SECTION 27 00 00
SUMMARY OF WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY OF WORK

A. This project provides for the complete installation of various communication systems.

B. The Work includes work that is primarily electrical in nature and also includes all equipment, cable and terminations associated with systems. Contractor shall utilize conduit runs and boxes installed by electrical contractor. Contractor shall provide face plates on all boxes as required. Contractor shall provide any supplementary systems required to meet the performance requirements of the system as part of the bid. This work includes, but is not necessarily limited to the following systems and components:

27 10 00 - Voice, Video, Data Cabling
27 20 00 – Network
27 21 00 – Wireless Network
27 31 23 – IP PABX Telephone System
27 41 17 - Broadband Video
27 41 19 - A/V Equipment
27 51 00 – PA/Master Clock
21 51 20 – Auditorium Sound
27 51 21 – Auditeria Sound
27 51 22 - Student Dining
27 51 24 – HS Gymnasium Sound System
27 51 28 – Aux & ES Gym Sound System
27 51 25 – HS Music Room Sound System
27 51 26 – MS Music Room Sound System
27 51 27 – Classroom Sound System
27 51 28 – Aux & ES Gym Sound System
27 53 13 - Clocks
28 13 00 - Security Systems
28 23 00 – CCTV System

C. Miscellaneous

1. Administrative and coordination responsibilities for entire project.
2. Temporary Facilities related to general work as specified in the “Temporary Facilities” section of these specifications.
3. Patching materials and surfaces disturbed by new work to match adjacent existing materials and surfaces.
4. Restoration of site disturbed by this work to its original condition.

1.03 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Project consists of furnishing and installing electronic communications equipment at

Logan-Hocking High School
Logan Middle School
Green Elementary School
Central Elementary School
Logan, Ohio

Owner:
Logan-Hocking School District

Logan, Ohio

Architect:
VSWC ARCHITECTS, Inc.
414 Reading Road
Mason, Ohio 45040

Technology Consultant
BCL, Inc.
8111 Eagleridge Drive
West Chester, Ohio 45069

1.04 CONTRACTOR USE OF PREMISES

A. General: Each Prime Contractor shall limit his use of the premises to the work indicated, so as to allow for Owner occupancy and use by the public. The work is to be conducted to provide the least possible interference to the activities of the Owner's personnel, students, other building occupants and the general public. The normal order of school business shall be maintained throughout the duration of the project.

B. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.

1. Owner Occupancy: Allow for Owner occupancy and use by the public.
2. Driveways and Entrances: Keep driveways and entrances serving the premises clear and available to the Owner, the Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
3. Materials and Equipment: Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials and location of storage sheds to the area indicated. If additional storage is necessary obtain and pay for such storage off-site.
4. Vehicles: Lock automatic type vehicles such as passenger cars and trucks and other types of mechanized or motorized construction equipment, where parked and unattended, so as to prevent unauthorized use. Do not leave such vehicles or equipment unattended with the motor running or the ignition key in place.

C. Contractor Use of the Existing Building: Maintain the existing building in a safe and weather tight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period.

1.05 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 27-28 division format and CSI/CSC's "MasterFormat" numbering system.

B. Section Identification: The Specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.

C. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
3. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.06 DRAWING OVERVIEW

A. Associated with the Information Technology specification is a "T" drawing series.

1. Symbols and Floor Plans

1.07 USE OF TECHNOLOGY AND THE INTERNET

A. This project will take full advantage of the benefits of the Internet, e-mail and other electronic documentation. Contractors are encouraged to use this technology.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 27 00 05

BASIC REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, General and Special Conditions and Division 1 Sections apply to this Section.

1.02 SCOPE OF WORK

A. The scope of this work includes furnishing, installing, testing and warranty of all Technology work and complete systems shown on the drawings and specified herein.

B. If more conduit, cable trays, pathways and penetrations etc. are needed for a complete system, beyond what is shown on the construction drawings, these shall be deemed to be the responsibility of the Contractor.

1.03 DRAWINGS AND SPECIFICATIONS

A. The drawings indicate the general arrangement of the work and are to be followed insofar as possible. The word "provide", as used, shall mean, "Furnish and install". If significant deviations from the layout are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Architect/Consultant for approval before proceeding with the work.

B. The drawings and specifications shall be carefully studied during the course of bidding and construction. Any errors, omissions or discrepancies encountered shall be referred immediately to the Architect/Consultant for interpretation or correction, so that misunderstandings at a later date may be avoided. The contract drawings are not intended to show every vertical or horizontal offset, which may be necessary to complete the systems. Having wire ways and fittings fabricated and delivered in advance of making actual measurements shall not be sufficient cause to avoid making offsets and minor changes as may be necessary to install wire ways, fittings and equipment.

C. The Architect/Consultant shall reserve the right to make minor adjustment in locations of system runs and components where he considers such adjustments desirable in the interest of protecting and concealing work or presenting a better appearance where exposed. Any such changes shall be anticipated and requested sufficiently in advance as to not cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties which can be anticipated.

D. Equipment shall not be installed in the space above electrical switchboard or panelboards as identified by NEC Article 384.

E. Where any system runs and components are so placed as to cause or contribute to a conflict, it shall be readjusted at the expense of the contractor causing such conflict. The Architect/Consultant's decision shall be final in regard to the arrangement of panels, conduit, etc., where conflict arises.

F. Utility feed conduits, conduit stubs and device outlet boxes and a corridor cabletray system will be supplied by the Electrical Contractor. Provide any additional necessary conduit, fittings, pull boxes, conductors, switches and devices required to complete the installation, or for the proper operation of the system. This Contractor shall exercise due and particular caution to determine that all parts of the work are made quickly and easily accessible.

G. Should overlap of work among the trades become evident, this shall be called to the attention of the Architect/Consultant. In such event, none of the trades or their suppliers shall assume that he is relieved of the work which is specified under his branch until instructions in writing are received from the Architect/Consultant.

H. If there is a discrepancy in quantity or quality between the drawings, the specifications, and the room charts, the contractor shall include the higher quality or quantity in his bid proposal.

1.04 INSPECTION

A. All work shall be subject to inspection of Federal, State and local agencies as may be appropriate.

1.05 FINAL REVIEW AND PUNCH LIST

A. As the time of work completion approaches, the Contractor shall survey and inspect his work and develop his own punch list to confirm that it is complete and finished. He shall then notify the Architect/Architect/Consultant and request that a final review be made. It shall not be considered the Architect/Consultant's obligation to perform a final review until the Contractor has inspected the work and so states at the time of the request for the final review.

B. Requests to the Architect/Consultant, Construction Manager and Owner for final review may be accompanied by a limited list of known deficiencies in completion, with appropriate explanation and schedule for completing these; this is in the interest of expediting acceptance for beneficial occupancy.

C. The Architect/Consultant will review the work and prepare a punch list of items requiring correction, completion or verification. Corrective action shall be taken by the Contractor to the satisfaction of Architect/Architect/Consultant within 30 days of receipt of the Architect/Consultant's punch list.

1.06 WARRANTY

A. This Contractor shall warrant all workmanship, equipment and material entering into this contract for a period of one (1) year from date of final acceptance or date of beneficial use, as agreed to between Contractor and Architect/Consultant. Any materials or equipment proving to be defective during this warranty period shall be made good by this Contractor without expense to the Owner.

B. This provision is intended specifically to cover deficiencies in contract completion or performance which are not immediately discovered after systems are placed in operation. These items include, but are not limited to, fuse replacement where fuses blow due to abnormal shorts, adjustments and/or replacement of malfunctioning equipment and adjusting special equipment and communication systems to obtain optimum performance.

C. This provision shall not be construed to include maintenance items such as making normally anticipated adjustments or correcting adjustment errors on the part of the Owner's personnel.

D. Provisions of this warranty shall be considered supplementary to warranty provisions under General Conditions.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment furnished under this contract shall be in strict accordance with the specifications and drawings and shall be new and of best grade and quality. When two or more articles of the same material or equipment are required, they shall be of the same manufacturer.

B. All electrical equipment and wiring shall bear the Underwriters Laboratories, Inc. label where UL labeled items are available, and shall comply with NEC (NFPA-70) and NFPA requirements.

2.02 REFERENCE STANDARDS

A. Where standards are referenced in the specifications or on the drawings, the latest edition is to be used except, however, where the authority having jurisdiction has not yet adopted the latest edition, the edition so recognized shall be used.

2.03 EQUIPMENT SELECTION

A. The selection of materials and equipment to be furnished under this contract shall be governed by the following:

1. Where trade names, brands, or manufacturers of equipment or materials are listed in the specification, the exact equipment listed shall be furnished. Where more than one name is used, the Contractor shall have the option of selecting between any one of the several specified. All products shall be first quality line of manufacturers listed.

2. Where the words "or approved equal" appear after a manufacturer's name, specific approval must be obtained from the Architect/Consultant during the bidding period in sufficient time to be included in an addendum. The same shall apply for equipment and materials not named in the specifications, where approval is sought.

3. Where the words "equal to" appear, followed by a manufacturer's name and sometimes a model or series designation, such designation is intended to establish quality level and standard features.

Equal equipment by other manufacturers will be acceptable, subject to the Architect/Consultant's approval.

B. Before bidding equipment, and again in the preparation of shop drawings, the Contractor and his supplier shall verify that adequate space is available for entry and installation of the item of equipment, including associated accessories. Also verify that adequate space is available for servicing of the equipment.

C. If extensive changes in conduit, equipment layout or electrical wiring and equipment are brought about by the use of equipment which is not compatible with the layout shown on the drawings, necessary changes by all other trades shall be deemed to be included in the contract.

2.04 SHOP DRAWINGS

A. Completely detailed shop drawings shall be prepared and submitted for review prior to the procurement of equipment or commencement of work. Blue-line drawings shall be prepared and submitted on full-size (D or E size) paper. Equipment lists, data sheets, etc. shall be 8-1/2" x 11" size properly bound into a single or multiple volumes.

B. Within 45 days, after the notice to proceed, submit six (6) identical copies of the following for approval:

1. A complete equipment list, with manufacturers' names, model numbers, and quantities of each item
2. Manufacturer's data sheets on all equipment items, including system cable, with specific selected product(s) clearly indicated
3. Equipment rack layouts showing all rack mounted equipment items and the proposed Floor plans, prepared at a scale of not less that 1/8" = 1'0", showing loudspeaker locations and orientation, wall plates, and all other related device locations.
4. Proposed construction details for all custom fabricated items, including interface panels, patch panels, wall plates, mounting and rigging hardware. These details shall show dimensions and indicate finishes and color selection.
5. Riser diagrams showing conduit requirements with pull boxes, outlet boxes, part numbers of cable types used, and number of circuits in each conduit
6. Electrical power requirements for head-end and ancillary equipment. Include diagrams for any remote control of electrical power, in sufficient detail to coordinate with electrical work.
7. Certain other submittals as noted elsewhere in this specification, and as may be required for various equipment items prior to construction, fabrication, or finishing of that item.

C. Submittals will be rejected unless all above information is included.

D. The review of shop drawings by the Architect/Consultant shall not relieve the Technology Contractor from responsibility for errors in the shop drawings. Deviations from specifications and drawing requirements shall be called to the Architect/Consultant's attention in a separate clearly stated notification at the time of submittal for the Architect/Consultant's review.

E. Shop drawings of the following equipment and materials shall be submitted:

27 10 00 - Voice, Video, Data Cabling
27 20 00 – Network
27 21 00 – Wireless Network
27 31 23 – IP PABX Telephone System
27 41 17 - Broadband Video
27 41 19 - A/V Equipment
27 51 00 – PA/Master Clock
21 51 20 – Auditorium Sound
27 51 21 – Auditeria Sound
27 51 22 - Student Dining
27 51 24 – HS Gymnasium Sound System
27 51 28 – Aux & ES Gym Sound System
27 51 25 – HS Music Room Sound System

27 51 26 –MS Music Room Sound System
27 51 27 – Classroom Sound System
27 51 28 – Aux & ES Gym Sound System
27 53 13 - Clocks
28 13 00 - Security Systems
28 23 00 – CCTV System

PART 3 - EXECUTION

3.01 TESTING

A. All signaling and communications systems shall be inspected and tested by a qualified representative of the manufacturer or equipment vendor. Submit four (4) copies of reports indicating results.

B. Tests shall be witnessed by field representatives of the Architect/Consultant or shall be monitored by a recorder where appropriate. Furnish a written record of each system test indicating date, system, test conditions, duration and results of tests.

C. Instruments required for tests shall be furnished by the Contractor.

3.02 EQUIPMENT CLEANING

A. Before placing each system in operation, the equipment shall be thoroughly cleaned; cleaning shall be performed in accordance with equipment manufacturer's recommendations.

3.03 OPERATION AND ADJUSTMENT OF EQUIPMENT

A. As each system is put into operation, all items of equipment included therein shall be adjusted to proper working order. This shall include balancing and adjusting voltages and currents and adjusting all operating equipment.

3.04 OPERATING DEMONSTRATION AND INSTRUCTIONS

A. The Contractor shall set the various systems into operation and demonstrate to the Owner and Architect/Consultant that the systems function properly and that the requirements of the Contract are fulfilled.

B. The Contractor shall provide the Owner's representatives with detailed explanations of operation and maintenance of equipment and systems. A thorough review of the operating and maintenance manuals shall be included in these instructional meetings.

C. A minimum of 24 hours shall be allowed for instructions and training to personnel selected by the Owner. Instructions shall include not less than the following:

1. Show location of items of equipment and their purpose.

2. Review binder containing instructions and equipment and systems data.

3. Coordinate written and verbal instructions so that each is understood by personnel.

4. Separate instructions shall be given by manufacturer's representatives for the various special and communications systems.

D. A minimum of 48 hours continuous trouble-free operating time shall be acceptable to prove that the systems function properly.

3.05 TRAINING

A. All training shall be video taped for the school district’s future use.

B. Training hours are listed in the individual system sections.

3.06 AS BUILT DOCUMENTATION

A. All as built documentation, drawings and test results shall be delivered to the school district in both hard copy and in ADOBE PDF Files for future printing or use.

END OF SECTION

SECTION 27 00 10
BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, General and Special Conditions and Division 1 Sections apply to this Section.

PART 2 - PRODUCTS - NOT APPLICABLE

PART 3 - EXECUTION

3.01 WORKMANSHIP

A. Materials and equipment shall be installed and supported in a first-class and workmanlike manner by mechanics skilled in their particular trades. Workmanship shall be first-class in all respects, and the Consultant shall have the right to stop the work if highest quality workmanship is not maintained.

3.02 PROTECTION

A. The Contractor shall be entirely responsible for all material and equipment furnished in connection with his work. Special care shall be taken to properly protect all parts thereof from theft, damage or deterioration during the entire construction period in such a manner as may be necessary, or as directed by the Consultant.

B. The Owner's property and the property of other contractors shall be scrupulously respected at all times. Provide drop cloths and visqueen or similar barriers where dust and debris is generated, to protect adjacent areas.

3.03 CUTTING AND PATCHING

A. Plan the work well ahead of the general construction. Where conduits, wireways, cable trays, etc. are to pass thru walls, partitions, floors, roof or ceilings, place sleeves in these elements or arrange with the General Contractor to provide openings where sleeves are not practical. Where sleeves or openings have not been installed, sawcut or core drill holes and patch as required for the installation of this work, or pay other trades for doing this work when so directed by the Consultant. Any damage caused to the building in this work shall be repaired or rectified.

B. All sleeves and openings shall be closed to prevent passage of smoke and fire.

3.04 PAINTING

A. In addition to any painting specified for various individual items of equipment, the following painting shall be included in the technology package:
   1. Ferrous metal which is not factory or shop painted or galvanized and which remains exposed to view in the finished areas of the building / building including finished areas, mechanical rooms, storage rooms, and other unfinished areas shall be given a prime coat of paint and two finish coats of paint.
   2. Ferrous metal installed outside the building which is not factory or shop painted or galvanized shall be given a prime coat of paint and two finish coats of paint.
   3. Equipment and materials which have been factory or shop coated (prime or finished painted or galvanized), on which the finish has been damaged or has deteriorated, shall be cleaned and refinished equal to its original condition. The entire surface shall be repainted if a uniform appearance cannot be accomplished by touch-up.
   4. Apply Cold Galvanizing Compound for touch-up of previously galvanized surfaces.

B. Paint, surface preparation and application shall conform to applicable portions of the Painting section of the Specifications. All rust must be removed before application of paint.

C. Finish painting is included in the General Contract. Refer to the Cutting and Patching paragraph in this Section for finishing requirements.

3.05 FIRESTOPPING

A. Technology Contractors are responsible for firestopping all applicable areas that are used by them.

3.06 CEILING GRID AND TILE

A. Technology contractors are responsible for any damage to ceiling tile or gird that they cause during above ceiling work. It is suggested that digital photos be taken in those areas that have ceiling grid and/or tile installed before any work is done. These photos should be dated and given to the CM or Consultant. Damage done to ceilings will be charged to the offending contractor.

3.07 PRODUCT COORDINATION

A. Equipment cabinets and racks shall be coordinated with the contractors after contract award. Matching cabinets and racks will be utilized for all vendors.

END OF SECTION

SECTION 27 10 00

VOICE, VIDEO, DATA CABLING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, General and Special Conditions and Division 1 Sections apply to this Section.

B. 27 00 05 – Basic Requirements

C. 27 00 10 – Basic Materials and Methods

1.02 SCOPE OF WORK **(CENTRAL ELEMENTARY SCHOOL)**

A. The intent of this specification section is to cover the materials and installation of a technology wiring system and termination equipment as outlined herein and as detailed on the drawings and room charts. Work shall consist of a copper voice and data station cabling system, a copper voice backbone cabling system, a fiber data backbone system, a coaxial video backbone and station cabling system, Video, voice and data outlets/jacks and a local audio/video cabling system as follows:

B. Voice and Data station cabling (copper and fiber) system shall consist of:
   1. Workstation outlet jacks.
   2. Voice and data station cabling as specified herein from each workstation outlet to the termination equipment located in the Intermediate Distribution Frame Closet (IDF) or the Main Distribution Frame Closet (MDF).
   3. Station Cable Termination Equipment in each IDF/MDF.
   4. Final connections of the station cabling at the workstation outlet jack and the termination equipment in each IDF/MDF.
   5. Voice and Data Backbone cabling system (copper and fiber) shall consist of:
      a. Voice and Data backbone cabling as specified herein from each IDF to the MDF and Voice Backbone cabling from the main telephone service entrance to the MDF. Refer to the drawings for specific cabling requirements.
      b. Backbone Cable Termination equipment in each IDF/MDF and at the telephone service entrance.
      c. Final connections of the backbone cabling on the termination equipment in each IDF/MDF and at the telephone service entrance.
   6. Video station cabling system shall consist of:
      a. Video jacks and termination equipment incorporated with the voice/data workstation jacks within the same coverplate as indicated on the drawings.
      b. Video jacks and termination equipment for the Video distribution system within the building.
      c. Local video and audio station cabling within the classroom
   7. Video Backbone cabling system shall consist of:
      a. Video backbone cabling as specified herein from each IDF to the MDF and Video Backbone cabling from the main cable TV service entrance to the MDF. Refer to the drawings for specific cabling requirements.
      b. Backbone Cable Termination equipment in each IDF/MDF.
      c. Final connections of the backbone cabling on the termination equipment in each IDF/MDF.
   8. Telecommunications Grounding System per EIA/TIA 607.
      a. Provide a Telecommunications Main Ground Bar (TMGB) in the MDF. This ground bar shall be electrically bonded to the Building Main Electrical Service Ground with an Insulated, #6, copper grounding conductor.
      b. Provide a Telecommunications Ground Bar (TGB) in each IDF.
      c. Provide a Telecommunications Bonding Backbone (TBB) from the TMGB to each TGB. This backbone shall consist of a minimum #6, insulated, copper grounding conductor. The TBB shall be bonded to the ground bars at each end

and shall be run with the backbone cabling from the MDF to each IDF. The TBB shall run continuous and be unspliced.

d. Provide an additional grounding connection (minimum #6) from each ground bar to the nearest accessible Building Electrode Grounding System.

e. All work shall be in compliance with NEC, Article 250

1.03 STANDARDS

A. All work shall be installed in compliance with the latest edition of the Commercial Building Telecommunications Wiring Standard EIA/TIA. BICSI Standards and applicable National Electric Code Sections. All equipment shall be UL listed.

B. The Contractor or Sub-Contractor shall be a member of Building Industry Consulting Service International (BICSI) and have a Registered Communication Distribution Designer (RCDD) status.

C. The Contractor or Sub-Contractor shall provide the services and equipment of a company listed by Underwriters Laboratories, Inc. in its directory as being capable of furnishing the system specified herein. Said company shall be authorized to, and shall, issue a certificate stating that the equipment and connected wiring and devices which form the specified system, together with installation and maintenance service, are in compliance with the requirements established by Underwriters Laboratories and EIA/TIA Standards.

D. Work shall be performed by a BICSI certified Telecommunications Contractor or Sub-Contractor. Telecommunications Contractors that wish to be considered for this project shall have an on-staff RCDD. Proof of this shall be presented in writing by the winning contractor to the Owner/Architect/engineer prior to contract signing. It shall not be acceptable for any portion of the work specified herein to be performed by a sub-contractor unless such sub-contractor has been pre-approved by the Owner/Architect in writing.

E. BICSI Certification shall include the following:

1. Copy of the BICSI RCDD certificate for the Contractor's or Sub-Contractor on-staff, full time project manager.
2. Copy of the BICSI Apprentice, Installer or Technician certificate(s) for the Contractor's or Sub-Contractor on-staff, full time installation personnel. Prior to commencement of work, the Contractor shall submit the resume of personnel assigned to the project. Any approval given during bidding shall be based upon the information submitted. Change in approved personnel prior to completion of the project shall be brought to the attention of the Engineer for review.
3. Copy of the Voice/Data system Manufacturers Approval Certificate indicating that the contractor is a certified installer of the proposed voice and data cabling equipment/Cabling System Solution.

1.04 WIRING METHODS

A. The entire voice/video and data horizontal station cabling solution shall be a listed EIA/TIA, Link configuration for voice and Link/Channel configuration for data, cabling system solution from a single Manufacturer/Source as required by the Manufacturer/Source. Standard: The Cabling System Solution shall be CommScope/Systemax, Nordx/CDT, Belden/CDT, General Cable/Hubbel or Leviton/Mohawk.

B. All cables shall be run in conduit from outlet to above accessible ceiling.

C. Horizontal (station) cable shall be plenum rated. Backbone cabling shall be plenum rated.

D. J-hooks/cable management system where specifically allowed shall be installed on 48" centers and supported from structure as required by the manufacturer.

E. Refer to drawings for quantity and arrangement of voice/data/technology outlets including jacks and cabling.

F. General - All Multi-Mode fiber and Single-Mode fiber shall be terminated utilizing a factory-made SC Pigtail, factory polished end, and fusion spliced. All fiber to be installed in innerduct.

PART 2 - PRODUCTS

2.01 DATA BACKBONE CABLE

A. Outdoor type, if necessary (used to interconnect buildings and run in underground duct) shall be loose tube buffered, 12 strand multi-mode and a 12 strand single mode fiber optic cable filled with a gel type water blocking compound, with polyethylene high density overall jacket sheath. Provide a generous amount of slack at each fiber connect panel.

1. Core/Cladding Diameter — Single-mode 8.5/125 micron
   (i) Multi-mode 62.5/125
2. Maximum Attenuation @ 1310/1550nm — Single-mode .4/.3 db/km
3. Maximum Attenuation @ 850/1300nm — Multi-mode 3.4/1.0 db/km
4. Minimum Bandwidth @ 850/1300nm — 200/500 MHz-km
5. Tension rating — 600 lb
6. Cable shall be terminated on both ends as specified herein. Coordinate termination type (SC) with Owner.
7. Provide a maintenance loop at the termination point. Consult the cable manufacturer for the recommended loop radius.
8. Each cable shall be labeled on both ends and at all accessible points. Coordinate labeling scheme with A/E.
9. Refer to drawings for quantities and locations.
10. Standard: The Cabling System Solution shall be CommScope/Systemax, Nordx/CDT, Belden/CDT, General Cable/Hubbel or Leviton/Mohawk.

B. Indoor type (used for interior applications) shall be FDDI-Plus 12 strand multi-mode and a 12 strand single mode **minimum**, with di-electric strength members, 2.9mm, heavy duty, with individual jackets for easy connectorization, Fan-Out cable plenum rated with overall jacket. See Drawings for exact strand count/configuration per closet.

1. Core/Cladding Diameter — 62.5/125 um
2. Maximum Attenuation @ 850/1300nm — 3.75/1.5 db/km
3. Minimum Bandwidth @ 850/1300nm — 160/500 MHz-km
4. Cable shall be terminated on both ends as specified herein. Coordinate termination type (SC) with Owner.
5. Provide a 3 meter maintenance loop at the termination point. Consult the cable manufacturer for the recommended loop radius.
6. Cable shall be labeled on both ends and at all accessible points where the cable can be administered. Coordinate labeling scheme with A/E.
7. Refer to the drawings for quantities and locations.
8. Standard: The Cabling System Solution shall be Nordx/CDT, Belden, Berk-Tek, General Cable or Leviton/Mohawk.

2.02 DATA STATION CABLE

A. Copper - Unshielded, twisted pair. (Standard See Section 1.03, A.)

B. Category 6 plenum rated, 4 twisted pair, non-shielded (UTP) station cable (capable of transmissions speeds up to 1 Gb and supporting IEEE 802.3ab Gigabit Ethernet) shall be used for serving data outlets. Cable shall be rated for minimum 350 MHZ. Cable shall be insulated with FEP material and sequentially marked at 2 foot intervals.

1. Gauge 24 AWG
2. Nominal O.D. .2 in.
3. Min. Bend Radius .5 in.
4. Standards/Certification UL Type CMP TIA/EIA, CAT. 6
5. Attenuation (100 MHz) 21.3 dB
6. NEXT (100 MHz) 39.9 dB
7. PSNEXT (100 MHz) 37.1 dB
8. ACR (dB/100M) (100 MHz) 18.6 dB
9. ELFEXT (dB/100M) (100 MHz) 23.2 dB
10. PSELFEXT (dB/100M) (100 MHz) 20.2 dB
11. Return Loss (100 MHz) 12.0 dB

C. Each cable shall be a dedicated home run from the workstation outlet jack to the data termination equipment in the local IDF/MDF. Terminate cable at the workstation and at the IDF/MDF termination equipment as specified herein and as indicated on the drawings.

D. Cable shall be labeled at both ends to indicate patch panel and port served. Coordinate labeling scheme with A/E **PRIOR TO INSTALLATION**

E. Standard: The Cabling System Solution shall be CommScope/Systemax, Nordx/CDT, Belden/CDT, General Cable/Hubbel or Leviton/Mohawk.

F. Data Jack Color shall be Orange.

2.03 VOICE BACKBONE CABLE

A. Outdoor Type (used to interconnect buildings and run in underground duct) shall consist of a core of 24-gauge, Category 3, unshielded twisted (UTP) solid copper conductors dual insulated with foam skin and plastic encapsulated with a water blocking compound, surrounded by a corrugated aluminum shield, a corrugated steel shield and a polyethylene outer jacket. Pair sizes shall be available in 25, 50, 100, 150, 200, 300, 400, 600 and 900 pair. Pair quantities as specified herein and shown on the drawings.
   1. Gauge 24 AWG
   2. DC Resistance 26.5 (ohms/1000 ft.)
   3. Mutual Capacitance (1 kHz) 15 pf/ft.
   4. Impedance (1 kHz) 100 OHM (25 pair)
   5. Max Attenuation (1 kHz) 6.707.8 dB (25 pair)
   6. Cable shall terminate in a protector panel upon entrance to building. Cable and protector panel grounds shall be bonded to the electrical service ground as required by the N.E.C. Protector panel shall be Lucent Technologies #188ENA1 series with #3B1E-W gas tube protector modules or equals by PolyPhaser or Citel. Provide protector panel fully loaded. Protector panel shall be sized to accommodate backbone cable pair count as specified herein.
   7. Cable shall be labeled at both ends and at all accessible points. Coordinate labeling scheme with Owner and submit to Owner/Architect for review. **PRIOR TO INSTALLATION**
   8. All cable must be lightning protected.

B. Indoor type (used for interior applications) shall consist of a core of 24-gauge, Category 3, plenum rated unshielded twisted (UTP) solid copper conductors insulated with expanded polyethylene covered by a PVC skin. The core shall be covered by a layer of plastic tape and overlaid with a corrugated aluminum shield (to provide EMI protection), adhesively bonded to an outer jacket of plenum rated PVC plastic. Pair sizes shall be available in 25, 50, 100, 150, 200, 300, 400, 600 and 900 pair. Pair quantities as specified herein and shown on the drawings.
   1. Insulation thickness .006 in.
   2. Jacket thickness .045 in. (100 pair)
   3. Max. Avg. DC Resistance 26.5 Ohms/1000 ft.
   4. Max. Avg. DC Resistance Unbalance 1.5%
   5. Typical Mutual Capacitance at 1 KHz 15.7pF/1000 ft.
   6. Max. Avg. Capacitance Unbalance
      a. (pair to ground) 175pF/1000 ft.
   7. Max. Attenuation (dB/1000 ft.):
      a. At .772 MHz 6.7 dB
      b. At 1.0 MHz 7.6 dB
      c. At 16.0 MHz 32.0 dB
   8. Characteristic Impedance (Ohms):
      a. At .772 MHz 102 ± 15%
      b. At 1.0 - 16 MHz 100 ± 15%
   9. Worst Pair Loss Next (dB/1000 ft.)
      a. At .772 MHz 41 dB
      b. At 1.6 MHz 37 dB
      c. At 10.0 MHz 25 dB
   10. UL Listed
      a. CSA Approved PCC FT4
   11. Refer to the drawings and/or room charts for cable pair size from each IDF to the MDF. Cable shall be terminated on both ends as specified herein and as shown on the drawings.
   12. Refer to the drawings and/or room charts for cable pair size from the phone service entrance backboard to the MDF. Cable shall be terminated on both ends as specified herein and as shown on the drawings.
   13. Provide one (1) 1000 ft. spool of 1 pair cross-connect wire (white/blue) at each backbone cable termination point in each IDF and in the MDF.

14. Cable shall be labeled at both ends and at each point where the cable is accessible and can be administered. Coordinate labeling scheme with A/E. All cable must be lightning protected.
15. Standard: The Cabling System Solution shall be CommScope/Systemax, Nordx/CDT, Belden/CDT, General Cable/Hubbel or Leviton/Mohawk..

2.04 VOICE STATION CABLE

A. Category 6 plenum rated, 4 twisted pair, non-shielded (UTP) station cable (capable of transmissions speeds up to 1 Gb and supporting IEEE 802.3ab Gigabit Ethernet) shall be used for serving voice outlets. Cable shall be insulated with FEP material and sequentially marked at 2 foot intervals.

1. Gauge 24 AWG
2. Nominal O.D. .2 in.
3. Min. Bend Radius .5 in.
4. Standards/Certification UL Type CMP TIA/EIA, CAT. 6
5. Attenuation (100 MHz) 21.3 dB
6. NEXT (100 MHz) 39.9 dB
7. PSNEXT (100 MHz) 37.1 dB
8. ACR (dB/100M) (100 MHz) 18.6 dB
9. ELFEXT (dB/100M) (100 MHz) 23.2 dB
10. PSELFEXT (dB/100M) (100 MHz) 20.2 dB
11. Return Loss (100 MHz) 12.0 dB

B. Each cable shall be a dedicated home run from the workstation outlet to the voice termination equipment in the local IDF/MDF. Terminate each cable at the workstation outlet and in the IDF/MDF as specified herein and as indicated on the drawings.

C. Cable shall be labeled at both ends to indicate patch panel / punch block and port served. Coordinate labeling scheme with A/E.

D. Standard: The Cabling System Solution shall be CommScope/Systemax, Nordx/CDT, Belden/CDT, General Cable/Hubbel or Leviton/Mohawk..

E. Voice Jack Color shall be IVORY

2.05 VIDEO BACKBONE CABLE

A. Basic Construction: RG11 Plenum rated (used for interior applications) shall consist of:
1. Center conductor - 18 AWG Copper Covered Steel; 0.040" O.D. (nominal); foamed polyethylene dielectric
2. Inner shield - aluminum-polypropylene-aluminum laminated tape with overlap bonded to dielectric
3. Second shield - 60% 34 AWG bare aluminum braid wire
4. Third shield - non-bonded aluminum foil tape
5. Outer shield -42% 34 AWG bare aluminum braid wire
6. Outer Jacket - Flame retardant PVC
7. Impedance 75-Ohms
8. Velocity of propagation 85%

B. Standard: The Cabling System Solution shall be CommScope/Systemax, Nordx/CDT, Belden/CDT, General Cable/Hubbel or Leviton/Mohawk.

2.06 VIDEO STATION CABLE

A. Basic Construction: RG6 Plenum rated (used for interior applications) shall consist of:
1. Center conductor - 18 AWG Copper Covered Steel; 0.040" O.D. (nominal); foamed polyethylene dielectric
2. Inner shield - aluminum-polypropylene-aluminum laminated tape with overlap bonded to dielectric
3. Second shield - 60% 34 AWG bare aluminum braid wire
4. Third shield - non-bonded aluminum foil tape
5. Outer shield -42% 34 AWG bare aluminum braid wire
6. Outer Jacket - Flame retardant PVC
7. Impedance 75-Ohms
8. Velocity of propagation 85%

B. Standard: The Cabling System Solution shall be CommScope/Systemax, Nordx/CDT, Belden/CDT, General Cable/Hubbel or Leviton/Mohawk.

2.07 VIDEO AND AUDIO CABLE

A. Video Cable

1. VGA Video Cable – VGA cable utilizing 5 miniature high resolution coax cables in a plenum rated jacket, terminated on 15 pin din connector (computer video) in classroom technology outlet and local classroom video outlets.

2. 75 OHM Video Cable RG6 Plenum rated Audio Cable
   a. Center conductor - 18 AWG Copper Covered Steel; 0.040" O.D. (nominal); foamed polyethylene dielectric
   b. Inner shield - aluminum-polypropylene-aluminum laminated tape with overlap bonded to dielectric
   c. Second shield - 60% 34 AWG bare aluminum braid wire
   d. Third shield - non-bonded aluminum foil tape
   e. Outer shield -42% 34 AWG bare aluminum braid wire
   f. Outer Jacket - Flame retardant PVC
   g. Impedance 75-Ohms
   h. Velocity of propagation 85%
3. Stereo Video / Audio Cables - 22 gauge, tinned copper, 4 conductor cable with 100% overall shield, black FEP jacket. Plenum rated.
4. Standard: The Cabling System Solution shall be CommScope/Systemax, Nordx/CDT, Belden/CDT, General Cable/Hubbel or Leviton/Mohawk..

2.08 WORKSTATION OUTLETS

A. Data Jacks – Copper
1. Shall be Cat. 6 rated, 8 position, 8 wire flush mounted modular jack (RJ-45), T568A/B coded. Equipment to be of manufacturer and series as required by Specified Link/Channel Solution Warranty.

B. Voice Jacks
1. Shall be Category 6 rated, 8 position, 8 wire flush mounted modular jack (RJ-45), T568A/B coded. Equipment to be of manufacturer and series as required by Specified Link/Channel Solution Warranty.

C. Local Classroom Audio/Video Jacks
1. Local Classroom Audio/Video jacks shall be by same manufacturer as workstation voice & data jacks.
2. Component Video - Type RCA. Equipment to be of manufacturer and series as required by Specified Link/Channel Solution Warranty. Color as selected by Owner/Architect.
3. VGA Video – 15 Pin Computer Video. Equipment to be of manufacturer and series as required by Specified Link/Channel Solution Warranty. Color as selected by Owner/Architect.
4. Stereo Audio - Type RCA or 1/8th" mini. Equipment to be of manufacturer and series as required by Specified Link/Channel Solution Warranty. Color as selected by Owner/Architect.
5. Local Video – Type "F". Equipment to be of manufacturer and series as required by Specified Link/Channel Solution Warranty. Color as selected by Owner/Architect.
6. Standard: The Cabling System Solution shall be CommScope/Systemax, Nordx/CDT, Belden/CDT, General Cable/Hubbel or Leviton/Mohawk..

