill of Material items shall be listed in the Bill of Material Index / Equipment List, in the same order as they appear in the specification.
2. “Specification Section Number”, reference specification section number/location, that identifies each individual item, for every item specified and submitted.
a. Example of Specification Section number/location: 2.13, B., 7., c., 4), e)

3. “Description” of each item
4. Manufacturer’s “Name” for each item
5. Manufacturer’s “Model #” for each item
6. “Quantity” of each item being provided
7. Submittal Page Number(s) of specification sheet(s) for each item

H. Any Submittal that does not include a submittal Bill of Materials, and provide a minimum of the information requested herein, shall be rejected without further review and returned to the applicable parties.

I. Submittal shall include complete Specifications and all applicable addendums, including type of materials, electrical characteristics, capacities, performance, and power requirements, to determine compliance with Contract Documents. All data submitted, including wiring diagrams, shall be complete for all equipment, and shall apply only to this specific project. All extraneous material shall be deleted or marked out. Items to be supplied shall be specifically indicated, using a method that will be visible after photocopying.

1. Submit equipment prints, inter-panel and intra-panel, full electronic wiring diagrams and specification sheets for each item specified herein. Specification Sheets shall be submitted on all items, including cable types.
2. Submit three copies of all repair and maintenance manuals.
3. Shop drawings detailing the Instructional technology network system including, but not limited to, the following:
   a. Built-in station arrangement.
   b. Equipment cabinet arrangement.
4. Wiring diagrams, detailing wiring for power, signal, and control, differentiating clearly between manufacturer-installed wiring and field-installed wiring. Identify terminals to facilitate installation, operation, and maintenance.
5. Submit wiring diagrams showing typical connections for all equipment.
6. Provide a riser diagram for the system showing in technically accurate detail all connections, interconnections, and provisions available, and made for adaptability of all specified future functions, and including all calculations, charts, and test data necessary to demonstrate that all systems and system components deliver the specified signals, grades, and levels at all required points and locations.
7. Submit a valid certificate from the manufacturer(s) indicating the Public Address/Intercom System Subcontractor is an authorized installer for the system (or systems) being submitted.
8. Submit a valid certificate of completion of installation and service training on the latest up-to-date version of the manufacturer’s equipment being provided for a present employee.

J. Regardless of any information included in the submittal submitted for review, the requirements of the Drawings and Specifications shall not be superseded in any way by the review. Review by the Architect does not relieve responsibility for submittal errors or from meeting the requirements of the Contract Documents.

K. It is intended that Submittal data be complete and accurate at the first submission.

L. A minimum period of 15 working days, exclusive of transmittal time, will be required in the Architect’s office each time Shop Drawings, Product Data, layout drawings, catalog data and brochures are submitted or resubmitted for review. A minimum period of 20 working days, exclusive of transmittal time, will be required for reviewing substitute materials or manufacturer. These time periods shall be considered when scheduling the work.

M. If proposed equipment deviates from the Specifications or Drawings, indicate in writing on Company letterhead those differences and provide sufficient data to justify acceptance. FAILURE TO INDICATE DEVIATIONS OR SUBSTITUTIONS IMPLIES FULL COMPLIANCE WITH DRAWINGS AND SPECIFICATIONS.

N. The term “by others” or similar wording shall not be used on Submittal. Submittal shall state by whom related items of work are to be provided. Where not indicated, it is implied that the work or item is provided under this Contract.

O. Indicate clearly all equipment, components or assemblies that are not NRTL listed or labeled. Failure to indicate otherwise implies NRTL-listing or labeling. Products found not to be NRTL-listed or labeled where such listing or labeling is available shall be replaced.

P. Include in Submittal:

1. Application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements.
2. Instructions for storage, handling, protection, examination, preparation, operation, and installation of product.

Q. Maintain at the job site the latest equipment submittal showing the action taken by the Architect. Make this submittal available to Architect.

R. Product Data: Submit catalog data sheets or other published materials showing appearances, electrical ratings characteristics and connection requirements, performance characteristics, dimensions, weights, installation methods, and space requirements of equipment and its accessories, as listed below and required by the individual paragraphs:
1. Identification Methods
2. Grounding and Bonding
3. Electrical Connections for Equipment
4. Supports and Supplementary Steel
5. Electrical Identification
6. Test Report Formats
7. Test Equipment

S. Shop Drawings: Submit shop drawings that indicate physical size and arrangement, (plans and elevations) construction details, provisions for conduits, access requirements for installation and maintenance, finishes, and materials used in fabrication. Supplement shop drawings with wiring diagrams and information as described under Product Data. Provide shop drawings as required by the individual paragraphs.

1. Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location and size of each field connection.
2. Console layouts.
3. Control panels.
4. Rack arrangements.
5. Calculations: For sizing backup battery.
6. Wiring Diagrams: For power, signal, and control wiring.
   a. Identify terminals to facilitate installation, operation, and maintenance.
   b. Single-line diagram showing interconnection of components.
   c. Cabling diagram showing cable routing.

T. Delegated-Design Submittal: For supports and seismic restraints for control consoles, equipment cabinets and racks, and components indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of supports and seismic restraints for control consoles, equipment cabinets and racks, and components.

U. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings are shown and coordinated with each other, using input from installers of the items involved.

1. Refer to SECTION 013300 - SUBMITTALS for coordination drawing requirements.

V. Operation and Maintenance Data: For public address and intercom systems to include in emergency, operation, and maintenance manuals.
1.08 INTERPRETATION OF DRAWINGS

A. All work indicated on the Drawings is intended to be approximately correct to scale, but figures, dimensions, and detailed Drawings are to be followed in every case. The Drawings shall be taken in a sense as diagrammatic. Size of raceways and methods of running them are indicated, but it is not intended to show every offset and fitting, nor every structural difficulty that may be encountered.

B. Locations indicated on the Drawings are approximate, and it is intended that all equipment shall be located in accordance with the general and detail Drawings of the construction proper. Coordinate the location, mounting heights, and routing of cabling work with other trades' requirements and with field conditions.

C. All measurements shall be taken at the building before fabrication commences.

D. Schematic diagrams shown on the Drawings indicate the required functions. Standard diagrams of the manufacturer may be used for the functions indicated without exact adherence to the Schematic Drawings shown. Work required for such deviations shall be provided.

E. Items referred to in singular number in Contract Drawings shall be provided in quantities necessary to complete work.

F. The right is reserved to make reasonable changes in locations of work prior to rough-in at no additional cost.

G. Where Drawings or Specifications conflict or are unclear, advise the Architect in writing before Award of Contract. Otherwise, interpretations of Contract Documents by the Architect shall be final, and no additional compensation shall be permitted due to discrepancies or ambiguities that are resolved according to the Architect's interpretation.

