SECTION 27 05 00
COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Common work results for communications systems including general project requirements, other related specification sections, communications references, standards, definitions, abbreviations and acronyms, quality control requirements, communication submittals to include shop drawings, product and material data sheets, project record documentation, testing, certification, and other items required, for complete functioning communications system.

1.2 REFERENCES

A. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.
B. Florida Building Code, 7th Edition (2020).
C. NFPA 70 (National Electrical Code, 2017 Edition).
D. Telecommunications Standards:
   1. ANSI/TIA/EIA standards and BICSI methodologies (TDMM and CO-OSP). Reference to term "telecommunications network", is hereinafter referred to as Information Transport System Installation (ITSI).
   2. Methodologies refers to BISCI manuals for telecommunications design and CO-OSP.
E. American Standards for Testing Materials (ASTM).
F. Underwriters Laboratories (UL).
G. St. Johns County School District Structured Cabling Standards V7.4.

1.3 REFERENCES, DEFINITIONS, AND ACRONYMS

A. See Section 01 42 00 – References for additional reference standards, abbreviations, definitions, and acronyms.
B. See BICSI Dictionary, 3rd Edition for additional work meanings for communications work.
C. Structured Cabling System Description:
   1. Information Transport System includes copper and optical fiber, and equipment owned by outside providers carrying Owner information. Pathways are not limited to Owner's system but may include those owned by third parties. Information Transport System may be referred to as "the network." Elements of Information Transport System to be handled uniquely within overall Information Transport System will be specifically addressed (e.g., fire alarm cabling). This term replaces "telecommunication network" in building codes, standards, or methodologies.
   2. Inside Cable Plant: Part of Information Transport System running within building. Inside Cable Plant elements includes workstation outlet assembly, cabling to workstation from network rooms, backbone cabling within buildings, backbone cabling running between physically contiguous buildings network racks and hardware (routers, switches, hubs, firewalls, etc.), patch panels, punch blocks fiber distribution panels patch cords, and cross-connect cables/wires. Inside Cable Plant will be referred to as "ISP."

3. Outside Cable Plant: That part of Information Transport System running between buildings, from building to a definable exterior point, between definable exterior points, or from a non-Owner source to Owner's building or definable exterior point, including termination punch blocks, fiber distribution panels, interior splices for outside to inside optical fiber transition, and other initial device into which outside cable attaches. The Outside Cable Plant does not include backbone cable running between physically contiguous buildings unless cabling enters OSP pathway element (e. g. OSP conduits, maintenance holes, etc.). Outside Cable Plant includes underground cabling and aerial cabling. Outside Cable Plant may be referred to as "OSP."

C. Specific Communication System Elements:
1. Alien Crosstalk: Emissions from one or more adjacent cables affecting wire pairs in other cables.
2. Attenuation: Decrease in magnitude or signal power loss propagated between two points.
3. Cable: Assembly of one or more insulated conductors or optical fibers, within enveloping sheath.
4. Campus: Includes buildings owned or leased by Owner with direct physical cable connection to contiguous campus through Owner's owned or leased conduits, including pathways.
5. Dead pairs: Unused copper pairs terminating within splice case, but without being spliced to outgoing cable.
6. Equipment Grounding Conductor: Usually a rod, pipe or plate (or group of conductors) in direct contact with earth for purpose of providing low-impedance connection to the earth.
7. Grounding electrode conductor: Conductor used to connect grounding electrode to equipment grounding conductor, or to grounded conductor of circuit at service equipment, or at the source of separately derived system.
8. Handbox: Rectangular or square underground pathway element similar to small maintenance hole, which cannot be fully entered, that allows for pulling point or splice point in pathway.
9. Handhole: Round underground pathway element similar to handbox, which cannot be fully entered, that allows for pulling point in pathway.
10. Identifier: Information that links specific element of Information Transport System infrastructure with its corresponding record.
11. Infrastructure (Information Transport System): Collection of Information Transport System components, excluding equipment that together provides basic support for distribution of information within or between buildings.
12. Linkage: Connection between record and identifier or between records.
13. Maintenance holes: Underground pathway element large enough for person to fully enter work, used to provide access to underground cable to pull, splice, and maintain. Formerly known as manhole.
14. Media (Information Transport System): Wire, cable, or conductors used for Information Transport System.
15. Outlet box: Metallic or nonmetallic box used to hold Information Transport System outlets/connectors or transition devices.
16. Outlet/connector (Information Transport System): Connecting device in work area on which horizontal cable or outlet cable terminates.
17. Pathway: Facility for placement of Information Transport System cable.
18. Record: Collection of detailed information related to specific element of Information Transport System infrastructure.
19. Report: Presentation of collection of information from various records.

20. Space (Information Transport System): An area used for housing installation and termination of Information Transport System equipment and cable, e.g., equipment rooms, network rooms, work areas, and maintenance holes/handboxes/handholes.
21. Splice: Joining of conductors in splice closure, meant to be permanent.
22. Splice box: Box, located in pathway run, intended to house cable splice.
23. Splice closure: Device used to protect splice.
24. Termination position: Discrete element of termination hardware where information Transport System conductors are terminated.
25. Wire Map: Method used to identify wiring errors.
26. Work area (workstation): Building space where the occupants interact with Information Transport System terminal equipment.

D. Communications System Acronyms:
1. ACR: Attenuation-to-Crosstalk Ratio.
2. ADA: Americans with Disabilities Act.
3. AFF: Above finished floor.
4. ANSI: American National Standards Institute.
5. ASTM: American Society for Testing and Materials (ASTM International)
6. AWG: American Wire Gauge
7. BICSI®: Building Industry Consulting Service International.
8. dB: Decibel.
9. EIA: Electronic Industries Alliance.
10. ELFEXT: Equal Level Far-End Crosstalk.
11. EMC: Electromagnetic Compatibility.
12. EMI: Electromagnetic Interference.
13. FCC: Federal Communications Commission.
14. FEXT: Far-End Crosstalk.
15. FOTP: Fiber Optic Test Procedure.
16. Freq: Frequency.
17. GE: Grounding equalizer (replacing TBBIBC).
18. Gnd: Ground.
19. HB: Handbox.
20. HH: Handhole.
21. HVAC: Heating, Ventilation, and Air Conditioning.
22. Hz: (Hertz) or MHz (Megahertz).
23. IDC: Insulation Displacement Connectors.
24. IEEE: Institute of Electrical and Electronics Engineers.
25. ISO: International Organization for Standardization.
26. ISP: Inside Cable Plant.
27. IDF: Intermediate Distribution Frame: Location of building distribution equipment room(s).
28. MDF: Main Distribution Frame: Location of campus wide central equipment room).
29. St. Johns County School District (SJCSD): Owner.
30. Mbps: Megabits per second.
31. MDF. Main Distribution Frame also referred to as Main Equipment Room.
32. MH: Maintenance Hole.
33. MM: Multimode fiber optic cable.
34. NEC: National Electrical Code, NFPA 70.
35. NESC: National Electric Safety Code, C2-1997.
36. NEXT: Near End Cross Talk.
37. NFPA: National Fire Protection Association.
38. OSHA: Occupational Safety and Health Administration.

39. OSP: Outside Cable Plant.
40. OTDR: Optical Time Domain Reflectometer.
41. PSACR: Power Sum Attenuation to Crosstalk Ratio.
42. PSELFEXT: Power Sum Equal Level Far End Cross Talk.
43. PSFEXT: Power Sum Far End Crosstalk.
44. PSNEXT: Power Sum Near End Crosstalk.
45. PR: Pair.
46. RCDD®: Registered Communications Distribution Designer.
47. RFI: Radio Frequency Interference.
48. RH: Relative Humidity.
49. SM: Single Mode Fiber Optic Cable.
50. TBB: Telecommunication Bonding Backbone.
51. TBBIBC: Telecommunication Bonding Backbone Interconnecting Bonding Conductor.
52. TE: Telephone Equipment (Wall Mounted Equipment Rack).
53. TGB: Telecommunications Grounding Bussbar.
54. TIA: Telecommunications Industry Association.
55. TMGB: Telecommunications Main Grounding Bussbar.
56. TR: Telecommunications Room (MDF or IDF).
57. UL: Underwriters Laboratory.
58. UPS: Uninterruptible Power Supply.
59. WAO: Work Area Outlet.