D. Outlet Components
1. Faceplates shall be modular and shall accept the approved voice/ data and video jacks including voice/data (RJ-11, RJ-45), Video (type F, type RCA, type BNC, VGA), Audio (type RCA, 1/8th "mini) and fiber (type ST, SC, LC and MT-RJ). Faceplates shall cover single or dual ganged boxes. Faceplates and jacks shall be by a single manufacturer. Equipment to be of manufacturer and series as required by Specified Link/Channel Solution Warranty. Color as selected by Owner/Architect.
2. Outlets designated to serve wall phones shall be of a type that is designed to support a wall mounted telephone. Equipment to be of manufacturer and series as required by Specified Link/Channel Solution Warranty. Color as selected by Owner/Architect.

3. Each and every jack shall be labeled to corresponding patch panel and port. Coordinate labeling scheme with A/E. Labels shall be computer generated on an adhesive media and attached to the workstation outlet. Labels applied with pens or markers will not be acceptable.
4. Provide blank inserts for all unused ports.
5. Faceplates for specialized drops (Type 1,2,1A,2A and 2B) shall be as shown on the drawings.
6. Refer to drawings for arrangement of various workstation outlets including jack types and quantities within each outlet type. All voice/data/video/audio and fiber jacks indicated in the faceplate shall be deemed included in this specification unless specifically noted otherwise.

E. Surface mounted raceway products
1. All faceplates and jacks utilized in the installed surface mounted raceway must be compatible with the raceway.

2.09 IDF/MDF TERMINATION EQUIPMENT (ER AND TELECOM CLOSETS)

A. Equipment Cabinets and Racks
1. Equipment cabinets shall have vented side panels and lockable front and back doors. Cabinets shall be 22-1/2 inches wide 30 inches deep and 84 Inches high. Units shall have front glass hinged doors. Each rack shall be securely mounted and provided with a #6 ground wire from rack to the local telecommunications ground bar. Multiple racks shall be bonded together with a #6 ground wire. Open equipment racks shall be 4 post, standard 19" wide 84" high.
2. Provide a front/rear, two-space cable management panel with each rack mounted fiber/copper patch panel. .
3. Provide a full height front/rear vertical wire management panel with integral cable spools with each floor mounted rack. Coordinate location at each rack with A/E. Where multiple racks are ganged together, there shall be one vertical wire management section between each two racks and one additional section at each end of the line up. Ladder tray shall be utilized to route cable to the racks.
4. Attached to each rack shall be a worksheet identifying each patch panel port, its associated wall jack identifier and the date of installation.
5. Patch panels shall be mounted no higher then 60" A.F.F
6. Provide a six outlet power strip with integral surge suppression and a 10' cord with plug in each rack. Provide a dedicated 120V, 20A circuit to a rack mounted isolated ground receptacle for each rack.
7. Refer to drawings for type, quantities and locations of racks.
8. Manufacturers: Great Lakes, B-Line, Ortronics, Hubbel, Middle Atlantic.

B. Data Termination Equipment - Fiber Backbone
1. Rack Mounted Installation - Provide fiber optic, rack mounted patch panels with type SC coupler panels as coordinated with the owner. Provide quantity of 12, 24 or 48 port panels as required by quantity of fiber backbone cables to be terminated. Equipment to be of manufacturer and series as required by Specified Link/Channel Solution Warranty. Color as selected by Owner / Architect. Provide each patch panel fully loaded. Each connected port to be labeled as coordinated with owner. Refer to drawings for locations of rack mounted patch panels.

C. Data Termination Equipment - Copper Station Cable
1. Twisted pair patch panels, rack mounted, Cat.6 rated, 110 termination, RJ-45, T568B coded, multi-port (24 or 48). Equipment to be of manufacturer and series as required by Specified Link/Channel Solution Warranty. Provide quantity of patch panels as required by quantity of data station cable. Mount panels in data racks in each IDF/MDF. Each panel shall be fully loaded. Provide labeling for each connected port as coordinated with owner. Provide a 10ft., Cat. 6 patch cable for each connected port in each patch panel. Coordinate patch cable color with owner.

D. Voice Termination Equipment - Backbone (Indoor)
1. IDF/MDF Twisted pair patch panels, rack mounted, Cat. 6 rated, 110 termination, RJ-45, T568B coded, multi-port (24 or 48). Panduit Mini-Com series. Each voice backbone cable shall terminate three pairs per patch panel port. Provide quantity of patch panels as required by quantity of voice station cable. Mount panels in racks in each IDF/MDF. Each panel shall be fully loaded. Provide labeling for each connected port as coordinated with owner. Provide a 10ft., Cat. 6 patch cable for each connected port in each patch panel. Coordinate patch cable color with owner. All Voice cable must be lightning protected.

E. Voice Termination Equipment - Station Cable
   1. Twisted pair patch panels, rack mounted, Cat. 6 rated, 110 termination, RJ-45, T568B coded, multi-port (24 or 48). Each voice station cable shall terminate all pairs per patch panel port. Provide quantity of patch panels as required by quantity of voice station cable. Mount panels in racks in each IDF/MDF. Each panel shall be fully loaded. Provide labeling for each connected port as coordinated with owner. Provide either a 3ft. or 5ft Cat. 6 patch cables for each connected port in each patch panel. Coordinate patch cable color and lengths with Owner/Architect.

2.010 STATION CABLE TERMINATION ASSIGNMENTS

A. Refer to the drawings and/or room charts for assignment of room station cabling to the respective IDF or MDF termination equipment.

2.011 PATCH CABLES

Application	Color	TC	OUT END
Data	Blue	5'	10'
Control	Green	5'	5”
Voice	Yellow	5'	N/A
Wireless Access Point	Orange	5'	10'

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION

A. Where specifically permitted for cabling to be run in J-hook / cable management system above accessible ceiling, wiring shall be run as high as possible above piping and ductwork, so as to not interfere with mechanical trades, access to mechanical and electrical devices, and to allow freedom to remove ceiling panels. Cables shall not run next to electrical conduits or within 5” of lighting fixtures utilizing electronic ballasts. Cables shall be run in continuous lengths, without splices. Cabling laying on top of the ceiling grid will not be acceptable. J-hooks / cable management system shall be sized to provide 100% growth of supported cables. Data and voice UTP cable lengths shall not exceed 90 meters.

B. Where cables are installed open wired through the use of J-Hooks/cable management systems, they shall be installed such that there is a minimum sag of 4 inches for every 4 foot of horizontal run.

C. Where backbone cables are installed in conduit, the conduit system shall conform to the following:
   1. No section of conduit shall be longer then 100 feet between pulling points.
   2. No more then two 90 deg. Bends in a section of conduit between pulling points.
   3. Each section of conduit shall be labeled for length, destination closet and origination closet.
   4. Refer to EIA/TIA 569-A for specific conduit and pull box requirements.

D. Backboard mounted wiring connecting blocks shall be mounted such that the top of block is no more than 72 inches from the floor and the bottom of lowest block is no lower than 30 inches from the floor.

E. Each Telecommunications Closet (IDF/MDF) shall be provided with a Telecommunications Ground Bar (TGB). In Addition, the MDF shall be provided with the Main Telecommunications Ground Bar (MTGB). The MTGB shall be bonded to the building Electrical System Ground and shall be bonded to one additional building electrical system ground (such as building steel). Provide a Telecommunications Bonding Backbone (TBB) from the MTGB to each TGB. The TBB shall be routed with the backbone cabling. Ground all backbone cable sheaths, shield drain wires from all voice/data horizontal cable, equipment racks and equipment to the local TGB / MTGB. All grounding and bonding shall be in conformance with the National Electric Code, article 250 and as recommended by EIA/TIA-607.

F. At voice termination equipment at MDF and IDF racks/backboards, voice backbone and station cables shall be terminated following the standard telephone color code unless otherwise indicated.

G. Backbone cable shall be identified and labeled on the blocks and patch panels. Both ends of data and telephone system cabling shall be tagged and identified utilizing a Brady or Panduit cable marking system or other system as approved by the Owner / Engineer. DYMO style labels, cloth or plastic “numbers” or hand written labels WILL NOT BE ACCEPTED.

H. Cross connects / patch cables from voice backbone cable to voice station cables shall be provided by this Contractor. Patch cables from data patch panels to network electronic equipment shall be provided by this Contractor.

I. Each voice and data jack shall be wired with a dedicated home run. Each voice and data jack shall be identified. The jacks shall be labeled on the faceplate. Station cables shall be labeled at IDF/MDF termination point with corresponding workstation outlet jack number.

J. Make all telephone and data terminations at IDF/MDF termination equipment and at each workstation outlet jack utilizing a tool appropriate for the equipment as recommended by the equipment manufacturer.

K. Coordinate color requirements for all jacks, station cables, patch panels, patch cables, etc. with Owner / Architect. Color coding shall be consistent for all like equipment.

L. Voice and data cables shall be handled and installed with extreme care. Twisted pairs shall not be untwisted more than .5 inch Cat 6. Tie wraps shall loosely hold cables; do not over tighten. Cables shall have sweeping bends and shall have a maximum bending radius at any point in the installation of not less then 4 times the outer diameter of the cable. The cable manufacturer's recommended bending radius and maximum pulling tensions shall be strictly adhered and shall not be exceeded. Failure to comply will result in the removal and replacement of affected cable at no additional cost to the Owner.

M. Voice and data horizontal station cable shall not exceed the EIA/TIA guidelines for LINK distances. The LINK shall be as defined in the EIA/TIA standards as the distance from the workstation outlet jack to the IDF/MDF termination equipment patch panel/cross-connect port.

N. Provide adequate cable slack at each workstation outlet and the IDF/MDF termination equipment as follows:
   1. Workstation outlet
      a. 12" of copper cable slack.
      b. 1 meter of fiber cable slack in an integral storage loop.

O. IDF/MDF Termination equipment -
   1. Fiber Backbone - Provide an additional 1 meter slack in each fiber strand in termination equipment integral storage loops.

3.02 VOICE / DATA / CABLE TESTING

A. The Contractor shall be responsible for testing 100% of all installed data station cables, 100% of all installed voice station cables, all fiber backbone cable strands and all voice backbone cable pairs.

B. Each user voice and data station cable system shall be electronically verified. The voice / data system shall be tested in the LINK (from the workstation outlet jack to the termination equipment patch panel port/cross-connect port). Each voice and data LINK shall meet or exceed the EIA/TIA Solution Manufacturer's specified parameters of components within each LINK. The respondent's test plan will specify the procedures for the following tests:
   1. Wire Map - A continuity test to determine correct 568/B eight position pin-out. The test inherently verifies correct circuit identification.
   2. Length - Each cable pair is TDR scanned to determine each pair's individual length. The test results are recorded in feet. The EIA/TIA specification limit of 90 meters is used to qualify the overall length of each circuit.
   3. Attenuation - This test measures the loss or attenuation that each pair exhibits to determine whether or not high speed data packets will be discernible at their destination.
   4. Induced Noise - The noise test measures the presence of external signals at three critical frequency ranges. The test results of each pair are recorded. The three ranges to be tested are as follows:
      a. Low Band (10Hz-150KHz)
      b. Mid Band (150KHz-16MHz)
      c. High Band (16MHz-100MHz)
   5. Resistance - This test individually measures loop resistance on each of the four pairs. Resistance is checked to see that it is within manufacturer's tolerance limits for the circuit's length and gauge.
   6. Near End Crosstalk (NEXT) - The NEXT of each pair is measured as impacted by every other possible pair combination. The test sweeps the specification bandwidth to determine the worst case NEXT frequency for a particular pair. Both the NEXT value and occurring frequency are documented for each possible pair combination. The order of testing is as follows:
      a. Pair 1 & 2 to Pair 3 & 6
      b. Pair 1 & 2 to Pair 4 & 5
      c. Pair 1 & 2 to Pair 7 & 8
      d. Pair 3 & 6 to Pair 4 & 5

e. Pair 3 & 6 to Pair 7 & 8
f. Pair 4 & 5 to Pair 7 & 8

C. Test for Return Loss, Delay, Delay Skew, NEXT, PSNEXT, ELFEXT, PSELFEXT, ACR and PSACR shall be as required by the latest edition of EIA / TIA Level III tests and the latest edition of the Manufacturer's/Source's Channel Solution Program to verify adherence to these specifications of the cabling system.

D. Provide a hard copy of the test results of each and every voice and data channel tested to the Owner. Documentation shall be in the following format:
1. Cable ID
2. Test parameter used
3. Date of test
4. Length
5. Pass / Fail result

E. Provide an electronic copy of the testing done with a cable analyzer and saved on PC formatted CD. Test results saved in a proprietary file type shall be included with software for reading the test results on the Owner's computer system. Test results shall be verified by the Owner as part of the acceptance procedure.

3.03 OPTICAL CABLE TESTING

A. Provide an end-to-end attenuation test at 850 nm and 1300 nm for all fiber optic cable links after installation and terminations. The db loss test shall be performed in accordance with EIA/TIA-526-14, method B: "Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant". Provide a hard copy of the test results to the Owner / Construction Manager.

B. Fiber cables shall be pre-tested for length and OTDR on the spool prior to installation. A variance of more then 3dB from the Manufacturer's OTDR or a length discrepancy of more then 10% shall be reported to the Owner / Construction Manager.

C. Each optical fiber cable and jack shall be electronically verified based upon the following criteria:
1. Continuity Test
2. Insertion Loss Test
3. Optical Time Domain Reflectometer (OTDR)
4. Bandwidth Certification or Link Confidence Testing (LCT)

D. The raw information which is generated from these test methods will be compiled, organized and presented as an indication of the installed fiber optic network's compliance to specifications and overall quality.

3.04 SYSTEM TESTING

A. Tests shall be witnessed by Owner/Architect / Construction Manager / Owner and shall be monitored by a recorder.

B. System testing shall be performed with final test results turned over to the Construction Manager / Owner prior to acceptance of the system. Missing or incomplete test results will not be reviewed and the system will not be commissioned by the Construction Manager / Owner / Owner/Architect.

C. Instruments and labor required for tests shall be furnished by the Contractor. All system test equipment shall be approved by the A/E prior to application.

D. The Construction Manager / Owner / Owner/Architect / Engineer reserve the right to spot test 5% of the installed cabling plant to verify documented test results. Where the Construction Manager / Owner / Owner/Architect have determined that the installed cable plant does not agree with the documented test results, the contractor shall be responsible for re-testing the installed voice/data/fiber cabling plant and revising/updating all test documentation as required.

E. Instruments required for tests shall be furnished by the Contractor.

3.05 LABELING

A. The Contractor shall be responsible for labeling all supplied communications equipment, cable, etc. in accordance with EIA/TIA guidelines. The end of each cable, each jack, patch panel, cross-connect and rack/backboard shall be identified and permanently recorded on 8-1/2 X 11 sheets attached to each rack/backboard.

B. Each cable, jack cross-connect and patch panel shall be labeled at every location where they are administered per TIA/EIA-606.

C. Coordinate all labeling with the schooldistrict's representative PRIOR TO INSTALLATION

D. Create a detailed record sheet for each backbone cable. Record shall indicate connection rack / backboard, patch panel / cross-connect and jack / port, at both ends, for each cable within each backbone cable assembly.

E. Create a detailed records sheet for the station cabling including floor plans showing outlet locations and which jacks are in which outlet. Records shall indicate connection rack/backboard, patch panel / cross-connect and jack / port, at both ends, for each cable.

F. All labeling and recording shall be approved by the A/E prior to application.

3.06 WARRANTY

A. The entire technology wiring system as specified herein shall be guaranteed against defects in workmanship and materials for a period of TWENTY(20) years warranty. Period shall commence after system has been commissioned by the Owner, Engineer and Owner/Architect. The Installing Contractor shall provide the warranty service. Provide a written statement of this warranty as part of the shop drawing submittal and included in the O&M Manuals.

3.07 SUBMITTALS

A. Submit shop drawings including product data sheets and wiring diagrams per requirements in the General Conditions including the following:

B. A complete list of materials with model and part numbers and reference to the specification paragraph number.

C. A complete set of detailed manufacturers specifications describing and illustrating all standard and special components and materials.

D. A complete set of drawings of special items.

E. Illustrations and scale drawing of the system rack and special cabinets.

F. Drawings shall include designations, dimension, operating controls, instruments, etc.

G. Submittals that do not contain all this required information WILL BE REJECTED.

3.08 PROJECT CLOSE-OUT

A. Prior to final system commission by the Engineer/Owner/Architect, the contractor shall provide the following information for review and inclusion in the O&M manuals:
   1. AutoCAD floor plans at a scale of 1/8"=1'-0" on 30x42/24x36 size sheets showing the location and label of each workstation outlet, IDF closet and MDF closet. Labeling shall match the labeling installed in the field.
   2. AutoCAD floor plans at a scale of ¼"=1'-0" on 30x42, 24x36 size sheets showing the telecommunications equipment layout in each IDF closet and the MDF closet. This layout shall include the racks, backboards, cable tray, conduit sleeves, 120V power, etc. Each piece of equipment where labeled in the field shall have the corresponding label on these plans.
   3. AutoCAD drawings showing the elevations of each telecommunications rack. The details shall indicate each piece of telecommunications equipment in each rack including equipment labels such a s patch panel, wire management panel, blank panel, space, etc. Each port of each patch panel shall be fully labeled to match the labeling installed in the field.
   4. The contractor shall also submit a copy of his valid state contractor's license and show proof that he is a factory authorized distributor of the submitted equipment and in general meets all requirements of these specifications including on-staff RCDD and BICSI Certification of project Foreman.
   5. ADOBE PDF Files of all documentation and drawings for the owners use.

END OF SECTION

SECTION 27 20 00

DATA COMMUNICATIONS NETWORK EQUIPMENT

PART 1- GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, General and Special Conditions and Division 1 Sections apply to this Section.

B. 27 00 05 – Basic Requirements

C. 27 00 10 – Basic Materials and Methods

D. 27 10 00 - Voice Video Data Cabling

1.02 SCOPE OF WORK

A. This specification shall be utilized to provide Local Area Network electronics consisting of workgroup switches, and backbone layer 3 switch(s). Provide and install SNMP based management system as recommended by the manufacturer of the electronics.

B. Work includes the High School, Middle School, Green Elementary and Central Elementary Schools.

1.03 SECTION INCLUDES

A. DATA COMMUNICATIONS NETWORK EQUIPMENT
   1. File/Building Server.
   2. Network Switches.
   3. Network Core Switch.
   4. Network Security Equipment.
   5. Uninterruptible Power Supplies (UPSs).

1.04 QUALITY ASSURANCE

A. All equipment shall be UL listed.

B. All equipment and Installation Practices shall comply with the latest ANSI/NFPA-70 National Electric Code.

C. All equipment Installation Practices shall comply with the Local Electric Code.

D. All equipment shall comply with the latest ANSI-J-STD-607 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications Standard.

E. All equipment and Installation Practices shall comply with the latest BICSI Telecommunications Distribution Methods Manual (TDMM).

F. All equipment shall comply with the latest ANSI TIA/EIA-568, 569, 606, 607, 862, standards.

1.05 SYSTEM WARRANTY

A. The Local Area Network Electronics and software shall be warranted by the contractor for a period of one (1) year from date of substantial completion.

B. Provide advanced replacement for all Network Electronics for the one (1) year period.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. As a minimum, the Network may be used to support the following applications on a Local and Wide Area basis:
   1. Automation Systems.
   2. Control Systems.

3. Data Networking
4. Security Systems.
5. Video Conferencing.
6. Video Streaming/Media Retrieval.
7. VoIP Telecommunications.
8. Wireless Access Points.

2.02 FILE/BUILDING SERVER

A. Provide Network File/Building Server for the central administration and storage of computer files and information. One per building (total of 4)
1. Processor – (2) 3.0GHz dual core Xenon
2. 100/1000 Ethernet NIC
3. 4GB RAM (4x1GB)
4. Xserve RAID Card
5. (3) 750GB Serial ATA ADM @ 7200 rpm
6. 24x Optical Drive (DVD-ROM/CD-RW)
7. ATI Radeon X1300 64MB SDRAM with VGA Adapter
8. 650 Watt Power Supply
9. Rack Mount Kit

B. Manufacturers: APPLE Xserve

2.03 NETWORK SWITCHES

A. Provide 10/100/1000BaseT Manageable Ethernet Switches for all Horizontal connections with a minimum of one (1) full duplex SFP Gigabit uplink for every 24 10/100/1000 Ethernet Ports.

B. Switches shall be equipped with a minimum of 1 SFP pluggable Uplink port per 24 10/100 ports.

C. The 10/100/1000 switches shall support a minimum forwarding bandwidth of 30 Mbps.

D. The Network switches shall support advanced services such as:
1. IP Telephony.
2. Wireless Access Points.
3. Building Management Systems.
4. Video Streaming.

E. Power Over Ethernet (POE) Switches shall be IEEE 802.3.af compliant.

F. The 10/100 /1000switches shall support the following features and specifications:
1. 1000BASE-LX/LH.
2. 1000BASE-SX.
3. 1000BASE-X (SFP).
4. 1000BASE-ZX.
5. Access Control Lists (ACL).
6. Advanced QoS.
7. IEEE 802.1s.
8. IEEE 802.1D Spanning Tree Protocol.
9. IEEE 802.1p CoS Prioritization.
10. IEEE 802.1Q VLAN.
11. IEEE 802.1s.
12. IEEE 802.1w.
13. IEEE 802.1x.
14. IEEE 802.3 10BASE-T specification.
15. IEEE 802.3ab 1000BASE-T specification.
16. IEEE 802.3ad.
17. IEEE 802.3af POE.
18. IEEE 802.3u 100BASE-TX specification.
19. IEEE 802.3x full duplex on 10BASE-T, 100BASE-TX, and 1000BASE-T ports.
20. IEEE 802.3z 1000BASE-X specification.
21. IPv6.

22. Rapid Spanning Tree.
23. Rate Limiting.
24. RMON I and II standards.
25. SNMPv1, SNMPv2c, and SNMPv3.

G. Manufacturers: 3Com. Equals by CISCO, Enterasys, or Foundry.

2.04 NETWORK CORE SWITCH

A. Provide a Central Layer-3, Ethernet Routing Switch with advanced QoS and a minimum 256 Gigabit backbone capacity to service the entire building or campus.

B. Equip the Central Layer-3 switch with two (2) Power Supplies.

C. All Core switch Gigabit Port Blades must support full line speed and shall not be over-subscribed.

D. Provide sufficient Gigabit (SX, LX and TX) Ports and 10/100/1000 Ports on the Layer-3 Core Switch, as a minimum, for the following devices:

E. 10/100/1000 Network Switch Up-Links – one link per 24 10/100 ports – typically SX or LX based on distance.

F. Building Automation Systems, as required (typically TX).

G. CCTV DVR System (typically TX).

H. File Servers (typically TX).

I. Firewall, as required (typically TX).

J. Media Distribution Servers & Controllers (typically TX).

K. Radius Authentication Server, as required, (typically TX).

L. WAN Connectivity (typically LX or CWDM).

M. Wireless Controllers (typically TX).

N. Wireless Phone Controller (typically TX).

O. Wireless Control Console (typically TX).

P. In addition to the above listed features and specifications for the Network Switches, the Network Core Switch shall support the following Features and Specifications:

1. 10 Gbps Support capabilities.
2. BGP4 and Multicast Border Gateway Protocol (MBGP).
3. Full Internet Control Message Protocol (ICMP) support.
4. Hot Standby Router Protocol (HSRP).
5. ICMP Router Discovery Protocol.
6. IGMP filtering.
7. IGMP v1, v2, and v3.
8. IP Multicast routing protocols.
9. IP routing protocols: EIGRP, OSPF, Routing Information Protocol (RIP), and RIP2.
10. Non-Blocking GBE Ports.
11. NSF awareness.
12. Policy-based routing (PBR).
13. Virtual Router Redundancy Protocol (VRRP).

Q. Attach Data Network 10/100/1000 switches to the Network Core Switch with one GBE Uplink per 24 Data Network Switch Ports.

R. Manufacturers: 3Com. Equals by CISCO, Enterasys or Foundry

2.05 UNINTERRUPTIBLE POWER SUPPLIES (UPSs)

A. Provide Dual Conversion UPS units for ER and TR Local area Network Electronics and File Server, providing sufficient protection from power anomalies.

B. Provide Power strips, connected to the UPS Unit via twist-lock plugs. Locate the power strips in the equipment racks and on the equipment backboards for powering all electronics systems in the ER and TRs.

C. Provide multiple UPS Units based on expected power load or a single large UPS Unit. Locate the multiple UPS units in the associated equipment racks or locate a larger central UPS unit in the Room.

D. Provide shutdown connections from the UPS to servers for graceful power down in the event of a power failure.

E. Connect the UPS Units to Building Emergency Generator when available.

F. Equip the UPS Units with a twist-Lock Power cable and SNMP Management Card.

G. Connect the UPS SNMP Management to the Management VLAN.

H. Manufacturers:

1. ER UPS – (2) APC 5000 (1) per Data/Voice Cabinet. Equals by TrippLite or Powerware.
2. TR UPS – APC 3000 (1) per Data/Voice Cabinet. Equals by TrippLite or Powerware.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install File Server and setup basic user accounts and network configuration.

B. Install Data Network Ethernet Switches and validate connectivity throughout.

C. Establish all VLANs, QoS, IP Routing and IP Subnets.

D. Consult with the District and consider providing the following VLANs as a minimum:
1. Administration.
2. HVAC.
3. Management.
4. Point of Sale.
5. Student.
6. Video.
7. Voice.
8. Wireless.

E. Coordinate network installation and integration with other systems connected to the network with District's and applicable DA-Site's technical and operational requirements.

F. Install and setup UPS units and establish power down procedures.

G. Connect System to DA-Site WAN Links and configure as per DA-Site requirements, when applicable.

H. Program and configure any State of Ohio Educational Network ATM switches required to access the DA-Site or the State of Ohio IVDL Network.

3.02 PORT COUNTS BY ER AND TR

A. HIGH SCHOOL ER ROOM 153A
1. Support for 264 - 10/100/1000 ports
2. Support for 72 POE Ports
3. Support for 24 Control Ports (10/100)
4. Support for Gigabit Backbone MM Fiber Connections to TC's and dmarc 2 Pair per 24 ports.

B. HIGH SCHOOL TR Room 108
1. Support for 192 - 10/100/1000 ports
2. Support for 96 POE Ports

3. Support for 24 Control Ports (10/100)
4. Support for Gigabit Backbone MM Fiber Connections to 153A.

C. HIGH SCHOOL TR Room 224
1. Support for 312- 10/100/1000 ports
2. Support for 96 POE Ports
3. Support for 24 Control Ports (10/100)
4. Support for Gigabit Backbone MM Fiber Connections to 153A

D. HIGH SCHOOL TR Room 327
1. Support for 240 - 10/100/1000 ports
2. Support for 48 POE Ports
3. Support for 24 Control Ports (10/100)
4. Support for Gigabit Backbone MM Fiber Connections to 153A

E. HIGH SCHOOL TR Room 433
1. Support for 48 - 10/100/1000 ports
2. Support for 24 POE Ports
3. Support for 24 Control Ports (10/100)
4. Support for Gigabit Backbone MM Fiber Connections to 153A

F. MIDDLE SCHOOL ER Room 107A
1. Support for 240 - 10/100/1000 ports
2. Support for 96 POE Ports
3. Support for 24 Control Ports (10/100)
4. Support for Gigabit Backbone MM Fiber Connections to TC's and dmarc 2 Pair per 24 ports.

G. MIDDLE SCHOOL TR Room 175
1. Support for 120 - 10/100/1000 ports
2. Support for 48 POE Ports
3. Support for 24 Control Ports (10/100)
4. Support for Gigabit Backbone MM Fiber Connections to 107A

H. MIDDLE SCHOOL TR Room 233
1. Support for 192 - 10/100/1000 ports
2. Support for 72 POE Ports
3. Support for 24 Control Ports (10/100)
4. Support for Gigabit Backbone MM Fiber Connections to 107A

I. MIDDLE SCHOOL TR Room 288B
1. Support for 192 - 10/100/1000 ports
2. Support for 72 POE Ports
3. Support for 24 Control Ports (10/100)
4. Support for Gigabit Backbone MM Fiber Connections to 107A

J. CENTRAL ELEMENTARY SCHOOL ER Room 143B
1. Support for 120 - 10/100/1000 ports
2. Support for 48 POE Ports
3. Support for 24 Control Ports (10/100)
4. Support for Gigabit Backbone MM Fiber Connections to TC's and dmarc 2 Pair per 24 ports.

K. CENTRAL ELEMENTARY SCHOOL TR Room 124
1. Support for 120 - 10/100/1000 ports
2. Support for 48 POE Ports
3. Support for 24 Control Ports (10/100)
4. Support for Gigabit Backbone MM Fiber Connections to 143B

L. CENTRAL ELEMENTARY SCHOOL TR Room 222B
1. Support for 196 - 10/100/1000 ports

2. Support for 48 POE Ports
3. Support for 24 Control Ports (10/100)
4. Support for Gigabit Backbone MM Fiber Connections to 143B

M. GREEN ELEMENTARY SCHOOL ER Room 03
1. Support for 144 - 10/100/1000 ports
2. Support for 48 POE Ports
3. Support for 24 Control Ports (10/100)
4. Support for Gigabit Backbone MM Fiber Connections to TC's and dmarc 2 Pair per 24 ports.

N. MIDDLE SCHOOL TR Room 31
1. Support for 96 - 10/100/1000 ports
2. Support for 48 POE Ports
3. Support for 24 Control Ports (10/100)
4. Support for Gigabit Backbone MM Fiber Connections to 03

3.03 LABELING AND MARKING

A. Provide a typed schedule of all data ports according to each related room jack designation for all IDFs, and MDF, in accordance with District's requirements.

3.04 TESTING

A. Test the system "end-to-end" (from IDF to MDF, and from IDF to station jack) at the direction of the Design Professional and verify, in writing, that the data network system is in proper working condition.

B. Verify and demonstrate proper operation of all switches, Access Points, VLANs, Routing, WAN Connectivity and possible ATM Connectivity with District and DA-Site representative, if applicable.

3.05 TRAINING

A. Provide a minimum of twenty-four (24) hours of training for District's personnel on the operation and maintenance of the systems.

B. Provide two (2) video copies of all training.

END OF SECTION

SECTION 27 21 00
DATA COMMUNICATIONS WIRELESS ACCESS POINTS

PART 1- GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, General and Special Conditions and Division 1 Sections apply to this Section.

B. 27 00 05 – Basic Requirements

C. 27 00 10 – Basic Materials and Methods

D. 27 10 00 - Voice Video Data Cabling

1.02 SECTION INCLUDES

A. Wireless Controllers and Network Tracking

B. Wireless Access Points

C. Work includes the High School, Middle School, Green Elementary and Central Elementary Schools.

1.03 QUALITY ASSURANCE

A. All equipment shall be UL listed.

B. All equipment and Installation Practices shall comply with the latest ANSI/NFPA-70 NEC

C. All equipment Installation Practices shall comply with the Local Electric Code.

D. All equipment shall comply with the latest ANSI-J-STD-607 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications Standard.

E. All equipment and Installation Practices shall comply with the latest BICSI Telecommunications Distribution Methods Manual (TDMM).

F. All equipment shall comply with the latest ANSI TIA/EIA-568, 569, 606, 607, 862, standards.

1.04 SYSTEM WARRANTY

A. The Wireless Network Electronics and software shall be warranted by the contractor for a period of one (1) year from date of substantial completion. Provide advanced replacement for all Network Electronics for the one (1) year-period.

PART 2 PRODUCTS

2.01 WIRELESS NETWORKING

A. GENERAL

1. Provide Centrally Powered, 802.11a/b/g Wireless Access Points and associated Wireless Network Controller(s), to support wireless Network Devices and Phones throughout the building.
2. Category-6 cable drops for each WAP and Patch Panels at the associated Telecommunication Rooms (TR) are installed under Section 27 10 00
3. Connect the AP to the IP Network via an IEEE 802.3af Power Over Ethernet (POE) Switch Port or via a Mid-Span IEEE 802.3af POE Injector connected to the IP Network.
4. Coordinate 802.31x, VLAN and Security Settings/Requirements with the District.
5. Provide Wireless coverage for the entire building and associated perimeter area.
6. Provide minimum of -75 dB signal level at all locations in building for 802.11 abg coverage.
7. Supply sufficient Access Points to provide for expected throughput and load sharing.
8. Perform an RF Survey to verify coverage.

9. Coordinate with local Law Enforcement and Safety Forces regarding their requirements for remote and wireless access into building Security and Energy Management Systems.
10. Law Enforcement and Safety Forces shall be responsible for providing their own remote access equipment.

B. WIRELESS CONTROLLERS AND LOCATION TRACKING
1. Equip the District with a Wireless Controller and associated Location Tracking Appliances.
2. These devices shall be directly attached to the associated L-3 Network Core Switch via Gigabit interfaces as required.
3. These devices shall provide shall provide dynamic channel assignment, interference detection and avoidance, load balancing across multiple access points, guest networking, Voice over WLAN (VoWLAN) Support, layer-2 and layer-3 roaming support, coverage hole detection and avoidance, dynamic power control, user location and tracking services, and real-time rogue access point detection and containment.
4. The Wireless Network Controllers and Associated Location Tracking devices shall be controlled via a centrally located Wireless Control System Console. Typically, only one Wireless Control Console is required.
5. MANUFACTURERS: 3Com. Equals by CISCO, Enterasys or Foundry

C. WIRELESS ACCESS POINTS
1. Provide centrally powered IEEE 802.11 a/b/g Wireless Access Points (APs) for the building.
2. The APs shall provide for rapid traffic forwarding capabilities that will enable the Access Points to support real-time voice, video and data services.
3. Each AP shall be aware of neighboring access points, enabling effective realtime, and air traffic-management through load balancing.
4. This feature shall be used to ensure maximum network uptime – clients shall be routed around a failed access point to the closest available alternative on a real-time basis without manual intervention.
5. Place and dimension the number of Access Points based on required throughput, load balancing and location tracking.
6. The APs shall conform to the following specifications for IEEE 802.11a/b/g operation:
    a. 802.11a
        (1) Data rate: 6, 9, 12, 18, 24, 36, 48, and 54 Mbps.
        (2) Frequency band: 5.15 - 5.25 GHz, 5.25 - 5.35 GHz, 5.725 - 5.850 GHz.
        (3) Orthogonal Frequency Division Multiplexing (OFDM)
        (4) Carrier Sense Multiple Access with Collision Avoidance
            (a) (CSMA/CA).
        (5) Non-overlapping channels: 13.
        (6) Typical receiver sensitivity: -72 dBm at 54 Mbps, -73 dBm at 48 Mbps, -78 dBm at 36 Mbps, -82 dBm at 24 Mbps, -83 dBm at 18 Mbps, -85 dBm at 12 Mbps, -88 dBm at 9 Mbps, -90 dBm at 6 Mbps
        (7) Transmit Power: 5.150 to 5.250 GHz, 50 mW, 5.250 to 5.350 GHz, 50 mW, 5.725 to 5.850 GHz, 50 mW.
        (8) Typical coverage: 1130 ft (40m) at 11 Mbps, 350 ft (107m) at 1 Mbps
    b. 802.11b
        (1) Data rate: 1, 2, 5.5 and 11 Mbps.
        (2) Frequency band: 2.4 – 2.4835 GHz.
        (3) Direct sequence spread spectrum.
        (4) Carrier Sense Multiple Access with Collision Avoidance
            (a) (CSMA/CA).
        (5) Non-overlapping channels: 3.