H. Drawings and Specifications form complimentary requirements. Provide work indicated on the Drawings, but not specified; and work specified, but not indicated on the Drawings as though explicitly required by both.

I. Drawings and Specifications do not undertake to indicate every item required to produce a complete and properly operating installation. Materials, equipment, or labor that is not indicated, but that can be reasonably inferred to be necessary for a fully complete, secure, and properly operating installation suitable for the intended use, shall be provided.

J. Drawings do not limit responsibility of determining full extent of work required by Contract Documents. Refer to all Drawings and Specifications that indicate types of construction in which work shall be installed, and work of other trades with which work of this Section must be coordinated.
K. Except where modified by a specific notation to the contrary, it shall be understood that the indication or description of any item, in the Drawings or Specifications or both, carries with it the instruction to provide the item, regardless of whether this instruction is explicitly stated as part of the indication or description.

L. Where Drawings or Specifications do not coincide with manufacturer's recommendations, or with applicable Codes and Standards, alert the Architect in writing before installation. Otherwise, make changes in installed work as the Architect requires without additional cost.

M. It is the intent of these Contract Documents to have systems and components that are fully complete and operational, and fully suitable for the intended use. There may be situations in the documents where insufficient information exists to precisely describe a certain component or subsystem, or the routing of a component. In such cases, where the Installer has failed to notify the Architect in writing of the situation prior to Contract Award, the Installer shall provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in workmanlike manner, either concealed or exposed per the design intent.

N. In situations where potential conflict exists, or where the Installer believes guidance is required, submit a sketch identifying proposed solution, and the Architect shall review, note if necessary, and return this sketch appropriately marked for use by the Installer.

1.09 OBTAINING INFORMATION

A. Obtain from the manufacturer the proper method of installation and connection of the equipment that is to be furnished or installed. Obtain all information that is necessary to facilitate the work and to complete the project. Include all such information in Operation and Maintenance Manuals.

1.10 PERMITS, FEES, RULES AND REGULATIONS

A. Give the proper Authorities all requisite notices or information relating to the work under this Section. Obtain and pay for all fees, licenses, permits and certificates. Comply with the rules and regulations of all local, state, and federal authorities having jurisdiction, Building Codes, the rules and regulations of the National Board of Fire Underwriters, and the public utility companies serving the building.

B. Public utility back charges will be paid for by the Owner and are not to be included in the base bid. Markups on utility back-charges will not be allowed.
C. Perform work in accordance with Nationally Recognized Testing Laboratory (NRTL) listing or labeling requirements, OSHA regulations, NFPA Standards, Electrical Code, the Americans with Disabilities Act Accessibility Guidelines (ADAAG), EIA/TIA, and BICSI. The Drawings and Specifications do not attempt to indicate all work required by codes, regulations, and authorities.

D. Nothing in these Contract Documents shall be construed to permit work not conforming to applicable codes and regulations. When conflicts occur, the more restrictive requirements shall govern.

E. Toxicity: Comply with applicable codes and regulations regarding toxicity of combustion products used or hazardous materials used, or disposed of.

F. Legally dispose of all material. Adhere to all regulations regarding disposal of hazardous material. Recycle hazardous material where recycling is possible. Submit certificates of legal recycling or disposal to the Architect. Include copy in the Owner and Maintenance Manual.

G. Should the Facility have established building standards, rules, or regulations, obtain a copy from the Building Owner, and comply with them.

### 1.11 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver items to the site until all specified submittals have been submitted to, and approved by, the Architect.

B. Deliver materials in original packages, containers, or bundles bearing brand name, or identification of manufacturer or supplier.

C. Deliver, store, protect, and handle products in accordance with recommended practices listed in Manufacturer's Installation and Maintenance Manuals.

D. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion, and damage from construction operations and other causes.

### 1.12 PROTECTION OF WORK AND PROPERTY

A. Be responsible for the care and protection of all work included under this Section until it has been tested and accepted.

B. Protect all equipment and materials from damage from all causes, including theft. All materials and equipment damaged or stolen shall be replaced with equal material or equipment at the option of the Architect and Owner.
C. Materials and equipment stored for this project shall be protected and maintained according to the manufacturer's recommendations and requirements, and according to the applicable requirements of NFPA 70B.

D. Protect all equipment, outlets and openings with temporary plugs, caps and covers. Protect work and materials of other trades from damage that might be caused by work or workmen, and make reparations for any damage caused.

E. Use caution to avoid damage to existing work, and to prevent harm to personnel working in all areas.

F. Observe all safety precautions and requirements for the construction.

G. When open-flame or spark-producing tools, such as blower torches, welding equipment, etc., are required in the process of executing the work, the General Contractor shall be notified not less than twenty four hours in advance of the time that the work is to begin and the location where the work is to be performed. Provide, where necessary, fire protective covering and maintain a constant non-working fire watch while work is being performed, and until it is completed.

H. The General Contractor and the Installer are responsible for initiating, maintaining, and supervising all safety precautions and requirements during construction.

1.13 MATERIAL AND EQUIPMENT STANDARDS

A. Manufacturers:

1. Manufacturers are listed for the purpose of establishing a specification standard for that particular item. Other manufacturers' shall be considered for approval, provided they meet or exceed all the specification requirements.

B. Except where no substitutions are indicated, where materials or equipment are specified by patent proprietary name, or name of the manufacturer, such specification is used for the purpose of establishing a standard for that particular item. If more than one manufacturer is listed, the Contract Documents are based on the first manufacturer listed, and every other manufacturer is considered a substitution.

C. If three or more manufacturers are indicated without the term "or equal", or "or approved equal", then the material and equipment shall be supplied by one of those indicated and that material and equipment shall conform in all respects to the Drawings and Specifications.

D. No equipment or material shall be used, furnished, or installed unless previously reviewed and accepted by the Architect.
E. Substitutions may be offered for review, provided the material, equipment, or process offered for consideration is equal in every respect to that indicated or specified. The request for each substitution must be accompanied by a letter from an Authorized Representative of the manufacturer and the Installer, indicating that the substitution meets or exceeds all specified requirements. Provide complete specifications, drawings, or samples to properly appraise the materials, equipment, or process. Acceptance of substitutions shall be based on performance, appearance, use, maintenance requirements, durability, aesthetics, physical arrangement, size, and quality.

F. If a substitution of materials or equipment, in whole or in part, is made, bear the cost of any changes, engineering, or construction, necessitated as a result of said substitution.

G. Materials shall be new, unused, of recent manufacture, not previously installed, full weight, standard, the best quality of its kind, and acceptable to the Architect.