E. ABBREVIATIONS
1. dB: Decibel: sound level or channel attenuation.
2. ” = inch(es); ,’ = ft, foot: ft = U.S. length.
3. mm, cm, m or km: metric length
4. Ω: Ohm(s): wire resistance.
5. λ: wavelength (nm) Nanometer.

1.4 SUBMITTALS

A. Comply with Section 01 33 00 Submittal Procedures.
B. Comply with Section 01 35 33 – Security Procedures for submittal of installer’s personnel information for security badging requirements.
C. Project Record Documents
1. Submit one (1) mylar reproducible set of Project Record Drawings and one electronic set of Project Record Drawings in AutoCAD Release 10 or later edition “DWG” rewritable file extension format.
2. Submit complete updated hard copy of project record drawings and specifications maintained on project site during construction.
3. See specific communication sections for additional requirements.
D. Operation & Maintenance Manuals:
1. Prior to the Substantial Completion Inspection, complete Operation & Maintenance (O&M) Manuals.
2. Submit O&M Manuals to Owner at Substantial Completion Inspection.
3. Instruction manuals shall contain sufficient information to permit Owner’s personnel to operate system without assistance from Contractor.
4. Provide O&M Manuals covering equipment and materials furnished.
5. O&M Manuals shall contain information necessary for operation, maintenance, parts procurement, and parts replacement for SCS.
6. Information shall include detailed documentation for firmware configuration.

7. Provide 8-1/2" x 11" loose leaf 3-ring binders with clear vinyl overlay designed to receive identification inserts with identification on front cover and back splines as follows:
   a. Operating & Maintenance Manual, Project Name, and Contractor.
   b. On front page, enclosed in 3-ring clear plastic sheet protector, provide the following:
      (1). Project Name.
      (2) Contractor Name.
      (3) Contractor's Project Manager.
      (4) Contractor's Project Number.
      (5) Owner's Project Number or Purchase Order Number.
   c. Contact list with name, address, contact person, phone number, and fax number for each of the following:
   d. Structured Cabling System Contractor.
   e. Conduit subcontractor.
8. Manufacturers of Equipment and local supply source(s) for repair parts.
9. Index: On the second page, enclosed in a 3-ring clear plastic sheet protector, provide index indicating section numbers and titles.
10. Sections shall be separated with tabbed section divider with number and title (typed) as follows:
    a. Section 1 – Cuts Sheets: Manufacturer's original data/cut sheets for each system component.
    b. Section 2 – Equipment List: Typed list of each item of equipment with brief description, serial number, and part number, enclosed in 3-ring clear plastic sheet protector.
    c. Section 3 – Factory Manuals: Manufacturer's printed Installation and Operating Manuals for each item of LAN equipment. Provide 3-ring zip-lock pockets for each manual not factory 3-ring punched. Do not include manuals loose or inserted in binder pockets.
    d. Section 4 - Warranties: Copy of Contractor's warranty and Manufacturer's printed warranty for each item of equipment. Enclose in 3-ring clear plastic sheet protector.
    e. Section 5 – Transmittal of Loose Items: Copy of transmittal to Owner's Project Manager for loose items such as patch cords, wire management rings, spare parts, with receipts signed-off by Owner's Project Manager. Enclose in 3-ring clear plastic sheet protector.
    f. Section 6 - Documentation of Training: Documentation of training signed-off by Owner's Project Manage (insert in manuals at Final Completion inspection). Enclose in 3-ring clear plastic sheet protector.
    g. Section 7 - Cable Tests: Executive summary of test results for Category 6, fiber optic, ITV, and voice backbone cabling.

1.5 QUALITY ASSURANCE

A. Comply with Section 01 45 00 – Quality Control.
B. Telecommunications installer shall have RCDD (Registered Communications Distribution Designer) on staff with minimum of 3 years of experience with specified manufacturers' hardware and cabling.
C. Telecommunications installers shall have experience with installation of specified manufacturers' hardware and cabling.

D. Telecommunications installers shall use BICSI registered installers. Seventy-five percent or more of installers shall be BICSI Installer Level II. Up to twenty-five percent of installers may be BICSI Installer Level I. Workers not involved in installing cable elements (e.g. laborers delivering/moving materials, installing grounding by electrician, or workers installing pathway elements) do not have to be registered.
E. Team leads shall be BICSI registered technicians. Provide statements in bid documents of experience for proposed team leads. Statements shall include industry-specific training and certifications with dates verifying active status on registrations/certifications, project experience, experience with Category 6 and shielded cabling, and experience as a team lead.
F. Only installers trained and certified by manufacturer shall be allowed to install copper products. Installers shall possess highest levels of certification available by manufacturer for specific structured cable solution being installed.
G Only installers trained and certified by fire stop manufacturer shall be allowed to install fire stop products. See Section 07 84 00 – Fire Stopping.
H. Only installers trained and certified for cable testing and wiring by manufacturer shall be allowed to terminate and test optical fiber. Other installers specified above may pull or place optical fiber cable under supervision of installer trained and certified by manufacturer. Submit proof of registration/certification of proposed installers to include narrative on levels of registration/certification of installers.
I. Owner reserves right to reject unregistered or uncertified installers performing work for which they are not certified. Installer shall be responsible for loss of work, delays in schedules, or extra cost from use of unregistered/uncertified workers. Additional cost and effort to maintain installation schedule shall be communications system installer's responsibility.
J. Provide required documentation for new workers after submittal of initial documentation on installers. Owner may periodically check installer identification and registrations/certifications during installation.

1.6 PROJECT CONDITIONS

A. Security and Work Coordination:
1. SCS construction area shall be protected and secured from unauthorized access.
3. Workplace safety and security is SCS installer's responsibility.
4. Contact Contractor/CM or Owner's Project Manager, if project has no Contractor/CM, of conditions preventing safe, timely or complete installation of telecommunications systems.
5. Failure to provide notification to Contractor/CM or Owner's Project Manager shall be deemed acceptance of working conditions.
6. Comply with Section 01 31 00 – Project Coordination. Access to project including SCS installer's approved parking and "lay-down areas", access to buildings, maintenance holes, handholes, handboxes, utility poles, underground spaces, and pathways shall be coordinated with Owner's Project Manager.
7. Contractor/CM or SCS installer, if project has no Contractor/CM, shall provide traffic control and signage to maintain safe working environment.
8. Work area access, road closures, parking spaces closures, and work outside of Owner's normal operating hours shall be coordinated with Owner's Project Manager.
9. Owner's continued occupation of existing facilities shall not be interrupted by SCS installer's work activities.
10. Active cable plant associated with specific work and active cable plant beyond construction area shall not be disrupted.

11. Unusual circumstances (e.g., voice cutovers) may occur if prior written notification and approval is granted by Owner's Project Representative. Disruptions, if needed, shall be at Owner's convenience and approved schedule.

B. Owner shall not be responsible for delays or additional compensation due to SCS installer's unsafe working practices or unacceptable work.