(6) Typical receiver sensitivity: -89 dBm at 11 Mbps, -91 dBm at 5.5 Mbps, -92 dBm at 2 Mbps, -94 dBm at 1 Mbps.

(7) Transmit power: 100 mW (20 dBm), 50 mW (17 dBm), 30 mW (15 dBm), 20 mW (13 dBm), 5 mW (7 dBm), and 1 mW (0dBm).

c. 802.11g

(1) Data rate: 1, 2, 5.5, 11, 12, 18, 24, 36, 48, 54 Mbps.

(2) Frequency band: 2.4 – 2.4835 GHz.

(3) Direct sequence spread spectrum.

(4) Orthogonal Frequency Division Multiplexing (OFDM).

(5) Carrier Sense Multiple Access with Collision Avoidance (a) (CSMA/CA).

(6) Non-overlapping channels: 3.

(7) Typical receiver sensitivity: -72 dBm at 54 Mbps, -76 dBm at 48 Mbps, -82 dBm at 36 Mbps, -85 dBm at 24 Mbps, -88 dBm at 18 Mbps, -90 dBm at 12 Mbps, -92 dBm at 9 Mbps, -92 dBm at 6 Mbps.

(8) Transmit power: 100 mW (20 dBm), 50 mW (17 dBm), 30 mW (15 dBm), 20 mW (13 dBm), 5 mW (7 dBm), and 1 mW (0 dBm).

C. MANUFACTURERS

1. 3Com Equals by CISCO, Enterasys or Foundry
2. Quantities and types shown on drawings and Room Charts.
3. Contractor to supply a unit price to add or delete WAP's as necessary for a complete working system.

PART 3 EXECUTION

3.01 INSTALLATION

A. Contractor shall provide and install Wireless System. POE devices, Central Controllers and Console. CAT6 cabling provided by 27 10 00 contractor.

B. The Building Floor Plans and Site Plans shall be entered into the Central Wireless Control Console.

C. The Central Wireless Control Console floor and site plans shall be calibrated after the installation has been performed.

D. Access Point cables and associated connectors shall be terminated in accordance with industry standards.

E. Balance Wireless Access Points to insure complete coverage with minimal service degradation.

F. Setup Wireless Access Security.

G. Determine the optimum location of all devices in the wireless LAN coverage areas and consider the access point density and location.

H. Locate all internal Access Points above the ceiling tile grid wherever possible.

3.02 LABELING

A. Cables, jacks, system components, etc. shall be labeled according to ANSI/EIA/TIA-606 specifications and in coordination with the District/architect.

B. All AP Cables shall be equipped with a self-laminating, wrap-around, machine printed label at both ends of the cable.

3.03 TESTING

A. Perform complete site survey after system placement and verify coverage and throughput.

3.04 TRAINING

A. Provide a minimum of twelve (12) hours of training for District's personnel on the operation and maintenance of the systems.

B. Provide two (2) video copies of all training.

END OF SECTION

SECTION 27 31 23
IP ONLY PABX SYSTEM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.

B. 27 00 05– Basic Requirements

C. 27 00 10 – Basic Materials and Methods

D. 27 10 00 - Voice Video Data Cabling

E. 27 51 00 - Central Sound

F. 27 20 00 - Network

1.02 SECTION INCLUDES

A. IP PABX. Systems for High School, Middle School, Green Elementary School and Central Elementary School. **Current System installed is a 3COM VOIP System. These system shall be Extended and enhanced with similar products from 3COM. A Pre-Bid site visit shall be arranged to inspect current systems.**

B. Attendant Console Terminal.

C. Executive Display Voice Terminal.

D. Standard Display Voice Terminal.

E. Single Line Voice Terminal.

F. Voice Mail with Automated Attendant.

G. E-911 Console.

H. Uninterruptible Power Supply (UPSs).

1.03 QUALITY ASSURANCE

A. All equipment shall be UL listed.

B. Compliance with the National Electric Code.

C. Compliance with FCC rules.

D. Comply with latest NENA E-911 requirements.

1.04 SYSTEM WARRANTY

A. The telephone components, software, parts etc. shall carry a ONE (1) year full warranty, including labor, software and material.

1.05 SYSTEM CONFIGURATION

A. Each Building's telephone system shall be able to handle ALL incoming calls, E-911, Direct Inward Dialing (DID), VoIP trunking, and a minimum capacity of: one (1) ISDN PRI Line, eight (8) analog lines, eight (8) analog trunk lines and eighty (80) digital Stations.

B. An IP PABX must be provided. Key Systems are NOT acceptable.

C. System shall be able to handle at least two (2) FAX Stations per building

D. System to have maintenance and administration terminal and remote access capabilities.

E. A common Telephone Switching Platform shall be used across the District to insure inter-operability. In the event that the District already has an established

F. UPS to be sized for four (4) busy hours.

1.06 WORK BY LOCAL UTILITIES

A. Coordinate all work with the local and long-distance Service Providers (SPs).

PART 2 PRODUCTS

2.01 IP PABX

A. The Central Switching Exchange shall be a fully-digital, IP Based PBX Telephone Switch.

B. The IP PABX shall be Digital Signal Processing based to provide the flexibility to adapt to the changes in communications.

C. The IP PABX must be modular in design.

D. The IP PABX shall be sized according to student population and traffic requirements and shall be equipped with Digital PRI service for incoming/outgoing call lines. The minimum circuits shall be as follows:
   1. One PRI for up to 100 stations.
   2. Two PRIs for greater than 100 stations.
   3. Additional PRIs based on traffic requirements...

E. The IP PABX shall be equipped with full Name and Number Caller ID functions for incoming and outgoing calls.

F. The IP PABX must have PRI, T-1 and VoIP interface capability as required.

G. The IP PABX must be equipped with a minimum of three (3) analog lines to the local Service Provider for E-911 services and PRI backup.

H. Connect the Analog Lines to a Power Failure Transfer (PFT) Unit and supply a minimum of three (3) analog phones, located in the Central Office Area for emergency operation.

I. The common control units for the IP PABX shall be fully duplicated.

J. The media gateways and other ancillary devices shall be distributed across a minimum of at least two (2) units for redundancy. For example, analog interfaces, PRI interfaces, etc. shall be duplicated.

K. For single building configurations, the duplicate Common Control Units, media gateways and other common devices shall all be located in the Main Equipment Room.

L. For multiple building configurations, consideration shall be given to distributing the common control units and media gateways between two buildings.

M. When an IP PABX system is deployed across the District, all PRI Lines and Voice mail and other common Services shall be centralized – a minimum of two central locations is required.

N. Design the District-Wide system to provide for Least-Cost Routing and Toll-Bypass when applicable. Supply additional PRI circuits as required.

O. All buildings shall be equipped with a survivable remote unit that shall continue to provide basic call processing for users via the back-up analog lines. Voice mail will not be required during a WAN Link cut between a remote building and a Core Building.

P. When the Wide Area Network permits, remote buildings shall be configured in such a fashion as to “dual-home” on the two, distributed Central Processing units.

Q. With few exceptions, all IP station devices shall be served by a dedicated Work Area

R. Cable and Voice traffic shall be segregated from standard data traffic by providing dedicated 802.3af Power Over Ethernet (POE) Switches for the Voice Network.

S. The POE switches shall follow the same design rules as the Data Network Switches, namely, one (1) dedicated GBE link to the Data Network Layer-3 Core switch per 24 10/100 ports.

T. All IP Phone instruments shall be 802.3af powered from POE Ethernet switches.

U. Connections between the Data Network and the voice network shall be made via a vendor supplied firewall device.

V. As a minimum, the Call Accounting shall include date, time, duration of call, extension number, account code (if applicable) and number dialed along with software export features to standard spread sheets.

W. The IP PABX telephone system must have the following minimum features:
1. Access Codes.
2. Attendant's Console.
3. Automatic Location Identifier (ALI).
4. Automatic Number Identification Support (ANI).
5. Call Accounting Software and Hardware.
6. Call Conferencing.
7. Call Forwarding on Busy.
8. Call Forwarding External Calls
9. Call Forwarding Internal Calls.
10. Call Hold.
11. Call Pickup.
12. Call Screening.
13. Dialed Number Identification Service (DNIS).
14. Direct Inward Dialing (DID).
15. Distinctive ring tones.
16. Do Not Disturb
17. E-911 and latest NENA support.
18. E-911 Call Recording and Bridging to E-911 Central Console.
19. FCC Registration.
20. Full Caller ID – Incoming/Outgoing.
21. Full duplex, Digital Display, Speaker Phones.
22. Hands Free Intercom – Phone-to-Phone.
23. IEEE 802.3af compliant VoIP Power
24. Least Cost Routing.
25. Maintenance and Administration Terminal.
26. Malicious Call Trace/Hold.
27. Message Waiting Lamp.
28. Paging Interface (minimum 6 zones).
29. Minimum of eight (8) Pre-program buttons.
30. PRI/T-1 Trunking.
31. Remote diagnostics.
32. SIP Signaling Protocol
33. Standards Based, VoIP Phone Support.
34. Support wireless 802.11 VoWLAN phones
35. System Speed Dial.
36. Unified Messaging.
37. VoIP Trunking – H.323 and SIP.

X. The main connection to the Local Exchange Carrier (LEC) shall be a minimum of one (1) PRI Line. A minimum of three (3) Analog Lines (1Bs) shall be provided for backup purposes. The PRI Line(s) shall support full Caller-ID services (ANI and ALI). The PRI Line(s) shall be dimensioned to support a minimum P=0.01 Grade of Service.

Y. Inter-Building Trunks (Links) between Systems shall be designed using T-1 Lines, PRI Lines or VoIP Trunking. A minimum capacity of 23 inter-building links shall be provided. Dimension all Trunks based on a minimum of P=0.01 Grade of Service.

Z. A Fiber WAN connection exists, use a VoIP connection between buildings.

AA. Provide IEEE 802.3af compliant Power Injectors/switches for all VoIP Phone instruments.

BB. Each District Building's IP PABX shall be capable of complete stand-alone operation (with the exception of centralized voicemail) in the event that the Inter-Building Trunks (Links) are not operational. Calling operation shall be limited only by the external links (trunks) available, District-Wide Systems shall function as a single system with Common Features, Centralized Voice Mail, and Centralized Call Detail Recording with a single record per call and the ability for Centralized Attendant Service for the entire District.

CC. All incoming and outgoing calls shall be routed over PRI Line(s) connected to a Central IP-Enabled PABX. The Central IP-ENABLED PABX capacity shall be dimensioned to handle all current and planned District buildings.

DD. IP PABX units shall employ a hardened Operating System that is not susceptible to Internet Computer Viruses.

EE. IP PABX units shall be provided with a minimum of 10% spare line/station capacity at initial installation.

FF. The IP system shall employ standards based signaling, instrument powering and redundant call servers in each District Building served by the system.

GG. Provide centralized PABX and phone instrument power with a minimum of two (2) Busy-Hour standby capabilities for all PABX equipment. IP Based systems shall also be provided with two (2) Busy-Hour standby capabilities for all powered Switches or Patch Panels located in each Telecommunications Room (TR). Connect the Central Power Supplies to Building Emergency Power.

HH. All IP Instruments and power sources shall be IEEE 802.3af compliant.

II. All PABX systems shall support IP Inter-building trunking (H.323 or SIP) and the attachment of IP Instruments such as IP Phones, PDAs, Soft Phones and 802.11 Phones.

2.02 ATTENDANT CONSOLE TERMINAL (C)

A. Minimum of 32 Character LCD Display.

B. Display day, date and time.

C. Display call durations.

D. Display caller name and extension/telephone number and incoming caller-ID information

E. Hands free, Full-Duplex, Speakerphone.

F. Shall have a system display panel capable of showing all system extension numbers and their status and capable of extending calls via single touch operation.

G. Provide a minimum of two (2) consoles per building for load sharing and redundancy.

H. Optional soft consoles should be considered by the designer for the attendant.

2.03 EXECUTIVE DISPLAY IP VOICE TERMINAL (E)

A. Provide one administrative phone for all administrative areas, conference rooms, small group rooms, and offices.

B. At least sixteen characters display window.

C. At least sixteen programmable keys.

D. Hands free, Speakerphone.

E. Display caller name and extension/telephone number.

F. Message Waiting Lamp.

G. Pre-programmed E-911 button that automatically puts the phone into a hands-free mode, and initiates a 3-way conference call with the central console, as well as the local 911 center.

H. IEEE 802.3af powered.

2.04 STANDARD/CLASSROOM DISPLAY DIGITAL VOICE TERMINAL (S)

A. Provide one standard 8-button phone for all classrooms, labs, and other areas not covered in section 2.03 above.
B. At least sixteen characters display window.
C. At least eight (8) programmable keys.
D. Hands free, Full-Duplex, Speakerphone.
E. Display caller name and extension/telephone number.
F. Message Waiting Lamp.
G. Pre-programmed E-911 button that automatically puts the phone into a hands-free mode, and initiates a 3-way conference call with the central console, as well as the local 911 center.
H. IEEE 802.3af powered.

2.06 VOICE MAIL SYSTEM

A. System shall have the following number of voice ports:
    1. Elementary Schools (2) - Minimum of 4 ports (450 students).
    2. Middle School (1) - Minimum of 8 ports (650 students).
    3. High School (1) - Minimum of 12 ports (850 students).
B. System shall have the following capacity:
    1. One voice mailbox per station plus 20% minimum spares.
C. System shall have an automated attendant.
D. System shall be fully integrated with the IP PABX.
E. System shall activate telephone station "message waiting" light.
F. System shall have Integrated Messaging capability. Supply based on District's requirements. Verify E-Mail Server compatibility (Exchange, Notes, Groupwise, etc.)

2.07 E-911 CONSOLE

A. System shall support Call Bridging at Console for all E-911 calls.
B. System shall provide Call Recording for E-911 Calls
C. System shall support full NENA Compliant ANI and ALI data transmission from local Data Base to PSAP.

2.08 UNINTERRUPTIBLE POWER SUPPLIES (UPSs)

A. Provide Dual Conversion UPS units for call processing equipment, providing sufficient protection from power anomalies for two (2) busy hours.
B. Connect the UPS Units to Building Emergency Generator when available.
C. For buildings without a Generator, supply a four-hour (4) standby.
D. Provide shutdown connections from the UPS for graceful power down in the event of a power failure.
E. Equip the UPS Units with a twist-Lock Power cable and SNMP Management Card.
F. Connect the UPS SNMP Management to the Management VLAN.
G. Coordinate UPS voltage, circuit size, and connection requirements with the
H. Electrical Design Professional.

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate complete system installation, and Technology Headend Integration with District and other Technology Trades.

B. Coordinate installation and interconnect with local and long-distance Service Provider (SP). Contractor shall be responsible for all final cross connects and system

C. Data Base loading and verification.
   1. Contractor shall connect to, and interface with the in-house paging system and provide paging from any telephone handset.

D. Connect system to IP Data Network and program required VLANs, Firewall and 803.11e support.

E. Interconnect with existing systems via VoIP trunking.

F. Integrate system with District's Numbering Plan.

3.02 SYSTEM PROGRAMMING

A. Contractor shall provide the District/architect with a complete set of forms for the entire system and extension features for final programming.

B. Final programming of the system shall be co-developed between the District/architect and the contractor and must be approved prior to being implemented for system start-up.

C. Contractor shall supply the "latest" software updates as part of the system configuration for two (2) years after system acceptance.

3.03 TRAINING

A. Contractor shall provide a minimum of four (4) 2-hour, user system training classes, sixteen hours (16) of attendant Console Training and forty hours (40) of system programming and administration training to the District. Training shall be provided to all staff and shall be scheduled in advance with the District.
   1. Contractor shall provide two (2) video copies of all training.

END OF SECTION

SECTION 27 41 17

BROADBAND VIDEO RF DISTRIBUTION SYSTEM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, General and Special Conditions and Division 1 Sections apply to this Section.

B. 27 00 05– Basic Requirements

C. 27 00 10 – Basic Materials and Methods

D. 27 10 00 - Voice Video Data Cabling

1.02 SECTION INCLUDES

A. This specification shall be utilized to provide a complete Broadband Video Distribution System as shown on plans and defined in these specifications.

B. Work consists of an electronically operated, closed circuit RF distribution system with return path video for local cable television service and distribution of locally originated material. All units of equipment shall be listed by Underwriters' Laboratories. System shall comply with the NEC and CATV Industry Standards.

C. The CATV system shall provide for the distribution of broadband RF signals (5-1000 MHz) to and from video outlets utilizing a trunk and branch topology. All units of equipment shall be rated for operation up to 1000 MHz.

A. RF Head End Video Components – The system shall consist of broadband distribution amplifiers, splitters, taps, filters, equalizers etc. to distribute the broadband RF cable TV signal to all outlets within the buildings.

B. Work includes the High School, Middle School, Green Elementary and Central Elementary Schools.

1.03 QUALITY ASSURANCE

A. All equipment shall be UL listed.

B. All equipment and Installation Practices shall comply with the latest ANSI/NFPA-70

1.04 NATIONAL ELECTRIC CODE

A. All equipment Installation Practices shall comply with the Local Electric Code.

B. All equipment shall comply with the latest ANSI-J-STD-607 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications Standard.

C. All equipment and Installation Practices shall comply with the latest BICSI® Telecommunications Distribution Methods Manual (TDMM).

D. All equipment shall comply with the latest ANSI TIA/EIA-568, 569, 606, 607, 862, standards.

E. As a minimum, all equipment shall meet Category 5e transmission performance standards.

1.05 SYSTEM WARRANTY

A. System shall carry an industry standard, performance based warranty, by the manufacturer and contractor, for a period of at least 1 year from date of substantial completion.

PART 2 PRODUCTS

2.01 RF HEAD END

A. GENERAL

1. The CATV Horizontal Coaxial Cable RF Broadband System shall have a minimum frequency bandwidth between 5MHz and 1000MHz and full support for HDTV.
2. All RF devices shall be two-way for return video capability.
3. Provide all combining and splitting devices, as required.
4. Provide terminating devices and directional couplers, as required.
5. Provide all video distribution amps, as required.
6. Provide channel elimination filters, as required.
7. Provide Agile Channel Modulators, as required.
8. Provide Cable Equalizers, as required.

B. MANUFACTURERS: Drake RCA, Holland, Blonder Tongue

C. HORIZONTAL COAX CABLE
1. The RF Broadband Wiring System is installed by 27 10 00 contractor.

D. RF DISTRIBUTION EQUIPMENT
1. Broadband Amplifier (Head end) - Provide Broadband Indoor Distribution Amplifier rack mounted. Amplifier shall have a frequency response of 50-1000 MHz. Provide all required equalizer modules to compensate for signal tilt and slope and as required for system balancing and alignment.
2. Broadband Amplifier (Distribution) - Provide Broadband Indoor Distribution Amplifier with integrated return path filter and 20dB return path amplifier rack / backboard mounted. Amplifier shall have a forward frequency response of 50-1000 MHz and a reverse frequency response of 5-30 MHz. Refer to drawings for quantities and locations. Provide all required equalizer modules to compensate for signal tilt and slope and as required for system balancing and alignment.
3. Notch Trap - Provide tunable notch traps to remove channels to permit re-insertion of locally generated material. Coordinate channels with the Owner. Unit shall have a pass band of 50-1000 MHz and an elimination band as coordinated with required channels to eliminate. Refer to drawings for quantities.
4. Channel Elimination Filter – Provides a band pass brick wall filter to pass all channels within the specified set point.
    a. Pass Band 54-400 MHz
    b. Channels 2 – 53
    c. Band 206E Insertion Loss 5.5 dB
    d. Stop Band Rejection 50 dB
5. Heterodyne Processor - Provide rack mounted Heterodyne Processor with sub-band input option to convert locally originated material, broadcast on sub-band channels T-7 thru T-13 to VHF channels (2 thru 119) for re-broadcast. Coordinate channel assignments with Owner and channel elimination filters.
6. Combiner - Provide a rack mounted, active combiner to combine inputs from various sources. Channel quantity as required by system.
7. Modulator - Provide rack mounted modulator with BNC video input and sub-band output option.
8. Directional Couplers - Provide L style 1-way tap off mounted in video distribution rack.
9. Tri-Plexer - Provide multiplexer to separate sub-band video information for return path video as indicated on drawings.
10. Splitters - Provide required 3-way, 4-way and 8-way tap off units, rack mounted in video distribution racks or wall mounted on backboards in TC's. Splitters shall have a frequency response to 1000 MHz.
11. Terminating resistors with 75 Ohm impedance shall be installed at unused ports and feeder line ends. Terminating resistors shall be designed to cover the frequency range from 5 MHz to 10000 MHz with minimum return loss of 25 dB at UHF and 30 dB across the VHF band.
12. High-Q traps shall be installed where required for the rejection of interfering carriers. Traps shall have an input and output impedance of 75 ohms and connection shall be made

through standard "F" connectors. The minimum carrier reflection, when synchronously tuned shall be 50 dB.

13. Provide equalizers as required. The system shall provide for a reverse tilt of no more than 3 dB differential. Line equalizers shall be rated at 1000 MHz. They shall have a VSWR of no more than 1.2. The frequency response shall be within .7 dB.

E. VIDEO DISTRIBUTION EQUIPMENT RACKS

1. Equipment cabinets shall have vented side panels and lockable front and back doors. Cabinets shall be 22-1/2 inches wide and 84 Inches high. Units shall have front glass hinged doors. Each rack shall be securely mounted and provided with a #6 ground wire from rack to the local telecommunications ground bar. Multiple racks shall be bonded together with a #6 ground wire. Refer to drawings for quantities and locations of racks. Standard: Great Lakes, B-Line, Ortronics, Hubbel.
2. Provide rack mounted 120V surge suppression type outlet strips in each rack with quantity of receptacle required for devices mounted in rack. Provide each outlet strip with sufficient length cord to connect to local outlet.
3. Provide a one space, front/rear wire management panel for each patch panel and rack mounted piece of equipment.

F. MEDIA SOURCES

1. Provide the following Media source equipment and accessories to be mounted in the video equipment racks in TC01 in all buildings:
    a. All units to have built-in ATSC/QAM Digital and Analog Tuners.
    b. All units shall have composite AND component AV outputs.
    c. DVD/VHS Units shall be RCA or Equals by LG or PANASONIC

PART 3 EXECUTION

3.01 INSTALLATION

A. All cabling shall be installed according to ANSI/EIA/TIA specifications and BISCI standards.

B. Adjust amplifier tilt and gain as required. Connect User Coax to appropriate multi-port tap based on loss required to balance system. Supply Cable Equalizers as required.

3.02 LABELING

A. Patch panels, cables, jacks, system components, etc. shall be labeled according to ANSI/EIA/TIA-606 specifications and in coordination with the District/architect.

3.03 TESTING

A. All equipment shall be tested and demonstrated to the end user.

3.04 TRAINING

A. Contractor shall provide a minimum of sixteen hours (16) of Training to the District. Training shall be provided to all staff and shall be scheduled in advance with the District.
    1. Contractor shall provide two (2) video copies of all training.

END OF SECTION

SECTION 274119

VIDEO DISPLAY EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, General and Special Conditions and Division 1 Sections apply to this Section.

B. 27 00 05 – Basic Requirements

C. 27 00 10 – Basic Materials and Methods

1.02 SECTION INCLUDES

A. VIDEO DISPLAY EQUIPMENT
1. LCD TV AND PROJECTOR MOUNTS
2. LCD TV/Monitor Units
3. Projectors

1.03 QUALITY ASSURANCE

A. All equipment shall be UL listed.

A. All equipment and Installation Practices shall comply with the latest ANSI/NFPA-70 National Electric Code.

B. All equipment Installation Practices shall comply with the Local Electric Code.

C. All equipment and Installation Practices shall comply with the latest BICSI ® Telecommunications Distribution Methods Manual (TDMM).

D. All equipment shall comply with the latest ANSI TIA/EIA-568, 569, 606, 607, 862, standards as applicable.

1.04 SYSTEM WARRANTY

A. The Video Display Equipment Systems and associated software shall be warranted by the contractor for a period of one (1) year from date of substantial completion.

PART 2 PRODUCTS

2.01 LCD TV AND PROJECTOR MOUNTS

A. Provide wall type, articulating arm LCD mounts with 20 degrees of forward tilt and 180 degrees of side to side swivel. Mounts shall be rated for commercial use and capable of supporting up to 50” flat panel Televisions.

1 Manufacturers: Peerless, Premier or Chief

B. Provide Ceiling Mounts for projectors with appropriate knockouts for electrical outlet and A/V cables. Mounts shall incorporate adjustable length extension columns for proper viewing.

1 Manufacturers: Peerless, Omni-Mount or Chief

C. Mounts shall be installed in strict compliance with the manufacture’s instructions. Mounting configuration, method, and exact location of mounts to be approved prior to installation.

2.02 PROJECTORS

A. Classrooms & Labs
1 DLP or LCD type video/data projector
2 2500 ANSI Lumen (minimum)
3 Audio output cables to connect projector with sound reinforcement system.
4 Native 1024 x 768 XGA resolution
5 Capable of 16 x 9 Format
6 Network Attached

7 Projectors shall be EPSON or Equals by InFocus or NEC.

B. Auditeria
1 DLP or LCD type video/data projector
2 5000 ANSI Lumen (minimum)
3 Audio output cables to connect projector with sound reinforcement system.
4 Native 1024 x 768 XGA resolution
5 Capable of 16 x 9 Format
6 Network Attached
7 DLP Projectors shall be EPSON or Equals by InFocus or NEC

C. Vendor is to provide proper Lens for all projectors. Coordinate distances with consultant.

D. Provide Projectors with Ethernet connection and central management software.

E. Provide connection to classroom sound enhancement audio systems and the auditeria sound ystem for the use with the above LCD Projectors.

F. Enable volume control of speakers with projector remote.

2.03 TV/MONITOR

A. The LCD Monitors/TVs shall be equipped with a combination analog and digital 181-channel tuner and shall have minimum native resolution of 1024 x 768 (XGA) and support 1080p without the use of scan-converters or line-doublers. See Room Charts and drawings for sizes and mounts.
1 1024 X 768 Resolution Minumum
2 Wide Screen 16:9 Aspect Ratio
3 HDTV Capable
4 1080p Resolution
5 CC Compatible
6 Built-in speakers
7 Full Function Smart Remote Control
8 Rear 15-Pin Computer Connection
9 Provide a remote control with each unit.
10 Monitor receivers shall be SAMSUNG or Equals by NEC or Zenith.

2.04 DVD/VHS COMBINATION

A. All units to have built-in ATSC/QAM Digital and Analog Tuners.

B. All units shall have composite AND component AV outputs.

C. DVD/VHS Units shall be RCA or Equals by LG or PANASONIC

2.05 DOCUMENT CAMERA

A. See Room Charts for locations..

B. Document camera to have the following features:
1 Image sensor: ½"CMOS 3M Pixels
2 XGA (1024x768) Resolution
3 Automatic Iris
4 VGA Inputs from PC/MAC
5 Switch images from PC to camera and back
6 Document Camera shall be Toshiba TLP-C001 or Elmo HG-110XG or AverMedia A46-4100

2.06 AUDIO/VISUAL CABLE

A. Provide all associated A/V patch cables for each equipment item for a fully operational system.

1 M/M RCA audio cables
2 M/M RCA video cables
3 M/M 1/8th" audio cables
4 Component to VGA video cables

5 VGA to VGA Video Cables

2.07 REMOTE ORIGINATION EQUIPMENT

A. Provide (1) Remote Video Origination Systems per building (Total 4). Each equipped as follows:

1 Blonder Tongue AM-60-550 Modulator w/ AM-OPTO 4
b) Equals by Jarrod or RCA
2 Luxor VP-34B Production Cart
b) Equals by Peerless or Bretford
3 Digital Camcorder with Recordable hard drive
b) Equals by Panasonic SDR-H18, Sony DCRSR42 or JVC GZMG130
4 Shure 200 Microphone Mixer
b) Equals by Yamaha or Peavy
5 (2)Telex FMR-70L Wireless Mic System
b) Equals by TOA or Williams
6 Electro-Voice ND257B Microphone w/25' Cable
b) Equals by Sony or Panasonic
7 Panasonic CT-1388Y 13" Monitor
b) Equals by Sony or RCA
8 All connection cables and a 25 foot audio/video interconnection
b) Cable banded together with a protection sleeve to connect the system to the wall plates.

PART 3 EXECUTION

3.01 INSTALLATION

A. Mount Projectors and LCD TV/Monitors using manufacturer's recommended hardware.

B. Connect Devices to IP Network for Central Control.

C. Adjust all Projectors for proper focus, keystone correction and display size.

D. Install all associated software monitoring and control programs.

3.02 TESTING

A. Verify picture quality on all A/V inputs.

B. Test all associated software control programs.

C. Upon completion of installation and satisfactory testing of system by Contractor in presence of the equipment supplier, the Contractor shall test the system in the presence of the Owner and the Architect to demonstrate satisfactory performance.

3.03 TRAINING

A. Provide 12 hours of step-by-step user instructions identifying operator controls for normal use operations. This shall be included with the O&M manuals.

END OF SECTION

SECTION 27 51 00

CENTRAL SOUND / MASTER CLOCK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, General and Special Conditions and Division 1 Sections apply to this Section.

B. 27 00 05 – Basic Requirements

C. 27 00 10 – Basic Materials and Methods

1.02 SYSTEM DESCRIPTION AND SCOPE OF WORK (Central Elementary School)

A. The work to be provided herein consists of furnishing and installing all equipment, cabling and labor required for complete, operable, new building-wide public address/paging system as shown on plans and defined in these specifications.

B. The System shall provide communications used for "all call and emergency announcements. The system shall incorporate a master program clock/bell system to generate tone signals for class changes.

C. The systems shall be interfaced to the telephone system allowing any telephone location, with the entry of a password, to initiate a page, call a specific zone, or initiate an emergency or time tone.

D. The contractor shall have a factory trained service department on call 24 hours a day, 365 days a year, to service the specified product. Response time for service calls shall be 4 hours.

1.03 QUALITY ASSURANCE

A. NFPA 70 - National Electrical Code.

B. Underwriter's Laboratory.

C. TIA/EIA-607 Telecommunications Grounding.

D. Tenth Edition (or latest) BICSI Telecommunications Distribution Methods Manual (TDMM).

E. American with Disabilities Act.

F. Federal Communications Commission Part 15.

G. Sound System Engineering (Davis & Patronis) – 3rd Edition 2006.

H. Audio Systems Design and Installation (Giddings) 1990.

1.04 SYSTEM WARRANTY

A. The Sound System shall be warranted by the contractor for a period of one (1) year from date of substantial completion.

1.05 VOICE COMMUNICATIONS AND SOUND SYSTEM.

A. Furnish and install a complete microprocessor controlled voice communication system with all wire, outlets and equipment as may be required, as shown on the drawings, and as herein specified to provide a complete and operational sound and voice communication system.

B. The entire system shall be listed by Underwriters Laboratories. Proof of such a listing shall be furnished at time of submittal. All equipment shall be installed and connected in strict accordance with the manufacturer's recommended instructions. Systems having UL listings on power supplies and amplifiers only shall not be acceptable.

1. The vendor shall provide the following documentation and services:
2. As built drawings: These drawings shall include the manufacturer's specification sheets, including all the component parts, control equipment drawings, and wiring diagrams. They should include up-to-date drawings that include any changes made to the system during installation as well as operators manuals and instructions.

3. In-service Training: Provide the owner with a training program designed to make all administrative control center users familiar with the operation of the voice communication system.
4. System vendor shall provide programming changes free of charge for (1) year following installation and acceptance of the system.

1.03 SYSTEM DESCRIPTION

A. The system shall consist of a central equipment cabinet, microprocessor based control unit, power supply, speaker zone control cards, separate administrative control centers (ACC's), amplifiers, remote display units, classroom loudspeaker assemblies, and all associated material, hardware, wiring, and options as described herein to provide a complete working system which shall meet the specified requirements.

B. The system shall provide the following communication paths and functions:
   1. 8 paging zones.
   2. Telephone system to any programmed zone.

C. The system shall provide the facilities for:
   1. Paging
   2. Sounding emergency signals
   3. Timed event signals

D. The system shall include the facilities for a master clock and programmer.

1.04 SYSTEM FUNCTION

A. The system shall provide building-wide central sound (paging system) that provides communications used for "all call" and emergency announcements.
   1. Distribution of paging announcements via any ACC or telephone.
   2. Unique system tones for emergency and civil emergency
   3. Special tone for custodial call to all speakers.
   4. The system shall have eight zones and shall be programmed as directed by the school district.
   5. Automatic distribution of user programmable time signals activated by an internal time clock.

B. The system shall contain an integral master clock and programmer which shall be capable of performing the following functions:
   1. Displaying the time of day in either twelve or twenty-four hour format at each Administrative Control.
   2. Providing discrete time event entries for programming functions based on;
      b. The time of day in hours and minutes.
      c. The day or combination of seven {7} days of the week the event is to occur.
      d. Selection of any one or any combination of eight {8} zones or outputs to be activated.
      e. Selection of any one of eight schedules to allow for maximum flexibility due to special circumstances or seasonal changes
      f. Selection of fourteen user programmable tones.
   3. Provide for an editing and review routine to permit the user to change and edit time events, zones, and schedules.
   4. Provide automatic correction for daylight savings time adjustments.

PART 2 - PRODUCTS

2.01 CENTRAL EQUIPMENT

A. The equipment specified herein and shown on the drawings is based upon equipment as manufactured by Dukane, Telecor, Bogen and Rauland. The intent is to establish a standard of quality, function and features. It is the responsibility of the bidder to insure that the proposed product meets or exceeds all standards set forth in these specifications. Products of other manufacturers will be considered, providing their products equal or exceed the quality specified; and they can provide products of the type, function, size, arrangement, and configuration required.

B. Microprocessor based control unit.

C. Master clock time control for class change and scheduling.

D. Speaker Zone control cards

E. AM/FM Radio, CD Player w/MP3 Input, to provide music to any or all speakers. Connect AM/FM Tuner to external, building mounted antenna. Ground antenna in accordance with NEC and TIA/EIA-607.

F. Minimum of 8 Paging Zones.

G. Star-Wired cabling system terminated on paging zone Cross-connected blocks.

H. Building Evacuation tone and emergency tone generator.

I. Feed back eliminators.

J. Low-voltage, Amplified paging speakers and horns with central power supply units as required.

K. Rack Mounted UPS / Battery Backup
   1. APC #SU2200RMXL3U Equals by: Compaq, Powerware, Best Power

L. Classroom and Corridor Ceiling Speakers
   1. Provide ceiling mounted, recessed, Low-voltage speakers with Central Power Supply Units.
   2. Provide a white round recessed steel baffle with each unit and matching back box and tile support.
   3. Reflected Ceiling Plans are available at the construction office. Installation of all ceiling speakers shall be coordinated with these plans.

M. Other Speakers
   1. GYM - Provide surface mounted Paging Horn. Unit shall be installed on building structure.
   2. Outdoor locations shall be 8 inch speaker and baffle mounted in owner provided backboxes.

N. System Central Equipment Cabinet
   1. The central equipment shall be rack mounted in a standard cabinet.
      a. Manufacturers: Great Lakes, B-Line, Ortronics, Hubbel, Middle Atlantic.
   2. The unit shall require 110 VAC power.
   3. The system shall have at least one administrative control console.

O. Integrated Emergency Tone Generator
   1. Emergency Tone shall go over outside speakers.
   2. Emergency tones shall be distributed to all speakers

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install per manufacturers specifications.

B. Balance volume levels

C. Speakers on the drawings are shown for in their approximate location and for quantities needed. Reflected Ceiling Plans are available at the construction office. Installation of all ceiling speakers shall be coordinated with these plans. In general: Corridor speakers shall be centered and spaced 20 feet apart. Classroom speakers shall be centered in the room. Gym, media center and cafetorium speakers shall be positioned for proper sound coverage, avoiding ceiling sound panels.