H. Provide NRTL-listed or labeled products whenever there are NRTL standards, listings, or labeling available for that product category.

I. The Specifications or notes and description following a catalog number is basically to identify the item, but may also call for accessories, options, or modifications that are not indicated in the catalog number.

J. Reviewed submittals on substitute equipment shall only allow the Installer to proceed with installation. The substitution shall not be considered equal until such time as the Architect and Owner's Representative have completely accepted the installation. All costs for removal, relocation, or replacement of said Substitution shall be at the risk of the Installer.

K. Provide products of one manufacturer for each classification of equipment.

L. Provide documentation from both specified Product Manufacturer and the proposed substitute Product Manufacturer with separate comparative analysis sheet that matches product specification item for item. Substitutes shall not be considered unless accompanied by this documentation.

1.14 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with the respective trades responsible for installing interface work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Refer to the overall scheduling of the work of the project. Schedule work, process Submittal and order materials and equipment to conform to this
schedule, and install work to not delay nor interfere with the progress of the project.

C. Inform Architect immediately of any delays or potential delays. Furnish manufacturer's letter to verify order date, equipment delays, expected shipment date, order number, and potential remedies to speed up delivery. Any costs to speed up delivery shall be implemented at no cost to the project if the equipment or material was not ordered as soon as possible after Contract award or within the time frames indicated with the Submittal.

D. Include premium time required to comply with the project scheduling and phasing.

E. Be aware of, and plan for, project scheduling and phasing. Provide for complete continuous operation of all systems. Coordinate scheduling and phasing with the Architect, Owner, other Trades, and the General Contractor.

1.15 WARRANTY

A. Provide a warranty for two (2) years against defects in material and workmanship on all components, equipment, software, systems, cabling, etc. specified. Warranty shall start at time of substantial completion or routine use, which ever comes first. Warranty shall include all materials, equipment, and work furnished or installed under this Section. Any failure due to defective material, equipment, installation, or workmanship that may develop shall be corrected at no expense to the Owner, including all materials, labor, travel, expenses, system diagnostics, and damage to areas, materials, and other systems resulting from such failures.

B. Manufacturers shall provide replacement warranties for material and equipment furnished under this Section. Such warranties shall be in addition to and not in lieu of, all liabilities that the Manufacturer and the Installer may have by law or by provisions of the Contract Documents.

C. Include copies of all warranties, maintenance contracts, and training contracts or performance bonds in the Operation and Maintenance Manuals.

1.16 MAINTENANCE

A. Provide installer's maintenance contract quote upon request, for a period equal to warranty.

B. Upon receipt of notice from the Owner of failure of any part of the systems during the warranty period, the affected parts shall be replaced. Any equipment requiring excessive service, consisting of more than two unscheduled service calls, shall be considered defective and shall be replaced.
1. Response times to warranty issues shall differ according to the level of the problem.
2. A problem is considered to be corrected when the system and its components operate according to specified requirements.
3. Warranty work shall be performed according to the procedures of the Owner, its staff and tenants, and their normal operations.
4. The following levels of response to problems are required:
   a. Major Failure: 4-hour maximum response time if notified by telephone, 24 hours per day, 365 days per year.
   b. Minor Failure: 24 hours maximum response time if notified by telephone, 365 days per year.
5. Failures are defined as follows:
   a. Major Failure: a system failure that disables the entire system or major part of the system, or an individual critical piece of equipment that prevents the proper operation of more than one system component.
   b. Minor Failure: a system failure that affects only one non-critical component and does not affect operation of any other components or any failure that is not defined as a major failure.
   c. Major and minor failures are as defined by the Owner.
6. Response time to a call is defined as the time at which a qualified technician arrives at the site and starts repairs or diagnostics. If the problem has not been corrected within two hours of the initial response, regional and/or national support personnel shall be contacted for assistance.

C. Adequate stocks of parts, components, etc., and access to regional and national support personnel shall be available such that all major failures shall be corrected within 8 hours of Owner's initial telephone call, and all minor failures within 48 hours. Temporary components may be used to meet this requirement while new components or repairs are completed. Temporary components shall be replaced with new (unused) components or the original component repaired as soon as practical. Remanufactured equipment or components are not considered new and shall not be used.

D. Provide certified factory-trained technical service personnel for service and maintenance of the system.

1. Provide a copy of this warranty section in the Operations and Maintenance Manuals. Each copy shall be dated, signed, and certified by an authorized Representative of the Installer providing work under this Section stating that these requirements are understood and will be complied with without exception.
1.17 **CERTIFICATES OF APPROVAL**

A. Upon completion of all work, and as a condition to receiving payment at Substantial Completion, furnish to the Architect the following original, signed certificates, and include copies of these certificates as part of the Operation and Maintenance manuals:

1. Certification from the manufacturer's authorized representative stating that authorized factory engineers have inspected and tested the operation of their respective equipment and found same to be installed in accordance with the manufacturer's requirements, all requirements for manufacturer's warranties are complied with, and equipment is in satisfactory operating condition. This certification shall be provided for each piece of major equipment and for all complete systems. Provide certificate for additional items requested by the Architect.

2. Certificates of inspection, letters, or notices from the appropriate governmental authorized inspection authorities stating that all portions of the work (indicate trade and responsibility) have been inspected, and are installed in conformance with the applicable codes, laws, ordinances, and referenced standards. If non-conformance notices are received, include the re-inspection certificate, letter of explanation, etc. as required to indicate complete conformance. Provide written evidence of all exceptions or variances given by any Inspector.

3. Certificate from the installing firm responsible for the work (indicate trade and responsibility) signed by an authorized Officer of the firm and the Foreman or Project Manager in charge, indicating trade license numbers and stating that to the best of the signer's knowledge and belief that the project (indicate project name and address) has been installed in compliance with the Contract Drawings, Specifications, and Addenda, and all applicable codes, laws, ordinances, and referenced standards. Where sub-contractors perform a portion of the work of this Section, include certificates from them.

1.18 **SUBSTANTIAL AND FINAL COMPLETION**

A. Refer to General Conditions and Supplementary Conditions.

B. Substantial Completion shall not be considered unless all systems are tested and verified for adherence with Contract Documents and any work remaining is less than one percent of the total Contract Value of this Section.

1. Record Drawings, Operation and Maintenance Manuals, Acceptance Demonstrations, Owner personnel training, spare parts or extra materials required, test reports, warranties and certifications of installation inspections shall be submitted and accepted prior to Substantial Completion.
C. Final Completion shall be when all work under this Section is completed as defined by the Contract Documents and accepted by the Architect.