1.7 WARRANTY

A. Communications Installer shall provide warranties or guarantees in accord with Section 01 78 00 – Closeout Submittals and as noted herein.
B. Communications CAT 6 and fiber optic cabling shall adhere to warranty requirements of manufacturer which may not be manufactured by either systems manufacturer but shall be inclusive with manufacturers and installer's warranties for complete and functional communications system.
C. Manufacturer and authorized communications installer shall provide twenty (20) year warranty for category 6 structured cabling system for end-to-end channel model installation covering applications assurance, margin compliance claimed by manufacturer over category 6 channel specifications for transmission parameters across entire frequency range of 1-250 MHz in accord with manufacturers catalogs and literature, cable, connecting hardware and labor cost for repair or replacement.
D. Manufacturer shall provide 20-year Channel Performance Warranty for complete communications system.
    1. Manufacturers shall warranty worst-case performance data for installed cabling system, and performance data indicated in warranty documents/certificate.
    2. Twenty (20) year warranty for Cat 6 structured cabling system shall provide for end-to-end channel model installation which covers applications assurance, cable, connecting hardware, and labor cost for repair or replacement.
    3. Warranty shall indicate compliance with Margin claimed by manufacturers over Cat 6 channel specifications on transmission parameters across entire frequency range of 1-250 MHz as indicated in manufacturer's catalogs and product literature.
E. SCS installer shall provide 3-year warranty for communications system installation to include materials and labor warranty for replacement of defective installation or equipment including cables, jacks, patch cords, patch panels, devices, and cabling.
F. Date of warranty period shall begin from date of project's substantial completion and acceptance by Owner.

PART 2 PRODUCTS - NOT USED

PART 3 PRODUCTS - NOT USED

END OF SECTION

SECTION 27 05 26
GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Grounding and bonding for TMGB at entrance to main electrical room, and TGB for other network rooms, ISP, conductors, connections and required hardware.
B. Protection, grounding, and bonding shall be provided in new construction and in existing buildings where completely new communications system work is to be installed, or in existing buildings where expansion of existing communications system is required to interface with existing communication systems.
C. Upgrading of existing communication systems to current codes, including installation of lightning protection, grounding busbars, and bonding backbones.
D. Coordination of interface connections with electrical contractor for proper pathway and termination locations, busbar locations and connection to main electrical service ground and electrical distribution panels.

1.2 REFERENCES

A. Telecommunications Definitions (See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms).
   1. BCT (Bonding Conductor for Telecommunications): conductor that interconnects telecommunications bonding infrastructure to building's service equipment (power) ground.
   2. Bonding: Joining of metallic parts to form electrically conductive path.
   3. GE (Grounding Equalizer): conductor interconnecting elements of telecommunications grounding infrastructure.
   4. Ground: Conducting connection between electrical circuit or equipment and earth or to some conducting body that serves in lieu of earth.
   5. RBC (Rack Bonding Conductor): Bonding conductor connecting equipment rack directly to TMGB or TMB.
   6. RGB (Rack Grounding Busbar): Busbar vertically mounted on equipment rack.
   7. TBB (Telecommunications Bonding Backbone): Conductor connecting telecommunications main grounding busbar (TMGB) to
   8. TGB (Telecommunications Grounding Busbar): common point of connection for telecommunications system and equipment boding to ground and located in Telecommunications Room or Equipment Room.
   9. TMGB (Telecommunications Main Grounding Busbar): Busbar placed in convenient an accessible location and bonded by bonding conductor for telecommunications and to building service (power) ground.
   10. UBC (Unit Bonding Conductor): Conductor interconnecting Rack Bonding Busbar to telecommunications equipment.
B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.
C. Soares Book on Grounding.
D. IEEE Standard 1100 – IEEE Recommended Practice for Powering and Grounding Electronic Equipment (Emerald Book).
E. Building Industry Consulting Services International (ANSI/NECA/BICSI):
   1. BICSI–607 – Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings.

2. BICSI-607A – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.

F. St. Johns County School District Structured Cabling Standards V7.4.

1.3 QUALITY ASSURANCE

A. Comply with Section 01 45 00 – Quality Control.
B. Network equipment grounding shall be installed per ANSI-J-STD-607-A, NEC 800.90 (A), NEC 250, and NFPA 780 standards.
C. Voltage drop over grounding conductors shall not exceed 40 volts. Installer shall provide sizing calculations based on grounding electrode conductor to AE for review.
D. Protectors, grounding, and bonding hardware shall be products of same manufacturer.
E. Grounding conductors shall be sized for maximum current possible for electrical grounding electrode conductor to pass through telecommunications grounding system.
F. Sizing of Telecommunications Bonding Backbone (TBB) and Grounding Equalizer (GE):
   1. TBB and GE shall be copper conductors (#6 AWG minimum size).
   2. TBB and GE shall be sized at 2 kcmil per linear foot of conductivity length up to maximum of 3/0 AWG and may be insulated.
   3. If insulated, TBB and GE shall meet fire ratings of its pathway and shall be listed for space in which it is located.
   4. TBB and GE sizing noted in attached Schedule is not intended to account for reduction or control of electromagnetic interference.
   5. Bonding and Grounding Conductor Sizing Schedule:

TBB OR GE LENGTH Meters (Ft)	**TBB/GE Size (AWG)**
< 4 (13)	6 (13mm²)
4-6 (14-20)	4 (21mm²)
6-8 (21-26)	3 (27mm²)
8-10 (27-33)	2 (34mm²)
10-13 (34-41)	1 (42mm²)
13-16 (42-52)	1/0 (54mm²)
16-20 (53-66)	2/0 (67mm²)
>20 (66)	3/0 (85mm²)

1.4 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.
B. Product Data: Submit manufacturer's descriptive literature for each system component specified with specific product number clearly identified.
C. Shop Drawings:
   1. Provide scaled drawings of floor plans (not less than 1/16" = 1'-0") indicating proposed location and size, dimensions, type of connection (e.g., mechanical, exothermic weld of each bonding busbar (e.g., TMGB and TGB), conductor (e.g., BCT, GE and TBB), connections (e.g., lugs), and splice points.
   2. Provide scaled plan and elevation drawings of Telecommunication Rooms (not less than 1/4" = 1'-0") indicating proposed locations busbars (e.g., TMGB, TGB, UBC and RGB).
   3. Provide separate drawing for proposed bonding and grounding layouts and details.
D. Comply with Section 01 78 00 – Closeout Submittals for project closeout documents.

E. Project Record Documents:
   1. Provide scaled drawings of floor plans (not less than 1/16" = 1'-0") indicating actual location and size, dimensions, type of connection (e.g., mechanical, exothermic weld of each bonding busbar (e.g., TMGB and TGB), conductor (e.g., BCT, GE and TBB), connections (e.g., lugs), and splice points.
   2. Provide scaled plan and elevation drawings of Telecommunication Rooms (not less than 1/4" = 1'-0") indicating actual locations busbars (e.g., TMGB, TGB, UBC and RGB).
   3. Provide separate drawing for actual bonding and grounding layouts and details.

F. Operation and Maintenance (O&M) Manuals:
   1. Manufacturer's specification sheets (cut sheets), operation and maintenance manuals for each product and system maintenance.

G. Certification: Provide letter to Owner's Project Manager from Contractor/CM installer's RCDD that grounding system was installed in accord with contract documents, acknowledging that telecommunications grounding system has been successfully tested and is fully functional for intended purpose. One letter from RCDD may be submitted to include attesting requirements from other Div 27 Sections.

PART 2 PRODUCTS

2.1 MATERIALS

A. Approved Manufacturers:
   1. Ortronics Corporation, 125 Eugene O'Neill Dr., New London, CT 06320; Tel: 1 887 599-5393; Fax: 1 888 282-0043: Website; www.ortronics.com.
   2. Erico International Corp., 34600 Solon Rd., Solon, OH 44139. Tel: 440-248-0100; Fax: 440- 248-0723; Website: www.erico.com.
   3. Chatsworth Products Inc., 701 Industrial Dr., New Bern, NC 28562. Tel: 252-514-2779; Fax: 252-514-2977; Website: www.chatsworth.com.
   4. Thermoweld/Continental Industries, 4102 South 74th East Ave., Tulsa, OK 74145-4707. Tel: 918-627-5210; Fax: 918-622-1275; Website: www.conind.com.
   5. Harger Group, 301 Ziegler Dr. Grayslake, IL 60030; Tel: 800-842-7437; Fax: 847-548-8755; Website: www.harger.com.
   6. Panduit Corp., 18900 Panduit Dr., Tinley Park, IL 60478; Tel: 708-532-1800; Fax: 708-532-1811; Website: www.panduit.com.