D. Integrate Paging System with Telephone System so that a page can be made from any telephone in the school.

3.02 WIRING

A. Size and quantity of conductors shall be in accordance with manufacturer's requirement for cabling. Cables shall be UL listed for plenum use.

B. Cable manufactured by West Penn, Belden or General .

3.03 WARRANTY AND TRAINING

A. The system contractor shall warrant any equipment installed under this specification to be free from defect for a period of one year from date of final acceptance.

B. The system contractor shall provide a minimum of 20 hours training for school district personnel on proper operating procedures for the system.

C. All training shall be video taped..

END OF SECTION

SECTION 27 51 20
AUDITORIUM SOUND REINFORCEMENT SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, General and Special Conditions and Division 1 Sections apply to this Section.

B. 27 00 05 – Basic Requirements

C. 27 00 10 – Basic Materials and Methods

1.02 SECTION INCLUDES (High School)

A. The intent of this specification is to provide a Sound Reinforcement and Audio Program Playback System for live performances, programs, assemblies and other functions conducted in the Auditorium.

B. The work described by this section includes the furnishing of all components, materials, equipment, installation and technical labor and the performance of all operations necessary for the complete installation of a sound reinforcement and theatrical production intercom system in operating condition as indicated on the drawings and/or specified herein.

C. There shall be one (1) mixing location provided, each with a multi-pin connector for the insertion of the multi-pair, send-return audio mixer snake. One location shall be in the sound room with the multi-pin connector mounted on the side of the audio equipment cabinet, the other location shall be in the audience seating area as shown on plans.

1.03 QUALITY ASSURANCE

A. The intent of these Specifications is to describe and provide for a complete Sound Reinforcement System of professional quality and reliability. Professional performance standards as provided by a qualified and experienced sound systems contractor (hereafter referred to as Systems Contractor) will be required. References and documentation of the System Contractor's experience and following qualifications shall be provided, if requested.

B. The Systems Contractor shall:

1. Be an authorized dealer/service organization for all major items of electronic equipment furnished.
2. Maintain a factory trained service department on call 24 hours a day, 365 days a year, to service the specified product.
3. Employ, on a full-time basis, a qualified audio/electronics Engineer under whose direction and supervision the entire installation shall be carried out.
4. Employ, on a full-time basis, trained technician(s) who are experienced in the installation of sound reinforcement equipment, its interconnection and setup. Qualified technicians shall perform all assembly, wiring, soldering, interconnection, setup and programming of all equipment, jacks and devices.

C. The Systems Contractor shall coordinate final utility rough-in locations with actual equipment furnished. Verify dimensions and conditions at the job site prior to installation, and perform installation in accordance with these Specifications, manufacturer's recommendations and all applicable code requirements.

D. All installation work performed by the Electrical Contractor shall be performed under the supervision and guidance of the Systems Contractor.

E. All work shall be performed in accordance with the recommendations of the equipment manufacturers.

F. In all cases, the Owner and Engineer shall determine the acceptability of the work based upon site visits and observations.

G. NFPA 70 - National Electrical Code.

H. Underwriter's Laboratory.

I. TIA/EIA-607 Telecommunications Grounding.

J. Tenth Edition (or latest) BICSI Telecommunications Distribution Methods Manual (TDMM).

K. American with Disabilities Act.

L. Federal Communications Commission Part 15.

M. Sound System Engineering (Davis & Patronis) – 3rd Edition 2006.

N. Audio Systems Design and Installation (Giddings) 1990.

1.04 SYSTEM WARRANTY

A. The Sound System shall be warranted by the contractor for a period of one (1) year from date of substantial completion.

1.05 SHOP DRAWINGS AND SUBMITTALS

A. Refer to Shop Drawing requirements in Specification Section 27 00 05, Basic Requirements.

1.06 FINAL DOCUMENTATION

A. All final documentation shall be submitted and approved before final acceptance by the Owner will be granted. Within 45 days after completion of the work, deliver to the Owner, four (4) sets of blue-line drawings on full-size (D or E size) paper and four (4) identical copies of the following:

B. A complete as-installed equipment list, listed by room, with manufacturer's names, model numbers, serial numbers and quantities of each item.

C. A complete and correct system schematic, showing detailed connections for all parts of the system, including wire numbers, terminal block numbers and layouts and other designations and codings. System performance measurements as noted elsewhere in this specification shall be documented. Include diagrams or charts showing final setting of all control knobs in the system (mixers, equalizers, power amplifiers, etc.)

D. Complete equipment rack layouts showing all rack mounted equipment items.

E. Floor plans, prepared at a scale of not less that 1/8" = 1'0", showing loud speaker locations and orientation, wall plates, rack locations and other related device locations.

F. Riser diagrams showing installed conduit with pull boxes, outlet boxes, part number of cable types used, and number of circuits in each conduit.

G. Operations manuals for each and every major equipment item furnished.

H. Copies of any operating and/or setup software

I. Manufacturer's warranties and operating instructions for each and every equipment item furnished. Include a copy of the Certificate of Warranty, signed by both parties.

J. Technical Systems Operations Manual, custom-written by the Contractor, for the purpose of instructing the Owner's operating personnel in the detailed step-by-step operation of the system and preventive maintenance procedures. This manual shall include descriptions of the system components and their relationship to system function. This manual shall be bound separately and labeled appropriately.

K. Refer to Record Drawing and Operating and Maintenance requirements in Specification Section 27 00 05, Basic Requirement

PART 2 - PRODUCTS

2.01 GENERAL

A. All equipment items shall be new, unused and the latest version or model.

B. The following sections specifically list the acceptable equipment types and items for this project. Where quantities are not noted, they may be obtained from the drawing. In the event of a discrepancy between the specifications and the drawings, the greater quantity or better quality shall be furnished.

C. Speaker locations are shown on the drawings for bidding purposes only. The exact speaker locations, aiming points and mounting angles shall be coordinated with the Engineer and determined through the use of an acoustical modeling program and good engineering practices. Speaker aiming shall be adjusted as required after installation to provide optimal coverage and system performance.

2.02 PRODUCTS

A. Assistive Listening System shall include a transmitter and 20 receivers with ear buds (5 of the 20 must be hearing aid compatible).
   1. Provide system equal to Telex SM-1, TOA or Williams.

B. Yamaha MG-32 Mixing Console
   1. Acceptable equal manufacturers: Allen and Heath, Yamaha, Spirit/Soundcraft, or Crest

C. ProCo Snake Cable from a plate located on the rack to the mixing console in the sound booth. Equal by Whirlwind or Rapco.

D. CD /RW Deck Denon DN-C550R equal by Tascam or Marantz.

E. Amplifiers
   1. Crown CTS 4200 Power Amplifiers (1)
   2. Crown CTS 600 Power Amplifiers (2)
   3. Crown CTS 800 Power Amplifiers (1)
   4. Crown 180a Power Amplifier (1)
      a. Acceptable equal manufacturers: EVI, Crest or QSC

F. Marantz PMD-351 Combo CD/Cassette
   1. Acceptable equal manufacturers: Denon, Tascam

G. MP3 Audio Input

H. Audio Technica 3000 series hand held and lapel wireless mic system (4) Receivers, (8) Transmitters.
   1. Acceptable equal manufacturers: Telex, Shure, Beyer, EVI.

I. Biamp Audio Solo 8x8 Digital Signal Processor
   1. Acceptable equal manufacturers: EVI, Peavey or BSS.

J. Custom Made Digital Pre-Set Selector Panel to be installed and programmed to the schools requirements.

K. Lowell 262-77 Equipment Racks (2) with rack mounted drawers
   1. Acceptable equal manufacturers: Atlas Sound, Middle Atlantic

L. AC Power Systems
   1. Main Equipment Cabinets: Provide a combination of rack-mounted sequential-switching power strips and vertical power strips to adequately power all active audio devices in the main equipment cabinet.
      a. Middle Atlantic model USC-6R Universal Sequencing Controller or equal by Lowell, Atlas Sound, Furman or Surge-X.
      b. Middle Atlantic R-20 20-amp duplex modules or equal by Lowell, Atlas Sound, Furman or Surge-X. Quantity as required.

c. Middle Atlantic M-15 un-switched module or equal.
d. Middle Atlantic MPR-6 modular power raceway or equal with power jumpers as needed. Quantity as required.
e. Middle Atlantic USC-KL remote key switch and LED status indicator panel. Coordinate Location with owner.

M. Exploded speaker cluster (Color to be determined by Architect). Cluster rigging shall be used with a 5:1 safety ratio utilizing aircraft cable and a custom mounting bracket.
1. EV Fri+ 122/64 (2)
2. EV Fri+ 122/66 (1)
3. EV Fri+ 181/S (2)
a. Acceptable equal manufacturers: EAW, JBL

N. Delay Zone Speakers (Color to be determined by Architect).
1. EV Sx80 with mounting supports.(6)
2. Acceptable equal manufacturers: EAW, JBL

O. Ceiling Speakers
1. Atlas FD 72W with Atlas 96-8 Backbox
2. Acceptable equal manufacturers: Lowell or Quam-Nichols

P. Stage Monitor Speakers
1. EV Elimnator Series with accessory feet. (3)
2. Acceptable equal manufacturers: EAW, JBL

Q. Stage Floor Box
1. FSR FL-1500 equal by hubble or proco.

R. Microphone Plates
1. Custom Made and engraved. By Proco, Rapco or Conquest
2. Microphones:
3. Shure SM 58 (6)
4. Shure SM 57 (6)
5. Shure SM 81 (2)
6. Crowm PCC-160 (4)
7. Shure MX202B/S with 30 foot cord (2)
8. Shure BETE 87A (2)
9. Shure MX202w/c
a. Acceptable equal manufacturers; EVI, Audio-Technica, Crown, or Beyer.

S. Stands:
1. AKG KM211 (5)
2. AKG KM251 (5)
3. Acceptable equal manufacturers: Ultimate or Atlas

T. Wire and Cable

1. Wire not installed in equipment racks, not portable, or not installed in conduit shall be plenum-rated and meet all applicable codes.

U. Speaker Cable:
1. Main House Speaker Cable: Stranded 12AWG copper twisted pair from the equipment rack to the loudspeaker(s). West Penn 227 or approved equal by Belden, Mohawk, General.
2. Monitor/Effects Speaker Circuit Cable: Stranded 16AWG copper twisted pair from the equipment rack to the jackplates. West Penn 225 or approved equal by Belden, Mohawk, General.
3. Constant-voltage Speaker Circuit Cable: Stranded 18AWG copper twisted pair from the equipment rack to the loudspeaker(s). West Penn 224 or approved equal by Belden, Mohawk, General.

V. Installed Microphone-level Cable: Stranded 22AWG copper twisted, shielded pair with drain wire homerun to the equipment rack from each jack. West Penn 291 or approved equal by Belden, Mohawk, General.

W. Installed Line-level Cable: Stranded 20AWG copper twisted, shielded pair with drain wire homerun to the equipment rack from each jack. West Penn 292 or approved equal by Belden, Mohawk, General.

X. Other equipment control cables shall be stranded wire, appropriately shielded, of gauge and number of conductors required by the manufacturer for proper operation of the system or equipment item furnished and supplied in accordance with the recommendations of the National Electrical Code.

Y. Audio Snake:

1. Provide one (1) 50 ft. long factory-assembled, multi-channel, audio snake with a connectorized fan-out at the mixer end and a multipin connector at the other end. Each individually shielded 24 awg copper stranded pair shall be foil-shielded with a 24 awg drain wire. Provide a minimum of twenty-four (24) send channels and four (4) return channels with appropriate balanced connectors as required for use with the selected mixer. Acceptable manufacturers: ProCo, Whirlwind, Conquest.

Z. Direct Boxes:

1. Provide the following devices intended to facilitate the insertion of a wide variety of program source and other types of audio origination/playback equipment into standard microphone jacks:
    a. (3) Stereo Direct Box shall permit the connection of unbalanced line level audio outputs of computer sound cards, CD players, tape decks, etc. to balanced, low-impedance equipment. The balanced output signal shall be attenuated approximately 20dB below the input level. The color-coded stereo input jacks shall include dual RCA jacks and a 3.5mm stereo TRS jack. The unit shall be equipped with a switchable 20dB input pad and a ground lift switch. Provide Whirlwind model pcDI or equal by ProCo or Conquest with two (2) matching 10ft. dual XLR cables.
    b. (1) Mic Combiner shall combine low impedance, balanced, signals into a single low impedance balanced output. Dual female XLR input jacks and a single male XLR output jack shall be provided, in addition to a polarity reverse switch. Provide Whirlwind model IMCOM or equal by ProCo or Conquest with matching 10ft. dual XLR cable.

AA. Jack, Connectors and Wall Plates

1. All plate-mounted connectors shall be ground-insulated from the plates on which they are mounted.
2. All jacks shall be installed on standard stainless steel finish plates. Nomenclature shall be engraved into the plate with 1/8" block letters filled with black paint. All mic jack locations shall be numbered consecutively, starting from one (1).
3. Unless otherwise specified, all jacks and connectors for the sound system shall be as follows:
    a. Microphone and line input receptacles shall be 3-pin XLR-F with locking tab equivalent to Neutrik model NC3FP-1 or equal by Switchcraft or Calrad.
    b. Microphone and line output receptacles shall be 3-pin XLR-M equivalent to Neutrik model NC3MP or equal by Switchcraft or Calrad.
    c. Monitor/Effects Speaker Receptacles shall be 4-pole Speakon-type with gold-plated contacts equivalent to Neutrik model NL4MP-B. Equal by Switchcraft or Calrad.
    d. Cable-end Microphone/Auxiliary Connectors shall be 3-pin XLR equivalent to Neutrik model NC3XX or equal by Switchcraft or Calrad.

e. Furnish and install the required number of jacks and connectors as indicated on the drawings.

f. Multi-pin connector: Provide, where shown on plans and as described in Section 1 of these specifications, multi-pin, panel-mounted, quick disconnect connectors, sized to handle a minimum of 28 balanced audio channels (3 pins x 28 channels = 84 pins). Provide with protective caps. Approved manufacturers: Whirlwind, Veam, Cannon, Amphenol, Ramtech, Edac/Elco.

PART 3 - EXECUTION

3.01 GENERAL

A. Installation shall follow industry standard wiring and installation practices, and shall meet or exceed industry standards for such work, with particular attention given to any installation instructions in Parts 1 and 2 of these Specifications.

B. Equipment shall be secured firmly with proper types of mounting hardware. All equipment affixed to the building structure must be self-supporting with a safety factor of at least six unless otherwise stated.

C. All equipment shall be installed so as to provide reasonable safety to the operator.

D. All overhead or wall-mounted speaker systems shall be supported from the building structure utilizing the materials and methods recommended by the speaker manufacturer and good rigging practices, providing a load-rated safety factor of six (6). All required installation material and labor shall be deemed included in these specifications.

E. Furnish the system to facilitate expansion and servicing using modular, solid-state components. All equipment shall be designed and rated for continuous operation and shall be UL listed where applicable, or manufactured to UL standards.

F. Labeling

1. Clearly and permanently label all jacks, controls and connections with engraved laminated plastic labels or with engraved and back-filled mounting plates. Attach laminated plastic labels with contact cement.
2. Identify and permanently label all wires and cables at every point of termination and connection point with industry-standard cable markers. All cable identifications shall be logged, marked on drawings where appropriate and included in the owners' manual.

3.02 EQUIPMENT CABINETS

A. Locate freestanding equipment cabinet(s) where indicated and provide service access to both front and rear without having to move cabinets.

B. Install equipment in cabinets with ventilating panels and fans as required to provide adequate ventilation and according to equipment manufacturers' recommendations.

C. Connect all microphone, line level, DC control and speaker cables to equipment cabinets via approved audio terminal blocks. Use spade lugs if barrier strips are used. Do not buss commons together. Do not ground.

D. Locate patch panels and all frequently used controls at least 30" above floor.

E. Fill unused rack space with blank or ventilating panels finished to match cabinet color.

F. Signal processing equipment with front panel controls that are to be permanently set (e.g. equalizers, limiters, digital delays) shall be furnished with security panels or sub-panel mounted behind blank panels. Provide plastic vision panels to allow viewing of operational indicators such as meters or clipping indicators.

3.03 WIRING AND INTERCONNECTIONS

A. Observe proper circuit wiring polarity. No cables shall be wired with a polarity reversal between

connectors with respect to either end. Special care shall be taken when wiring microphone and speaker cables, to insure that uniform polarity is maintained. Balanced audio connectors shall be wired with shield at Pin #1, hi/positive at Pin #2.

B. Build-out all link circuits containing active components where necessary to provide proper impedance matching and optimum gain structure for maximum operating headroom and signal-to-noise ratio. Record all pad values in the final documentation.

C. All audio circuits shall be balanced and floating, except as noted in the specifications or directed by the Engineer at the time of final equalization and testing. Shields of audio cables installed between active interconnected equipment components shall be grounded at the sending end only.

D. All cables shall be installed in conduit except above accessible ceilings, where they shall be installed utilizing J-hooks or bridle rings on minimum 4 ft. centers or cable tray, where available. Provide an electrical wall box with conduit stubbed above accessible ceilings for all wall-mounted peripheral devices.

E. Separate conduits and/or cable harnesses shall be maintained for cables in the following categories:
   1. Levels below -20 dBm (microphone).
   2. Nominal levels from -20 dBm to +30 dBm (line).
   3. Loudspeaker
   4. Control
   5. Power

F. Group and route all cables within equipment cabinets according to type and function and separate according to signal levels. All cables shall be continuous lengths without splices.

G. All system wire shall be terminated by approved soldered or mechanical means. No unterminated wire ends will be accepted. Heat shrink type tubing shall be used to insulate and dress the ends of all ground or drain wires.

H. All solder joints and terminations shall be made with rosin-core silver solder.

I. Mechanical connections shall be made using approved connectors of the correct size and type for the connections. Wire nuts are not acceptable except in the case of distributed, constant-voltage speaker systems.

3.04 GROUNDING

A. Ground active components, equipment cabinets and audio line shields to independent audio system ground and to ground buss in the power panel.

B. Ground all conduits ONLY to power system ground. Insulate all conduits and electrical boxes from sound system, including audio equipment cabinets and audio system ground.

C. Insulate all conductors, including shields, from conduit, backboxes and from each other for the entire conduit length.

D. Take such precautions as may be necessary to prevent and guard against electro-magnetic and electro-static hum and to install the equipment so as to provide normal and reasonable safety for the operator.

3.05 TESTS AND ADJUSTMENTS

A. The completed sound system is to be inspected and tested for compliance with the Specifications.

B. The testing and equalization work shall be performed after the installation work has been completed, but prior to any use of the system.

C. The process of equalizing and testing the system may necessitate moving, adjusting or re-aiming certain loudspeakers. Adjustments shall be performed without claim for additional payment.

D. Coordinate as necessary to ensure a totally quiet room during the sound reinforcement systems testing and balancing period.

E. Tests - Prior to requesting systems acceptance testing, verify the following:
   1. Absolute Impedance:
      a. With loudspeaker level controls at zero attenuation and amplifiers disconnected, measure and record the absolute impedance value of each loudspeaker line at 250,1000 and 4000 Hz. Impedance shall be at least 90% of rated load impedance of respective amplifier.
   2. Check and record resistance of all lines to input receptacles, with receptacles open and short-circuited.
   3. Parasitic Oscillation And RFI Pickup
      a. Set up system for each mode of operation.
      b. Use 5MHz bandwidth oscilloscope and loudspeaker monitoring.
      c. Check to ensure that the system is free of spurious oscillation and RF pickup in the absence of any input signal and also with the system driven momentarily at full output at 160 Hz.
   4. Buzzes, Rattles And Distortion
      a. Apply a high quality music signal to the system. Adjust for frequent peaks at the specified system maximum sound pressure level.
      b. Apply a sine-wave sweep from 30-5,000 Hz at 6 dB below full amplifier power.
      c. In both cases, listen carefully for buzzes, rattles and objectionable distortion.
      d. Correct all causes of such defects. If a cause is outside the system, promptly notify the Engineer of the cause and suggested corrective procedures.
   5. Gain Structure: Adjust input sensitivity and output levels of interconnecting active devices in each signal chain for maximum headroom and signal-to-noise ratio. All devices in each signal chain should clip at the same time as gain is increased.

3.06 EQUALIZATION

A. Measure system acoustical performance using a calibrated sound level meter set for "slow" meter damping and flat response with random incidence at a height of 4 to 5 feet. All interior furnishings shall be in place and system gain shall be adjusted to provide levels of 70 to 80dB and at least 10dB above ambient noise levels at the measuring locations.

B. Using a precision calibrated 1/3 octave audio frequency analyzer and filtered pink noise, with all control equalization set for flat response, measure and record loudspeaker frequency response in 1/3 octave bands. Measurement microphone shall be placed on-axis to the pertinent speaker, in the center of each seating area.

C. Adjust equalization to provide average system response within +/-3 dB of a response curve that is flat from 300-3000 Hz then sloped uniformly to -4dB at 12KHz. Record both equalizer settings and analyzer curves.

D. Delay Settings: With the measurement microphone at a reference point that is within the coverage pattern of the FOH point-source reference cluster and on-axis of the delayed speaker, adjust the relative gain of the latter so that it is within 10dB of the SPL of the reference speaker. Calculate the differential in path length between the FOH point-source cluster reference cluster and the delayed speaker to the reference point and divide that distance by 1.13 to arrive at the time offset in milliseconds (msec). To that figure, add 18msec (+/- 2msec) to arrive at the delay offset of the delayed speaker(s). Calculate and program this delay setting for each delayed speaker or set of speakers.

E. Feedback Eliminator Settings: Set all filters to “dynamic” vs. “fixed” and fix the bandwidth of the filters at $1/10^{th}$ octave.

F. Should the performance testing show that the Contractor has not properly completed the installation and setup, the Contractor shall make all necessary corrections or adjustments, and a second demonstration shall be arranged at the Contractor's additional expense.

3.07 SYSTEM PERFORMANCE

A. After equalization and testing, the sound system shall meet or exceed the following specifications:
   1. System shall be free of short circuits, ground loops, parasitic oscillation, excessive system noise, hum, RF interference and instability of any form.
   2. Maximum short-term SPL with 300Hz to 3000Hz band limited pink noise input to the system shall be 110dB-SPL before audible distortion or clipping occurs.
   3. Seat to seat variation of SPL at 2kHz octave band pink noise shall be within a tolerance of +/-3dB.
   4. Acoustic response of the system shall be +/-3dB along a line which is flat from 300Hz to 3000Hz and which rolls off at 2dB/octave to 12kHz and 12dB/octave below 200Hz as measured in the seating area.

3.08 SYSTEMS ACCEPTANCE TESTING AND TRAINING

A. A qualified technical representative of the system contractor shall do systems acceptance testing. Installation must be complete in all respects before acceptance testing. Acceptance testing and training must be scheduled on separate dates to allow time for corrections, if necessary. Once all functions and devices within the system have been adequately demonstrated to be working properly, a complete owner's manual will be presented to the Owner's agent. It shall contain a comprehensive list of all supplied equipment, a complete point-to-point system wiring diagram with "AS BUILT" wire numbers indicated, details of hook-up connections including build-out devices (active and passive), systems control settings record, the final test results including plotted frequency response curves, operation and maintenance manuals for each active device including schematic diagrams and parts list.

B. The contractor shall have test equipment available on site during the testing period. He shall provide a listing of the specific equipment to be made available to the Engineer, prior to the testing appointment. The following minimal standard test equipment shall be provided:
   1. Oscilloscope - 10 MHz bandwidth
   2. 1/3 Octave real time analyzer
   3. Calibrated microphone
   4. Broadband random noise source
   5. Sine wave generator
   6. Low distortion sweepable sine wave oscillator
   7. Distortion analyzer
   8. AC impedance bridge
   9. Sound level meter
   10. Multimeter

C. The Contractor shall be prepared to verify the performance of any portion of the system by demonstration, listening tests and/or instrument measurements.

D. Acceptance tests may include speech intelligibility surveys and subjective evaluations by observers listening at various positions under various conditions using speech, music, and live or recorded program material.

E. Measurement of frequency response, distortion, noise, or other characteristics shall be performed (or a demonstration test requested) if deemed necessary to determine conformity with specifications.

F. The Contractor shall make additional mechanical and electrical adjustments within the scope of the work and which are deemed necessary by the Architect/Engineer as a result of acceptance tests.

G. Test Reports And Certification: Submit results of all tests conducted above and certification that the installation is complete and ready for checkout as specified.

3.09 OWNER TRAINING AND FAMILIARIZATION

A. Training of owner's personnel shall be performed by the Contractor. The Owner and/or his designated representative shall be fully advised as to the function of all operating controls and in techniques necessary to ensure proper operation of the entire system. The training session may include more than one trainee. If possible, several people should be trained. It may be necessary

to return for another session, possibly during an actual use of the system. Provide a minimum of eight (24) hours of instruction and familiarization for this purpose.

B. The Engineer or his representative will participate during the training period.

C. The training phase shall be accompanied by complete as-built documentation and the custom Technical System Operation manual. Review of the owner's manual and demonstration of all systems functions is required.

END OF SECTION

1) System shall be free of short circuits, ground loops, parasitic oscillation, excessive system noise, hum, RF interference and instability of any form.

2) Maximum short-term SPL with 300Hz to 3000Hz band limited pink noise input to the system shall be 110dB-SPL before audible distortion or clipping occurs.

3) Seat to seat variation of SPL at 2kHz octave band pink noise shall be within a tolerance of +/-3dB.

4) Acoustic response of the system shall be +/-3dB along a line which is flat from 300Hz to 3000Hz and which rolls off at 2dB/octave to 12kHz and 12dB/octave below 200Hz as measured in the seating area.

3.7 Systems Acceptance Testing And Training

A. A qualified technical representative of the system contractor shall do systems acceptance testing. Installation must be complete in all respects before acceptance testing. Acceptance testing and training must be scheduled on separate dates to allow time for corrections, if necessary. Once all functions and devices within the system have been adequately demonstrated to be working properly, a complete owner's manual will be presented to the Owner's agent. It shall contain a comprehensive list of all supplied equipment, a complete point-to-point system wiring diagram with "AS BUILT" wire numbers indicated, details of hook-up connections including build-out devices (active and passive), systems control settings record, the final test results including plotted frequency response curves, operation and maintenance manuals for each active device including schematic diagrams and parts list.

B. The contractor shall have test equipment available on site during the testing period. He shall provide a listing of the specific equipment to be made available to the Engineer, prior to the testing appointment. The following minimal standard test equipment shall be provided:

1) Oscilloscope - 10 MHz bandwidth

2) 1/3 Octave real time analyzer

3) Calibrated microphone

4) Broadband random noise source

5) Sine wave generator

6) Low distortion sweepable sine wave oscillator

7) Distortion analyzer

8) AC impedance bridge

9) Sound level meter

10) Multimeter

C. The Contractor shall be prepared to verify the performance of any portion of the system by demonstration, listening tests and/or instrument measurements.

D. Acceptance tests may include speech intelligibility surveys and subjective evaluations by observers listening at various positions under various conditions using speech, music, and live or recorded program material.

E. Measurement of frequency response, distortion, noise, or other characteristics shall be performed (or a demonstration test requested) if deemed necessary to determine conformity with specifications.

F. The Contractor shall make additional mechanical and electrical adjustments within the scope of the work and which are deemed necessary by the Architect/Engineer as a result of acceptance tests.

G. Test Reports And Certification: Submit results of all tests conducted above and certification that the installation is complete and ready for checkout as specified.

3.8 Owner Training and Familiarization

A. Training of owner's personnel shall be performed by the Contractor. The Owner and/or his designated representative shall be fully advised as to the function of all operating controls and in techniques necessary to ensure proper operation of the entire system. The training session may include more than one trainee. If possible, several people should be trained. It may be necessary to return for another session, possibly during an actual use of the system. Provide a minimum of eight (24) hours of instruction and familiarization for this purpose.

B. The Engineer or his representative will participate during the training period.

C. The training phase shall be accompanied by complete as-built documentation and the custom Technical System Operation manual. Review of the owner's manual and demonstration of all systems functions is required.

END OF SECTION

SECTION 27 51 21
AUDITERIA SOUND REINFORCEMENT SYSTEM

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, General and Special Conditions and Division 1 Sections apply to this Section.

B. 27 00 05 – Basic Requirements

C. 27 00 10 – Basic Materials and Methods

1.02 SCOPE OF WORK

A. Provide a sound system for the Auditeria (Total 2) as defined in these specifications and shown on the drawings. The system shall include all audio components as well as connecting cables and hardware.

B. Work to be done in Green and Central Elementary Schools.

1.03 QUALITY ASSURANCE

A. NFPA 70 - National Electrical Code.

B. Underwriter's Laboratory.

C. TIA/EIA-607 Telecommunications Grounding.

D. Tenth Edition (or latest) BICSI Telecommunications Distribution Methods Manual (TDMM).

E. American with Disabilities Act.

F. Federal Communications Commission Part 15.

G. Sound System Engineering (Davis & Patronis) – 3rd Edition 2006.

H. Audio Systems Design and Installation (Giddings) 1990.

1.04 SYSTEM WARRANTY

A. The Sound System shall be warranted by the contractor for a period of one (1) year from date of substantial completion.

PART 2 – PRODUCTS

2.01 GENERAL

A. All equipment items shall be new and unused.

B. The following sections specifically list the acceptable equipment types and items for this project. Where quantities are not noted, they may be obtained from the drawing. In the event of a discrepancy between the specifications and the drawings, the greater quantity or better quality shall be furnished.

C. Speaker locations are shown on the drawings for bidding purposes only. The exact speaker locations, aiming points and mounting angles shall be coordinated with the Engineer and determined through the use of an acoustical modeling program and good engineering practices. Speaker aiming shall be adjusted as required after installation to provide optimal coverage and system performance.

D. Furnish an equipment rack for use in housing the equalizers, processors, power amplifiers and ancillary devices necessary to the operation of the system.

E. Heat-producing components, such as power amplifiers, shall be mounted with one 1-3/4" vent panel installed between units. Fill all other unused portions of rack front sections with matching blank panels.

F. Furnish five (5) keys for each type of equipment rack lock installed. Lock types shall be coordinated with Owner.

G. Install the required number of units, of sufficient size to accommodate the equipment specified, at the locations indicated in the drawings.

H. Furnish and install the following:

I. Main equipment rack: Middle Atlantic or approved equal wall-mounted cabinet with solid locking front door (Qty: 1). Provide a Middle Atlantic rack-mounted power strip and 3-space storage drawer. Equals by Atlas Sound or Lowell. Rack shall be utilized to house the following in addition to providing a minimum of four EIA spare rack spaces for future expansion:
   1. Mixer/Premplifier
   2. Power Amplifier
   3. CD Player/Cassette Deck
   4. Digital Signal Processor
   5. Wireless Microphone Receiver
   6. Storage Drawer
   7. AC Power Strip

J. Mixer/Preamplifier: Shall provide up to eight (8) channels of modular input. Each channel shall be field configurable with plug in modules. Unit shall provide individual volume controls for each channel as well as a master volume and tone controls. Unit shall be provided with number and configuration of plug in modules as required by system description. TOA equal by Intellix or Peavey. (Qty. 1) Provide with rack mount kit and the following modules:
   1. Microphone Input Module with mute-receive. TOA for each microphone-level input. Equal by Intellix or Peavey.
   2. Unbalanced Line Input Module with mute-receive. TOA for CD Player/Cassette Deck. Equal by Intellix or Peavey.
   3. Unbalanced Line Input Module with mute-send. TOA for interface with Central Sound System for muting during pages. Equal by Intellix or Peavey.

K. Power Amplifier: The power amplifier shall be a mono-bridged stereo power amplifier providing 200w/channel @ 70 volts in the stereo mode or 400 watts @ 140 volts in the mono-bridged mode with less than 0.05% THD at 1kHz. Frequency response shall be 20Hz – 20kHz ± 0.2dB. The damping factor shall be >500. A variable speed, low-noise fan shall provide front-to-rear ventilation. Clip limiting, high pass filters and operation mode shall be adjustable via dipswitch settings. Protection circuitry shall include DC, infrasonic, thermal overload and short-circuit protection. The manufacturers warranty shall provide warranty coverage for three (3) years. Provide one (1) QSC power amplifier or equal by Crown or EVI.

L. Signal Combiners
   1. The auxiliary inputs from the combination microphone/auxiliary input jack plates shall be combined for insertion into a single channel of the Mixer-Amplifier. Provide one (1) Radio Design Labs microphone combiner or equal by Atlas Sound or FSR.
   2. Stereo line level signals to and from the cassette tape deck shall be combined/split for interfacing to the monaural playback input and record output of the mixer/preamplifier. Provide Radio Design Labs line level combiner or equal by Atlas Sound or FSR.

M. Audio Digital Signal Processor
   1. The Audio Digital Signal Processor shall be a single channel, software-controlled (RS-232 interface to external computer) multi-function unit incorporating the following functions:
      a. Peak Limiter: Threshold (-60dBFs to –0.5dBFs), Attack (1ms – 200ms), Decay (50ms to 1000ms), Ratio (infinity to 1)
      b. Ten bands of variable frequency (+6/ -18dB per band), variable Q (1/40 – 2 octave) parametric equalization
      c. Graphic Equalizer – 30 constant-Q bands on ISO, 1/3-octave centers (+6dB, -12dB) with high- and low-pass filters (12dB/octave nominal)
      d. Shelf (+6dB –18dB) and Rolloff (6dB, 12dB, 18dB, 24dB) Filters
      e. Digital Delay – up to 1300ms
      f. Ten (10) Feedback Reduction Filters – 1/10-octave adaptive notch filters with adjustable (High vs. Low) Q
   2. Additionally, the unit shall have the following features:
      a. Minimum 48kHz sampling rate for flat response to 20 kHz
      b. Minimum 104dB, A-weighted dynamic range
      c. Minimum 20-bit resolution digital-analog conversion
      d. Front panel 3-scene selection and DFR filter control

3. Provide one (1) Shure or equal by dbx or Biamp with rack-mount hardware.

N. CD Player/Cassette Deck with MP3 Audio Input
   1. The CD Player/Cassette Deck shall be a rack-mounted combination unit capable of either separate or mixed output. The cassette deck shall be wired to the system mixer-amplifier to enable the recording of local programs. Provide one (1) Denon or equal by Marantz or Tascam.

O. Wireless Microphone System
   1. The Wireless Microphone System shall be a VHF diversity type with handheld microphone/transmitter. It shall provide dual diversity reception from two external equipment cabinet-mounted ½ wave antennas. The operating frequency shall be selected to provide a minimum possibility of interference from local RF signals.
   2. The handheld transmitter/microphone shall have an 18-20 hour battery life using a single 9V battery. It shall provide adjustable gain control, three-segment LED battery power indicator, mute and power switches and a grip/switch cover. Provide with stand-mount swivel adaptor. The microphone element shall be a cardioid dynamic type.
   3. Provide one Shure rack-mounted, dual diversity receiver with handheld microphone/transmitter and two (2) Shure remote antenna kits or equal by Audio Technica or Telex.

P. Assistive Listening System shall include a transmitter and 4 receivers with ear buds (2 of the 4 must be hearing aid compatible).
   1. Provide system equal to Telex, TOA or Williams.

Q. Microphones
   1. Provide one (1) handheld cardioid dynamic microphone with 25ft. cord and microphone stand. Shure microphone or equal by Audio Technica or Audix with ProCo mic cord or equal by Whirlwind, Conquest and Atlas Sound mic stand or equal by K&M or Ultimate.
   2. Hanging microphones shall be provided as shown on plans. Each cardioid miniature hanging microphone shall have a frequency response of 30 to 20 KHz. The shielded preamp mounts to a single gang box. Provide a 30’ braided shield cable to maintain horizontal aiming. Provide hanging microphones by Electro Voice or equals by Sony or Panasonic.