D. Upon completion of all work under this Section, submit written certifications that:

1. Contract Documents including addenda, clarifications, change orders, RFIs, and instructions from Architect have been reviewed.
2. Work has been inspected for compliance with Contract Documents.
3. Work has been completed in accordance with Contract Documents, and any deficiencies listed with Certificate of Substantial Completion have been corrected.
4. Equipment and systems are fully operational.
5. Work is complete and ready for Architect's final review.

E. When Architect determines Work is complete, close out submittals will be considered.

1.19 OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS

A. At least thirty (30) days prior to Substantial Completion, submit for review (3) three sets of Operating and Maintenance Manuals containing Manufacturer's catalogs, and other similar data, including the necessary photographic equipment cuts, wiring diagrams and final reviewed Shop Drawings and Product Data covering all equipment and devices furnished or installed under this Section. These manuals shall provide complete instructions for the proper operation and use of the equipment together with instructions for lubrication and periodic maintenance, and for trouble shooting. Operating instructions shall be specific for each system and shall include copies of posted specific instructions. This manual shall contain only information that specifically applies to this project, and all unrelated material shall be deleted or clearly crossed out.

B. The Operating and Maintenance Manual material shall be bound in 3-ring binders and indexed.

1. On the edge of the binder provide a clear see-through plastic holder with a typed card indicating the Project name, the Architect's name, the installer's name and the Volume number (e.g., Vol. No. 1 of 2).
2. Index shall identify the page number(s) or section divider number for each item.
3. The Operating and Maintenance Manual Index column headings shall identify the following minimum information. Manuals must be submitted using the following "headings" in the order indicated from left-to-right on the Index:

   a. "Description" of each item
   b. "Manufacturer's" Name for each item
c. Manufacturer’s “Model #” for each item
d. Owner and Maintenance Manual “Page” Number(s) or “Section” Divider Number for each item.

C. Provide name, address, and telephone number of the manufacturer's representative and service company for all items supplied, so that the source of replacement parts and service can be readily obtained.

1. Include copies of manufacturer's and installer's warranties and maintenance contracts, and performance bonds properly executed and signed by an authorized representative.

D. Include copies of all test reports and certifications.

E. Include copies of all Warranties.

1.20 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain public address and mass notification systems from single source from single manufacturer.

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

D. Comply with NFPA 70.

1.21 COORDINATION

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

1.22 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Microphone: One (1).
2. Desk Stand(s): One (1).
1.23 SEISMIC REQUIREMENTS

A. Equipment and work shall meet the restraint requirements for a Seismic Zone - 2 location, including installation and connections of material and equipment to the building structure.
2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal.

1. Bogen Communications, Inc.
   a. Public Address and Intercom Systems, and all other components required for a completely operational system as specified.

2. Rauland-Borg Corporation.
   a. Public Address and Intercom Systems, and all other components required for a completely operational system as specified.

3. Telecor
   a. Public Address and Intercom Systems, and all other components required for a completely operational system as specified.

4. TOA
   a. Public Address and Intercom Systems, and all other components required for a completely operational system as specified.

B. General:

1. Provide all equipment, accessories, and materials in accordance with these specifications and related documents to provide a complete and operating Public Address and Intercom System.

2. The Public Address and Intercom System shall provide the school with state of the art technology for all Sound Systems specified. The system shall also provide telephonic features as specified once properly interfaced to a standard telephone system by others. The system shall be easy to learn and operate. All standard system programming shall be user friendly to allow the system administrator the ability to easily re-program station features.
3. Provide complete and satisfactorily operating, Public Address and Intercom System as described herein, using materials and equipment of types, sizes, ratings, and performances as indicated. Use materials and equipment that comply with referenced standards and manufacturers’ standard design and construction, in accordance with published product information. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions.

4. Features offered by this system shall be implemented and controlled by software programs that can be changed and expanded as needs evolve.

5. Interface the Public Address and Intercom System’s battery backup power cord to an outlet in the MDF/MCER that is on the Emergency Generator.

2.02 SYSTEM DESCRIPTION

1. System shall use all 25 volt public address and intercom speakers, systems that use 45 ohm speakers shall not be acceptable.

2. This Section includes requirements for programmable Public Address and Intercom System components including, but not limited to, the following:

   a. Public Address and Intercom System Headend.
   b. Public Address and Intercom System Software.
   c. Interface to Telephone System.
   d. Interface to Local Sound System(s).
   e. Interface to Master Clock System.
   f. Ceiling/Wall Mounted Speaker Assemblies.
   g. Administrative Intercom LCD Display Consoles.
   h. Bell / Class Change Signaling System.
   i. Public Address / Intercom System.
   j. Controls, Amplifiers, and Terminal Equipment.
   k. Power Supplies.
   l. Battery Backup for System Programming.
   m. Program Distribution System.
   n. Audio Program Distribution.
   o. Accessories.

2.03 FUNCTIONAL DESCRIPTION OF SYSTEM

A. System Functions:

1. Selectively connect any zone to any available signal channel.
2. Selectively control sound from microphone outlets and other inputs.
3. "All-call" feature shall connect the all-call sound signal simultaneously to all zones regardless of zone or channel switch settings.
4. Telephone paging adapter shall allow paging by dialing an extension from any local telephone instrument and speaking into the telephone.
5. Produce a program-signal tone that is amplified and sounded over all speakers, overriding signals currently being distributed.
6. Reproduce high-quality sound that is free of noise and distortion at all loudspeakers at all times during equipment operation including standby mode with inputs off; output free of non-uniform coverage of amplified sound.

2.04 SYSTEM REQUIREMENTS

A. The system shall lend itself to expansion by simple addition of modules.
B. Two-way communication between any telephone and any classroom speaker.
C. Sixteen (16) separate paging/class pass zones shall be provided; each location shall be programmed in software to belong to any combination of software zones.
D. Amplified two-way voice communication shall be available from any dial phone in the system, through any classroom speaker in the system.

1. This shall allow hands-free communication to any classroom loudspeaker unit. A warning tone shall sound and continue to sound at regular intervals when speaker monitoring is active.
2. Central Switching Network System Administration, the Public Address and Intercom Systems shall provide the following capabilities:
   a. Centralized attendant answering.
   b. A minimum of 216 sound/speaker stations for present and future system expansion capabilities.
   c. Storage of diagnostic results and other system messages. These may be printed out upon request via local or remote access.
   d. Main control unit to store information and give reports on features, restrictions, hunting patterns, etc. upon request either on site or remotely.
   e. Automatic sounding of a warning tone signal over any loudspeaker selected for two-way communications to alert the station attendant (classroom teachers) to the call and prevent unauthorized monitoring.
   f. Access to any single classroom loudspeaker unit, zone loudspeaker unit, or all loudspeaker units. The warning tone signal shall sound as soon as the station is selected and shall be automatically repeated at regular intervals for the duration of the call if the voice circuit is not activated.
g. Instantaneous distribution of emergency announcements by single button access, simultaneously to all locations equipped with speakers.