B. Other manufacturers shall comply with Section 01 25 13 - Product Substitution Procedures for product approval.

2.2. TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB)

A. Manufacturers:
   1. Harger BICSI pattern 4" x 12" TMGB kit (#GBI1412JKT); 2" x 12" MGB kit (#GBI14210GKT).
   2. Chatsworth BICSI pattern 4" x 12" TMGB kit, TMGB (40158-012): Chatsworth BICSI pattern 2" x 12" MGB kit, TGB (40156-012).
   3. Rack-mount busbar:
      a. Ortronics Grounding Strip (OR-808004551)
      b. Chatsworth Horizontal Rack Busbar, 19" (10610-019).

2.3 TELECOMMUNICATIONS GROUNDING BUSBAR (TGB)

A. Manufacturers:
   1. Harger BICSI pattern: 2" x 12" MGB kit (#GBI14210GKT).
   2. Chatsworth BICSI pattern: 2" x 12" MGB kit, TGB (40156-012).

2.4 BONDING CONDUCTORS FOR TELECOMMUNICATIONS (BCT)

A. Bonding Conductor:
   1. Bare copper conductor, stranded.
   2. Insulated copper conductors, insulated, green, stranded, or solid.
   3. Equal in size to largest Telecommunications Bonding Backbone (TBB).
B. Approved Manufacturers:
   1. Harger Group.
   2. Panduit Corp.

2.5 TELECOMMUNICATIONS BONDING BUSBAR (TBB)

A. TBB:
   1. Bare copper or insulated conductor.
   2. Conductor shall be listed for application when insulated.
   3. Conductor shall be sized at 2 kcmil per linear foot of conductor length up to maximum wire size of 3/0 AWG.

2.6 GROUNDING EQUALIZER (GE)

A. GE:
   1. Bare copper or insulated conductor.
   2. Conductor shall be listed for application when insulated.
   3. Conductor shall be same size as largest TBB.
B. Approved Manufacturers:
   1. Harger Group.
   2. Panduit Corp.

2.7 RACK BONDING CONDUCTOR (RBC)

A. RBC:
   1. Bare copper or insulated conductor.
   2. Conductor shall be listed for application when insulated.
   3. Conductor shall be minimum of same size as largest TBB.
B. Approved Manufacturers:
   1. Harger Group.
   2. Panduit Corp.

2.8 RACK BONDING BUSBAR (RBB)

A. RBB:
   1. Busbar shall be wrought copper and tin-plated grounding strip for use in 2-post and 4-post Communications Racks.
   2. Busbar shall support multiple unit bonding conductors and shall be UL listed.

B. Manufacturers:
   1. Hargar Rack Grounding Busbar Kit #RGBVKIT14583672A.
   2. Panduit Rack Grounding Busbar Strip Kit #RGS134-1Y.

2.9 GENERAL BONDING CONDUCTORS OR JUMPERS

A. Provide and install general bonding conductors and jumpers as indicated.
B. Provide conductors and jumpers connecting equipment located in same rooms as TMGB/TMB, conductors and jumpers shall be in green insulated jacket. Jacket shall include markings that indicate conductor size (minimum of #6 AWG), manufacturer, and UL listing.
C. Approved Manufacturers:
   1. Harger Group.
   2. Panduit Corp.

2.10 BONDING ACCESSORIES

A. Exothermic weld connectors, UL listed:
   1. Approved Manufacturers:
      a. Erico International; Cadweld products.
      b. Continental Industries; Thermoweld products.
B. Grounding Lugs:
   1. Two-lug connectors, UL-listed, irreversible compression.
   2. Single-lug connectors, UL-listed, irreversible compression.
   3. Approved Manufacturers:
      a. Enrico International Corp.
      b. Harger Group
      c. Panduit Corp.
C. Stand-off Insulators:
   1. Round or hexagon glass reinforced thermoset polyester insulators sized for voltage rating.
   2. Approved Manufacturers:
      a. Harger Group.
      b. Chatsworth Products, Inc.
D. Other materials as required for complete and functioning grounding system.

PART 3 EXECUTION

3.1 GENERAL

A. Install ¾" A/C grade plywood backboard covering all four walls ("A" side facing out) from 12" AFF to a height of 9' AFF, painted with two coats of fire-resistant paint on all six sides, on interior room walls of Telecommunications Rooms with sufficient anchorage to walls to support items attached to walls.
B. Locate TMGB and TGBs per approved shop drawings and shall be easily accessible to telecommunications staff.
C. Follow manufacturer's printed installation instructions. If manufacturer and contract documents are in conflict, most stringent shall apply. If manufacturer's printed instructions are conflicting, immediately report discrepancies to A/E in timely manner to maintain project schedule.

3.2 TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB)

A. TMGB Installation:
   1. Position TMGB to be protected from physical damage.
   2. Install TMGB with stand-off insulators.
   3. If building TMGB is located in another room, install TGB with stand-off insulators.
   4. TMGB shall be bonded to grounding conductor with exothermic weld.
   5. Bond entrance facility busbar to appropriately sized TBB with exothermic weld.
   6. Neatly install conductor from entrance facility busbar at right angles along walls or ceiling surfaces to structural steel within same room or room near the electrical service panel within room, or metallic cold-water pipes within room.
   7. Conductors attached to structural steel shall be connected with exothermic welds.
   8. Metallic raceways for telecommunications cabling in space where TMGB is located shall be bonded to the TMGB.
   9. Insulate TMGB 2" from wall.
   10. For outside plant cables entering building with cable shield isolation gap, bond cable shield (on building side of gap) to TMGB. Outside plant protectors shall be bonded to TMGB with #6 AWG copper conductors.
   11. Connections to busbar shall be made with 2-hole lugs.
   12. Connections shall be made by cleaning area of connection on busbar and 2-hole lugs and then applying thin coating of anti-oxidant compound.

3.3 COMMUNICATIONS GROUNDING BUSBAR (TGB)

A. TGB Installation:
   1. Provide and install necessary grounding hardware to properly ground equipment in network room per codes, standards and methodologies noted. Self-tapping screws, or any other type of screws, shall not be used to form bonds or attach grounding hardware.
   2. Within each network room, provide and install insulated (green), stranded #6 copper ground wire from network room busbar to following items:
      a. Racks
      b. Ladder rack
      c. BETs
      d. Electrical service panels- Provide and install two-lug connectors or exothermic bonds to busbar.
      e. Metallic, cold water pipes- Verify identification of water pipe with Owner's Project Manager prior to bonding to it. Provide and install two-lug connectors or exothermic bonds to busbar and provide and install appropriate grounding connectors for water pipes if present.
      f. Metallic raceways for telecommunications cabling in space where TMGB is located shall be bonded to the TMGB.
      g. Insulate TMGB 2" from wall.
      h. Connections shall be made by cleaning area of connection on busbar and 2-hole lugs and then applying thin coating of anti-oxidant compound
   3. Do not bend grounding conductor wires into tight angles. Changes in direction shall be of the highest radius possible.

3.4 MAIN DISTRIBUTION FRAME ENCLOSURES (MDF)

A. MDF Installation:
   1. Install pre-painted plywood panel on interior room walls with sufficient anchorage to walls to support items attached to walls.
   2. Install grounding busbar in enclosure housing networking or other active equipment. Install busbar at location indicated and approved by Owner's Project Manager. Busbar may be rack-mount busbar attached to rails or backboard.
   3. Provide and install necessary grounding hardware to properly ground equipment in network room per applicable codes, standards and methodologies noted. Self-tapping screws, or any other type of screws, shall not be used to form bonds or attach grounding hardware.
   4. Connect enclosure to TBB with not more than 30 feet of insulated (green), stranded #6 copper ground wire.
   5. Do not bend grounding conductor wires into tight angles. Changes in direction shall be of highest radius possible.