R. Main stage speakers shall be installed "over the proscenium" as shown on the plans. Each speaker shall be a two-way, full range cabinet with 100x50 deg. Constant directivity high frequency horn and a 12” low frequency transducer. Speakers shall have a minimum SPL at 1W/1m of 95dB, nominal impedance of 8 ohm, 600W program/2400W peak power handling. Provide 2 speakers by JBL or equals by Electro Voice or Yamaha with appropriate mounting hardware. Coordinate speaker color with architect prior to installation.

S. Assistive Listening System shall include a transmitter and 4 receivers with ear buds. Provide 1 system equal to Telex , Williams or Nady.

2.02 WIRE AND CABLE

A. All wire and cables shall be new and unused.

B. Wire not installed in equipment racks, not portable, or not installed in conduit shall be fire and plenum rated and meet all applicable codes.

C. Speaker cable: West Penn 25225 stranded 16AWG twisted pair for equipment rack internal wiring and from the equipment rack pull box to the loudspeaker drivers.

D. Microphone-level and line-level audio cable (installed in conduit, not portable): West Penn 291 stranded 22 AWG twisted pair with foils shield or approved equal.

E. Portable microphone cables: ProCo M-Series black flexible cable or equal by West Penn or Audio Technica.

F. Other equipment control cables shall be stranded wire, appropriately shielded, of gauge and number of conductors required by the manufacturer for proper operation of the system or equipment item furnished.

G. Wire and cable for all other devices shall be supplied in accordance with the recommendations of the device manufacturer and the National Electrical Code.

H. Acceptable cable manufacturers: Belden, Carol, General or West Penn.

2.03 JACK CONNECTORS AND WALLPLATES

A. All plate-mounted connectors shall be ground-insulated from the plates on which they are mounted.

B. All other jacks shall be installed on standard stainless steel finish plates. Nomenclature shall be engraved into the plate with 1/8" block letters filled with black paint. All mic jack locations shall be numbered consecutively, starting from one (1).

C. Unless otherwise specified, all jacks and connectors for the sound system shall be as follows:

1. Microphone and line input receptacles shall be 3-pin XLR-F with locking tab equivalent to Neutrik model NC3FP-1 or equal by Switchcraft or Studio 1.

2. Combination microphone/auxiliary input jackplates shall be impedance matching units suitable for interfacing one unbalanced high- or low-impedance source to a balanced low-impedance microphone preamplifier input. There shall be one ¼" 3-conductor phone jack marked "PROJ IN" and two RCA phono jacks marked "LINE IN L/R with a resistive mixing network to sum stereo line-level sources. A linear input level control will control the level of the auxiliary inputs. A "HUM CANCEL" rocker-type switch will selectively isolate the shields. A separate female XLR connector shall provide for a separate microphone input. There shall be no electrical connection between the impedance matching circuit and the microphone circuit. Provide Pro Co AVP-1V A/V interface jackplate assemblies or equal by Whirlwind or Conquest where shown on drawings.

3. Cable-end Microphone Connectors shall be 3-pin XLR equivalent to Neutrik model NC3XX or equal by Switchcraft or Calrad.

4. Furnish and install the required number of jacks and connectors as indicated on the drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Furnish components, racks, wire, cabinetry, connectors, materials, parts, equipment and labor necessary for the complete installation of the systems, in full accordance with the recommendations of the equipment manufacturers and the requirements of the drawings and specifications.

B. Installation shall follow standard broadcast wiring and installation practice, and shall meet or exceed industry standards for such work, with particular attention given to any installation instructions in Parts 1 and 2 of these Specifications.

C. Equipment shall be held firmly in place with proper types of mounting hardware. All equipment affixed to the building structure must be self-supporting with a safety factor of at least six. All equipment shall be installed so as to provide reasonable safety to the operator. Supply adequate ventilation for all enclosed equipment items that produce heat.

D. All overhead or wall-mounted speaker systems shall be supported from the building structure utilizing the materials and methods required by the speaker manufacturer and providing a load-rated safety factor of 6X. All required installation material and labor shall be deemed included in these specifications.

E. Furnish the system to facilitate expansion and servicing using modular, solid-state components. All equipment shall be designed and rated for continuous operation and shall be UL listed where applicable, or manufactured to UL standards.

F. Observe proper circuit polarity and loudspeaker wiring polarity. No cables shall be wired with a polarity reversal between connectors with respect to either end. Special care shall be taken when wiring microphone cables, to insure that uniform polarity is maintained. Balanced audio connectors shall be wired as follows:

1.	Wire	Connector	Signal
2.	Black	Pin #3 or Ring	Lo or Neg
3.	Red or White	Pin #2 or Tip	Hi or Pos
4.	Bare	Pin #1 or Shield	Ground

G. Terminate all unused inputs and outputs with proper precision-shielded resistors. Build-out or terminate all link circuits containing active components to provide proper impedance matching. Record all pad values in the final documentation.

H. All audio circuits shall be balanced and floating, except as noted in the specifications or directed by the engineer at the time of final equalization and testing. Shields of audio cables shall be grounding at one the sending end only of the various active interconnected equipment items in the system.

I. Route cables and wiring within equipment racks and cabinetry according to function, separating wires of different signal levels (video, microphone level, line level, amplifier output, 120VAC, intercom, control, etc.) by as much physical distance as possible. Neatly arrange and bundle all cables loosely with plastic cable ties. Cables and wires shall be continuous lengths without splices.

J. All system wire, except spare wire, after being cut and stripped, shall have the wire strands twisted back to their original lay and be terminated by approved soldered or mechanical means. No unterminated wire ends will be accepted. Heatshrink type tubing shall be used to insulate and dress the ends of all ground or drain wires.

K. All cables in conduits shall be insulated from each other and from the conduit the entire length and shall not be spliced. All cables and wires are to be continuous lengths without splices.

L. All solder joints and terminations shall be made with rosin-core silver solder.

M. Temperature regulated soldering irons rated at least 60 watts shall be used for all soldering work. No soldering guns or temperature unregulated irons shall be used.

N. Mechanical connections shall be made using approved connectors of the correct size and type for the connections. Wire nuts will not be accepted except in the case of distributed, constant-voltage speaker systems.

O. Each mechanical connector shall be attached using the proper size controlled-duty-cycle ratcheting crimp tool that has been approved by the manufacturer of the connectors. Conventional non-ratcheting type crimping tools are unacceptable, and shall not be used on the job site.

P. Label all wires in racks and at consoles as to destination and purpose. Clearly and permanently label all jacks, controls and connections with permanent engraved laminated plastic labels or by engraving and filling mounting plates, unless otherwise noted. Attach laminated plastic labels with contact cement. Embossed or printed label tape, and press-on or lift-off lettering systems will not be accepted. All labeling shall be completed prior to final system inspections. If permanent labels cannot be furnished prior to final system inspections, temporarily label all controls with write-on tape.

3.02 TESTING

A. The completed sound system is to be inspected and tested for compliance with the Specifications.

B. The testing and equalization work shall be performed after the installation work has been completed, but prior to any use of the system.

C. The process of equalizing and testing the system may necessitate moving, adjusting or re-aiming certain loudspeakers. Adjustments shall be performed without claim for additional payment.

D. Coordinate as necessary to ensure a totally quiet room during the sound reinforcement systems testing and balancing period.

E. Prior to requesting systems acceptance testing, verify the following:

1. All systems are in first class working condition and free of short circuits, ground loops, parasitic oscillations, excessive system noise beyond published specifications of the equipment, hum, RF interference, or instability of any form.

2. All loudspeaker circuits have been tested, properly and are in perfect working order. Furnish impedance measurements of each circuit prior to final tests.

3. All equipment controls are labeled, even if unused

4. Operation manuals for every furnished equipment item are on hand at the job site.

F. Should the performance testing show that the Contractor has not properly completed the systems, the Contractor shall make all necessary corrections or adjustments, and a second demonstration shall be arranged at the Contractor's additional expense.

3.03 SYSTEM PERFORMANCE

A. After equalization and testing, the sound system shall meet or exceed the following specifications:

1. System shall be free of short circuits, ground loops, parasitic oscillation, excessive system noise, hum, RF interference and instability of any form.

2. Maximum SPL with band limited pink noise input to the system shall be 100dB before audible distortion or clipping occurs.

3. Seat to seat variation of SPL at 4kHz octave band pink noise shall be within a tolerance of plus or minus 3dB.

4. Acoustic response of the system shall be plus or minus 3dB along a line which is flat from 100Hz to 3000Hz and which rolls off at 2dB per octave to 20kHz.

3.04 TRAINING

A. The Contractor shall furnish the Owner's representatives with training necessary to properly operate the systems. Demonstrate in detail all functions of the systems. Provide a minimum of eight (8) hours of instruction and familiarization for this purpose.

B. The training phase shall be accompanied by complete as-built documentation and the custom Technical System Operation manual.

END OF SECTION

SECTION 27 51 22
STUDENT DINING / CAFETERIA SOUND REINFORCEMENT SYSTEM

PART 1 GENERAL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, General and Special Conditions and Division 1 Sections apply to this Section.

B. 27 00 05 – Basic Requirements

C. 27 00 10 – Basic Materials and Methods

D. 27 51 24 – Gymnasium Sound System

1.02 SECTION INCLUDES

A. High School Dining room sound system and components for recording and playback of audio program material.

B. Connection to High School Gymnasium Sound system to allow sound to be played over the dining room speakers from the gym system.

1.03 QUALITY ASSURANCE

A. NFPA 70 - National Electrical Code.

B. Underwriter's Laboratory.

C. TIA/EIA-607 Telecommunications Grounding.

D. Tenth Edition (or latest) BICSI Telecommunications Distribution Methods Manual (TDMM).

E. American with Disabilities Act.

F. Federal Communications Commission Part 15.

G. Sound System Engineering (Davis & Patronis) – 3rd Edition 2006.

H. Audio Systems Design and Installation (Giddings) 1990.

1.04 SYSTEM WARRANTY

A. The Sound System shall be warranted by the contractor for a period of one (1) year from date of substantial completion.

PART 2 PRODUCTS

2.01 MATERIALS

A. Stationary Main Equipment Cabinet with the following rack mounted equipment:

1. Mixing console shall have 12 mic/line inputs and 4 group outputs. Each microphone channel shall have balanced XLR and phone jack line inputs, channel insertion jack, gain trim control, peak indicators, 3 band EQ, monitor send, effects send, 4 group assignment switches, pan control and channel faders. Mixing console shall be a Yamaha or equal by Peavey or Mackie.
2. Dual channel power amplifier shall have a power rating of 400 watts per channel into a 4 ohm load. Rear mounted attenuators with balanced XLR jacks and screw terminal barrier strips. Speakers are connected via screw terminals. Frequency response shall be 20Hz to 20KHz and have a signal to noise ratio of 104dB. Provide a power amplifier Crown or equal by TOA or Yamaha.
3. Graphic equalizer shall be a 1/3 octave, 31 band unit with 6 or 12dB of boost or cut. Inputs shall be XLR balanced connectors and standard unbalanced phone jacks. Provide a graphic equalizer. Yamaha or equal to Sabine or Crest.

4. The Compact disk player shall be a Marantz or equal by Carver or Sony. It shall be rack mounted with CD Text capability.
5. MP3 Audio Input.

B. Main speakers shall be installed on the wall as shown on the plans. Each speaker shall include 90 x 40 horn, 2" titanium compression driver and 12" lone speaker. Speaker shall include a built-in crossover network and be capable of handling 400 watts of program material. The frequency response shall be 60Hz to 16kHz. Provide (2) speakers Electro Voice, JBL or EAW with appropriate mounting hardware.

C. Stand microphones shall be dynamic cardioid with extended frequency range and ON/OFF switch and 25' cable. Provide 1 stand microphones equal to Electro Voice, Sony or Panasonic. Provide 1 floor stands by Atlas Soundolier or equal by Fender or Quiklok.

D. Handheld wireless microphone shall be a true diversity type with balanced XLR output connector. The handheld transmitter shall include a cardioid condenser element and include a stand adapter. Provide 1 handheld wireless microphone system equal to Telex, TOA or Williams.

E. Assistive Listening System shall include a transmitter and 41 receivers with ear buds (10 of the 41 must be hearing aid compatible).
1. Provide system equal to Telex, TOA or Williams.

F. Provide miscellaneous mic jacks, cable, connectors, patch cords and etc. to provide a complete system.

G. Distributed Jackplates
1. Microphone input jackplates (XLR-F connectors).
2. Balanced, auxiliary-input, jack plate assemblies.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install and balance system. Adjust all sound levels for desired operation levels and evenness of coverage.

B. Adjust all wireless equipment and verify coverage areas.

C. Check polarity of all speakers and adjust all microphone and source input levels.

D. Connect FM Tuner to external, building mounted FM Antenna and Distribution System. Ground Antenna in accordance with NEC and TIA/EIA-607.

E. Ground equipment cabinet and associated equipment to cabinet-mounted telecommunications grounding busbar in accordance with NEC and TIA/EIA-607

F. Install in accordance with manufacturer's installation instructions and recommendations.

3.02 PERFORMANCE TESTING

A. Frequency response: 80Hz – 14kHz +/- 3 dB.

B. Loudness: At least 90 dB-SPL program level with an additional 6 dB Crest factor.

C. Evenness of coverage: Variation of less than +/- 3dB (400Hz to 4000Hz) at all seats.

3.03 TRAINING

A. Provide eight (8) hours training for District's personnel on the operation and maintenance of the system.

B. Provide two (2) video copies of all training

END OF SECTION

SECTION 27 51 24

HIGH SCHOOL GYMNASIUM SOUND REINFORCEMENT SYSTEM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, General and Special Conditions and Division 1 Sections apply to this Section.

B. 27 00 05 – Basic Requirements

C. 27 00 10 – Basic Materials and Methods

D. 27 51 22 – Dining Room Sound System

1.02 SECTION INCLUDES

A. High School Gymnasium sound system and components.

B. Tie in to High School Student Dining Room system speakers to allow sound to be played over the dining room system from the Gymnasium system.

1.03 QUALITY ASSURANCE

A. NFPA 70 - National Electrical Code.

B. Underwriter's Laboratory.

C. TIA/EIA-607 Telecommunications Grounding.

D. Tenth Edition (or latest) BICSI Telecommunications Distribution Methods Manual (TDMM).

E. American with Disabilities Act.

F. Federal Communications Commission Part 15.

G. Sound System Engineering (Davis & Patronis) – 3rd Edition 2006.

H. Audio Systems Design and Installation (Giddings) 1990.

1.04 SYSTEM WARRANTY

A. The Sound System shall be warranted by the contractor for a period of one (1) year from date of substantial completion.

PART 2 PRODUCTS

2.01 GENERAL

A. All equipment items shall be new and unused.

B. The following sections specifically list the acceptable equipment types and items for this project. Where quantities are not noted, they may be obtained from the drawing. In the event of a discrepancy between the specifications and the drawings, the greater quantity or better quality shall be furnished.

C. Speaker locations are shown on the drawings for bidding purposes only. The exact speaker locations, aiming points and mounting angles shall be coordinated with the Engineer and determined through the use of an acoustical modeling program and good engineering practices. Speaker aiming shall be adjusted as required after installation to provide optimal coverage and system performance.

2.02 MATERIALS

A. Main equipment cabinet: Furnish and install a cabinet with a solid locking front door and vented top panel. Provide a 3-space storage drawer. Approved equals as manufactured by Middle Atlantic, Atlas Sound, Lowell Mfrg., HOME, or Homaco. Rack shall be utilized to house the

following in addition to providing a minimum of four (4) EIA spare rack spaces for future expansion:

1. Mixer/Preamplifier
2. Power Amplifiers
3. Digital Signal Processor
4. Feedback Eliminator
5. SPL Computer
6. Storage Drawer
7. Sequencing AC Power Strip

B. Mobile equipment cabinet: Program Source Cabinet: Mobile equipment cabinet: Provide one (1) ten-EIA space mobile, rackmount high-impact polyethylene equipment cabinet with locking front and back covers and casters. SKB model SKB-19-10U or equal by Anvil or Cabbage. Provide with one (1) 20 ft. output patch cable. Rack shall be utilized to house the following:

1. Portable Mixer/Preamplifier
2. CD Player/Cassette Deck
3. MP3 Audio Input
4. Wireless Microphone Receiver
5. AC Power Strip
6. Jack Panel: Provide one (1) custom rear-mounted jack panel with 3-pin balanced XLR-F input connectors and XLR-M output connector.

C. Mixer/Preamplifier: Shall provide up to eight (8) channels of modular input. Each channel shall be field configurable with plug in modules. Unit shall provide individual volume controls for each channel as well as a master volume and tone controls. Unit shall be provided with number and configuration of plug in modules as required by system description. TOA or equal by Intellix or Peavey. (Qty. 1) Provide with rackmount kit and the following modules:

1. Microphone Input Module with mute-receive. TOA Model M-11S for each microphone-level input. Equal by Intellix or Peavey.
2. Unbalanced Line Input Module with mute-receive. TOA Model U-13R for CD Player/Cassette Deck. Equal by Intellix or Peavey.
3. Unbalanced Line Input Module with mute-send. TOA Model U-43S for interface with Central Sound System for muting during pages. Equal by Intellix or Peavey.

D. Central Sound System Interface: The Central Sound System Interface shall convert the 25 volt speaker-level audio signal to the wall-mounted paging horns to an unbalanced line level signal for insertion into the mute send module of the mixer amplifier. An 18awg twisted pair cable shall be parallel-wired to and extended from the nearest paging horn to the equipment cabinet to provide required the muting input signal. The mute-send line input module shall have its gain control set at minimum so that no paging signal is amplified by the local sound system. Provide one (1) Radio Design Labs 25 volt interface or equal by FSR or Jensen.

E. Power Amplifiers:

1. Voice Coil Speakers (Type C): The power amplifiers shall be a stereo power amplifier providing 500w/channel @ 8-ohms in the stereo mode with less than 0.05% THD, 20Hz – 20kHz. Frequency response shall be 20Hz – 20kHz ± 0.2dB. The damping factor shall be >500. A variable speed, low-noise fan shall provide front-to-rear ventilation. Clip limiting, high pass filters and operation mode shall be adjustable via dipswitch settings. Protection circuitry shall include DC, infrasonic, thermal overload and short-circuit protection. The manufacturers warranty shall provide warranty coverage for three (3) years. Provide two (2) QSC model power amplifiers or equal by Crown or EVI as shown in system block drawing.
2. Constant Voltage Speakers (Type D): Power Amplifier: The power amplifier shall be a stereo power amplifier providing 400w/channel @ 70 volts in the stereo mode with less than 0.05% THD at 1kHz. Frequency response shall be

20Hz – 20kHz ± 0.2dB. The damping factor shall be >500. A variable speed, low-noise fan shall provide front-to-rear ventilation. Clip limiting, high pass filters and operation mode shall be adjustable via dipswitch settings. Protection circuitry shall include DC, infrasonic, thermal overload and short-circuit protection. The manufacturers warranty shall provide warranty coverage for three (3) years. Provide one (1) QSC power amplifier or equal by Crown or EVI as shown in system block drawing.

F. Audio Digital Signal Processor

1. The Audio Digital Signal Processor shall be a two-channel, software-controlled (RS-232 interface to external computer) multi-function unit incorporating the following functions:
   a. Output Peak Limiter with variable gain, threshold, attack/release time.
   b. Multiple parametric filters with variable frequency, gain and Q.
   c. High and Low-Pass Shelf Filters with variable frequency, gain and Q.
   d. Multiple Digital Delays – 20.83 micro-second incremental and 910 millisecond maximum delay.
   e. Compressor with variable gain, threshold, ratio, attack/release time.
   f. Signal mute.
   g. Built-in noise (pink & white) generator and variable frequency tone generator.

2. Additionally, the unit shall have the following features:
   a. Minimum 48kHz sampling rate for flat response to 20 kHz
   b. Minimum 104dB, A-weighted dynamic range
   c. Minimum 24-bit resolution digital-analog conversion
   d. Front panel 3-scene selection and DFR filter control

3. Provide one (1) QSC Digital Signal Processor. Other approved manufacturers: Shure, dBX, EVI, Biamp, Rane, Peavey and Ivie.

G. Feedback Exterminator: A single channel feedback exterminator shall provide twelve fixed and dynamic filters (selectable) with switchable bandwidths (1/10 and 1/5 octave) and automatically detect and eliminate acoustic feedback. Signal-to-noise shall be >100dB and THD shall be <0.01%. Provide one (1) Feedback Exterminator or equal by Shure, dbx or Peavey.

H. The SPL Computer shall control the output level of the masking system in response to the sampled acoustical noise level, utilizing an external sensing microphone. The unit shall provide user-adjustable parameters to alter the way that it responds to changes in the ambient noise level. These parameters include: minimum and maximum gain, gain/sense ratio and averaging time. The unit shall be capable of operating in the active mode, passive mode or history mode, in which ambient noise history is stored. The unit shall provide balanced inputs and outputs. The gain control range shall be –30dB to +20dB with less than 0.025% THD and noise. A lockout function shall be incorporated to prevent parameter setting changes by unauthorized users. Provide one (1) Symetrix equal by Protech or RDL. Provide with one (1) Telex Remote Sensing Microphone sensing microphone where shown on floor plans or equal by Crown or Shure.

I. The CD Player/Cassette Deck with MP3 Audio Input shall be a rack-mounted combination unit capable of both separate or mixed output. The cassette deck shall be wired to the system mixer-amplifier to enable the recording of local programs. Provide one (1) Denon or equal by Marantz or Tascam.

J. Portable Mixer: The portable mixer, to be housed in the mobile source mixer cabinet, shall be rack-mountable and provide four (4) transformer-balanced microphone inputs, a switchable mic/line level transformer-balanced output, five (5) –10dB line-level inputs, 12-volt phantom power and an internal power transformer. Provide one (1) Shure mixer or equal by Intellix or Peavey.

K. AC Power Systems

L. Main Equipment Cabinet: Provide a combination of rack-mounted sequential-switching power strips and vertical power strips to adequately power all active audio devices in the main equipment cabinet.

1. The rack-mounted controller shall provide 6-step sequencing to remote switchable outlets via 12VDC and/or switch closure. Adjustable sequence delay intervals of 1-3-6 seconds and 4-step start delays shall be provided. The unit shall have six (6) LED sequencing status indicators and an LED for power indication. Provide one (1) Middle Atlantic model Universal Sequencing Controller or equal by Lowell, Atlas Sound, Furman or Surge-X.
2. The switchable power modules shall be capable of being remotely switched via 12VDC. They shall be wired to multiple 20-amp 120VAC circuits as required to provide adequate load distribution. Provide five (5) Middle Atlantic 20-amp duplex modules or equal by Lowell, Atlas Sound, Furman or Surge-X.
3. Provide one (1) Middle Atlantic un-switched module or equal by Lowell, Atlas Sound, Furman or Surge-X.
4. Provide one (1) Middle Atlantic modular power raceway or equal by Lowell, Atlas Sound, Furman or Surge-X with power jumpers as needed.
5. Provide one (1) Middle Atlantic remote key switch and LED status indicator panel or equal by Lowell, Atlas Sound, Furman or Surge-X.

M. Mobile Equipment Cabinet: Provide one (1) rack-mounted power distribution unit with eight (8) rear-panel outlets and one (1) front-panel outlet and spike/surge protection with EMI filtering and a 9-foot cord terminated with a NEMA 5-15R plug and an illuminated combination switch/circuit breaker. The rack-mounted power distribution unit shall occupy one (1) EIA rack space and be a Middle Atlantic or equal by Lowell, Atlas Sound, Furman or Surge-X.

N. Wireless Microphone System

1. The Wireless Microphone System shall be a VHF diversity type with handheld microphone/transmitter. It shall provide dual diversity reception from two external equipment cabinet-mounted ½ wave antennas. The operating frequency shall be selected to provide a minimum possibility of interference from local RF signals.
2. The handheld transmitter/microphone shall have an 18-20 hour battery life using AA batteries. It shall provide adjustable gain control, three-segment LED battery power indicator, mute and power switches and a grip/switch cover. Provide with stand-mount swivel adaptor. The microphone element shall be a cardioid dynamic type.
3. Provide a wireless headset
4. Provide one Shure rack-mounted, dual diversity receiver with handheld microphone/transmitter and two (2) Shure remote antenna kits or equal by Telex, Audio Technica or Beyer.

O. Assistive Listening System shall include a transmitter and 4 receivers with ear buds. Provide 1 system equal to Telex, Williams or Nady.

P. Microphones

1. Provide one (1) handheld cardioid dynamic microphone with 25ft. cord and microphone stand. Shure microphone or equal by EVI or Audix with ProCo mic cord and Atlas Sound mic stand or equals by K&M or Ultimate.
2. Provide one (1) cardioid dynamic noise-canceling desk microphone with telescoping neck and non-locking switch with frequency response of 40Hz-10KHz. Shure microphone or equal by Telex or Audio Technica with ProCo mic cord or approved equals.

Q. Loudspeakers:

1. The speakers shall be an 8" coaxial-type speaker with 38-ounce (LF) and 7.5-ounce (HF) barium ferrite ceramic magnets and a nominal impedance of 8 ohms. A true 2^{nd}/ 3^{rd} order crossover and high frequency compression driver shall be

integral to the unit. The frequency response of the speaker shall be 65Hz to 20KHz (+/- 6dB) with power handling capacity of 100 watts RMS referenced to EIA standard 426A. Axial sensitivity shall be not less than 95dB, 1watt/1meter. Dispersion at 2KHz (-6dB) shall be 100-degrees. Provide with a 100 watt/70-volt transformer with primary taps of 100, 64, 32, 16 watts. The transformer frequency response shall be 50Hz-15KHz (+/- 1dB) with an insertion loss of < .6dB. Provide with a 1 cu. ft. rectangular suspension enclosure and square white grille. Provide Lowell assembly or equal by EVI, Atlas Sound or JBL where shown on drawings. Speakers to match background color.

R. Wire and Cable
   1. All wire and cables shall be new and unused.
   2. Wire not installed in equipment racks, not portable, or not installed in conduit shall be fire and plenum rated and meet all applicable codes.
   3. Speaker cable: West Penn 226 14awg twisted pair, plenum-rated for equipment rack internal wiring and from the equipment rack pullbox to the loudspeakers. Equal by Belden or Carroll.
   4. Microphone-level and line-level audio cable (installed in conduit, not portable): West Penn 291 stranded 22 AWG twisted pair with foils shield. Equal by Belden or Carroll.
   5. Portable microphone cables: ProCo M-Series black flexible cable or equal by Whirlwind or Conquest.
   6. Other equipment control cables shall be stranded wire, appropriately shielded, of gauge and number of conductors required by the manufacturer for proper operation of the system or equipment item furnished.
   7. Wire and cable for all other devices shall be supplied in accordance with the recommendations of the device manufacturer and the National Electrical Code.

S. Jack, Connectors and Wall Plates
   1. All plate-mounted connectors shall be ground-insulated from the plates on which they are mounted.
   2. All other jacks shall be installed on standard stainless steel finish plates. Nomenclature shall be engraved into the plate with 1/8" block letters filled with black paint. All mic jack locations shall be numbered consecutively, starting from one (1).
   3. Unless otherwise specified, all jacks and connectors for the sound system shall be as follows:
      a. Microphone and line input receptacles shall be 3-pin XLR-F with locking tab equivalent to Neutrik model NC3FP-1 or equal by Switchcraft or Calrad.
      b. Microphone and line output receptacles shall be 3-pin XLR-M equivalent to Neutrik model NC3MP or equal by Switchcraft or Calrad.
      c. Monitor/Effects Speaker Receptacles shall be 4-pole Speakon-type with gold-plated contacts equivalent to Neutrik model NL4MP-B. Equal by Switchcraft or Calrad.
      d. Cable-end Microphone/Auxiliary Connectors shall be 3-pin XLR equivalent to Neutrik model NC3XX or equal by Switchcraft or Calrad.
   4. Furnish and install the required number of jacks and connectors as indicated on the drawings.

PART 3 EXECUTION

3.01 GENERAL

A. Installation shall follow industry standard wiring and installation practice, and shall meet or exceed industry standards for such work, with particular attention given to any installation instructions in Parts 1 and 2 of these Specifications.

B. Equipment shall be secured firmly with proper types of mounting hardware. All equipment affixed to the building structure must be self-supporting with a safety factor of at least three unless otherwise stated.

C. All equipment shall be installed so as to provide reasonable safety to the operator.

D. All overhead or wall-mounted speaker systems shall be supported from the building structure utilizing the materials and methods recommended by the speaker manufacturer and good rigging practices, providing a load-rated safety factor of six (6). All required installation material and labor shall be deemed included in these specifications.

E. Furnish the system to facilitate expansion and servicing using modular, solid-state components. All equipment shall be designed and rated for continuous operation and shall be UL listed where applicable, or manufactured to UL standards.

1. Labeling

    a. Clearly and permanently label all jacks, controls and connections with engraved laminated plastic labels or with engraved and back-filled mounting plates. Attach laminated plastic labels with contact cement.
    b. Identify and permanently label all wires and cables at every point of termination and connection point with industry-standard cable markers. All cable identifications shall be logged, marked on drawings where appropriate and included in the owners' manual.

2. Cabinets, Cables, Connectors and Miscellaneous Equipment
    a. Equipment Cabinets
    b. Locate freestanding equipment cabinet(s) where indicated and provide service access to both front and rear without having to move cabinets.
    c. The 120 VAC power to the equipment racks shall be terminated inside the racks to plug mold plugstrips or quad convenience outlets.
    d. All conduit systems shall be insulated from the equipment racks using non-metallic bushings or raceways.
    e. Install equipment in cabinets with ventilating panels and fans as required to provide adequate ventilation and according to equipment manufacturers' recommendations.
    f. Connect all microphone, line level, DC control and speaker cables to equipment cabinets via approved audio terminal blocks. Use spade lugs if barrier strips are used. Do not buss commons together. Do not ground.
    g. Locate patch panels and all frequently used controls at least 30" above floor.
    h. Fill unused rack space with blank or ventilating panels finished to match cabinet color.
    i. Signal processing equipment with front panel controls that are to be permanently set (e.g. equalizers, limiters, digital delays) shall be furnished with security panels or sub-panel mounted behind blank panels. Provide plastic vision panels to allow viewing of operational indicators such as meters or clipping indicators.
    j. Wiring and Interconnections
    k. Observe proper circuit polarity and loudspeaker wiring polarity. No cables shall be wired with a polarity reversal between connectors with respect to either end. Special care shall be taken when wiring microphone cables, to insure that uniform polarity is maintained. Balanced audio connectors shall be wired with shield at Pin #1, hi/positive at Pin #2.
    l. Build-out all link circuits containing active components where necessary to provide proper impedance matching and optimum gain

structure for maximum operating headroom and signal-to-noise ratio. Record all pad values in the final documentation.

m. All audio circuits shall be balanced and floating, except as noted in the specifications or directed by the Engineer at the time of final equalization and testing. Shields of audio cables installed between active interconnected equipment components shall be grounded at the sending end only.

n. All cables shall be installed in conduit except above accessible ceilings, where they shall be supported utilizing J-hooks or bridle rings on minimum 4 ft. centers. Provide an electrical wall box with conduit stubbed above accessible ceilings for all wall-mounted peripheral devices.

o. Separate conduits and/or cable harnesses shall be maintained for cables in the following categories:
   (1) Levels below -20 dBm (microphone).
   (2) Nominal levels from -20 dBm to +30 dBm (line).
   (3) Loudspeaker
   (4) Control
   (5) Power

p. Group and route all cables within equipment cabinets according to type and function and separate according to signal levels. All cables shall be continuous lengths without splices.

q. All system wire shall be terminated by approved soldered or mechanical means. No unterminated wire ends will be accepted. Heat shrink type tubing shall be used to insulate and dress the ends of all ground or drain wires.

r. All solder joints and terminations shall be made with rosin-core silver solder.

s. Mechanical connections shall be made using approved connectors of the correct size and type for the connections. Wire nuts are not acceptable except in the case of distributed, constant-voltage speaker systems.

3. Grounding

a. Ground active components, equipment cabinets and audio line shields to independent audio system ground and to ground buss in the power panel.

b. Ground all conduits ONLY to power system ground. Insulate all conduits and electrical boxes from sound system, including audio equipment cabinets and audio system ground.

c. Insulate all conductors, including shields, from conduit, backboxes and from each other for the entire conduit length.

d. Take such precautions as may be necessary to prevent and guard against electro-magnetic and electro-static hum and to install the equipment so as to provide normal and reasonable safety for the operator.

4. Tests And Adjustments

a. The completed sound system is to be inspected and tested for compliance with the Specifications.

b. The testing and equalization work shall be performed after the installation work has been completed, but prior to any use of the system.

c. The process of equalizing and testing the system may necessitate moving, adjusting or re-aiming certain loudspeakers. Adjustments shall be performed without claim for additional payment.

d. Coordinate as necessary to ensure a totally quiet room during the sound reinforcement systems testing and balancing period.

e. Tests - Prior to requesting systems acceptance testing, verify the following:

f. Absolute Impedance:

(1) With loudspeaker level controls at zero attenuation and amplifiers disconnected, measure and record the absolute impedance value of each loudspeaker line at 250,1000 and 4000 Hz. Impedance shall be at least 90% of rated load impedance of respective amplifier.

(2) Check and record resistance of all lines to input receptacles, with receptacles open and short-circuited.

g. Parasitic Oscillation And RFI Pickup

(1) Set up system for each mode of operation.

(2) Use 5MHz bandwidth oscilloscope and loudspeaker monitoring.

(3) Check to ensure that the system is free of spurious oscillation and RF pickup in the absence of any input signal and also with the system driven momentarily at full output at 160 Hz.

h. Buzzes, Rattles And Distortion

(1) Apply a high quality music signal to the system. Adjust for frequent peaks at the specified system maximum sound pressure level.

(2) Apply a sine-wave sweep from 30-5,000 Hz at 6 dB below full amplifier power.

(3) In both cases, listen carefully for buzzes, rattles and objectionable distortion.

(4) Correct all causes of such defects. If a cause is outside the system, promptly notify the Engineer of the cause and suggested corrective procedures.

i. Gain Structure: Adjust input sensitivity and output levels of interconnecting active devices in each signal chain for maximum headroom and signal-to-noise ratio. All devices in each signal chain should clip at the same time as gain is increased.

j. Equalization

k. Measure system acoustical performance using a calibrated sound level meter set for "slow" meter damping and flat response with random incidence at a height of 4 to 5 feet. All interior furnishings shall be in place and system gain shall be adjusted to provide levels of 70 to 80dB and at least 10dB above ambient noise levels at the measuring locations.

l. Using a precision calibrated 1/3 octave audio frequency analyzer and filtered pink noise, with all control equalization set for flat response, measure and record loudspeaker frequency response in 1/3 octave bands. Measurement microphone shall be placed on-axis to the pertinent speaker, in the center of each seating area.

m. Adjust equalization to provide average system response within +/-3 dB of a response curve that is flat from 300-3000 Hz then sloped uniformly to -4dB at 12KHz. Record both equalizer settings and analyzer curves.

n. Feedback Eliminator Settings: Set all filters to “dynamic” vs. “fixed” and fix the bandwidth of the filters at $1/10^{th}$ octave.

o. Should the performance testing show that the Contractor has not properly completed the systems, the Contractor shall make all necessary corrections or adjustments, and a second demonstration shall be arranged at the Contractor's additional expense.

5. System Performance

a. After equalization and testing, the sound system shall meet or exceed the following specifications:
b. System shall be free of short circuits, ground loops, parasitic oscillation, excessive system noise, hum, RF interference and instability of any form.
c. Maximum SPL with 300Hz to 3000Hz band limited pink noise input to the system shall be 108dB-SPL before audible distortion or clipping occurs.
d. Seat to seat variation of SPL at 2kHz octave band pink noise shall be within a tolerance of +/-3dB.
e. Acoustic response of the system shall be +/-3dB along a line which is flat from 300Hz to 3000Hz and which rolls off at 2dB/octave to 12kHz and 12dB/octave below 200Hz as measured in the seating area.