1) Emergency announcements originating from any assigned administrative telephone shall have priority over all regular system functions.

3. Distribution, by single button access, of four (4) distinct alarm signals to all areas equipped with speakers.

4. Assignment of speaker locations within any one or more of the sixteen zones for zone paging or time signal reception; this assignment to be programmable. Systems without this feature will not be acceptable.

5. Origination of both emergency call-ins and nurse emergency call-ins from any staff location.

6. Call-ins originating from any staff location can be programmed for assignment to any of up to 12 locations simultaneously.

7. Review of all call-ins stored in memory, in groups of four, in the order received.

8. Answering of calls registered in the digital read-out display merely by pressing a single response button. This capability shall not prevent other calls from being placed or answered by dialing their numbers.

9. Multiple loudspeaker or telephone conversations to take place and not prevent announcements, educational, or music programs from being distributed to other areas of the building.

10. Broadcasting emergency instructions to the entire school. This capability shall be restricted to certain authorized telephones.

11. Single button access to allow page announcements into speaker zones without interrupting others performing simultaneous functions.

12. Provide Public Address and Intercom System Programming/Diagnostics Software which shall provide the following capabilities/programming/diagnostics from a single software program accessed and controlled from an owner-supplied desktop computer or workstation.

a. Provide and load Public Address and Intercom System Programming/Diagnostics Software on to a owner-supplied desktop computer or workstation. Provide proper interface of computer to the public address and intercom system.

2.05 DEVICES

A. Type IMS - Provide Administrative Intercom LCD Display Console indicated on the drawings. Also, provide one (1) unit at the Public Address, Intercom Systems head-end, unit shall be mounted on the outside of the rack/cabinet, which shall provide functions as scheduled below:
1. The associated digital display shall provide a 16-character display of numerals or letters.
2. The unit shall be a multi-button console with industry standard Twelve-(12) button DTMF matrix keys.
3. Provide built-in soft tone ringer with volume control.
4. Instrument shall include "Last Number Redial" key to permit user to automatically redial most recently dialed number.
5. Provide single button activation of the following features.
   a. All-call paging button.
   b. Zone page button
   c. Class change signal button
   d. Emergency evacuation signal button
   e. Program (Music) distribution button.

2.06 PROGRAM DISTRIBUTION SYSTEM

A. System shall provide the maximum capacity of function as stated herein.

B. School shall have the ability to provide selective programming.

C. The school shall be provided with a minimum of two (2) program channels, eight (8) time channels, sixteen (16) zone-page channels, and multiple linkage for telecommunications.

D. Time zones may be easily selected and easily accessed by designated administrative control units. A means of programming any or all loudspeakers for the separate zone functions shall allow for easily arranging and rearranging zones. Simultaneous administrative control unit functions and channel programming shall in no way cause system interference.

E. Capability for assigning speaker locations within any one or more of the zones for zone-paging or time signal reception; this assignment to be a programmable function. Systems without this feature will not be acceptable.

F. Time signal tones shall be generated throughout zone selected for time signaling over programmed loudspeakers on a manual or automatic basis.

G. Emergency tones shall be distributed from designated administrative control units.
H. All power amplifiers shall utilize 25-volt industry standard outputs to all public address and intercom speakers in the system, and shall meet all specifications exactly as specified herein, including power capacity and count. Power amplifiers shall also provide a minimum of 25-volt, half-watt power to all speaker locations, 15 watts of power to all horn-type speaker locations, plus 15% spare wattage for future expansion.

I. The system shall be equipped with one (1) rack-mounted AM/FM tuner, one (1) rack-mounted CD player and one (1) front-mounted monitor panel.

   1. A front-mounted monitor panel shall include: a back-lit digital readout that displays the time; a monitor speaker that permits these audio programs to be monitored before they are transmitted to classrooms or other locations; and a four-position monitor switch offering the follow selections: send program; send/monitor program; monitor program only, and "OFF" position.

J. Roof-mounted Antenna:

   1. A dedicated roof-mounted, twin dipole, omni-directional FM Antenna shall be provided. Two half-wave dipole elements mounted 90 degrees to one another on the antenna mast give this antenna an omni-directional reception pattern. The antenna shall be supplied with the following accessories: connector cable, an 18" boom, vertical mounting bracket and horizontal mounting bracket. The Antenna shall be a Blonder Tongue FM Omni-Directional Antenna #BTY-2-FM.

   2. Provide an RG-6U coax cable between the roof-mounted antenna location and the AM/FM tuner location, terminated with “F” type connectors.

      a. Antenna location shall be determined by Architect.

K. Audio Program Distribution

   1. The system shall provide capability to distribute program material (i.e., music, CD player, radio broadcasts, etc.) to a room, multiple rooms, zone, or all zones serviced by the system speakers.

   2. The system shall provide non-restrictive program-distribution channels.

   3. The user shall cue remotely located music source or select radio station.

   4. From an Administrative LCD Intercom Display Console or a properly interfaced telephone, the user can select the room(s) or areas to which to distribute program.

   5. Systems that require manually operated switch-banks for distribution shall not be acceptable.
2.07 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS

A. Compatibility of Components: Coordinate component features to form an integrated system. Match components and interconnections for optimum performance of specified functions.

B. Equipment: Comply with UL 813. Equipment shall be modular, using solid-state components, and fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.

C. Equipment Mounting: Where rack, cabinet, or console mounting is indicated, equipment shall be designed to mount in a 19-inch housing complying with TIA/EIA-310-D.

D. Weather-Resistant Equipment: Listed and labeled by a qualified testing agency for duty outdoors or in damp locations.

2.08 PREAMPLIFIERS

A. Preamplifier: Separately mounted.

B. Preamplifier: Integral to power amplifier.

C. Output Power: Plus 4 dB above 1 mW at matched power-amplifier load.

D. Total Harmonic Distortion: Less than 1 percent.

E. Frequency Response: Within plus or minus 2 dB from 20 to 20,000 Hz.

F. Input Jacks: Minimum of two. One matched for low-impedance microphone; the other matchable to cassette deck, CD player, or radio tuner signals without external adapters.

G. Minimum Noise Level: Minus 55 dB below rated output.

H. Controls: On-off, input levels, and master gain.

2.09 POWER AMPLIFIERS

A. Mounting: Rack.

B. Output Power: 70-V balanced line. 80 percent of the sum of wattage settings of connected for each station and speaker connected in all-call mode of operation, plus an allowance for future stations.
C. Total Harmonic Distortion: Less than 3 percent at rated power output from 50 to 12,000 Hz.