3.5 BONDING CONDUCTOR FOR TELECOMMUNICATIONS (BCT)

A. Route BCT in conduit from telecommunications service entrance room to main electrical service ground connection.
   1. See Section 27 05 53 – Identification for Communication Systems.
   2. Label conduit at telecommunications service entrance with tag or adhesive label that states "Building Conductor for Telecommunications (BCT) to Main Electrical Service Ground Connection".
   3. Label conduit at main electrical service ground c with tag or adhesive label that states, "Building Conductor for Telecommunications (BCT) to Telecommunications Main Grounding Busbar".
   4. BCT shall not be run in metallic conduit nor completely encircled with metallic clamps.

3.6 TELECOMMUNICATIONS BONDING BACKBONE (TBB)

A. TBB when located along same route as cable tray, TBB shall be located on outer side of cable tray to minimize contact with communications cabling.
B. TBB cabling sizes shall be per Paragraph 1.04.F.5.

3.7 BONDING CONDUCTORS OR JUMPERS

A. Bonding conductors or jumpers shall be applied in each telecommunications room between TMGB/TGB and following components:
   1. Communications building entrance protectors.
   2. Electrical panel board (if in same room as TMGB/TGB).
   3. Building steel frame (if available in same room as TMGB/TGB).
   4. Telecommunications ladder rack and cable tray:
      a. Bonding jumpers may be applied to ground adjacent pieces of ladder rack and cable tray together, reducing need for single conductor back to TMGB/TGB.
      b. Where ladder racks or cable trays are painted, paint shall be removed at connection points prior to making connections.

5. Telecommunications equipment racks and cabinets:
   a. Cabinets and racks shall be bonded to TMGB/TGB directly with #6 AWG Rack Bonding Conductor (RBC) from Rack Grounding Busbar (RGB).
   b. Where ladder racks or cable trays are painted, paint shall be removed at connection points prior to making connections.

3.8 GROUNDING LUGS

A. Wires shall be inserted to full depth of lugs.
B. Space between wire insulation and body of compression lugs shall be not greater than 0.25” (6.3mm).
C. Lugs shall be sized to match wire size per lug manufacturer’s printed recommendations.
D. Lugs shall have manufacturer’s embossed coding system imprinted on lugs.
E. Connectors may not be modified. Daisy chaining and stacking (piggy backing) of ground lugs is prohibited.
F. Bolts, nuts, washers for securing connections shall match hole diameters.

3.9 TESTING

A. Comply with Section 27 18 00 - Communications Testing.
B. Telecommunication Grounding System Test Notification:
   1. Grounding connections shall be tested for continuity and resistance after installation but prior to project substantial completion.
   2. A/E, District Instructional Technology Department, and Owner’s Project Manager shall be given forty-eight (48) hours notice prior to start of testing.
C. Telecommunication Grounding System Testing:
   1. Testing shall be performed for impedance of bonds of grounding system, including cable armor bonding to ground. Impedance of two-point bonding test across any bond shall not exceed 0.1 ohm. Remediate bond(s) over limit or which contribute to total impedance exceeding 0.1 ohm from any point in network room to busbar in that room.
   2. Bonds installed shall be tested for impedance with earth ground resistance test in its two-point setup (LEM Handy GEO tester, or approved tester). Place QA label (with date and inspector) in proximity to each bond tested
   3. Test grounding conductors, once installed, for current. Measure AC and bi-directional DC current. Report AC current over 1 Amp. Report any DC current, in either direction, over 500 milliamps.

END OF SECTION

SECTION 27 05 28
PATHWAYS FOR COMMUNICATION SYSTEMS

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Surface metallic raceways, surface nonmetallic raceways, fittings, device and cover brackets, communication systems utility columns, outlet boxes, Poke-thrus, floor boxes, pull and junction boxes for communications systems.

1.2 REFERENCES

A. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.
B. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code; National Fire Protection Association; 2011.
C. National Electrical Manufacturers Association (NEMA):
   1. NEMA WD 6 - Wiring Devices - Dimensional Requirements, 2002 Edition.
   2. NEMA VE 1 - Metallic Cable Tray System; National Electrical Manufacturers Association; 2002 Edition.
D. Telecommunications/Electronics Industry Association (TIA/EIA): TIA/EIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces; Rev. A, 1998, and relevant Addenda (ANSI/TIA/EIA-569).
E. Underwriters Laboratories (UL): UL 5 - Surface Metal Raceways and Fittings; Underwriters Laboratories Inc; 1996.
F. National Electrical Contractors Association (NECA): NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2000.
G. National Electrical Manufacturers Association (NEMA):
   1. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association; 2003.
   2. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; National Electrical Manufacturers Association; 2003.
H. St. Johns County School District Structured Cabling Standards V7.4.

1.3 QUALITY ASSURANCE

A. Comply with Section 01 45 00 Quality Control. Comply with Reference Standards indicated.
B. Provide products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.

1.4 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.
B. Product Data: Submit manufacturer's descriptive literature for each system component specified in this section.
C. Stop Drawings:
   1. Submit raceway layouts, each system component required for complete system, raceway lengths, device types, locations and identify circuits.
   2. Indicate cable tray type, dimensions, support points, and finishes.
   3. Indicate box, outlets, systems furniture, and service pole locations.

4. Provide manufacturer's catalog data for fastening systems.

D. Comply with Section 01 78 00 – Closeout Submittals: If variations from approved shop drawings occur during installation of raceway system, submit final as-built drawings indicating such variations.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 66 00 – Product Storage and Handling Requirements.
B. Store products in manufacturer's unopened packaging until installation.
C. Maintain storage area conditions for products in accord with manufacturer's written instructions.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Approved manufacturers are listed herein. Other manufacturers may submit for approval per Section 01 25 13 – Product Substitution Procedures.

2.2 SURFACE METALLIC RACEWAYS

A. Surface Metallic Raceways:
   1. Acceptable product: Wiremold 4000 System by The Wiremold Company, 60 Woodlawn St., West Hartford, CT 06110. Tel: 800-621-0049, 860-233-6251; Fax: 860-232-2062; Website: www.wiremold.com.
   2. Product description: Two-piece system of galvanized steel, nominal 0.040" (1.27 mm) metal thickness, having total assembled cross-section dimension 4.75" (120 mm) high by 1.75" (44 mm) deep, having cross-section area 7.5 square inches (48.38 sq cm), consisting of base, snap-on cover, and removable longitudinal barrier, dividing raceway interior into two equal spaces.
   3. Surface-mount locations shall use shallow, wall-mount boxes with outlets on the sides of box.
   4. Finish: ScuffCoat grey or ivory color as selected.
B. Fittings:
   1. Factory-formed units to complete indicated configuration of raceway systems, including external corner units, internal corner units, flat units, blank end units, and elbows.
   2. Couplings: one per raceway unit.
   3. Wire clips: One per two-foot intervals (61 cm) of indicated raceway configuration.
   3. Replacement longitudinal barrier: One section per 8 linear feet (2.44 m) of indicated raceway configuration.
   4. Material: Same material and metal thickness as linear raceway components.
   5. Finish: Matching linear raceway components.
C. Device Brackets and Plates:
   1. Factory-formed brackets and plates allowing installation of indicated power, data, and communications devices, both single-gang and two-gang, either vertically or horizontally in raceways.
   2. Finish: Color matching linear raceway components.

2.3 SURFACE NONMETALLIC RACEWAY SYSTEMS

A. Surface Nonmetallic Multi-Channel Raceway System
   1. Approved Product: Wiremold Access 5000 System by The Wiremold Company, 60 Woodlawn St., West Hartford, CT 06110. Tel: 800-621-0049, 860-233-6251; Fax: 860-232-2062; Website: www.wiremold.com.
   2. Corner Units:
      a. Supply factory-formed cover and trim cover units for internal and external corners of indicated raceway layouts:
      b. Finish corner units to match linear cover and trim cover units.
   3. Fittings:
      a. Provide factory-formed fittings in rigid PVC compound with base to eliminate mitering for indicated configurations and service requirements.