6. Systems Acceptance Testing And Training

a. A qualified technical representative of the system contractor shall do systems acceptance testing. Installation must be complete in all respects before acceptance testing. Acceptance testing and training must be scheduled on separate dates to allow time for corrections, if necessary. Once all functions and devices within the system have been adequately demonstrated to be working properly, a complete owner's manual will be presented to the Owner's agent. It shall contain a comprehensive list of all supplied equipment, a complete point-to-point system wiring diagram with "AS BUILT" wire numbers indicated, details of hook-up connections including build-out devices (active and passive), systems control settings record, the final test results including plotted frequency response curves, operation and maintenance manuals for each active device including schematic diagrams and parts list.
b. The contractor shall have test equipment available on site during the testing period. He shall provide a listing of the specific equipment to be made available to the Engineer, prior to the testing appointment. The following minimal standard test equipment shall be provided:
c. Oscilloscope - 10 MHz bandwidth
d. 1/3 Octave real time analyzer
e. Calibrated microphone
f. Broadband random noise source
g. Sine wave generator
h. Low distortion sweepable sine wave oscillator
i. Distortion analyzer
j. AC impedance bridge
k. Sound level meter
l. Multimeter

m. The Contractor shall be prepared to verify the performance of any portion of the system by demonstration, listening tests and/or instrument measurements.
n. Acceptance tests may include speech intelligibility surveys and subjective evaluations by observers listening at various positions under various conditions using speech, music, and live or recorded program material.
o. Measurement of frequency response, distortion, noise, or other characteristics shall be performed (or a demonstration test requested) if deemed necessary to determine conformity with specifications.
p. The Contractor shall make additional mechanical and electrical adjustments within the scope of the work and which are deemed necessary by the Architect/Engineer as a result of acceptance tests.

q. Test Reports And Certification: Submit results of all tests conducted above and certification that the installation is complete and ready for checkout as specified.

7. Owner Training and Familiarization

a. Training of owner's personnel shall be done by the Contractor. The Owner and/or his designated representative shall be fully advised as to the function of all operating controls and in techniques necessary to ensure proper operation of the entire system. The training session may include more than one trainee. If possible, several people should be trained. It may be necessary to return for another session, possibly during an actual use of the system. Provide a minimum of eight (8) hours of instruction and familiarization for this purpose.

b. The Engineer or his representative will participate during the training period.

c. The training phase shall be accompanied by complete as-built documentation and the custom Technical System Operation manual. Review of the owner's manual and demonstration of all systems functions is required.

END OF SECTION

SECTION 27 51 25

MUSIC ROOM AUDIO PROGRAM PLAYBACK SYSTEM - MIDDLE SCHOOL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, General and Special Conditions and Division 1 Sections apply to this Section.

B. 27 00 05 – Basic Requirements

C. 27 00 10 – Basic Materials and Methods

1.02 SECTION INCLUDES

A. Music room sound system and components for recording and playback of audio program material.

1.03 QUALITY ASSURANCE

A. NFPA 70 - National Electrical Code.

B. Underwriter's Laboratory.

C. TIA/EIA-607 Telecommunications Grounding.

D. Tenth Edition (or latest) BICSI Telecommunications Distribution Methods Manual (TDMM).

E. American with Disabilities Act.

F. Federal Communications Commission Part 15.

G. Sound System Engineering (Davis & Patronis) – 3rd Edition 2006.

H. Audio Systems Design and Installation (Giddings) 1990.

1.04 SYSTEM WARRANTY

A. The Sound System shall be warranted by the contractor for a period of one (1) year from date of substantial completion.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Portable sound rack shall be constructed of ½" laminated plywood with recessed hardware. Rack shall be 31 ½" high, front and rear mounting rails, casters, removable front, rear and top lids. Provide for a slanted block mounting in top of case for mixer. Provide a portable sound rack LM Engineering equipment/mixer case or equal by Starcase or Lowell with the following equipment.

B. Dual channel power amplifier shall have a power rating of 200 watts per channel into a 4 ohm load. Rear mounted attenuators with balanced XLR jacks and screw terminal barrier strips. Speakers are connected via screw terminals. Frequency response shall be 20Hz to 20KHz and have a signal to noise ratio of 104dB. Provide a power amplifier Crown or equal by TOA or Yamaha.

C. Graphic equalizer shall be a 1/3 octave, 31 band unit with 6 or 12dB of boost or cut. Inputs shall be XLR balanced connectors and standard unbalanced phone jacks. Provide a graphic equalizer. Yamaha or equal to Sabine or Crest.

D. The Dual Auto-Reverse Dubbing Deck shall be a Carver or equal by Marantz or Sony. It shall be a front-loading dual bay unit capable of recording and playback of standard compact cassettes. Tape speed shall be 1-7/8 inches per second Wow and flutter shall be 0.08% or better. Each tape transport shall have on DC servo Motor for capstan drive and fast forward, rewind and take-up torques. The recorder shall include Dolby B and C noise reduction and Dolby HX PRO High frequency extension.

E. Main speakers shall be installed on the wall as shown on the plans. Each speaker shall include 90 x 40 horn, 2" titanium compression driver and 12" lone speaker. Speaker shall include a built-in

crossover network and be capable of handling 300 watts of program material. The frequency response shall be 60Hz to 16kHz. Provide speakers Electro Voice, JBL or EAW with appropriate mounting hardware. Speakers shall be permanently mounted in each Middle School music room.

F. Provide miscellaneous mic jacks, cable, connectors, patch cords and etc. to provide a complete system.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install and balance system volume levels.

B. Check polarity of all speakers and microphones.

C. Install in accordance with manufacturer's installation instructions and recommendations.

3.02 TRAINING

A. Provide four (4) hours training for District's personnel on the operation and maintenance of the system.

B. Provide two (2) video copies of all training.

END OF SECTION

SECTION 27 51 26

MUSIC ROOM AUDIO RECORDING/PLAYBACK SYSTEM – HIGH SCHOOL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, General and Special Conditions and Division 1 Sections apply to this Section.

B. 27 00 05 – Basic Requirements

C. 27 00 10 – Basic Materials and Methods

1.02 SECTION INCLUDES

A. Music room sound system and components for recording and playback of audio program material.

1.03 QUALITY ASSURANCE

A. NFPA 70 - National Electrical Code.

B. Underwriter's Laboratory.

C. TIA/EIA-607 Telecommunications Grounding.

D. Tenth Edition (or latest) BICSI Telecommunications Distribution Methods Manual (TDMM).

E. American with Disabilities Act.

F. Federal Communications Commission Part 15.

G. Sound System Engineering (Davis & Patronis) – 3rd Edition 2006.

H. Audio Systems Design and Installation (Giddings) 1990.

1.04 SYSTEM WARRANTY

A. The Sound System shall be warranted by the contractor for a period of one (1) year from date of substantial completion.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Portable sound rack shall be constructed of ½" laminated plywood with recessed hardware. Rack shall be 31 ½" high, front and rear mounting rails, casters, removable front, rear and top lids. Provide for a slanted block mounting in top of case for mixer. Provide a portable sound rack LM Engineering equipment/mixer case or equal by Starcase or Lowell with the following equipment.

B. Mixing console shall have 12 mic/line inputs and 4 group outputs. Each microphone channel shall have balanced XLR and phone jack line inputs, channel insertion jack, gain trim control, peak indicators, 3 band EQ, monitor send, effects send, 4 group assignment switches, pan control and channel faders. Mixing console shall be a Yamaha or equal by Peavey or Mackie.

C. Dual channel power amplifier shall have a power rating of 200 watts per channel into a 4 ohm load. Rear mounted attenuators with balanced XLR jacks and screw terminal barrier strips. Speakers are connected via screw terminals. Frequency response shall be 20Hz to 20KHz and have a signal to noise ratio of 104dB. Provide a power amplifier Crown or equal by TOA or Yamaha.

D. Graphic equalizer shall be a 1/3 octave, 31 band unit with 6 or 12dB of boost or cut. Inputs shall be XLR balanced connectors and standard unbalanced phone jacks. Provide a graphic equalizer. Yamaha or equal to Sabine or Crest.

E. The Digital Recorder: TASCAM CD-RW 750 or Equal by Yamaha CDR HD 1000 or Carver.

F. The Dual Auto-Reverse Dubbing Deck shall be a Carver or equal by Marantz or Sony. It shall be a front-loading dual bay unit capable of recording and playback of standard compact cassettes. Tape speed shall be 1-7/8 inches per second Wow and flutter shall be 0.08% or better. Each tape transport shall have on DC servo Motor for capstan drive and fast forward, rewind and take-up torques. The recorder shall include Dolby B and C noise reduction and Dolby HX PRO High frequency extension.

G. Main speakers shall be installed on the wall as shown on the plans. Each speaker shall include 90 x 40 horn, 2" titanium compression driver and 12" lone speaker. Speaker shall include a built-in crossover network and be capable of handling 300 watts of program material. The frequency response shall be 60Hz to 16kHz. Provide speakers Electro Voice, JBL or EAW with appropriate mounting hardware.

H. Hanging microphones shall be provided and location to be coordinated with A/E. Each cardioid miniature hanging microphone shall have a frequency response of 30 to 20 KHz. The shielded preamp mounts to a single gang box. Provide a 30' braided shield cable to maintain horizontal aiming. Provide hanging microphones Electro Voice or equal by Sony or Panasonic.

I. Stand microphones shall be dynamic cardioid with extended frequency range and ON/OFF switch and 25' cable. Provide 1 stand microphones equal to Electro Voice , Sony or Panasonic. Provide 1 floor stands by Atlas Soundolier or equal by Fender or Quiklok.

J. Handheld wireless microphone shall be a true diversity type with balanced XLR output connector. The handheld transmitter shall include a cardioid condenser element and include a stand adapter. Provide 1 handheld wireless microphone system equal to Telex , TOA or Williams.

K. Provide miscellaneous mic jacks, cable, connectors, patch cords and etc. to provide a complete system.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install and balance system volume levels.

B. Check polarity of all speakers and microphones.

C. Install in accordance with manufacturer's installation instructions and recommendations.

3.02 TRAINING

A. Provide four (4) hours training for District's personnel on the operation and maintenance of the system.

B. Provide two (2) video copies of all training.

END OF SECTION

SECTION 27 51 27
CLASSROOM SOUND REINFORCEMENT SYSTEM

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, General and Special Conditions and Division 1 Sections apply to this Section.

B. 27 00 05 – Basic Requirements

C. 27 00 10 – Basic Materials and Methods

1.02 SCOPE OF WORK

A. Provide classroom Sound Reinforcement Systems for all classrooms and learning areas as shown on the drawings. The system shall consist of an Amplifier / Receiver capable of amplifying signals from multiple wireless transmitters and several audio devices simultaneously.

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of components and accessories, of types, capacities and characteristics required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firms with at least 3 years of successful installation experience with projects utilizing system work similar to that required for this project.

C. Electrical Code Compliance: Comply with applicable local code requirements to the authority having jurisdiction and NEC codes that pertain to this type service.

D. NFPA Compliance: Comply with applicable requirements of NFPA Lightning Protection Code, pertaining to this type system.

E. UL Compliance: Comply with applicable requirements of UL Standards pertaining to systems and products of this type. Provide components that are UL listed.

1.04 WARRANTY

A. Warranty all equipment and materials for a period of 2 years from the date of Final acceptance from the specifying authority /owner. If any defects in materials, workmanship or operational failures under **"NORMAL"** conditions are experienced within the warranty period, promptly (next business day) correct at no expense to the owner.

PART 2 – PRODUCTS

2.01 EQUIPMENT

A. Provide and install An IR Wireless PA system with wireless Microphone and ceiling speakers with the following capabilities:
   1. System shall function clearly alongside 40-45 duplicate systems
   2. The combination receiver/amplifier shall supply 4x10 watts rms capable of powering up to 8 speakers mounted in the ceiling.
   3. The system shall have team teaching for up to 2 individuals with wireless microphones.
   4. The system shall have stereo auxiliary inputs with separate volume controls, allowing interfacing to other media formats, i.e. music, TV, LCD Projector, DVD/VCR.
   5. The system shall have the capability to have multiple devices i.e. LCD projector and the teacher Microphone to be heard at the same time in the same speakers.
   6. The systems shall have the capability to connect wireless transmitters for hearing disabled students.

B. Base system shall include Amplifier/Receiver, Wireless Pendent Transmitter/Microphone, rechargeable battery w/ charger.

1. Manufacturers: Lightspeed LES 750IR or PhonicEar Frontrow Pro.

C. Provide and install speakers as shown on the drawings with back boxes and white grills. Speakers are to be installed in the ceiling as show on the drawings.

1. Standard: Lowell "D" Series. Equals by Lightspeed DRQ or PhonicEar AT0806

D. Provide miscellaneous mic jacks, cable, connectors, patch cords and etc. to provide a complete system.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install system components and ancillary equipment as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that equipment complies with requirements. Comply with requirements of NEC, and applicable portions of NECA's "Standard of Installation" pertaining to general electrical installation practices.

B. Coordinate with other electrical work, including raceways, and electrical boxes and fittings, as necessary to interface installation of equipment work with other work.

C. Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL STDs 486A and B.

D. Provide equipment grounding connections for control equipment as indicated. Tighten connectors to comply with tightening torques specified in UL STD 486A to assure permanent and effective grounding.

E. Cables (Plenum Rated) shall be pulled as unbroken runs from device to device, or from device home-run to the equipment without need for intermediate splicing.

3.02 FINAL CLOSEOUT

A. System Supplier: The services of a qualified representative of the system supplier shall be provided as required to check the installations and instruct Owner's personnel in the care and proper operation of the system. Said services shall continue until such time as Architect/Engineer determines that system operation is satisfactory.

B. The equipment supplier shall be the authorized distributor of equipment supplied, stock sufficient parts and be authorized to provide factory warranty service on all items supplied.

C. Building Operating Personnel Training (8 HOURS): Train Owner's building personnel in procedures for starting-up, testing and operating system equipment.

END OF SECTION

SECTION 27 51 28
AUX GYMNASIUM SOUND REINFORCEMENT SYSTEM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, General and Special Conditions and Division 1 Sections apply to this Section.

B. 27 00 05 – Basic Requirements

C. 27 00 10 – Basic Materials and Methods

1.02 SECTION INCLUDES

A. High School Auxiliary Gymnasium sound systems and components.

1.03 QUALITY ASSURANCE

A. NFPA 70 - National Electrical Code.

B. Underwriter's Laboratory.

C. TIA/EIA-607 Telecommunications Grounding.

D. Tenth Edition (or latest) BICSI Telecommunications Distribution Methods Manual (TDMM).

E. American with Disabilities Act.

F. Federal Communications Commission Part 15.

G. Sound System Engineering (Davis & Patronis) – 3rd Edition 2006.

H. Audio Systems Design and Installation (Giddings) 1990.

1.04 SYSTEM WARRANTY

A. The Sound System shall be warranted by the contractor for a period of one (1) year from date of substantial completion.

PART 2 - PRODUCTS

2.01 GENERAL

A. All equipment items shall be new and unused.

B. The following sections specifically list the acceptable equipment types and items for this project. Where quantities are not noted, they may be obtained from the drawing. In the event of a discrepancy between the specifications and the drawings, the greater quantity or better quality shall be furnished.

C. Speaker locations are shown on the drawings for bidding purposes only. The exact speaker locations, aiming points and mounting angles shall be coordinated with the Engineer and determined through the use of an acoustical modeling program and good engineering practices. Speaker aiming shall be adjusted as required after installation to provide optimal coverage and system performance.

2.02 EQUIPMENT RACK

A. Furnish an equipment rack for use in housing the equalizers, processors, power amplifiers and ancillary devices necessary to the operation of the system.

B. Heat-producing components, such as power amplifiers, shall be mounted with one 1-3/4" vent panel installed between units. Fill all other unused portions of rack front sections with matching blank panels.

C. Furnish five (5) keys for each type of equipment rack lock installed. Lock types shall be coordinated with Owner.

D. Install the required number of units, of sufficient size to accommodate the equipment specified, at the locations indicated in the drawings.

E. Furnish and install the following:

1. Main equipment cabinet: Furnish and install a cabinet with a solid locking front door and vented top panel. Provide a 3-space storage drawer. Approved equals as manufactured by Middle Atlantic, Atlas Sound, Lowell Mfrg., HOME, or Homaco. Rack shall be utilized to house the following in addition to providing a minimum of four (4) EIA spare rack spaces for future expansionMixer/Preamplifier
    b. Power Amplifier
    c. CD Player/Cassette Deck
    d. MP3 Audio Input
    e. Digital Signal Processor
    f. Wireless Microphone Receiver
    g. Storage Drawer
    h. Sequencing AC Power Strip
2. Dual channel power amplifier shall have a power rating of 600 watts per channel into a 8 ohm load. Speakers are connected via screw terminals. Frequency response shall be 20Hz to 20KHz and have a signal to noise ratio of 102dB. Provide a power amplifier Crown or equal by Peavey, or Bogen.
3. Mixing console shall have 12 mic/line inputs and 4 group outputs. Each microphone channel shall have balanced XLR and phone jack line inputs, channel insertion jack, gain trim control, peak indicators, 3 band EQ, monitor send, effects send, 4 group assignment switches, pan control and channel faders. Mixing console shall be equal to Yamaha equals by Crest or Klark
4. Graphic equalizer shall be a 1/3 octave, 31 band unit with 6 or 12dB of boost or cut. Inputs shall be XLR balanced connectors and standard unbalanced phone jacks. Provide a graphic equalizer Yamaha or equals by Crest or Klark.
5. Main speakers shall be installed on the ceiling as shown on the plans. Each speaker shall include 90 x 40 horn, 2" titanium compression driver and 12" lone speaker. Speaker shall include a built-in crossover network and be capable of handling 300 watts of program material. The frequency response shall be 60Hz to 16kHz. Provide speakers equal to JBL, Electro Voice or YAMAHA with appropriate mounting hardware. Speaker color shall match ceiling background.
6. The CD Player/Cassette Deck shall be a rack-mounted combination unit capable of either separate or mixed output. The cassette deck shall be wired to the system mixer-amplifier to enable the recording of local programs. Provide one (1) Denon or equal by Marantz or Tascam.
7. Provide miscellaneous mic jacks, cable, connectors, patch cords and etc. to provide a complete system.

F. Wireless Microphone System

1. The Wireless Microphone System shall be a VHF diversity type with handheld microphone/transmitter. It shall provide dual diversity reception from two external equipment cabinet-mounted ½ wave antennas. The operating frequency shall be selected to provide a minimum possibility of interference from local RF signals.
2. The handheld transmitter/microphone shall have an 18-20 hour battery life using an AA or 9V battery. It shall provide adjustable gain control, three-segment LED battery power indicator, mute and power switches and a grip/switch cover. Provide with stand-mount swivel adaptor. The microphone element shall be a cardioid dynamic type.
3. Provide one Shure rack-mounted, dual diversity receiver with handheld microphone/transmitter and two (2) Shure remote antenna kits or equal by Audio Technica or Telex.

G. Assistive Listening System shall include a transmitter and 6 receivers with ear buds.

1. Provide system equal to Telex, TOA or Williams.

H. Microphones

1. Provide one (1) handheld cardioid dynamic microphone with 25ft. cord and microphone stand. Shure microphone or equal by Audio Technica or Audix with ProCo mic cord or equal by Whirlwind, Conquest and Atlas Sound and Atlas Sound mic stand or equal by K&M or Ultimate.
2. Provide one (1) cardioid dynamic noise-cancelling desk microphone with telescoping neck and non-locking switch with frequency response of 40Hz-10KHz. Shure model microphone with ProCo mic cord or equals by Audio Technica or Telex.

I. Wire and Cable
1. All wire and cables shall be new and unused. All wire and cables are to be installed in a manner that hides them from view.
2. Wire not installed in equipment racks, not portable, or not installed in conduit shall be fire and plenum rated and meet all applicable codes.
3. Speaker cable: West Penn 25226 14awg twisted pair, plenum-rated for equipment rack internal wiring and from the equipment rack pull box to the loudspeakers.
4. Microphone-level and line-level audio cable (installed in conduit, not portable): West Penn 291 stranded 22 AWG twisted pair with foils shield or approved equal.
5. Portable microphone cables: ProCo M-Series black flexible cable or equal by Whirlwind or Conquest.
6. Other equipment control cables shall be stranded wire, appropriately shielded, of gauge and number of conductors required by the manufacturer for proper operation of the system or equipment item furnished.
7. Wire and cable for all other devices shall be supplied in accordance with the recommendations of the device manufacturer and the National Electrical Code.
8. Acceptable cable manufacturers: Belden, Carroll, General or West Penn.

J. Jack, Connectors and Wall Plates
1. All plate-mounted connectors shall be ground-insulated from the plates on which they are mounted.
2. All other jacks shall be installed on standard stainless steel finish plates. Nomenclature shall be engraved into the plate with 1/8" block letters filled with black paint. All mic jack locations shall be numbered consecutively, starting form one (1).
3. Unless otherwise specified, all jacks and connectors for the sound system shall be as follows:
    a. Combination Microphone/Auxiliary Input Jackplates shall be impedance matching units suitable for interfacing one unbalanced high- or low-impedance source to a balanced low-impedance microphone preamplifier input. There shall be one ¼" 3-conductor phone jack marked "SPKR IN" and two RCA phono jacks marked "LINE IN L/R" with a resistive mixing network to sum stereo line-level sources. A "HUM CANCEL" rocker-type switch shall selectively isolate the shields. A separate female XLR connector shall provide for a separate microphone input. There shall be no electrical connection between the impedance matching circuit and the microphone circuit. Provide ProCo AVP-1 A/V interface jackplate assemblies or equal by Whirlwind or Conquest where shown on drawings.
    b. Furnish and install the required number of jacks and connectors as indicated on the drawings.

PART 3 EXECUTION

3.01 GENERAL

A. Installation shall follow industry standard wiring and installation practice, and shall meet or exceed industry standards for such work, with particular attention given to any installation instructions in Parts 1 and 2 of these Specifications.

B. Equipment shall be secured firmly with proper types of mounting hardware. All equipment affixed to the building structure must be self-supporting with a safety factor of at least three unless otherwise stated.

C. All equipment shall be installed so as to provide reasonable safety to the operator.

D. All overhead or wall-mounted speaker systems shall be supported from the building structure utilizing the materials and methods recommended by the speaker manufacturer and good rigging practices, providing a load-rated safety factor of six (6). All required installation material and labor shall be deemed included in these specifications.

E. Furnish the system to facilitate expansion and servicing using modular, solid-state components. All equipment shall be designed and rated for continuous operation and shall be UL listed where applicable, or manufactured to UL standards.

1. Labeling

    a. Clearly and permanently label all jacks, controls and connections with engraved laminated plastic labels or with engraved and back-filled mounting plates. Attach laminated plastic labels with contact cement.
    b. Identify and permanently label all wires and cables at every point of termination and connection point with industry-standard cable markers. All cable identifications shall be logged, marked on drawings where appropriate and included in the owners' manual.

2. Cabinets, Cables, Connectors and Miscellaneous Equipment
    a. Equipment Cabinets
    b. Locate freestanding equipment cabinet(s) where indicated and provide service access to both front and rear without having to move cabinets.
    c. The 120 VAC power to the equipment racks shall be terminated inside the racks to plug mold plugstrips or quad convenience outlets.
    d. All conduit systems shall be insulated from the equipment racks using non-metallic bushings or raceways.
    e. Install equipment in cabinets with ventilating panels and fans as required to provide adequate ventilation and according to equipment manufacturers' recommendations.
    f. Connect all microphone, line level, DC control and speaker cables to equipment cabinets via approved audio terminal blocks. Use spade lugs if barrier strips are used. Do not buss commons together. Do not ground.
    g. Locate patch panels and all frequently used controls at least 30" above floor.
    h. Fill unused rack space with blank or ventilating panels finished to match cabinet color.
    i. Signal processing equipment with front panel controls that are to be permanently set (e.g. equalizers, limiters, digital delays) shall be furnished with security panels or sub-panel mounted behind blank panels. Provide plastic vision panels to allow viewing of operational indicators such as meters or clipping indicators.
    j. Wiring and Interconnections
    k. Observe proper circuit polarity and loudspeaker wiring polarity. No cables shall be wired with a polarity reversal between connectors with respect to either end. Special care shall be taken when wiring microphone cables, to insure that uniform polarity is maintained. Balanced audio connectors shall be wired with shield at Pin #1, hi/positive at Pin #2.
    l. Build-out all link circuits containing active components where necessary to provide proper impedance matching and optimum gain

structure for maximum operating headroom and signal-to-noise ratio. Record all pad values in the final documentation.

m. All audio circuits shall be balanced and floating, except as noted in the specifications or directed by the Engineer at the time of final equalization and testing. Shields of audio cables installed between active interconnected equipment components shall be grounded at the sending end only.

n. All cables shall be installed in conduit except above accessible ceilings, where they shall be supported utilizing J-hooks or bridle rings on minimum 4 ft. centers. Provide an electrical wall box with conduit stubbed above accessible ceilings for all wall-mounted peripheral devices.

o. Separate conduits and/or cable harnesses shall be maintained for cables in the following categories:
   (1) Levels below -20 dBm (microphone).
   (2) Nominal levels from -20 dBm to +30 dBm (line).
   (3) Loudspeaker
   (4) Control
   (5) Power

p. Group and route all cables within equipment cabinets according to type and function and separate according to signal levels. All cables shall be continuous lengths without splices.

q. All system wire shall be terminated by approved soldered or mechanical means. No unterminated wire ends will be accepted. Heat shrink type tubing shall be used to insulate and dress the ends of all ground or drain wires.

r. All solder joints and terminations shall be made with rosin-core silver solder.

s. Mechanical connections shall be made using approved connectors of the correct size and type for the connections. Wire nuts are not acceptable except in the case of distributed, constant-voltage speaker systems.

3. Grounding

a. Ground active components, equipment cabinets and audio line shields to independent audio system ground and to ground buss in the power panel.

b. Ground all conduits ONLY to power system ground. Insulate all conduits and electrical boxes from sound system, including audio equipment cabinets and audio system ground.

c. Insulate all conductors, including shields, from conduit, backboxes and from each other for the entire conduit length.

d. Take such precautions as may be necessary to prevent and guard against electro-magnetic and electro-static hum and to install the equipment so as to provide normal and reasonable safety for the operator.

4. Tests And Adjustments

a. The completed sound system is to be inspected and tested for compliance with the Specifications.

b. The testing and equalization work shall be performed after the installation work has been completed, but prior to any use of the system.

c. The process of equalizing and testing the system may necessitate moving, adjusting or re-aiming certain loudspeakers. Adjustments shall be performed without claim for additional payment.

d. Coordinate as necessary to ensure a totally quiet room during the sound reinforcement systems testing and balancing period.

e. Tests - Prior to requesting systems acceptance testing, verify the following:

f. Absolute Impedance:

(1) With loudspeaker level controls at zero attenuation and amplifiers disconnected, measure and record the absolute impedance value of each loudspeaker line at 250,1000 and 4000 Hz. Impedance shall be at least 90% of rated load impedance of respective amplifier.

(2) Check and record resistance of all lines to input receptacles, with receptacles open and short-circuited.

g. Parasitic Oscillation And RFI Pickup

(1) Set up system for each mode of operation.

(2) Use 5MHz bandwidth oscilloscope and loudspeaker monitoring.

(3) Check to ensure that the system is free of spurious oscillation and RF pickup in the absence of any input signal and also with the system driven momentarily at full output at 160 Hz.

h. Buzzes, Rattles And Distortion

(1) Apply a high quality music signal to the system. Adjust for frequent peaks at the specified system maximum sound pressure level.

(2) Apply a sine-wave sweep from 30-5,000 Hz at 6 dB below full amplifier power.

(3) In both cases, listen carefully for buzzes, rattles and objectionable distortion.

(4) Correct all causes of such defects. If a cause is outside the system, promptly notify the Engineer of the cause and suggested corrective procedures.

i. Gain Structure: Adjust input sensitivity and output levels of interconnecting active devices in each signal chain for maximum headroom and signal-to-noise ratio. All devices in each signal chain should clip at the same time as gain is increased.

j. Equalization

k. Measure system acoustical performance using a calibrated sound level meter set for "slow" meter damping and flat response with random incidence at a height of 4 to 5 feet. All interior furnishings shall be in place and system gain shall be adjusted to provide levels of 70 to 80dB and at least 10dB above ambient noise levels at the measuring locations.

l. Using a precision calibrated 1/3 octave audio frequency analyzer and filtered pink noise, with all control equalization set for flat response, measure and record loudspeaker frequency response in 1/3 octave bands. Measurement microphone shall be placed on-axis to the pertinent speaker, in the center of each seating area.

m. Adjust equalization to provide average system response within +/-3 dB of a response curve that is flat from 300-3000 Hz then sloped uniformly to -4dB at 12KHz. Record both equalizer settings and analyzer curves.

n. Feedback Eliminator Settings: Set all filters to “dynamic” vs. “fixed” and fix the bandwidth of the filters at $1/10^{th}$ octave.

o. Should the performance testing show that the Contractor has not properly completed the systems, the Contractor shall make all necessary corrections or adjustments, and a second demonstration shall be arranged at the Contractor's additional expense.

5. System Performance

a. After equalization and testing, the sound system shall meet or exceed the following specifications:
b. System shall be free of short circuits, ground loops, parasitic oscillation, excessive system noise, hum, RF interference and instability of any form.
c. Maximum SPL with 300Hz to 3000Hz band limited pink noise input to the system shall be 108dB-SPL before audible distortion or clipping occurs.
d. Seat to seat variation of SPL at 2kHz octave band pink noise shall be within a tolerance of +/-3dB.
e. Acoustic response of the system shall be +/-3dB along a line which is flat from 300Hz to 3000Hz and which rolls off at 2dB/octave to 12kHz and 12dB/octave below 200Hz as measured in the seating area.

6. Systems Acceptance Testing And Training

a. A qualified technical representative of the system contractor shall do systems acceptance testing. Installation must be complete in all respects before acceptance testing. Acceptance testing and training must be scheduled on separate dates to allow time for corrections, if necessary. Once all functions and devices within the system have been adequately demonstrated to be working properly, a complete owner's manual will be presented to the Owner's agent. It shall contain a comprehensive list of all supplied equipment, a complete point-to-point system wiring diagram with "AS BUILT" wire numbers indicated, details of hook-up connections including build-out devices (active and passive), systems control settings record, the final test results including plotted frequency response curves, operation and maintenance manuals for each active device including schematic diagrams and parts list.
b. The contractor shall have test equipment available on site during the testing period. He shall provide a listing of the specific equipment to be made available to the Engineer, prior to the testing appointment. The following minimal standard test equipment shall be provided:
c. Oscilloscope - 10 MHz bandwidth
d. 1/3 Octave real time analyzer
e. Calibrated microphone
f. Broadband random noise source
g. Sine wave generator
h. Low distortion sweepable sine wave oscillator
i. Distortion analyzer
j. AC impedance bridge
k. Sound level meter
l. Multimeter

m. The Contractor shall be prepared to verify the performance of any portion of the system by demonstration, listening tests and/or instrument measurements.
n. Acceptance tests may include speech intelligibility surveys and subjective evaluations by observers listening at various positions under various conditions using speech, music, and live or recorded program material.
o. Measurement of frequency response, distortion, noise, or other characteristics shall be performed (or a demonstration test requested) if deemed necessary to determine conformity with specifications.
p. The Contractor shall make additional mechanical and electrical adjustments within the scope of the work and which are deemed necessary by the Architect/Engineer as a result of acceptance tests.

q. Test Reports And Certification: Submit results of all tests conducted above and certification that the installation is complete and ready for checkout as specified.

7. Owner Training and Familiarization

a. Training of owner's personnel shall be done by the Contractor. The Owner and/or his designated representative shall be fully advised as to the function of all operating controls and in techniques necessary to ensure proper operation of the entire system. The training session may include more than one trainee. If possible, several people should be trained. It may be necessary to return for another session, possibly during an actual use of the system. Provide a minimum of eight (8) hours of instruction and familiarization for this purpose.

b. The Engineer or his representative will participate during the training period.

c. The training phase shall be accompanied by complete as-built documentation and the custom Technical System Operation manual. Review of the owner's manual and demonstration of all systems functions is required.

END OF SECTION

SECTION 27 53 13
CLOCK SYSTEMS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, General and Special Conditions and Division 1 Sections apply to this Section.

B. 27 00 05 – Basic Requirements

C. 27 00 10 – Basic Materials and Methods

1.02 SCOPE OF WORK

A. Provide a master satellite time system including a GPS Receiver/Wireless FM transmitter and battery-operated FM receiver clocks as shown on plans and defined in these specifications.

B. In general, system components, the conduit, outlets and terminal cabinets, as required for a complete operating system, shall be furnished and installed under the Electrical Contract. The entire responsibility for the system, its operation and function shall be that of the Electrical Contractor.

C. Work includes the High School, Green Elementary and Central Elementary Schools.

1.03 QUALITY ASSURANCE

A. All equipment shall be UL listed.

B. All equipment and Installation Practices shall comply with the latest ANSI/NFPA-70 National Electric Code.

C. All equipment Installation Practices shall comply with the Local Electric Code.

D. All equipment shall comply with the latest ANSI-J-STD-607 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications Standard.

E. All equipment and Installation Practices shall comply with the latest BICSI Telecommunications Distribution Methods Manual (TDMM).

F. All equipment shall comply with the latest ANSI TIA/EIA-568, 569, 606, 607, 862, standards.

1.04 SYSTEM WARRANTY

A. The Local Area Network Electronics and software shall be warranted by the contractor for a period of one (1) year from date of substantial completion.

PART 2 – PRODUCTS

2.01 WIRELESS GPS MASTER SATELLITE SYSTEM

A. The Wireless GPS Master Satellite System shall utilize GPS technology to provide atomic time and synchronize all wireless system clocks.

B. Clocks shall automatically adjust for Daylight Savings Time and be synchronized to within 10 milliseconds six (6) times per day.

C. The system shall include an internal clock so that failure of the GPS signal shall not cause the system clocks to lose the synchronizing signal.

2.02 TRANSMITTER/RECEIVER

A. The transmitter/receiver shall consist of a wireless transmitter with GPS receiver. It shall obtain current time from a GPS satellite and transmit the time to all clocks within the system.

B. The narrow band FM transmission shall be one watt at 72.1 to 72.4 MHz frequency range.

C. Sixteen (16) channels at no more than 20kHz shall be provided.

D. Time zone selection, daylight savings bypass and 12-24 hours display switches shall be provided.

E. The GPS receiver shall be a complete GPS receiver and antenna in a waterproof case. Provide interconnecting cable and mounting bracket for attachment to roof structure.

2.03 CLOCKS

A. All clocks shall be battery operated using two (2) alkaline D-cell batteries. Battery life shall be five (5) years.

B. All clocks shall incorporate an internal FM antenna with a –7dB gain.

C. Upon losing the synchronizing signal from the transmitter, the clocks shall continue to function as accurate stand-alone quartz clocks until regaining reception of a valid time signal.

D. Provide 12-1/2" diameter clocks in classrooms.

E. Provide 16" diameter clocks in dining/auditeria, gymnasiums, auxiliary gymnasiums and multi-purpose rooms.

F. Each clock shall have a white 12-hour dial face with a quartz crystal movement, red sweeping second hand.

G. Each clock shall be surface mounted and have an impact resistant molded polycarbonate case.

H. Provide wire guards on all clocks located in gymnasium, locker rooms, and auxiliary gymnasiums.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install and set the time on clocks at all locations shown on the plans.

3.02 WARRANTY

A. Provide one-year warranty on material and labor.

3.03 TRAINING

A. Provide a minimum of twenty-four (8) hours of training for District's personnel on the operation and maintenance of the systems.