E. Frequency Response: Within plus or minus 2 dB from 50 to 12,000 Hz.

F. Output Regulation: Less than 2 dB from full to no load.

G. Controls: On-off, input levels, and low-cut filter.

H. Input Sensitivity: Matched to preamplifier and to provide full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.

2.10 TRANSFER TO STANDBY AMPLIFIER

A. Monitoring Circuit and Sensing Relay: Detect reduction in output of power amplifier of 40 percent or more and, in such event, transfer load and signal automatically to standby amplifier.

2.11 MICROPHONES

A. Paging Microphone:

1. Type: Dynamic, with cardioid polar characteristic.
2. Impedance: 150 ohms.
3. Frequency Response: Uniform, 50 to 14,000 Hz.
4. Output Level: Minus 58 dB, minimum.
5. Finish: Satin chrome.
6. Cable: C25J.


2.12 VOLUME LIMITER/COMPRESSOR

A. Minimum Performance Requirements:

1. Frequency Response: 45 to 15,000 Hz, plus or minus 1 dB minimum.
2. Signal Reduction Ratio: At least a 10:1 and 5:1 selectable capability.
3. Distortion: 1 percent, maximum.
4. Rated Output: Minimum of plus 14 dB.
5. Inputs: Minimum of two inputs with variable front-panel gain controls and VU or decibel meter for input adjustment.
2.13 **EQUIPMENT CABINET**

A. Comply with TIA/EIA-310-D.

B. House amplifiers and auxiliary equipment at each location.

C. Cabinet Housing:
   1. Constructed of 0.0478-inch steel, minimum, with front- and rear-locking doors and standard TIA/EIA-310-D-compliant, 19-inch racks.
   2. Arranged for floor or wall mounting as indicated.
   3. Sized to house all equipment indicated, plus spare capacity.
   4. Include 20 percent minimum spare capacity for future equipment in addition to space required for future cassette deck and CD player.

D. Power Provisions: A single switch in cabinet shall disconnect cabinet power distribution system and electrical outlets, which shall be uniformly spaced to accommodate ac-power cords for each item of equipment.

E. Ventilation: A low-noise fan for forced-air cabinet ventilation. Fan shall be equipped with a filtered input vent and shall be connected to operate from 105- to 130-V ac, 60 Hz; separately fused and switched; arranged to be powered when main cabinet power switch is on.

2.14 **SURGE-PROTECTED POWER STRIP**

A. Manufacturer: Provide products meeting the requirements of the Drawings and Specifications from one of the following Manufacturers:
   1. Leviton #5500-192, Great Lakes # 7219-20AR, or approved equal.
   2. Provide quantities as required to cover all equipment installed.

B. Specifications
   1. Surge-protected power strip shall be 19” rack-mount type.
   2. Surge protected power strip with six NEMA 5-20R outlets 20 amp capacity, 120 volts, UL 1449 listed, maximum surge current of 33,000 amps, clamping voltage of 260 volts, maximum 5 picoseconds response time, reset-able overload circuit breaker, surge suppression warning light, surge protection for line to neutral, line to ground, neutral to ground, EMI/RFI filters.
   3. Power cord shall have a NEMA 5, 20A twist lock plug.
2.15 **TELEPHONE PAGING ADAPTER**

A. Adapters shall accept voice signals from telephone extension dialing access and automatically provide amplifier input and program override for preselected zones.
   
   1. Minimum Frequency Response: Flat, 200 to 2500 Hz.
   2. Impedance Matching: Adapter matches telephone line to public address equipment input.

2.16 **TONE GENERATOR**

A. Generator shall provide clock and program interface with public address and mass notification system.

B. Signals: Minimum of seven distinct, audible signal types including wail, warble, high/low, alarm, repeating and single-stroke chimes, and tone.

C. Pitch Control: Chimes and tone.

D. Volume Control: All outputs.

E. Activation-Switch Network: Establishes priority and hierarchy of output signals produced by different activation setups.

2.17 **LOUDSPEAKERS**

A. Note: all public address and intercom speakers shall be 2-way speakers for bi-directional intercom use.

B. Speakers: all Public Address and Intercom Speakers (classrooms, offices, hallways, etc.) shall be 25-Volt, with line-matching transformer speakers.

   1. Systems that use 45 ohm speakers shall not be acceptable.

C. Cone-Type Loudspeakers:

   1. Minimum Axial Sensitivity: 91 dB at one meter, with 1-W input.
   2. Frequency Response: Within plus or minus 3 dB from 50 to 15,000 Hz.
   3. Size: 8 inches with 1-inch voice coil and minimum 5-oz. ceramic magnet.
   5. Rated Output Level: 10 W.
   6. Matching Transformer: Full-power rated with four taps. Maximum insertion loss of 0.5 dB.
7. Surface-Mounting Units: Ceiling, wall, or pendant mounting, as indicated, in steel back boxes, acoustically dampened. Front face of at least 0.0478-inch steel and whole assembly rust proofed and shop primed for field painting.

D. Horn-Type Loudspeakers:

1. Type: Single-horn units, double-reentrant design, with minimum full-range power rating of 15 W.
2. Matching Transformer: Full-power rated with four standard taps. Maximum insertion loss of 0.5 dB.
3. Frequency Response: Within plus or minus 3 dB from 250 to 12,000 Hz.
4. Dispersion Angle: 130 by 110 degrees.
6. Units in Hazardous (Classified) Locations: Listed and labeled for environment in which they are located.

E. Lay-In Speaker Package by Penton, #LiS8T, for flush suspended-ceiling speaker applications.

1. Unit shall be a 1-piece assembly comprised of a damped high-compliance 8-inch loudspeaker, factory-mounted, 70.7/25-volt transformer, tile bridge, enclosure and 1’ x 2’ grille. Speaker shall include a 10-watt, twin-cone speaker and transformer having power taps of 5, 2, 1, 0.5 and 0.25 watts. Output shall be 95 dB @ 1 watt, 1 meter. Frequency response shall be 60Hz-20 kHz.

2.18 NOISE-OPERATED GAIN CONTROLLER

A. Gain controller shall be designed to continuously sense space noise level and automatically adjust signal level to local speakers.
B. Frequency Response: 20 to 20,000 Hz, plus or minus 1 dB.
C. Level Adjustment Range: 20 dB minimum.
D. Maximum Distortion: 1 percent.
E. Control: Permits adjustment of sensing level of device.