B. Finish: White.

C. Surface Nonmetallic Single Channel Raceway System:
   1. Approved Product: Wiremold Eclipse PN03, PN05, PN10 Series by The Wiremold Company, 60 Woodlawn St., West Hartford, CT 06110. Tel: 800-621-0049, 860-233-6251; Fax: 860-232-2062; Website: www.wiremold.com.
   2. Surface mount boxes:
      a. Wiremold Large Data Box, four-port, PDB4TJ.
   3. Corner Units:
      a. Supply factory-formed cover and trim cover units for internal and external corners of indicated raceway layouts:
      b. Finish corner units to match linear cover and trim cover units.
   4. Fittings:
      a. Supply factory-formed fittings specified in manufacturer's product data for indicated configurations and service requirements.
      b. Finish: White.

2.4 INDOOR SERVICE POLES AND COMPONENTS

A. Approved Product: Wiremold Tele-Power Pole Multi Outlet Assembly by The Wiremold Company, 60 Woodlawn St., West Hartford, CT 06110. Tel: 800-621-0049, 860-233-6251; Fax: 860-232-2062; Website: www.wiremold.com.

B. Main Body: Aluminum with clear anodized finish in single unit lengths as required.

C. Cover Plates: Match pole finish.

D. Convenience Receptacle Configuration: NEMA WD 6; Type 5-15. Furnish 4 per column.

E. Foot: Suitable for floor finish as indicated.

F. Provide concealed top clamp to fasten pole to inverted "T" grid ceiling suspensions member.

G. Accessories:
   1. Trim plates for closing ceiling opening to match poles.
   2. Flexible cable assembly with connector for branch circuit connections.

H. FABRICATION
   1. Provide full-sized opening at top of pole.

2.5 BOXES

A. Manufacture: The Wiremold Company: 60 Woodlawn St., West Hartford, CT 06110. Tel: 800-621-0049, 860-233-6251; Fax: 860-232-2062; Website: www.wiremold.com.

B. Outlet Boxes.
   1. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.

2. Nonmetallic Outlet Boxes: NEMA OS 2.

C. Poke Throughs
1. Two 20A duplex receptacles and up to four communications devices:
a. Wiremold RC4 Flush Poke-Thru
2. One 20A duplex receptacle and up to two communication devices
a. Wiremold RC7 Flush Poke-Thru
3. No other products are acceptable.

D. Floor Boxes.
1. Wiremold AC Series Raised Floor Boxes.
2. Wiremold 880 Floor Boxes for Wood Floors.

E. Pull Boxes and Junction Boxes.
1. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

PART 3 EXECUTION

3.1 INSTALLATION

A. Verification of Conditions: Verify that substrates are prepared and ready to receive products specified.

3.2 SURFACE RACEWAY INSTALLATION

A. Raceway shall be mounted in unobtrusive manner. Horizontal raceway shall be used at baseboard elevation, under or over chair rails, or along ceiling.
B. Where possible, raceway shall extend vertically up or down from WAO. Installer shall discuss placement of raceway prior to installation with Owner's Project Manager.
C. Secure surface-mount raceway with screws. Do not use adhesive attachments.

3.3 COMMUNICATION SYSTEM FURNITURE POLES

A. Install utility columns plumb and fasten support to structure.
B. Use pre-manufactured knock-outs for work area outlets. WAOs shall be installed flush or with minimal profile. Surface-mount boxes shall not be used on utility poles.
C. Neatly cut openings in ceiling panels and install trim plates.

3.4 BOX INSTALLATION

A. Install boxes securely, in neat and workmanlike manner, per NECA 1.
B. Install in locations indicated, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.
C. Set wall mounted boxes at elevations to accommodate mounting heights at 18" (45.72cm) above finished floor, unless otherwise noted.
D. Set wall mounting boxes for wall phones at 46" (1.17m) to center of box, if installed over counter or other low obstruction.
E. Set wall mounting boxes for wall phones at 48" (1.21m) to center of box, if unobstructed access is available.
F. Boxes indicated on Drawings are approximate locations unless dimensioned.
G. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
H. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6" (15.24 cm) from ceiling access panel or from removable recessed luminaire.

I. Install boxes to preserve fire resistance rating of building elements, using materials and methods specified in Section 07 84 00.
J. Work area outlet boxes on opposite sides of a fire-rated wall shall not share the same stud space.
K. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
L. Use flush mounting outlet box in finished areas.
M. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
N. Do no install flush mounting box back-to-back in walls; provide minimum 6 inches (mm) separation. Provide minimum 24” (60cm) separation in acoustic rated walls.
O. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
P. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
Q. Do no fasten boxes to ceiling support wires.
R. Support boxes independently of conduit.
S. Use gang box where more than one device is mounted together. Do not use sectional box.
T. Do not install work area outlets in standard AC outlet shaped openings within floor boxes.
U. Set floor boxes level.
V. Large Pull Boxes: Use enclosure with removable cover in interior dry locations, surface-mounted cast metal box in other locations. Hinged lids may be used, if provided with a means to fasten securely open.

3.5 ADJUSTING

A. Adjust floor boxes and poke-thrus flush with finish flooring material.

3.6 CLEANING

A. Remove dust, debris, and other material from product installation.
B. Clean exposed surfaces and restore finishes.

END OF SECTION

SECTION 27 05 29
HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Hangers and supports, wire baskets, cable trays and accessories for communications systems.

1.2 REFERENCES

A. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.
B. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.
C. National Electrical Manufacturers Association (NEMA):
   1. NEMA WD 6 - Wiring Devices - Dimensional Requirements, 2002 Edition.
   2. NEMA VE 1 - Metallic Cable Tray System; National Electrical Manufacturers Association; 2002 Edition.
D. Telecommunications/Electronics Industry Association (TIA/EIA): TIA/EIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces; Rev. A, 1998, and relevant Addenda (ANSI/TIA/EIA-569).
E. Underwriters Laboratories (UL): UL 5 - Surface Metal Raceways and Fittings; Underwriters Laboratories Inc; 1996.
F. National Electrical Contractors Association (NECA): NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2000.
G. National Electrical Manufacturers Association (NEMA):
   1. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association; 2003.
   2. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; National Electrical Manufacturers Association; 2003.
F. St. Johns County School District Structured Cabling Standards V7.4.

1.3 QUALITY ASSURANCE

A. Comply with Section 01 45 00 Quality Control.
B. Provide products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.

1.4 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.
B. Product Data: Submit manufacturer’s descriptive literature for each system component specified in this section.
C. Shop Drawings:
   1. Submit raceway layouts, each system component required for complete system, raceway lengths, device types, locations and identify circuits.
   2. Indicate cable tray type, dimensions, support points, and finishes.
   3. Indicate box, outlets, systems furniture, and service pole locations.
   4. Provide manufacturer’s catalog data for fastening systems.

D. Comply with Section 01 78 00 – Closeout Submittals: If variations from approved shop drawings occur during installation of raceway system, submit final as-built drawings indicating such variations.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 66 00 – Product Storage and Handling Requirements.
B. Store products in manufacturer's unopened packaging until installation.
C. Maintain storage area conditions for products in accord with manufacturer's written instructions.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURES

A. Approved manufacturers are listed herein. Other manufacturers may submit for approval per Section 01 25 13 – Product Substitution Procedures.