END OF SECTION

SECTION 28 13 00

SECURITY MANAGEMENT SYSTEM

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, General and Special Conditions and Division 1 Sections apply to this Section.

B. 27 00 05 – Basic Requirements

C. 27 00 10 – Basic Materials and Methods

D. 28 23 00 - CCTV

1.02 SCOPE OF WORK

A. Provide a Security Management System which integrates all the functions and features specified herein for door access control and intrusion alarm. Additionally, the SMS shall provide integration with the digital CCTV system covered under a separate specification section 28 23 00. Refer to system description below for required integration.

B. The scope includes all hardware, software, training and services required to provide a fully operational system, programmed to the owner's requirements and containing all software and licenses required to perform the specified functions.

1.03 QUALITY ASSURANCE

A. National Fire Protection Association.

B. National Electric Code.

C. American with Disabilities Act.

D. Underwriter's Laboratory.

E. Latest ANSI TIA/EIA-568, 569, 606, 607 Standards and Tenth Edition (or later).

F. BICSI Telecommunications Distribution Methods Manual (TDMM).

1.04 SYSTEM DESCRIPTION

A. The SMS shall provide for the centralized monitoring and control of door access and intrusion alarm. The SMS shall also provide integration with the digital CCTV system. The SMS shall integrate Access Control, Alarm Monitoring, Video Badging and Database Management.

1. The Communications and database server module.
2. The server shall provide network communications (both thru the dedicated hardwired network and the owner's LAN) to all remote hardware and software components of the system. The server shall provide system communications to remote control panels, administer the database, and provide system programming. The SMS server shall utilize industry standard relational database management for the storage and manipulation of related data. The server shall be PC based and provided with all required communications and database software and licenses to perform the required functions and system integrations. The server shall only be required on the SMS to perform programming functions. The SMS remote components shall be capable of operating without the presence of the server once the system is programmed. The PC with monitor, keyboard and mouse shall be provided as part of the system.
3. This module shall contain the required proximity cards. Include all hardware and software required to create, program, administer and distribute proximity cards.
4. This module shall contain the necessary RS-232 and RS-485 ports and Ethernet network cards for communication with remote hardware and the owner's LAN.
5. This module shall contain remote access and control software installed on workstations as directed by the owner. These workstations, through the LAN connection, shall be able to perform access, control, monitoring and programming features. The software shall be provided with all required licensing and password protected.
6. Door access control module.

a. The access control module shall control access and provide positional status at selected doors through the use of proximity cards, proximity card readers and door sensors. The electronic locking door hardware is being provided by the door hardware contractor.

7. Alarm management module
   a. The alarm management module shall provide for the control and annunciation of alarm conditions. The module shall accept inputs from the door access module, remote devices such as motion detectors and keypads and from other systems such as fire alarm and CCTV. The module shall include alarm reporting to off-site services, event logging with printouts and annunciation through audible devices.
   b. The alarm management module shall consist of the hardware and software required to generate multiple zones. Each zone shall be capable of independently controlling input and out devices programmed to that zone regardless of physical location within the building.
   c. The alarm management module shall consist of a 3 year service contract with an UL listed off-site monitoring company. Service contract shall be included in the bid price but shall be coordinated with the owner prior to activation.
8. Digital CCTV integrations module
   a. The digital CCTV system is provided under a separate specification section. The integration module shall provide alarm points to the CCTV system to activate different recording options for selected cameras based upon specific alarm or access control monitoring conditions. These shall include providing full motion recording of cameras utilized to cover access control doors. The SMS and CCTV systems shall communication via RS-232 communications provided under this specification section.

1.05 SUBMITTALS

A. Job specific system block diagram indicating the actual hardware required for the project including part numbers and interconnecting wiring requirements.

B. Details of interconnection with CCTV system.

C. Complete and comprehensive Equipment Catalog Specification Sheets of each component provided, job specific.

D. 30x42 floor plans at a scale of not less then 1/8”=1’-0” showing location of all items of equipment. Drawings shall also indicate each location where 120 power is required.

E. Software Data: The data package shall consist of descriptions of the operation and capability of system and application software as specified. This shall also include licensing information where applicable.

F. Submittals that do not contain all the above information will be rejected.

G. Operation and Maintenance Manuals: Submit in accordance with Section 16011 a complete End User Manual including the following:
   1. Component Operating Manual including technical data sheets.
   2. Information for reordering replacement parts.
   3. Provide a replacement parts list.
   4. Provide a list of recommended parts, tools, and instruments for testing and maintenance purposes.
   5. Wiring diagrams/details:
   6. System functional block diagrams.
   7. System schematic diagrams.
   8. System wiring list.
   9. Identify terminals to facilitate installation, operating and maintenance.

H. System Operating Instructions: Provide a clear and concise description of operation which gives, in detail, the information required to properly operate the equipment and system.

I. Component Service Manual: Include information for testing, repair, troubleshooting, assembly, disassembly, and required/recommended maintenance intervals.

1.06 MANUFACTURERS

A. Qualification of the Manufacturer:

1. All equipment described herein shall be the product of a manufacturer of established reputation and experience, who shall have produced similar equipment for a period of at least 5 years and who shall be able to refer to similar installations now rendering satisfactory service.
2. Perform all work under the on site supervision of a factory authorized, trained technician. It shall be the responsibility of the technician to check, inspect and adjust this installation to the engineer's and owner approval. A CSR of the installing contractor or manufacturer shall train the owner's personnel on the proper operation and maintenance of the equipment. Perform all work in conjunction with this installation in accordance with good engineering practices as established by NEC.
3. The manufacturer and their local agent shall show satisfactory evidence upon request that they maintain a fully equipped service center capable of furnishing adequate inspection and service to the equipment including standard replacement parts. The manufacturer and/or agent shall be prepared to offer a service contract for the maintenance of the system after the warranty period.
4. To establish continuity in the manufacturer, systems components shall be the standard product of one manufacturer. Further, an effort shall be made to establish common sources for equipment of all systems. The manufacturer will have a minimum of five (5) years' experience in the manufacture of progressive products specified.

B. Qualifications of the Contractor/Subcontractor:
1. The contractor/subcontractor is required to answer all warranty and Service calls within 4 hours of the initial customer contact and provide an authorized technician onsite within 24 hours.
2. Proper identification is required and must be visible while onsite for warranty/service calls. Notification of completion must be provided to authorized personnel onsite before departing facility.
3. Consult and coordinate with all trades providing adjoining work and make an Adjustment or relocation necessary to accommodate other equipment or to maintain proper function of existing equipment without claims for additional payment.
4. These Specifications contained herein describe specific functional requirements of the SMS as required by the owner. It is the intent of these specifications to detail and describe the exact performance of the system. The system features outlined in the Specifications are deemed mandatory for the project. References to model numbers are intended only for descriptive purposes. Systems that deviate from these Performance Specifications shall be considered alternate systems.

1.07 WARRANTY

A. Warranty all equipment and materials for a period of 1 year from the date of Final acceptance from the specifying authority /owner. If any defects in materials, workmanship or operational failures under "NORMAL" conditions are experienced within the warranty period, promptly correct at no expense to the owner.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. The SMS shall be a regularly manufactured system offered by a single manufacturer/source as an integrated system. The SMS shall be equal in quality, features and performance to NexWatch, Software House, Andover Controls, Galaxy Controls, Lenel Systems and RS2 Technologies.

2.02 COMMUNICATIONS, DATABASE AND CONTROL SERVER

A. All software and PC workstations provided under this project required to operate on or through the owner's LAN, shall be compatible and provided with the current version of the owner's Network Operating System Client. Software and hardware incompatibility issues with equipment and software provided under this project and the owner's Network Operating System Client shall be considered the responsibility of this contract and shall be resolved to the owner's satisfaction to provide a stable and consistent operating environment.

B. Provide the owner with a PC workstation per building to be utilized for the local head end server. The PC shall have the following minimum requirements:
1. 2.66 Ghz Intel Core 2 Duo Processor.
2. 2GB SDRAM.
3. 150GB Hard drive.
4. Video card 1024 x 768 resolution.

5. 8X, 4X, 32X CD/RW reader/recorder.
6. 10/100 switched Ethernet Card.
7. Parallel port.
8. Quantity of COM ports to support RS-232 readers and all system Loops.
9. Quantity of USB ports to support external hardware.
10. 17" LCD high resolution color monitor with rack mount shelf.
11. 101 Key keyboard and PS/2 3-button mouse with rack mount shelf.
12. Windows XP Professional. Coordinate exact OS as required by owner and software requirements.
13. Microsoft Internet Explorer Version 5.0 or higher as currently available.
14. Rack Mounted UPS / Battery Backup
    a. APC #SU2200RMXL3U Equals by: Compaq, Powerware, Best Power
15. Workstation shall be fully functional with all required software and drivers to perform the functions and features specified herein.
16. Approved Manufacturers: DELL. Equals by: HP, Compaq, IBM

C. Remote RS-232 reader with cabling for easy insertion and programming of proximity devices such as cards. Coordinate location of reader with owner.

D. Remote access software to be loaded onto owner selected network workstations. Provide a total of two (2) complete software packages with multiple concurrent user licenses. Systems that utilize hardware keys for licensing shall not be acceptable. All license keys shall be software activated.

E. Proximity Cards – Provide a total of 500 HID "thin" proximity cards as directed by the owner.

F. Integrated Video Image / ID Badging System
1. Provide a badge printing system capable of printing badges compatible with the access systems.
2. The system shall provide a minimum of 37 default badge fields.
3. Capable of printing cards and adhesive labels for proximity cards
4. System be a complete and shall include Camera, Printer and PC.
5. Starter Supplies sufficient for processing 500 badges
6. Adhesive labels, card punch, Strap Clips, ribbons

2.03 ACCESS CONTROL MODULE

A. Door Control Panel(s) shall consist of network communications via RS-485 or RS-232 loop to head end PC and shall contain all electronics and on-board memory to provide door access and interface with card readers, door position sensors, electronic door hardware and the local fire alarm system. The panel(s) shall provide access control, alarm monitoring, and time zone control for both access and egress of selected areas.

B. Proximity Readers – Provide proximity readers as indicated on plans. Operation of the Proximity Readers for the elevator must be coordinated with the elevator contractor.

C. Several doors will have handicapped door openers and push plates to operate the openers. The security contractor is responsible for interfacing these door openers and push plates into the door access system. This integration shall consist of connecting the prox readers to the push plates (openers) so that it will be necessary to have a proper proximity badge to allow operation of the handicapped door. Without the proper card, the door should not operate during restricted hours.

D. Main entrance doors shall be capable of unlocking via remote buttons. These doors are shown on the drawings.

E. Door position sensors – Provide recessed mounted door magnetic switch contacts to function as door position sensors and alarm points. Refer to drawings for locations. Switches to flush mount into top of door and door frame. Utilize sensors to provide door position status during occupied hours as required by owner's programming.

F. Electronic door hardware – Provide wiring and controls to electronic door hardware to remotely lock/unlock selected doors. System shall provide the owner with the ability to remotely control doors from the remote access workstations, head end server, associated proximity readers, request-to-exit devices and the fire alarm system.

G. Contractor shall include all necessary wire, cable and accessories for a complete working system.

2.04 ALARM MANAGMENT MODULE

A. Alarm monitoring panel(s) shall consist of network communications via RS-485 or RS-232 loop to head end PC and shall contain all electronics and on-board memory to provide alarm monitoring and interface with keypads, door position sensors, electronic door hardware and the alarm dialer. The panel(s) shall provide alarm monitoring and time zone control for all protected areas.

B. Motion Detectors – Ceiling mounted, DUAL-MODE Motion Detectors with 360 deg. coverage, equal to Ademco, Opex or Bravo. Provide and install motion detectors as shown on the drawings. Motion detectors shall be controlled by zone or room, so that and individual area may be turned on or off without effecting the other areas. Provide ¾" plywood mounted above ceiling tile containing motion sensor to minimize false alarms due to vibration.

C. Door position sensors – furnished with access control module. Utilize door position sensors to activate alarms as required by owner's programming requirements.

D. Remote access keypad – Wall mounted equal to ADEMCO, Caddix or DSC. Provide and install keypads as shown on drawings. Keypads shall be programmed to accept different access codes to control different zones.

E. Monitoring and annunciation – Provide control panel and telephone system dialer to provide off-site monitoring through a UL listed Central Station Service. Provide power and signaling to exterior, weatherproof horns, roof mounted for local alarm annunciation. Panel shall be provided with integral battery back-up.

F. A panic button shall be installed at the school secretary's desk. Coordinate final location with district.

G. An audible alarm shall sound throughout the building in the event of a burglar/intrusion alarm is tripped.

H. Contractor shall include all necessary wire, cable and accessories for a complete working system.

2.05 DIGITAL CCTV INTEGRATION MODULE

A. Provide alarm input/output modules and panels to interface with the digital CCTV system. Interface shall provide commands to operate cameras located at doors with card readers/keypads. Provide additional alarm monitoring of camera system motion detection.

B. Contractor shall include all necessary wire, cable and accessories for a complete working system.

PART 3 - INSTALLATION

3.01 INSTALLATION

A. Install systems in accordance with UL, NEC and all other applicable codes. Install system to comply with drawings and final shop drawings in compliance with manufacturer instructions. Provide all required hardware and labor for rack mounting of head-end system components.

B. It is the Contractor's responsibility to program the devices in this section according to the Owner's wishes. This involves day and night restrictions, time schedules, and building zoning, etc. The Contractor shall meet with the Owner and/or Engineer and reach agreement on the programming. This programming agreement shall then be written out in detail and forwarded to the Engineer for approval. After approval is granted, proceed with final programming.

3.02 PROGRAMMING

A. Coordinate programming of the system with Owner.

3.03 TRAINING

A. Provide the owner with a minimum of 30 hours of training designed to make all users familiar with the operation of the system.

B. Provide all training and utilize specified manuals and record documentation. All training shall be provided at the project site and coordinated with the Owner.

C. Training shall include multiple four-hour sessions encompassing all instructions required for system operation. Provide operators manuals and user guides with training. Provide follow up training after initial training.

D. Training shall utilize the equipment provided at the project site. Coordinate use, time and availability of equipment with the Owner.

E. Demonstrate adjustment, operation and maintenance of the system including each component and control.

END OF SECTION

SECTION 28 23 00

CLOSED CIRCUIT TELEVISION SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, General and Special Conditions and Division 1 Sections apply to this Section.

B. 27 00 05 – Basic Requirements

C. 27 00 10 – Basic Materials and Methods

D. 28 13 00 - Security System

1.02 SCOPE OF WORK

A. The Closed Circuit Television Systems (CCTV) shall be an electronically operated, supervised system of modular design. System includes interior and exterior camera assemblies, multiplexers, recorders, monitors, controllers, power supplies, supervised wiring, etc., as required for a complete and operational system.

1.03 QUALITY ASSURANCE

A. National Fire Protection Association.

B. National Electric Code.

C. American with Disabilities Act.

D. Underwriter's Laboratory.

E. Latest ANSI TIA/EIA-568, 569, 606, 607 Standards and Tenth Edition (or later).

F. BICSI Telecommunications Distribution Methods Manual (TDMM).

G. The Contractor shall maintain a fully equipped, factory certified service organization capable of providing full maintenance and service of the installed system.

H. The equipment supplier shall have been an authorized distributor of the equipment provided for a minimum of 3 years. The equipment supplier shall provide factory trained technicians for programming, installation support and training of personnel.

1.04 SYSTEM DESCRIPTION

A. Interior Camera System - System consists of multiple color cameras with specified housings and lenses throughout the building interior as coordinated with the consultant and Owner, as indicated on the drawings and wired to system head end.

B. Exterior **PAN, TILT, ZOOM** Camera System - System consists of switching color/monochrome cameras with specified housings and lenses located on the building exterior as indicated on the plans and coordinated with the consultant and Owner.

C. All cameras shall be powered by low voltage wire and transformers. Distances shall be determined by the contractor and the necessary power and signal cables shall be provided by the contractor. Power runs may be made from the Telecommunications Closets (TC) in the area closest to the cameras.

D. Head End System - System shall consist of the following equipment:

1. Digital Video Multiplexed Recorder(s) with Ethernet connectivity to receive and record signals from the CCTV cameras. It shall be an integrated security system, capable of time division multiplexing multiple cameras and storing their digitized and compressed images on integral hard disk drives for fast search and retrieval either locally at the unit, or from a remote workstation using a Graphical User Interface (GUI).
2. Remote viewing via a fully WEB basedviewer.
3. Floor standing/wall mounted enclosed rack(s) with locking front and rear doors to house the head end equipment.
4. Remote viewing PC workstations.

E. System Operation – Digital

1. System shall provide a means to digitally record and view images from cameras installed throughout the facility. Access to real-time or recorded images shall be either through front panel controls on the multiplexer/recorder(s) or through the Owner's LAN via an Ethernet port in the recorder.
2. Remote view of images shall be accessible through the LAN in a database form with multiple search criteria such as date, time, camera, and motion detection. Images shall be viewable through standard Windows based media players. Where systems require proprietary software for system remote access, software shall be made available to the Owner and unrestricted copies permitted to be installed throughout the owner's facility.
3. Remote access to equipment through the LAN shall be via multiple levels of password secured steps. Each level shall provide increasing access to system functions.
4. System shall provide the means to archive recorded material either digitally or analog directly from the recorder unit. Each unit will also provide analog video to monitors for real-time viewing.
5. The Security Management System is provided under a separate specification section. The integration module of the Security Management system shall provide alarm points to the CCTV system to activate different recording options for selected cameras based upon specific alarm or access control monitoring conditions. These shall include providing full motion recording of cameras utilized to cover access control doors. The SMS and CCTV systems shall communication via RS-232 communications provided under this specification section.

1.05 SUBMITTALS

A. Submittals shall include as a minimum the following items:

1. Shop drawings including product and cable data sheets and wiring diagrams specific to the project. Data sheets shall indicate exact model numbers and options specific to the project.
2. A complete bill of material including cables, connectors, etc. with model and part numbers.
3. System block diagram.
4. CCTV system console installation, block diagrams, and wiring diagrams.
5. CCTV equipment, installation, interconnection with console equipment, block diagrams and wiring diagrams.
6. Camera wiring and installation drawings.
7. Camera mount, wiring, and installation drawings.
8. Details of interconnection with intrusion detection system.
9. 30x42 floor plans at a scale of not less then 1/8"=1'-0" showing location of all items of equipment including cameras, racks, power supplies, etc. Drawings shall also indicate each location where 120 power is required.
10. System descriptions, analyses and calculations used in sizing the equipment required by these specifications. Descriptions and calculations shall show how the equipment will operate as a system to meet the performance of this specification.
11. Software Data: The data package shall consist of descriptions of the operation and capability of system and application software as specified.

1.06 WARRANTY

A. Provide a one year full warranty of the system, including equipment, wiring and software against defects in material and workmanship from the date of system completion and acceptance. If any defects are found within the warranty period, the defective system component shall be replaced at no extra cost to the Owner for parts or labor.

B. During the first year's warranted operation, the Contractor shall perform two inspections at 6-month intervals or less. This work shall be performed during regular working hours, Monday through Friday, excluding legal holidays. These inspections shall include:

1. Visual checks and operational test of the multiplexer, peripheral equipment, interface panels, recording devices, monitors, video equipment electrical and mechanical controls, and a check of the picture quality from each camera.
2. Correct all diagnosed problems.
3. Resolve any previous outstanding problems.

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

D. The Contractor shall be responsible to provide service during normal working hours within (4) hours after notification by the Owner for normal service or within (2) hours for emergency service. Emergency service is defined as the loss of 25% or more of system component operation, or the loss of the video switcher or other head-end equipment. Provide an on-site authorized factory technician within 24 hours if required.

E. If equipment cannot be repaired within 24 hours of service visit, Contractor shall provide "loaner" equipment to the Owner at no charge.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Camera and enclosure Equipment Approved manufacturers: Panasonic, Toshiba, Pelco, Silent Witness, Kalatel, SONY, Bosch. Equipment supplier shall have a service organization that can respond to emergency service calls within 4 hours. All material and/or equipment necessary for proper operation of the system, not specified or described herein, shall be deemed part of these specifications.

2.02 EXTERIOR CAMERA

A. Installation of each camera shall include lens, housing, mounting brackets, power supplies, and controllers fully compatible with the camera/lens combination provided and as shown on plans and specified herein. Refer to plans for quantities

B. Cameras shall have the following features
   1. Switching color/black and white.
   2. Automatic electronic shutter and a power and control jack for automatic iris control and shall be for exterior use under normal and low light conditions of illumination.
   3. Switchable internal/external linelock to avoid roll during switching operations.

C. The camera shall meet or exceed the following minimum specifications:
   1. Switching color/black and white.
   2. PAN TILT ZOOM
   3. Horizontal resolution - 400 lines or better
   4. Signal to noise ratio - 50 db (AGC off, weight on)
   5. Automatic light compensation
   6. Sensitivity - 3 lux color, .5 lux B&W at F1.6, AGC on
   7. Dynamic range - 10 shades of gray
   8. Scanning system - 2:1 interlace
   9. Operating temperature range - 0 to +130 deg. F.

D. The camera shall be provided with outdoor rated domes with dual element heater, wall/pendant mount. Housing shall be dust-tight and waterproof, aluminum construction with clear viewing window. Heater elements shall be configured to provide de-fog and de-frost operations. Housing shall contain all required hardware for mounting internal of camera. Coordinate color/finish with Owner/Consultant.

2.03 INTERIOR CAMERAS

A. Installation of each camera shall include lens, housing, mounting brackets and backboxes, receiver, power supplies, and controllers fully compatible with the camera/lens combination provided and as shown on plans and specified herein. Refer to plans for quantities.

B. The camera shall have the following features:
   1. Color, high resolution.
   2. Automatic electronic shutter and backlight compensation for automatic iris control and shall be for interior use under normal and low light conditions of illumination.
   3. Camera shall have switchable internal/external line lock to avoid roll during switching operations.

C. The camera shall have the following minimum specifications:
   1. Horizontal resolution - 400 lines or better
   2. Signal to noise ratio - 44 db
   3. Composite video signal - Adj. to 1 volt, peak to peak
   4. Automatic light compensation - 66,000 to 1
   5. Sensitivity - 1 lux at F1.2 (fixed focus stand. lens), AGC on
   6. Auto backlight compensation - switchable, factory preset

7. Scanning system - 2:1 interlace
8. 3 -10mm Varifocal lens
9. Operating temperature range - 20 to 122 deg. F
10. Line voltage – 12 or 24 VAC

D. Camera housings shall be compatible with CCTV camera specified to be installed within housings. Housings shall be provided with all cable entrance facilities for camera control and shall be adaptable to mounting devices used with cameras. All camera installations shall be securely attached to mounting surface. Use lead shields on solid masonry, toggle bolts for hollow masonry, and machine bolts for steel. All anchoring devices shall be rated to support not less than five times the total equipment weight. Escutcheon plates attached with security screws shall be used to conceal holes in walls or ceilings.
1. Corridor housings shall be domes, semi-recessed, totally enclosed and tamperproof with integral camera mounting hardware. Viewing window shall be clear Lexan. Camera and housing shall be suitable for mounting in lay-in ceiling.
2. Housings for areas with exposed ceilings or where shown as wall mounted shall be wall mounted, enclosed, all steel. Coordinate locations and mounting heights with owner and consultant.

E. Cameras shall be powered from a central low voltage power supply located by the contractor as required. Locations of low voltage power supplies shall be coordinated with the consultant.

2.04 VIDEO SWITCHER/CONTROLLER/RECORDER - DIGITAL

A. The unit shall be a digital encoder/decoder for use in recording and playing back images from multiple cameras. The unit shall consist of a digital encoding/decoding multiplexer module, a digital hard disc recording module and a remote access Ethernet module.

B. The digital multiplexer module shall have the following features at a minimum:
1. Up to 16 camera input. AGC shall be automatically, individually adjusted for each input channel.
2. Full screen or multi-screen display during record and playback modes. Unit shall provide two (2) video outputs for NTSC and one (1) video output S-VHS. Each output shall be separately configurable for full-screen or multi-screen.
3. Simultaneous playback on monitor A while live view on monitor B.
4. Provide time, date, camera number, and a user programmable 16 character camera title which is recorded with each camera image.
5. On screen menu programming, sequencing of cameras, video loss with on screen notification, freeze function, 2x digital zoom, alarm output relays.
6. Accept and broadcast industry standard pan/tilt/zoom controls to equipped cameras.

C. The digital recorder module shall have the following features:
1. Simultaneous playback and record in both real time and lapse modes with a record rate of 40 images per second. Unit shall be user programmable for frame rates specific to each camera or global to system. The scheduling for each camera of frame rate, image size and resolution shall be individually programmable.
2. 300 GB integral hard disc recorder per 16 cameras.
3. Record time, date, camera number, and a user programmable 16 character camera title with each camera image.
4. Front panel controls to mimic an analog VCR including forward, rewind, play, stop, and pause.
5. Motion detection with direction sensing. Settings and sensitivity shall be user adjustable for each camera. Settings shall also include variable frame rate for each camera upon motion or alarms.
6. 1024x512 digital memory array producing 720Hx484V resolution.
7. Wavelet, MPEG or other standard video compression algorithm. User programmable video image file size based upon image size, resolution and quality.
8. System hardware and software shall provide automatic reboot after power loss or system lock-up and return to record without user intervention.

D. The remote access module shall have the following features:
1. Ethernet port for remote viewing on a LAN/WAN system via a Graphical User Interface (GUI). The GUI software shall also allow simultaneous record and playback.
2. Multiple users shall be able to access the system simultaneously.
3. SCSI-2 port for external archiving hardware via DAT, DVT, or other media.
4. Password protection with multiple levels of control for system access and programming.

5. Instant access to stored images utilizing a common database. Images shall be searchable by time, date, camera or motion detection.

E. The digital video switcher/controller/recorder approved manufacturers shall be, Integral Technologies, GE, Dedicated Micros, or Honeywell.

F. General Requirements - Each camera shall be a dedicated homerun to the digital multiplexer/recorder. Refer to plans for quantities. Units shall be installed in system head end rack in room. Special attention must be paid to cable lengths. Signal boosters shall be utilized where applicable.

2.05 REMOTE VIEWING PC WORKSTATION

A. All software and PC workstations provided under this project required to operate on or through the owner's LAN, shall be compatible and provided with the current version of the owner's Network Operating System Client. Software and hardware incompatibility issues with equipment and software provided under this project and the owner's Network Operating System Client shall be considered the responsibility of this contract and shall be resolved to the owner's satisfaction to provide a stable and consistent operating environment.

B. Remote access software to be loaded onto owner selected network workstations. Provide a total of four (4) complete software packages with multiple concurrent user licenses. Systems that utilize hardware keys for licensing shall not be acceptable. All license keys shall be software activated.

C. Head-end Workstation shall be fully functional with all required software and drivers including software for digital CCTV system and remote access. Turn over copy of remote access software to owner. Provide workstations as follows:

1. 2.66 Ghz Intel Core 2 Duo Processor.
2. 2GB SDRAM.
3. 150GB Hard drive.
4. Video card 1024 x 768 resolution.
5. 8X, 4X, 32X CD/RW reader/recorder.
6. 10/100 switched Ethernet Card.
7. Parallel port.
8. Quantity of COM ports to support RS-232 readers and all system Loops.
9. Quantity of USB ports to support external hardware.
10. 17" LCD high resolution color monitor with rack mount shelf.
11. 101 Key keyboard and PS/2 3-button mouse with rack mount shelf.
12. Windows XP Professional. Coordinate exact OS as required by owner and software requirements.
13. Microsoft Internet Explorer.
14. Rack Mounted UPS / Battery Backup
    a. APC #SU2200RMXL3U Equals by: Compaq, Powerware, Best Power

2.06 VIDEO CONTROL RACK

A. Provide a floor standing, totally enclosed, ventilated rack with hinged locking front and rear doors and top mounted "quiet" type ventilation fan. Back doors to be solid and side panels to be ventilated. Front Doors to be glass. Rack to have front and rear 19" mounting rails. Floor rack to be standard 19" EIA rails. Coordinate cabinets with other trades to ensure color matching and compatibility.

B. Provide all required 120V power distributed through rack as required by installed equipment from local, dedicated, 120V receptacle in room.

C. Mount the multiplexer/recorder in rack. Locate rack in as located on plans.

D. Manufacturers: Great Lakes, B-Line, Ortronics, Hubbel, Middle Atlantic

2.07 WIRING

A. Video cable - Provide plenum rated, 75 ohm, type RG/6 video cable from each camera to head end controller/multiplexer/recorder. All video cable shall utilize solid copper conductors, 95% copper braid, FEP foam insulation with foam barrier and plenum rated outer jacket. Cable shall meet the following minimum electrical characteristics:

1. Nominal capacitance 17 pf/ft.
2. Nominal velocity of propagation 82%

3.	Nominal Impedance		75 ohm
4.	Nominal attenuation	1 MHz	.3dB/100ft.
	(i)	10 MHz	.75dB/100ft
	(ii)	100 MHz	2.0dB/100ft.

B. Provide additional RG/59 video cable as required to interconnect all items of head end equipment.

C. Provide twisted pair power cable from each camera to remote power supply as required by power supply and voltage drop calculations.

PART 3 - EXECUTION

3.01 INSTALLATION

A. CCTV wiring shall be furnished and installed in accordance with manufacturer's recommendations in compliance with all Local, State and National codes. All cables shall be run in conduit or above accessible ceilings where wiring may be open run, suspended by J-hooks, cable trays, or other approved means on four foot centers. Cables shall not be laid upon ceiling. Where multiple runs are required all cables shall be bundled with approved cable ties on four foot centers. Cables in exposed areas (GYM) shall be concealed on beams. All cabling shall be plenum rated.

B. Provide firestop material and seal all cable penetrations in the building.

C. Camera Mounts: The Contractor shall install the camera mounts as specified by the manufacturer and as shown; provide mounting hardware sized appropriately to secure the mount, camera and housing, provide electrical and signal transmission cabling to the mount location as specified.

D. Cameras: The Contractor shall install the cameras with power and signal lines to the camera; aim camera to give field of view as needed to cover the alarm zone and synchronize all cameras so the picture does not roll on the monitor when cameras are selected.
   1. Coordinate all camera lenses and aiming of each camera as directed by the Owner and consultant.

E. Multiplexer/Recorder (Digital): The Contractor shall install the units as shown and according to manufacturer's instructions; connect all subassemblies as specified by the manufacturer and as shown; connect video signal inputs and outputs as shown and specified; terminate video inputs as required; connect alarm signal inputs and outputs as specified. Connect to owner's LAN via local data outlets and provide IP addresses for each unit as coordinated with the Owner. Program units as required by owner.

3.02 IDENTIFICATION

A. Contractor shall identify and tag all cables with permanent type markers to denote equipment served. Cables shall be tagged at both ends and at each point where the cable is administered. All control and signal cable shall be installed continuous and without splices. Provide appropriate connectors or pre-manufactured cables for each application.

3.03 TESTS

A. System Startup
   1. The Contractor shall not apply power to the CCTV system until the following items have been completed:
      a. CCTV system equipment items and circuitry have been set up in accordance with manufacturer's instructions.
      b. A visual inspection of the CCTV system has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.
      c. System wiring has been tested and verified as correctly connected as indicated.
      d. All system grounding and transient protection systems have been verified as properly installed and connected as indicated.
      e. Power supplies to be connected to the CCTV system have been verified as the correct voltage, phasing, and frequency as indicated.
   2. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installation, defective equipment items, or collateral damage as a result of Contractor work/equipment.

B. Site Testing

1. General: The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all site testing. The Owner and consultant will witness all performance verification. Original copies of all data produced during performance verification shall be turned over to the Owner at the conclusion of testing prior to final approval.
2. Contractor's Field Testing: The Contractor shall calibrate and test all equipment, verify operation, place the integrated system in service, and test the integrated system. The Contractor shall deliver a report describing results of functional tests, diagnostics, and calibrations including written certification to the Owner that the installed complete system has been calibrated, tested, and is ready to begin performance verification testing. The report shall also include a copy of the approved performance verification test procedure. In addition, the Contractor shall make a master video tape recording showing typical day and night views of each camera in the system and shall deliver the tape with the report. Note any objects in the field of view that might produce highlights that could cause camera blinding. Note any objects in the field of view or anomalies which may cause blind spots. Note if a camera cannot be aimed to cover the zone. Note night assessment capabilities and whether lights or vehicle headlights cause blooming or picture degradation. If any of the above conditions or other conditions exist that cause picture degradation or interfere with the camera field of view, the Contractor shall inform the consultant. The tape shall be recorded using the video recorder installed as part of the CCTV system. The Contractor shall provide the Owner with the original tape as part of the documentation of the system and shall submit a letter certifying that the CCTV system is ready for performance verification testing. The field testing shall as a minimum include:
    a. Verification that the video transmission system and any signal or control cabling have been installed, tested, and approved.
    b. Verification that the multiplexer is fully functional and that the multiplexer has been programmed as needed for the site configuration.
    c. Verification that all video sources and video outputs provide a full bandwidth signal that complies with EIA 170 at all video inputs.
    d. Verification that all video signals are terminated properly.
    e. Verification that all cameras are synchronized and that the picture does not roll when cameras are switched.
3. The Contractor shall deliver a report describing results of functional tests, diagnostics, and calibrations including written certification to the Owner that the installed complete system has been calibrated, tested, and is ready to begin performance verification testing. The report shall also include a copy of the approved performance verification test procedure.
4. Performance Verification Test: The Contractor shall demonstrate that the completed CCTV system complies with the contract requirements. Using approved test procedures, all physical and functional requirements of the project shall be demonstrated and shown. The performance verification test, as specified, shall not be started until receipt by the Contractor of written permission from the consultant, based on the Contractor's written report. This shall include certification of successful completion of Contractor Field Testing as specified in paragraph "Contractor's Field Testing," and upon successful completion of training as specified. The consultant may terminate testing at any time when the system fails to perform as specified.

3.04 TRAINING REQUIREMENTS

A. The Contractor shall conduct training courses for designated personnel in the maintenance and operation of the CCTV system as specified. The training shall be oriented to the specific system being installed under this contract. Training manuals shall be delivered for each trainee with two additional manuals delivered for archiving at the project site. The Contractor is responsible for furnishing all audio-visual equipment and all other training materials and supplies. A training day is 8 hours of instruction, including two 15 minute breaks and excluding lunchtime, Monday through Friday, during the daytime shift in effect at the facility. Approval of the planned training schedule shall be obtained from the Owner at least 14 days prior to the training.

B. The course shall be taught at the project site for one full day during or after the Contractor's field testing. No part of the training given during this course will be counted toward completion of the performance verification test. The course shall consist of classroom instruction, hands-on training, instruction on the specific hardware configuration of the installed system, and specific instructions for operating the installed system. The course shall demonstrate system start up, system operation, system shutdown, system recovery after a failure, the specific hardware configuration, and operation of the system and its software.

The students should have no unanswered questions regarding operation of the installed CCTV system. The Contractor shall prepare and insert additional training material in the training manuals when the need for additional material becomes apparent during instruction. The course shall include:

1. 24 Total Hours
2. General CCTV hardware, installed system architecture and configuration.
3. Functional operation of the installed system and software.
4. Operator commands.
5. Fault diagnostics and correction.
6. General system maintenance.
7. Replacement of failed components and integration of replacement components into the operating CCTV system.

C. This training period shall be scheduled with the Owner after the successful completion of the system.

3.05 AS-BUILT DOCUMENTATION

A. The Contractor shall furnish the Owner two (2) complete bound as-built manuals in an 8.50" x 11" format. Drawings shall be a minimum of 11" x 17" engineering format. These manual shall be assembled in a loose leaf binder and shall contain:

1. System Operating Instructions
2. System Functional Block Diagram(s)
3. System Schematic Diagram(s)
4. System Wiring Diagrams
5. As-Built Drawings of Entire System including Equipment Rack Elevations
6. Component Technical Operating Manuals
7. Component Service Manuals
8. Final Endurance Test Report

B. Maintenance Manual: The maintenance manual shall describe maintenance for all equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

3.06 CERTIFICATION

A. Upon completion of the testing, the manufacturer or representative shall 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 and free of defects, and that the system is in compliance with this specification.