2.19 OUTLETS

A. Volume Attenuator Station (VC): Wall-plate-mounted autotransformer type with paging priority feature.
1. Wattage Rating: 10 W unless otherwise indicated.
2. Attenuation per Step: 3 dB, with positive off position.
3. Insertion Loss: 0.4 dB maximum.
4. Attenuation Bypass Relay: Single pole, double throw. Connected to operate and bypass attenuation when all-call, paging, program signal, or prerecorded message features are used. Relay returns to normal position at end of priority transmission.
5. Label: "PA Volume."

B. Microphone Outlet: Three-pole, polarized, locking-type, microphone receptacles in single-gang boxes. Equip wall outlets with brushed stainless-steel device plates. Equip floor outlets with gray tapered rubber or plastic cable nozzles and fixed outlet covers.

C. Headphone Outlet (for the Hearing Impaired): Microphone receptacles in single-gang boxes. Equip wall outlets with brushed stainless-steel device plates. Equip floor outlets with gray tapered rubber or plastic cable nozzles and fixed-outlet covers.

2.20 MODEMS
A. Provide required quantities of modems for remote diagnostics and system programming of the Public Address and Intercom System, each with the following capabilities; full or half duplex, auto dial/auto answer, monitor speaker with software volume control, nonvolatile memory, tone detection, lighting protection, adaptive equalization, power up analog and digital loop-back diagnostics, and FCC registration.

1. Provide an easily accessible rack mounted switch that allows owner to switch modem between off-line and on-line when interfaced with an available outside CO line.

2.21 BATTERY BACKUP POWER UNIT
A. Unit shall be rack mounted, consisting of time-delay relay, sealed lead-calcium battery, battery charger, on-off switch, "normal" and "emergency" indicating lights, and adequate capacity to supply maximum equipment power requirements for one hour of continuous full operation.

B. Unit shall supply public address equipment with 12- to 15-V dc power automatically during an outage of normal 120-V ac power.

C. Battery shall be on float charge when not supplying system and to transfer automatically to supply system after three to five seconds of continuous outage of normal power, as sensed by time-delay relay.
D. Unit shall automatically retransfer system to normal supply when normal power has been reestablished for three to five seconds continuously.

E. Provide UPS for Public Address and Intercom System.

1. APC Smart-UPS #SU SUA2200RM2U, or equal
   b. Nominal Output Voltage: 120V
   c. Output Voltage Distortion: Less than 5% at full load
   d. Output Frequency (sync to mains): 47 - 53 Hz for 50 Hz nominal, 57 - 63 Hz for 60 Hz nominal
   e. Waveform Type: Sine wave
   f. Output Connections: (2) NEMA 5-20R and (6) NEMA 5-15R
   g. Nominal Input: Voltage 120V
   h. Input Frequency: 50/60 Hz +/- 3 Hz (auto sensing)
   i. Input Connections: NEMA 5-20P
   j. Surge energy rating: 480 Joules
   k. Filtering: Full time multi-pole noise filtering: 0.3% IEEE surge let-through: zero clamping response time: compliant with UL 1449
   l. Regulatory Approvals: BSMI, CSA, UL 1778,FCC Part 15 Class A
   m. Interface Port(s): DB-9 RS-232, Management Interface Slot, USB
   n. Management interface: included
   o. Manufacturer’s Warranty: 2 years repair or replace

2.22 CONDUCTORS AND CABLES

A. Jacketed, twisted pair and twisted multi-pair, untinned solid copper.
   1. Insulation for Wire in Conduit: Thermoplastic, not less than 1/32 inch thick.
   2. Microphone Cables: Neoprene jacketed, not less than 2/64 inch thick, over shield with filled interstices. Shield No. 34 AWG, tinned, soft-copper strands formed into a braid or approved equivalent foil. Shielding coverage on conductors is not less than 60 percent.

B. Provide and terminate all cabling per manufacturers’ recommendations for a completely operational system as specified.

C. At all backbox locations, cables shall have a minimum 18” service loop coiled in backbox.

D. Sound/Speaker cabling shall be home-run and looped directly to applicable headend termination board, as specified. All cable runs shall be free from in-line splices. Insulate all cable shields (at field device end) from field grounds by cutting and taping shields.
E. Classroom speakers, office speakers, conference room speakers, work room speakers, exterior horn speakers, and others areas that have only one (1) public address speaker shall each be individually home-run, without splices, back to their respective sound or master clock headend. Provide 22 AWG stranded shielded speaker cables.

F. Hallways and other areas that have multiple speakers may have a maximum of eight (8) speakers per speaker loop home-run, without splices, back to their respective sound headend. Provide 18 AWG-stranded speaker cables.

G. Horn Speaker areas that have multiple speakers, may have a maximum of four (4) speakers per speaker loop home run, without splices, back to their respective sound headend. Provide 18 AWG-stranded speaker cables.

2.23 INTERFACES TO OTHER SYSTEMS

A. Master Clock System Interface.

1. Provide interface between Master Clock System and Public Address System to allow master clock class change schedules (tones or bells), to be broadcast over applicable public address speakers.
2. Provide four (4) inputs on the Public Address System for interface to the Master Clock System.
3. The Master Clock System Contractor shall provide applicable interface cables between these two systems and interface to the Master Clock System.
4. Public Address System Contractor shall provide applicable interface ports for the Public Address and Intercom Systems and provide proper interface/programming to their system.
5. Once properly interfaced, the Master Clock class change schedules (tones or bells), shall be broadcast over applicable Public Address Speakers.

B. Local Sound System Interface: Provide a 10dB balanced-audio, line-level output from the public address system to each local sound system rack/cabinet/amplifier for interface.

1. Public Address system Contractor shall provide all cabling and interface to the public address system.
2. Local sound system Contractor shall interface cabling to the local sound systems to be used for muting of local sound systems audio during public address announcements or for interfacing public address audio to the local sound systems speakers.
C. Telephone System Cabling and Interface: The Public Address and Intercom System shall interface to the Telephone System and shall provide capabilities as specified once properly interfaced.

1. Provide two (2) telephone interface ports on the Public Address and Intercom System for interface to the Telephone System by others.
2. The Public Address and Intercom System Contractor shall provide applicable interface cables between these two systems and interface to the Public Address System.
3. Telephone system Contractor shall provide applicable interface ports for the Public Address and Intercom Systems and provide proper interface/programming to their telephone system.
4. Once properly interfaced, authorized telephones shall be able to access the Public Address and Intercom System from the telephone system and perform the following capabilities:
   a. All-Call Announcements
   b. Zone Paging Announcements
   c. Intercom calls to room speakers
   d. Initiate class change & emergency tones.