2.2 WIRE BASKET CABLE TRAY

A. Approved Products:
   1. FieldMate Wire Basket Cable Tray by The Wiremold Company: 60 Woodlawn St., West Hartford, CT 06110. Tel: 800-621-0049, 860-233-6251; Fax: 860-232-2062; Website: www.wiremold.com.
   2. Cablofil, Inc: www.cablofil.com: Wire Cable Tray.
   3. Cooper B-Line, Inc: www.b-line.com:
      a. Cent-R-Rail Systems.
      b. Cable Tray Systems.
      c. Wire Basket Cable Support.
   4. GS Metals Corp: www.flextray.com: FLEXTRAY Cable Management System.
   5. Cable Management Solutions, Inc.
      a. Floor and Overhead Snake Tray.
      b. Snake Canyon.
      c. Wall Snake.
      d. Ladder Snake.
B. Accessories:
   1. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, and connectors.
   2. Provide bushings or rubber edge trim as needed. Products shall be free of sharp edges or points that may damage cables.
   3. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, and connectors.

2.3 HANGERS AND SUPPORTS

A. Approved Cable Support Manufacturer: ERICO International Corporation, 34600 Solon Rd., Solon, OH 44139. Tel: 440-248-0100; Fax: 440-349-2996; Website: www.erico.com.
   1. CableCat Adjustable Cable Support (CAT425 series slings).
   2. CableCat Cable Support (CAT64 series).

B. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
C. Anchors and Fasteners:
   1. Obtain permission from Owner's Project Manager before using powder-actuated anchors.
   2. Concrete Structural Elements: Use precast inserts, expansion anchors, powder-actuated anchors, or preset inserts.
   3. Steel Structural Elements: Use beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.
   4. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
   5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
   6. Solid Masonry Walls: Use expansion anchors or preset inserts.
   7. Sheet Metal: Use sheet metal screws.
   8. Wood Elements: Use wood screws.

PART 3 EXECUTION

3.1 INSTALLATION

A. Verification of Conditions: Verify that substrates are prepared and ready to receive products specified.
B. Install hangers, supports and components in accord with Drawings, Shop Drawings and manufacturer's printed installation instructions.

3.2 CABLE TRAY SYSTEM

A. Install cable tray securely, in neat and workmanlike manner, per NECA 1.
B. Cut cable tray using manufacturer's equipment, if available from manufacturer. Smooth rough or jagged edges and points.
C. Arrange supports to prevent misalignment during wiring installation.
D. Fasten support to building structure and surfaces.
E. Cable tray elements shall be supported with manufacturer's hardware to provide minimal profile. Suspension shoes and brackets shall be used in place of trapeze struts. Sharp corners and threaded rod shall not extend below the basket.
F. Install cable trays maintaining following minimum clearance:
   1. 12" (304mm) of unobstructed clearance above cable tray's highest plane
   2. 6" (152mm) from source of EMI.
   3. 12" (304mm) from heat source exceeding 104° F (40° C).
G. If cables rise to ceiling space of floor above network room greater than 12' (3.4m), install cable tray to relieve vertical weight from cables on each floor. Secure cables with Velcro-type traps as needed to relieve vertical weight strain.
H. Continuous support elements shall be bonded from ground to TMGB/TGB with grounding wire. Sections may be bolted together or tied together with grounding jumpers, if support structure is approved by manufacturer as a grounding conductor.
I. Provide pull strings in cable trays.
J. Provide fittings or gaps with bonding jumpers to accommodate expansion and deflection where cable tray crosses expansion joints.
K. Cable tray shall not penetrate fire-rated barriers. Cable tray shall end within 18" (45.6cm) of fire-rated barriers. Cables shall use firestop assemblies or sleeves to penetrate fire-rated barriers.

L. Cable tray shall be installed only in main corridors and hallways. Cable tray shall not be installed in Communications Rooms if room enclosure is fire or smoke rated.
M. Cable tray shall be single tiered wire basket installed to allow 12" (30.4cm) of open space above and to one side of tray. Cable tray shall be 2" (5.1cm) deep wire basket tray with appropriate width dimensions as required by volume of cable planned for installation at time of construction, and account for 20 per cent future growth.
N. Cable tray shall not be filled more than 50% capacity. Cable tray shall extend up to communications room wall to provide access to racks and walls in "T" design. Small rooms may use single, straight cable tray in line with rack, provided it extends parallel to face of rack.
O. Use at least 2- 4" (101mm) conduits in lieu of cable tray where installation passes through rated walls. Additional conduits may be required as cable volume dictates. Determination of conduits requirements shall be coordinated with Owner's Project Manager.
P. Install cable tray products within network rooms for vertical strain relief as needed while maintaining 50% additional capacity within support structure. Secure cables with Velcro-type straps at minimum of 36" (91.5cm), or as recommended by manufacturer to relieve vertical weight strain.
Q. Use appropriate hardware and parts to attach tray to permanent building structure (concrete columns or deck, structural steel, or other immovable structures capable of supporting cable tray). Parts shall be specifically designed and where possible UL-listed for final installed configuration.

3.3 HANGERS AND SUPPORT DEVICES

A. Attachment Devices.
   1. Obtain Owner's project Manager's permission before using powder-actuated anchors.
   2. Concrete Structural Elements: Use precast inserts, expansion anchors, powder-actuated anchors, or preset inserts.
   3. Steel Structural Elements: Use beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.
   4. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
   5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
   6. Solid Masonry Walls: Use expansion anchors or preset inserts.
   7. Sheet Metal: Use sheet metal screws.
   8. Wood Elements: Use stainless steel wood screws.
B. Install cable supports above concealed ceilings using rigid support to structural element or by attaching directly to structural element.
C. Install hangers and supports as required to adequately and securely support electrical system components in neat and workmanlike manner, per NECA 1.
   1. Do not fasten support to pipes, ducts, mechanical equipment, or conduit.
   2. Installer may use existing threaded rods for other utilities, if pre-approved by Owner's Project Manager and is capable of supporting additional load and maintaining clearances.
   3. Do not drill or cut structural members.
   4. Installation of hangars and supports to suspended ceiling grid support system in not allowed.
D. J-hooks or sling-type supports may be installed with suspended ceiling grid wire with manufacturer clamps, provided:
   1. Wire is painted orange prior to installation, to differentiate from ceiling grid support wires.

2. Wire is not used to support ceiling grid, as required by the NEC.

E Weld support members or use hexagon-head bolted fasteners to present neat appearance with adequate strength and rigidity. Use spring lock washers under nuts.

F. Support Category 5e cables with J-hook type or sling-type supports in concealed ceiling spaces.

G. Support Category 6 cables with Cat 6 rated “J” hooks with wide base if supporting more than eight cables.

H. J-hook and sling-type supports shall be installed every 4-5’ (1.2-1.5m) on center for runs exceeding 30’ (9.12m). Runs from main or secondary corridors into classrooms and offices do not require support.

I. Close J-hook supports with manufacturer provided bars and not with cable ties. Do not use cable ties to strap cable to J-hook supports. Install cables under such strain as to require tying to supports.

3.4 CLEANING

A. Clean cable trays and supports of dust and debris.

B. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 27 05 36
CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Labor, supervision, materials, equipment, and services for fully functional cable runway support system to include ladder and wire mesh cable trays, hangers, supports, and accessories for fully functional cable support system.

1.2 REFERENCES

A. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.
B. National fire Protection Association (NFPA):
   1. NFPA 70, 2011 Edition, National Electrical Code.
   2. NFPA 70B, 2013 Edition, Recommended Practice of Electrical Equipment Maintenance.
C. American National Standards Institute (ANSI):
   1. TIA/EIA-568A – Commercial Building Telecommunications Cabling Standard.
   2. TIA/EIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces; Rev. A, 1998, and relevant Addenda (ANSI/TIA/EIA-569).
   3. TIA/EIA-606-A – Administration Standard for Telecommunications Infrastructure of Commercial Buildings, 2002.
   4. TIA/EIA-607-A – Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2002.
D. National Electrical Manufacturer's Association (NEMA):
   1. NEMA VE 1 - Metallic Cable Tray Systems, 2002.
   2 NEMA VE 2 - Metallic Cable Tray Installation Guidelines.
E. Building Industry Consulting Industry, Inc. (BICSI): Telecommunications Distribution Methods Manual, 11th Edition, 2009.
F. American Standards and Testing Materials (ASTM):
   1. ASTM F593-01: Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
   2. ASTM F594-09e1: Standard Specification for Stainless Steel Nuts.
G. St. Johns County School District Structured Cabling Standards V7.4.