END OF SECTION

CENTRAL ELEMENTARY SCHOOL

CABLE INFRASTRUCTURE

			DROP TYPE AND QUANTITY															
FROM	TO	DESCRIPTION	1	2	1A	2A	2B	1C	2C	3	4	5	6	7	8	9	10	11
124A	100	Vestibule																
124A	102	Reception / Secretary						1	1								1	2
124A	102B	Conference Room						1	1									
124A	102C	Principal Office						1	1									
124A	102D	Guidance Office						1	1									
124A	102E	Admin Storage																
124A	102F	Mail Copy Room																2
124A	102G	In-School Suspension								1				1				
124A	102H	Itinerant Office												1				
124A	103	Health Clinic												1				
124A	104	Corridor															2	
124A	105	Teacher Prep						1	1									1
124A	106	Self Contained Classroom			1	1	1			2								
124A	107	Workspace Conference Room												1				
124A	109	Self Contained Classroom			1	1	1			2								
124A	110	Corridor															1	
124A	113	Classroom			1	1	1			2								
124A	114	Classroom			1	1	1			2								
124A	115	Classroom			1	1	1			2								
124A	116	Classroom			1	1	1			2								
124A	117	Kindergarten Classorrm			1	1	1			2								
124A	118	Kindergarten Classorrm			1	1	1			2								
124A	119	Kindergarten Classorrm			1	1	1			2								
124A	120	Kindergarten Classorrm			1	1	1			2								
124A	121	Kindergarten Classorrm			1	1	1			2								
124A	123A	Elevator Equipment Room																1
124A	124A	Telecom Room																
143B	127	Auditeria							1								2	
143B	128	Gymnasium												2			2	
143B	128A	PE Workroom / Storage																1
143B	129	Kitchen																
143B	129E	Dietician Office																1
143B	130	Corridor																
143B	131	Custodial Work Office																1
143B	133	Loading / Receiving									1							
143B	135	Mechanical Space																1
143B	136	Stage						2										
143B	139	Music Room			1	1	1			2								
143B	141	Art Room			1	1	1			2								
143B	142	Computer Lab			1	1	1			15								
143B	143	Reading Room						1	1	2							1	1
143B	143A	Media Office												1				

CENTRAL ELEMENTARY SCHOOL

CABLE INFRASTRUCTURE

			DROP TYPE AND QUANTITY														
FROM	TO	DESCRIPTION	1	2	1A	2A	2B	1C	2C	3	4	5	6	7	8	9	10	11
143B	143B	Main Equipment Room												1				
143B	143C	AV Storage																1
143B	200A	Corridor															1	
143B	201	Mechanical Space																1
143B	202	Extended Learning Area															1	
143B	203	Classroom			1	1	1			2								
143B	204	Classroom			1	1	1			2								
143B	205	Small Group Room						1	1	1								
143B	206	Small Group Room						1	1	1								
143B	207	Classroom			1	1	1			2								
143B	208	Small Group Room						1	1	1								
222B	209	Classroom			1	1	1			2								
222B	210	Special Ed Resource			2	2	2			1								
222B	211	Classroom			1	1	1			2								
222B	212	Corridor															1	
222B	213	Classroom			1	1	1			2								
222B	214	Classroom			1	1	1			2								
222B	215	Classroom			1	1	1			2								
222B	216	Classroom			1	1	1			2								
222B	217	Classroom			1	1	1			2								
222B	218	Classroom			1	1	1			2								
222B	219	Classroom			1	1	1			2								
222B	220	Classroom			1	1	1			2								
222B	221	Corridor															1	
222B	222	Custodial storage																
222B	222B	Tech Closet																
222B	224	Small Group Room						1	1	1								
222B	225	Small Group Room						1	1	1								
222B	226	Classroom			1	1	1			2								
222B	227	Mechanical Space																1

NOTE: IF ANY DISCREPANCIES IN AMOUNTS BETWEEN THESE ROOM SCHEDULES AND THE DRAWINGS ARE FOUND, THE CONTRACTOR IS TO BID THE HIGHER AMOUNT

NOTES

NOTES

LOGAN-HOCKING
CENTRAL ELEMENTARY SCHOOL ROOM TECHNOLOGY

		27 31 13			27 41 19						27 51 27	27 53 23	27 21 00	
		TELEPHONE			MONITOR			DVD	LCD	PROJ	AUDIO	SAT	WIRELESS	
AREA #	DESCRIPTION	AMT	TYPE	MOUNT	AMT	SIZE	MOUNT	VCR		SCREEN	SYSTEM	CLOCK	ACCESS	COMMENTS
100	Vestibule													
102	Reception / Secretary	2	1C 1S	Desk	1	32	Wall					1		
102A	Corridor												1	
102B	Conference Room	1	S	Desk	1	42	Wall	1				1		
102C	Principal Office	1	S	Desk	1	32	Wall	1				1		
102D	Guidance Office	1	S	Desk	1	32	Wall	1				1		
102E	Admin Storage	1	S	Desk								1		
102F	Mail Copy Room	1	S	Desk								1		
102G	In-School Suspension	1	S	Desk	1	42	Wall	1				1		
102H	Itinerant Office	1	S	Desk								1		
103	Health Clinic	1	S	Desk								1		
104	Corridor												2	
105	Teacher Prep	1	S	WALL	1	42	Wall	1				1		
106	Self Contained Classroom	1	S	Desk				1	1	1	1	1		
107	Workspace Conference Room	1	S	WALL										
109	Self Contained Classroom	1	S	Desk				1	1	1	1	1		
110	Corridor													
111	Corridor												1	
112	Corridor													
113	Classroom	1	S	Desk				1	1	1	1	1		
114	Classroom	1	S	Desk				1	1	1	1	1		
115	Classroom	1	S	Desk				1	1	1	1	1		
116	Classroom	1	S	Desk				1	1	1	1	1		
117	Kindergarten Classorrm	1	S	Desk				1	1	1	1	1		
118	Kindergarten Classorrm	1	S	Desk				1	1	1	1	1		
119	Kindergarten Classorrm	1	S	Desk				1	1	1	1	1		
120	Kindergarten Classorrm	1	S	Desk				1	1	1	1	1		
121	Kindergarten Classorrm	1	S	Desk				1	1	1	1	1		
123	Inst Material Storage	1	S	WALL										
123A	Elevator Equipment Room													
124A	Telecom Room													
127	Auditeria							1	1	1	1	2	2	
128	Gymnasium										1	1	2	
128A	PE Workroom / Storage	1	S	Desk								1		
129	Kitchen	1	S	Desk								1		
129E	Dietician Office	1	S	Desk								1		
130	Corridor												1	
131	Custodial Work Office	1	S	Desk								1		
133	Loading / Receiving													
134	Outdoor Storage													
135	Mechanical Space													
136	Stage												1	
138	Table Storage	1	S	WALL										
139	Music Room	1	S	Desk				1	1	1	1	1		
140	Corridor													
141	Art Room	1	S	Desk				1	1	1	1	1		
142	Computer Lab	1	S	Desk				1	1	1	1	1	1	

LOGAN-HOCKING
CENTRAL ELEMENTARY SCHOOL ROOM TECHNOLOGY

		27 31 13			27 41 19						27 51 27	27 53 23	27 21 00	
		TELEPHONE			MONITOR			DVD	LCD	PROJ	AUDIO	SAT	WIRELESS	
AREA #	DESCRIPTION	AMT	TYPE	MOUNT	AMT	SIZE	MOUNT	VCR		SCREEN	SYSTEM	CLOCK	ACCESS	COMMENTS
143	Reading Room	1	S	Desk								1	2	
143A	Media Office	1	S	Desk								1		
143B	Main Equipment Room	1	S	WALL								1		
143C	AV Storage	1	S	WALL										
200A	Corridor												1	
201	Mechanical Space													
202	Extended Learning Area												1	
203	Classroom	1	S	Desk				1	1	1	1	1		
204	Classroom	1	S	Desk				1	1	1	1	1		
205	Small Group Room	1	S	Desk	1	42	Wall	1				1		
206	Small Group Room	1	S	Desk	1	42	Wall	1				1		
207	Classroom	1	S	Desk				1	1	1	1	1		
208	Small Group Room	1	S	Desk	1	42	Wall	1				1		
209	Classroom	1	S	Desk				1	1	1	1	1		
210	Special Ed Resource	2	S	Desk				2	2	2	2	2		
211	Classroom	1	S	Desk				1	1	1	1	1		
212	Corridor												3	
213	Classroom	1	S	Desk				1	1	1	1	1		
214	Classroom	1	S	Desk				1	1	1	1	1		
215	Classroom	1	S	Desk				1	1	1	1	1		
216	Classroom	1	S	Desk				1	1	1	1	1		
217	Classroom	1	S	Desk				1	1	1	1	1		
218	Classroom	1	S	Desk				1	1	1	1	1		
219	Classroom	1	S	Desk				1	1	1	1	1		
220	Classroom	1	S	Desk				1	1	1	1	1		
221	Corridor													
222	Co													
222B	Tech Closet													
224	Small Group Room	1	S	Desk	1	42	Wall	1				1		
225	Small Group Room	1	S	Desk	1	42	Wall	1				1		
226	Classroom	1	S	Desk				1	1	1	1	1		
227	Mechanical Space													
NOTE: IF ANY DISCREPANCIES IN AMOUNTS BETWEEN THESE ROOM SCHEDULES AND THE DRAWINGS ARE FOUND, THE CONTRACTOR IS TO BID THE HIGHER AMOUNT														

LOGAN-HOCKING
GREEN ELEMENTARY SCHOOL ROOM TECHNOLOGY

		27 31 13			27 41 19						27 51 27	27 53 23	27 21 00	
		TELEPHONE			MONITOR			DVD	LCD	PROJ	AUDIO	SAT	WIRELESS	
AREA #	DESCRIPTION	AMT	TYPE	MOUNT	AMT	SIZE	MOUNT	VCR		SCREEN	SYSTEM	CLOCK	ACCESS	COMMENTS
1	Vestibule													
2	Reception				1	32	WALL	1				1	1	
2A	Secretary	2	1C 1D	DESK								1		
2C	Health Clinic	1	S	DESK								1		
2E	Conference Room	1	S	DESK	1	42	WALL	1				1		
2F	Principal Office	1	S	DESK	1	32	Wall	1				1		
2G	Guidance Office	1	S	DESK								1		
2H	Admin Storage													
2I	Mail/Work Room	1	S	DESK								1		
2K	Itinerant Office	1	S	DESK								1		
3	Media Center	1	S	DESK				1	1	1	1	1	1	
3B	Media Office	1	S	DESK								1		
3C	Main Equipment Room	1	S	DESK								1		
4	Corridor													
5	Computer Lab	1	S	DESK				1	1	1	1	1	1	
6	Corridor													
6A	PE Storage	1	S	DESK										
7	Corridor													
8	Auditeria							1	1			2	2	
9	Gymnasium	1	S	DESK								2	1	
10	Mechanical	1	S	WALL										
11	Workroom Storage	1	S	DESK										
11A	Custodial Office	1	S	DESK								1		
12	Outdoor Storage													
13	Table Storage													
14	Receiving											1		
15	Kitchen											1		
15	SERVING	1	S	DESK										Next to POS computer
15C	Kitchen Office	1	S	DESK								1		
17	Stage	1	S	DESK										
19	Classroom	1	S	DESK				1	1	1	1	1		
20	Music Classroom	1	S	DESK				1	1	1	1	1		
21	Classroom	1	S	DESK				1	1	1	1	1		
22	Classroom	1	S	DESK				1	1	1	1	1		
23	Classroom	1	S	DESK				1	1	1	1	1		
24	Classroom	1	S	DESK				1	1	1	1	1		
25	Classroom	1	S	DESK				1	1	1	1	1		
26	Classroom	1	S	DESK				1	1	1	1	1		
27	Classroom	1	S	DESK				1	1	1	1	1		
28	Classroom	1	S	DESK				1	1	1	1	1		
29	Corridor												3	
30	In-School Suspension											1		
31	Corridor												3	
31B	Tech Closet													
32	Teacher Prep / Dining	1	S	DESK	1	42	WALL	1				1	1	
34	Material Storage											1		
35	Admin storage	1	S	DESK								1		
36	Art Classroom	1	S	DESK				1	1	1	1	1		
37	Pre K Classroom	1	S	DESK				1	1	1	1	1		
38	Self Contained Classroom	1	S	DESK				1	1	1	1	1		
39	Kindergarten Classroom	1	S	DESK				1	1	1	1	1		

LOGAN-HOCKING
GREEN ELEMENTARY SCHOOL ROOM TECHNOLOGY

		27 31 13			27 41 19						27 51 27	27 53 23	27 21 00	
		TELEPHONE			MONITOR			DVD	LCD	PROJ	AUDIO	SAT	WIRELESS	
AREA #	DESCRIPTION	AMT	TYPE	MOUNT	AMT	SIZE	MOUNT	VCR		SCREEN	SYSTEM	CLOCK	ACCESS	COMMENTS
40	Small Group Room	1	S	DESK				1	1	1	1	1		
41	Kindergarten Classroom	1	S	DESK				1	1	1	1	1		
42	Classroom	1	S	DESK				1	1	1	1	1		
44	Classroom	1	S	DESK				1	1	1	1	1		
45	Self Contained Classroom	1	S	DESK				1	1	1	1	1		
46	Classroom	1	S	DESK				1	1	1	1	1		
NOTE: IF ANY DISCREPANCIES IN AMOUNTS BETWEEN THESE ROOM SCHEDULES AND THE DRAWINGS ARE FOUND, THE CONTRACTOR IS TO BID THE HIGHER AMOUNT														

LOGAN-HOCKING
HIGH SCHOOL ROOM TECHNOLOGY

		27 31 13			27 41 19						27 51 27	27 53 23	27 21 00	
		TELEPHONE			MONITOR			DVD	LCD	PROJ	AUDIO	SAT	WIRELESS	
AREA #	DESCRIPTION	AMT	TYPE	MOUNT	AMT	SIZE	MOUNT	VCR		SCREEN	SYSTEM	CLOCK	ACCESS	COMMENTS
100	Lobby	1	C	DESK								1		
101A	Career Center/Attend/Reception	1	S	DESK								1		
101B	Health Clinic	1	S	DESK								1		
101E	Asst. Principal	1	S	DESK								1		
101F	Guidance Conference	1	S	DESK	1	42	WALL					1		
101G	Corridor												1	
101I	Guidance Office	1	S	DESK								1		
101J	Itinerant Office	1	S	DESK								1		
101K	Guidance Office	1	S	DESK								1		
101L	Itinerant Office	1	S	DESK								1		
101M	Guidance Office	1	S	DESK								1		
101O	Guidance Office	1	S	DESK								1		
101Q	Guidance Conference	1	S	DESK	1	42	WALL					1		
102A	Secretary/Reception	1	C	DESK								1		
102B	Corridor												1	
102C	Mail/Work/Copy	1	S	WALL								1		
102D	Conference Room	1	S	DESK	1	42	WALL					1		
102F	Asst. Principal	1	S	DESK								1		
102G	In-School Suspension	1	S	DESK				1	1	1	1	1		
102H	Asst. Principal	1	S	DESK								1		
102I	Itinerant Office	1	S	DESK								1		
102J	Asst. Principal	1	S	DESK								1		
102K	Principal's Office	1	S	DESK								1		
102L	Conference Room	1	S	DESK	1	42	WALL					1		
102O	Secretary/Reception	1	C	DESK								1		
102P	Athletic Director	1	S	DESK								1		
103	Commons				1	42	Wall							
107A	Elevator Equipment													
108	Tech Closet													
109	Small Group Room	1	S	WALL								1		
110	Corridor												1	
111	Spec Ed Resource	1	S	DESK				1	1	1	1	1		
112	Spec Ed Resource	1	S	DESK				1	1	1	1	1		
113	Self-Contained Classroom	1	S	DESK				1	1	1	1	1		
113A	Conference Room	1	S	DESK	1	42	WALL					1		
114	Self-Contained Classroom	1	S	DESK				1	1	1	1	1		
114A	Conference Room	1	S	DESK	1	42	WALL					1		
115	Classroom	1	S	DESK				1	1	1	1	1		
116	Classroom	1	S	DESK				1	1	1	1	1		
117	Classroom	1	S	DESK				1	1	1	1	1		
118	Classroom	1	S	DESK				1	1	1	1	1		
402	Kitchen	1	S	DESK								1	1	
402E	Office	2	S	DESK								1		
403	Cafeteria				1	42	Wall	1	1	1	1	1	3	
408	Life Skills Lab	1	S	DESK				1	1	1	1	1		
409	Lobby Services	1	S	DESK				1			1	1		
410	Life Skills Lab	1	S	DESK				1	1	1	1	1		
412A	Corridor												1	
413	Staff Dining	1	S	DESK	1	42	WALL					2		
201	Business Classroom	1	S	DESK				1	1	1	1	1		
202	Business Classroom	1	S	DESK				1	1	1	1	1		

LOGAN-HOCKING
HIGH SCHOOL ROOM TECHNOLOGY

		27 31 13			27 41 19						27 51 27	27 53 23	27 21 00	
		TELEPHONE			MONITOR			DVD	LCD	PROJ	AUDIO	SAT	WIRELESS	
AREA #	DESCRIPTION	AMT	TYPE	MOUNT	AMT	SIZE	MOUNT	VCR		SCREEN	SYSTEM	CLOCK	ACCESS	COMMENTS
203	Corridor												1	
204	Corridor												1	
205	Control Room	1	S	WALL								1		
206A	Sound Booth													
208	Mechanical Room													
209	Small Group Room	1	S	WALL								1		
210	Corridor												1	
211	Marketing Classroom	1	S	DESK				1	1	1	1	1		
212	Spec Ed Resource	1	S	DESK				1	1	1	1	1		
213	Spec Ed Self-Cont	1	S	DESK				1	1	1	1	1		
214	Spec Ed Self-Cont	1	S	DESK				1	1	1	1	1		
215	Classroom	1	S	DESK				1	1	1	1	1		
216	Classroom	1	S	DESK				1	1	1	1	1		
217	Classroom	1	S	DESK				1	1	1	1	1		
218	Classroom	1	S	DESK				1	1	1	1	1		
219	Science Classroom	1	S	DESK				1	1	1	1	1		
220	Science Classroom	1	S	DESK				1	1	1	1	1	1	
225	Small Group Room	1	S	WALL								1		
226	Small Group Room	1	S	WALL								1		
235	Corridor													
239	Spec Ed Self-Cont	1	S	DESK				1	1	1	1	1		
241	Classroom	1	S	DESK				1	1	1	1	1	1	
242	Spec Ed Self-Cont	1	S	DESK				1	1	1	1	1		
243	Classroom	1	S	DESK				1	1	1	1	1		
244	Classroom	1	S	DESK				1	1	1	1	1	1	
245	Classroom	1	S	DESK				1	1	1	1	1	1	
246	Classroom	1	S	DESK				1	1	1	1	1		
247	Classroom	1	S	DESK				1	1	1	1	1		
248	Classroom	1	S	DESK				1	1	1	1	1		
249	Project Classroom	1	S	DESK				1	1	1	1	1		
250	Science Classroom	1	S	DESK				1	1	1	1	1	1	
251	Corridor													
252	Science Classroom	1	S	DESK				1	1	1	1	1	1	
252A	Science Prep	1	S	WALL								1		
253	Project Classroom	1	S	DESK				1	1	1	1	1		
254	Classroom	1	S	DESK				1	1	1	1	1		
255	Classroom	1	S	DESK				1	1	1	1	1		
256	Classroom	1	S	DESK				1	1	1	1	1	1	
257	Classroom	1	S	DESK				1	1	1	1	1		
258	Classroom	1	S	DESK				1	1	1	1	1		
259	Classroom	1	S	DESK				1	1	1	1	1		
260	Teach Prep Room	1	S	WALL								1		
261	Classroom	1	S	DESK				1	1	1	1	1	1	
263	Spec Ed Self-Cont	1	S	DESK				1	1	1	1	1		
267	Corridor													
268	Mechanical Closet													
301	Lobby				1	42	Wall							
302	Multi-Use Classroom	1	S	DESK				1	1	1	1	1	1	
305	Corridor												1	
306	Auditorium							1	1	1	1	1		
307	Classroom	1	S	DESK				1	1	1	1	1		
309	Classroom	1	S	DESK				1	1	1	1	1		

LOGAN-HOCKING
HIGH SCHOOL ROOM TECHNOLOGY

		27 31 13			27 41 19						27 51 27	27 53 23	27 21 00	
		TELEPHONE			MONITOR			DVD	LCD	PROJ	AUDIO	SAT	WIRELESS	
AREA #	DESCRIPTION	AMT	TYPE	MOUNT	AMT	SIZE	MOUNT	VCR		SCREEN	SYSTEM	CLOCK	ACCESS	COMMENTS
309A	Reference Room	2	S	DESK								1		
311	Vo-Ag	1	S	WALL								1	1	
311A	Office	1	S	DESK								1		
311B	Greenhouse													
312	Custodial Workroom	1	S	DESK								1		
313	Production Lab	1	S	DESK								1	1	
313B	Office	2	S	DESK								1		
314	Custodial Office	1	S	DESK								1		
315	Corridor												1	
316	Drama Classroom	1	S	DESK				1	1	1	1	1		
317	Cadd Lab	1	S	DESK				1	1	1	1	1		
318	Dressing Room	1	S	WALL								1		
320	Dressing Room	1	S	WALL								1		
319	Classroom	1	S	DESK				1	1	1	1	1		
323	Mechanical Room													
324	Stage	1	S	WALL								1	1	
327	Tech Closet													
330	Corridor												1	
331	Art Classroom	1	S	DESK				1	1	1	1	1		
331B	Digital Photo Lab	1	S	WALL								1		
332	Instrumental Room	1	S	WALL				1	1	1	1	1		
332D	Music Library	2	S	DESK								1		
333	Art Classroom	1	S	DESK				1	1	1	1	1		
334	Vocal Room	1	S	WALL				1	1	1	1	1		
334A	Vocal Music Room	1	S	DESK								1		
335A	Ensemble	1	S	WALL								1		
335B	Ensemble	1	S	WALL								1		
414	Aux Gym											2	1	
414A	Aux Gym STORAGE	1	S	WALL										
415	Gym											2	2	
415A	Gym STORAGE	1	S	WALL										
416	Multi-Use PE Room	1	S	WALL								1		
418	Physical Health Room	1	S	DESK				1	1	1	1	1	1	
423	PE Office	1	S	DESK								1		
426	Conference Room	1	S	WALL	1	42	WALL					1		
427	Conference Room	1	S	WALL	1	42	WALL					1	1	
428	Trainer	1	S	WALL								1		
429	PE Office	1	S	DESK								1		
433	Tech Closet													
437	PE Office	3	S	DESK								1		
119	Science Classroom	1	S	DESK				1	1	1	1	1		
120	Science Classroom	1	S	DESK				1	1	1	1	1		
125	Small Group Room	1	S	WALL								1		
126	Small Group Room	1	S	WALL								1		
135	Corridor												1	
139	Small Self-Contained Classroom	1	S	DESK				1	1	1	1	1		
141	Classroom	1	S	DESK				1	1	1	1	1		
142	Classroom	1	S	DESK				1	1	1	1	1		
143	Classroom	1	S	DESK				1	1	1	1	1		
144	Classroom	1	S	DESK				1	1	1	1	1		
145	Classroom	1	S	DESK				1	1	1	1	1		
146	Science Classroom	1	S	DESK				1	1	1	1	1		

LOGAN-HOCKING
HIGH SCHOOL ROOM TECHNOLOGY

		27 31 13			27 41 19						27 51 27	27 53 23	27 21 00	
		TELEPHONE			MONITOR			DVD	LCD	PROJ	AUDIO	SAT	WIRELESS	
AREA #	DESCRIPTION	AMT	TYPE	MOUNT	AMT	SIZE	MOUNT	VCR		SCREEN	SYSTEM	CLOCK	ACCESS	COMMENTS
147	Teach Prep Room	1	S	WALL	1	42	WALL					1		
147A	Material Storage													
148	Science Classroom	1	S	DESK				1	1	1	1	1		
148A	Science Prep	1	S	WALL										
149	Project Classroom	1	S	WALL				1	1	1	1	1		
150	Corridor												1	
151	Media Center	1	S	DESK	2	42	WALL	2			1	2	2	
151A	Conference Room	1	S	DESK	1	42	WALL					1		
152	Science Classroom	1	S	DESK				1	1	1	1	1		
152A	Science Prep	1	S	WALL										
153A	Main Cross Connect	1	S	WALL										
153	Media Office	5	S	DESK	1	42	WALL					1		
154	Classroom	1	S	DESK				1	1	1	1	1		
155	Material Storage													
156	Classroom	1	S	DESK				1	1	1	1	1		
157	Multi-Media Classroom	1	S	WALL	2	42	WALL	2				1		
158	Classroom	1	S	DESK				1	1	1	1	1		
159	Classroom	1	S	DESK				1	1	1	1	1		
160	Spec Ed Self-Cont	1	S	DESK				1	1	1	1	1		
161	Classroom	1	S	DESK				1	1	1	1	1		
163	Classroom	1	S	DESK				1	1	1	1	1		
167	Corridor												1	
421	Locker Rm											1		
424	Locker Rm											1		
425	Locker Rm											1		
432	Locker Rm											1		
434	Locker Rm											1		
435	Locker Rm											1		
436	Locker Rm											1		
438	Locker Rm											1		
439	Locker Rm											1		
NOTE: IF ANY DISCREPANCIES IN AMOUNTS BETWEEN THESE ROOM SCHEDULES AND THE DRAWINGS ARE FOUND, THE CONTRACTOR IS TO BID THE HIGHER AMOUNT														

LOGAN-HOCKING
MIDDLE SCHOOL ROOM TECHNOLOGY

		27 31 13			27 41 19						27 51 27	27 53 23	27 21 00	
		TELEPHONE			MONITOR			DVD	LCD	PROJ	AUDIO	SAT	WIRELESS	
AREA #	DESCRIPTION	AMT	TYPE	MOUNT	AMT	SIZE	MOUNT	VCR		SCREEN	SYSTEM	CLOCK	ACCESS	COMMENTS
76	Classroom	1	S	DESK				1	1	1	1	1		
77	Classroom	1	S	DESK				1	1	1	1	1		
78	Classroom	1	S	DESK				1	1	1	1	1		
79	Classroom	1	S	DESK				1	1	1	1	1		
80	Classroom	1	S	DESK				1	1	1	1	1		
81	Classroom	1	S	DESK				1	1	1	1	1		
82	Classroom	1	S	DESK				1	1	1	1	1		
83	Classroom	1	S	DESK				1	1	1	1	1		
85	Locker/Commons													
87	Conference Room	1	E	DESK	1	42	WALL	1				1		
88	Corridor												4	
90	SECRETARY/RECEPTION	1	C	DESK	1	32	WALL							
100	Reception	1	C	DESK	1	32	WALL					1		
102	Conference Room	1	S	DESK	1	42	WALL					1		
104	Workroom	1	S	DESK				1	1	1	1	1		
106	Clinic	1	S	DESK								1		
107	Library	2	S	DESK				2	2	2	1	3		
108	Conference Room	1	S	WALL								1		
110	Reception	1	C	DESK	1	32	WALL					1		
112	Storage	1	S	WALL										
113	Classroom	1	S	DESK				1	1	1	1	1		
114	Classroom	1	S	DESK				1	1	1	1	1		
116	Classroom	1	S	DESK				1	1	1	1	1		
118	Observation	1	S	WALL								1		
121	Classroom	1	S	DESK				1	1	1	1	1		
122	Classroom	1	S	DESK				1	1	1	1	1		
124	Conference Room	1	E	DESK	1	42	WALL	1				1		
125	Classroom	1	S	DESK				1	1	1	1	1		
126	Classroom	1	S	DESK				1	1	1	1	1		
127	Classroom	1	S	DESK				1	1	1	1	1		
128	Classroom	1	S	DESK				1	1	1	1	1	1	
130	Classroom	1	S	DESK				1	1	1	1	1	1	
131	Classroom	1	S	DESK				1	1	1	1	1		
132	Classroom	1	S	DESK				1	1	1	1	1	1	
134	Classroom	1	S	DESK				1	1	1	1	1		
136	Classroom	1	S	DESK				1	1	1	1	1		
138	Classroom	1	S	DESK				1	1	1	1	1		
139	Classroom	1	S	DESK				1	1	1	1	1		
140	Classroom	1	S	DESK				1	1	1	1	1		
142	Classroom	1	S	DESK				1	1	1	1	1		
143	Classroom	1	S	DESK				1	1	1	1	1		
144	Computer Lab	1	S	DESK				1	1	1	1	1		
146	Keyboard Lab	1	S	DESK				1	1	1	1	1		
147	Workroom	1	S	WALL	1	42	WALL					1		
148	BOYS PE OFFICE	2	S	DESK								1		
148	TRAINING ROOM	1	S	WALL								1		
148	STORAGE	1	S	WALL										
149	Gym											2		

LOGAN-HOCKING
MIDDLE SCHOOL ROOM TECHNOLOGY

		27 31 13			27 41 19						27 51 27	27 53 23	27 21 00	
		TELEPHONE			MONITOR			DVD	LCD	PROJ	AUDIO	SAT	WIRELESS	
AREA #	DESCRIPTION	AMT	TYPE	MOUNT	AMT	SIZE	MOUNT	VCR		SCREEN	SYSTEM	CLOCK	ACCESS	COMMENTS
149D	Press Room													
151	Conference Room	1	S	WALL	1	42	WALL					1		
156	AUDITORIUM							1	1	1				
162	Stage	1	S	WALL								1		
168	Music Lobby												1	
170	Food & Clothing Lab	1	S	DESK				1	1	1	1	1		
171	Dining				2	42	WALL					4	2	
172	Home Ec	1	S	DESK				1	1	1	1	1		
173	Concession													
175	IDF													
176	Serving													
177	Storage													
178	Food Prep													
179	GIRLS PE OFFICE	1	S	DESK								1		
180	Mechanical													
182	Art	1	S	DESK				1	1	1	1	1		
184	Art	1	S	DESK				1	1	1	1	1		
186	Dining													
188	Lab	1	S	DESK				1	1	1	1	1		
202	Classroom	1	S	DESK				1	1	1	1	1		
204	Classroom	1	S	DESK				1	1	1	1	1		
206	Classroom	1	S	DESK				1	1	1	1	1		
208	Classroom	1	S	DESK				1	1	1	1	1		
210	Conference Room	1	E	WALL	1	42	WALL	1				1		
211	Classroom	1	S	DESK				1	1	1	1	1		
212	Science Classroom	1	S	DESK				1	1	1	1	1	1	
213	Computer Lab	1	S	DESK				1	1	1	1	1		
214	Science Classroom	1	S	DESK				1	1	1	1	1	1	
216	Science Classroom	1	S	DESK				1	1	1	1	1	1	
217	Classroom	1	S	DESK				1	1	1	1	1		
218	Science Classroom	1	S	DESK				1	1	1	1	1	1	
220	Science Classroom	1	S	DESK				1	1	1	1	1		
221	Classroom	1	S	DESK				1	1	1	1	1		
222	Classroom	1	S	DESK				1	1	1	1	1		
224	Classroom	1	S	DESK				1	1	1	1	1		
226	Classroom	1	S	DESK				1	1	1	1	1		
227	Classroom	1	S	DESK				1	1	1	1	1		
228	Classroom	1	S	DESK				1	1	1	1	1		
230	Conference Room	1	E	WALL	1	42	WALL	1				1		
231	Classroom	1	S	DESK				1	1	1	1	1		
232	Classroom	1	S	DESK				1	1	1	1	1		
233	IDF													
234	Mechanical													
235	Classroom	1	S	DESK				1	1	1	1	1		
236	Classroom	1	S	DESK				1	1	1	1	1		
237	Classroom	1	S	DESK				1	1	1	1	1		
238	Conference Room	1	E	WALL	1	42	WALL	1				1		
256	Corridor												2	

LOGAN-HOCKING
MIDDLE SCHOOL ROOM TECHNOLOGY

		27 31 13			27 41 19						27 51 27	27 53 23	27 21 00	
		TELEPHONE			MONITOR			DVD	LCD	PROJ	AUDIO	SAT	WIRELESS	
AREA #	DESCRIPTION	AMT	TYPE	MOUNT	AMT	SIZE	MOUNT	VCR		SCREEN	SYSTEM	CLOCK	ACCESS	COMMENTS
276	Classroom	1	S	DESK				1	1	1	1	1		
277	Classroom	1	S	DESK				1	1	1	1	1		
278	Classroom	1	S	DESK				1	1	1	1	1		
279	Classroom	1	S	DESK				1	1	1	1	1		
280	Classroom	1	S	DESK				1	1	1	1	1		
281	Classroom	1	S	DESK				1	1	1	1	1		
282	Classroom	1	S	DESK				1	1	1	1	1		
283	Classroom	1	S	DESK				1	1	1	1	1		
285	Classroom	1	S	DESK				1	1	1	1	1		
287	Teach Prep Room	1	E	DESK	1	42	WALL	1				1		
288	Corridor													
290	Project Classroom	1	S	DESK				1	1	1	1	1		
305	Corridor												2	
306	Corridor												2	
307	Corridor												2	
308	Corridor												2	
309	Corridor													
310	Corridor													
311	Corridor													
315	Corridor												2	
319	Corridor												1	
320	Corridor												1	
321	Corridor												3	
322	Corridor												2	
403	Corridor												5	
404	Corridor												1	
405	Corridor												1	
406	Corridor												1	
407	Corridor												6	
100A	Principal's Office	1	S	DESK								1		
100B	Office	1	S	DESK								1		
100C	Office	1	S	DESK								1		
107A	MDF ROOM	1	S	WALL										
107B	Office/Process AV Storage	4	S	DESK	1	42	WALL	1				2		
110A	Office	1	S	DESK								1		
110B	Office	1	S	DESK								1		
149BAM	Mechanical													
149BDM	Mechanical													
149C	Storage													
149D	Press Room	1	S	DESK										
149E	Storage													
156A	Control Room	1	S	WALL								1		
168A	Music	1	S	DESK				1	1	1	1	1		
168B	Music Library													
168C	Practice Room													
168D	Practice Room													
168E	MUSIC OFFICE	2	S	DESK								1		
168F	Practice Room													

LOGAN-HOCKING
MIDDLE SCHOOL ROOM TECHNOLOGY

		27 31 13			27 41 19						27 51 27	27 53 23	27 21 00	
		TELEPHONE			MONITOR			DVD	LCD	PROJ	AUDIO	SAT	WIRELESS	
AREA #	DESCRIPTION	AMT	TYPE	MOUNT	AMT	SIZE	MOUNT	VCR		SCREEN	SYSTEM	CLOCK	ACCESS	COMMENTS
168G	Practice Room													
168H	Band Room	1	S	WALL				1	1	1	1	1		
178G	Office	1	S	DESK								1		
180A	Mechanical													
288B	Tech Closet													
88B	Conference Room	1	E	DESK	1	42	WALL	1				1		
90A	Guidance	1	S	DESK								1		
90B	Guidance	1	S	DESK								1		
90C	Guidance	1	S	DESK								1		
90E	Conference Room	1	E	DESK	1	42	WALL	1				1		
90F	Instructional Material Storage													
E2	Elevator Equipment													
154a	Main Entrance Corridor (Chieftain Head)				1	42	Wall							
NOTE: IF ANY DISCREPANCIES IN AMOUNTS BETWEEN THESE ROOM SCHEDULES AND THE DRAWINGS ARE FOUND, THE CONTRACTOR IS TO BID THE HIGHER AMOUNT														