D. Fire Alarm System interface: provide and terminate a Cat 5E cable between the Public Address/Intercom System and the Fire Alarm Control Panel (FACP). Interface can be used to allow secondary annunciations of Fire Alarm Signals over the Public Address/Intercom System Speakers.

1. Fire Alarm system Contractor shall provide applicable interface ports on the Fire Alarm System for the Public Address/Intercom System and proper interface/programming to their Fire Alarm System.
PART 3 - EXECUTION

3.01 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters, and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in SECTION 260001 – ELECTRICAL.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.02 INSTALLATION OF RACEWAYS

A. Comply with requirements in SECTION 260001 - ELECTRICAL for installation of conduits and wireways.

B. Install manufactured conduit sweeps and long-radius elbows whenever possible.

3.03 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Cable Installation Requirements:

1. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
2. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
3. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

5. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

6. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.

C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

2. Suspend speaker cable not in a wireway or pathway a minimum of 8 inches above ceiling by cable supports not more than 60 inches apart.

3. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.

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

3.04 INSTALLATION

A. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

B. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.

C. Equipment Cabinets and Racks:

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

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

3. Blank Panels: Cover empty space in equipment racks so entire front of rack is occupied by panels.
D. **Volume Limiter/Compressor:** Equip each zone with a volume limiter/compressor. Install in central equipment cabinet. Arrange to provide a constant input to power amplifiers.

E. **Wall-Mounted Outlets:** Flush mounted.

F. **Floor-Mounted Outlets:** Conceal in floor and install cable nozzles through outlet covers. Secure outlet covers in place. Trim with carpet in carpeted areas.

G. **Conductor Sizing:** Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than No. 18 AWG and conductors from microphone receptacles to amplifiers not smaller than No. 22 AWG.

H. **Weatherproof Equipment:** For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.

I. **Speaker-Line Matching Transformer Connections:** Make initial connections using tap settings indicated on Drawings.

J. Connect wiring according to SECTION 260001 – ELECTRICAL.

### 3.05 GROUNDING

A. **Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.**

B. **Signal Ground Terminal:** Locate at main equipment cabinet. Isolate from power system and equipment grounding.

C. **Install grounding electrodes as specified in Section 270000 -3.18 “Grounding”.**

### 3.06 FIELD QUALITY CONTROL

A. **Testing Agency:** Engage a qualified testing agency to perform tests and inspections.

B. **Manufacturer's Field Service:** Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. **Perform tests and inspections.**
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Schedule tests with at least seven days’ advance notice of test performance.
2. After installing public address and mass notification systems and after electrical circuitry has been energized, test for compliance with requirements.
3. Operational Test: Perform tests that include originating program and page messages at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and that system is free of noise and distortion.
4. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:
   a. Disconnect microphone at connector or jack closest to it and replace it in the circuit with a signal generator using a 1000-Hz signal. Replace all other microphones at corresponding connectors with dummy loads, each equal in impedance to microphone it replaces. Measure signal-to-noise ratio.
   b. Repeat test for each separately controlled zone of loudspeakers.
   c. Minimum acceptance ratio is 50 dB.
5. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 50, 200, 400, 1000, 3000, 8000, and 12,000 Hz into each preamplifier channel. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 3 percent total harmonics.
6. Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each zone. For spaces with seated audiences, maximum permissible variation in level is plus or minus 2 dB. In addition, the levels between locations in same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.
7. Power Output Test: Measure electrical power output of each power amplifier at normal gain settings of 50, 1000, and 12,000 Hz. Maximum variation in power output at these frequencies must not exceed plus or minus 1 dB.
8. Signal Ground Test: Measure and report ground resistance at public address equipment signal ground. Comply with testing requirements specified in SECTION 270000.
E. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.

F. Public address and mass notification systems will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.
   1. Include a record of final speaker-line matching transformer-tap settings, and signal ground-resistance measurement certified by Installer.

3.07 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Verify that electrical wiring installation complies with manufacturer’s submittal and installation requirements.
   2. Complete installation and startup checks according to manufacturer’s written instructions.

3.08 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electronic safety and security installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in SECTION 270000.

3.09 ADJUSTING

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

B. Occupancy Adjustments: When requested within 24 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to four (4) visits to Project during other-than-normal occupancy hours for this purpose.

3.10 ACCEPTANCE DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the public address and mass notification systems and equipment.
B. Use equipment operations manuals during training session(s).

3.11 SYSTEM DOCUMENTATION

A. Label all equipment as herein specified.

B. Provide all documentation for review ten (10) business days before the substantial completion date for each construction phase.


D. Provide documentation of test results in hard copy format for every cable segment and link shall be provided in 3-ring binders.

E. Provide test results in electronic format along with testing report viewing software.

F. Provide documentation for each test hall include measured values as well as whether or not the test passed.

G. Provide "Record" drawings indicating location of all equipment, including but not limited to Work Area Outlets, patch-panels, cross-connect blocks, on each segment and cable routing. Indicate labeling for each piece of equipment.

H. Provide Record drawings indicating actual cable routes and outlet identifiers. Provide respective copies mounted in each telecommunications closet and the main cross-connect.

I. Provide "As-built" Drawings for review in hard copy and in electronic format, AutoCAD Version 2000 or higher with at least the following information. Obtain a copy of original Drawings from the Architect.

   a. All equipment and speaker locations identified.

   b. Riser diagrams shall include:

      1) One-line diagrams for cabling and speaker loops.

   c. Floor diagrams shall include:

      1) Horizontal cabling pathways including penetrations and fire stopping.

   2. Provide three (3) full size copies of approved as-built drawings and one copy in electronic format to the owner.

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3.12 CLEANING UP

A. Upon completion of all work and testing, thoroughly inspect all exposed portions of the installation and completely remove all exposed labels, markings, and foreign material.

B. The interior of all boxes and cabinets shall be left clean; exposed surfaces shall be cleaned and plated surfaces polished.

C. Repair damage to finished surfaces resulting from work under this Section.

D. Remove material and equipment from areas of work and storage areas.

E. All equipment shall be clean from dirt, dust, and fingerprints prior to final acceptance.

F. Touch up all damaged pre-finished equipment using materials and methods recommended by the Manufacturer.

3.13 PROJECT CLOSEOUT

A. Provide close-out submittals as required herein and in SECTION 017700 - PROJECT CLOSEOUT, including the following close out submittals.

1. Operation and Maintenance Manuals.
2. Record Drawings with "as-built" corrections
4. All Test Reports
5. All Warranties

B. Obtain written receipts of acceptance closeout submittals submitted. Receipts shall specifically detail what is being delivered (description, quantity, and specification section) and shall be dated and signed by firm delivering materials, and by the Owner's Representative.

END OF SECTION