1.3 QUALITY ASSURANCE

A. Comply with Section 01 45 00 Quality Control. Comply with Reference Standards indicated.
B. Products listed shall be classified by Underwriters Laboratories, Inc. (UL), as suitable for purpose specified and indicated.
C. Cable trays, supports and related accessories shall be new, defect free, and from single manufacturer.

1.4 DESIGN CRITERIA

A. Provide ladder and wire cable tray sizes based on numbers and types of wire indicated plus 20% extra capacity for future growth.

B. Cable trays and supports shall be designed by SCS installer's Registered Communications Distribution Designer (RCDD), based on cable loading, size and length of ladder or wire units, and support elements, and submitted as part of Shop Drawing submittals.

1.5 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.
B. Product Data: Submit manufacturer's descriptive literature for each cable tray system, tray support and attachment components, and accessories specified or indicated.
C. Shop Drawings:
   1. Submit runway layouts for each cable tray type and location, dimensions, support points, and finishes.
   2. Cable tray layouts, floor plans and sections shall be drawn to scale and shall include:
      a. Relationships between components and adjacent structural, electrical, and mechanical elements.
      b. Vertical and horizontal offsets and transitions.
      c. Clearances for access above and to side of cable trays.
      d. Vertical elevations of cable trays above floor or below bottom of ceiling structure.
   3. Provide manufacturer's catalog data for fastening systems.
D. Submit manufacturer's printed installation instructions for installation, including product storage, protection, and handling requirements.
E. Comply with Section 01 78 00 – Closeout Submittals: If variations from approved shop drawings occur during installation of raceway system, submit Project Record Documents indicating system installed based on final locations.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 66 00 – Product Storage and Handling Requirements.
B. Deliver and store cable trays, racks and accessories products in manufacturer's unopened packaging in clean dry area, protected from weather and construction traffic until installation.
C. Maintain storage area conditions for products in accord with manufacturer's printed instructions.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURES

A. Chatsworth Products Inc., 701 Industrial Dr., New Bern, NC 28562. Tel: 252-514-2779; Fax: 252-514-2977; Website: www.chatsworth.com
B. Cooper B-Line – USA, Division of Cooper Industries, PLC, 509 West Monroe St., Highland, IL 62249; Tel: 800-851-7415; Fax: 800-356-1438; Website: www.cooperindustries.com.
C. Cablofil, Division of Legrand, 8319 State Route 4, Mascoutah, IL 62258; Tele: 618-566-3230; Fax: 618-566-3250; Website: www.legrand.us/cablofil.com.
D. Other manufacturers may submit for approval of products per Section 01 25 13 – Product Substitution Procedures.

2.2 WIRE BASKET CABLE TRAY

A. Approved Products:
   1. ONTRAC® wire basket cable tray by Chatsworth Products, Inc.

2. FLEXTRAY™ Wire Basket Cable Support System by B-Line – USA, Division of Cooper Industries, PLC.
3 Cablofil Wire Basket Cable Tray by Legrand.

B. Wire Basket Cable Tray Design:
1. Mesh Configuration: 2" (52mm) x 4" (104mm) wire mesh stainless steel with intersecting welded wire mesh and continuous longitudinal wires.
2. Tray unit length: 10' (3m).
3. Wire basket depth shall be minimum 4" (101mm) deep by minimum 12" (304mm) width, with width and depth sized to support maximum 3" diameter cable bundles in one row across cable tray.
4. Tray wire shall be black polyester baked paint coated A36 steel bars.
5. Wire ends along flanges shall be rounded during basket manufacture.
5. Fittings and hardware shall be as recommended by manufacturer for equipment and cable routing and support.
6. Loading of trays shall not exceed manufacturer's load span criteria.
7. Hardware and Fasteners: ASTM F593 and ASTM F594, Stainless Steel, Type 316.
8. Wire Tray Material: Stainless steel, Type 316L, low-carbon, passivated per ASTM F1136.

2.3 LADDER CABLE TRAYS

A. Approved Products:
1. TELCO-STYLE cable runway by Chatsworth Products, Inc.
2. REDI-RAIL™ ladder cable tray by Cooper B-Line – USA, Division of Cooper Industries, PLC:
3. ITRAY ladder cable tray by PW Industries, Inc., Division of Legrand/Cablofil.

B. Ladder Cable Tray Design:
1. Configuration: 1.5" (38 mm) high x 0.375" (9.53mm) wide x .065" (1.65mm) thick stringers with .5" (12.7mm) wide x 1" (25.4mm) wide x .065" (1.65mm) thick cross members (rungs) welded to stringers at 9" (228.6mm) o.c.
2. Tray unit length: 9'- 8.5" (2.959m).
3. Rungs shall support maximum cable load plus 50% safety factor, and 200 lbs. (90 kg) concentrated load, when tested in accord with NEMA VE 1.
4. Maximum Usable Load Depth (as required); 3" (78mm), 4" (104mm), 5" (130mm), or 6" (156mm).
5. Straight Section Lengths: 10' (3m), 12' (3.6m), 20' (6m), or 24' (7.4m), as required, except where shorter lengths are required to facilitate tray assembly.
6. Width: 12" (304mm), 18" (456mm), or 24" (608mm), as required.
7. Minimum Bending Radius: 24" (608mm).
8. Splicing Assemblies: Bolted type utilizing serrated flange locknuts.
9. Hardware and Fasteners: ASTM F593-1 and ASTM F594-09e1, Stainless Steel Bolts, Hex Cap Screws and Nuts, Type 316.

2.4 ACCESSORIES

A. Fittings: Tees, crosses, risers, elbows, and other required fittings or as indicated shall be same material and finish as cable tray.
B. Cable tray supports and connectors, including bonding jumpers, shall be as recommended by manufacturer.

2.5 WARNING SIGNS

A. Lettering: 1.5" (38mm) high, black letters on yellow background with words, "Warning! Not To Be Used as Walkway, Ladder, or Support for Ladders or Personnel".
B. Comply with fastener requirements in Section 27 05 53 – Identification for Communications Systems.

PART 3 EXECUTION

3.1 CABLE TRAY INSTALLATION

A. Verification of Conditions: Verify that substrates are prepared and ready to receive products specified.
B. Install components of raceway systems per NEMA VE 1 and in accord with Drawings, Shop Drawings, and manufacturer's printed installation instructions.
C. Install cable trays securely, in neat and workmanlike manner, level with floors and ceilings, plumb and aligned with adjacent walls.
D. Install trays as complete system, including fastener, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, and bonding.
E. Install cable trays to be accessible for cable installation and splices are accessible for inspection and adjustment with following clearances:
    1. 12" (304mm) of unobstructed clearance above cable tray's highest plane
    2. 6" (152mm) from source of EMI.
    3. 12" (104mm) from heat source exceeding 104° F (40° C).
F. Cut cable trays using manufacturer's equipment, or as recommended by manufacturer. Smooth rough or jagged edges and points.
G. If cables rise to ceiling space of floor above network room greater than 12' (3.66m), install cable tray to relieve vertical weight from cables on each floor. Secure cables with Velcro-type straps as needed to relieve vertical weight strain.
H. Continuous support elements shall be bonded from ground to TMGB/TGB with grounding wire. Sections may be bolted together or tied together with grounding jumpers if support structure is approved by manufacturer as a grounding conductor.
I Provide pull strings in cable trays.
J. Provide fittings or gaps with bonding jumpers to accommodate expansion and deflection where cable tray crosses expansion joints.
K. Cable tray shall not penetrate fire-rated barriers. Cable tray shall end within 18" (45.6cm) of fire-rated barriers. Cables shall use firestop assemblies or sleeves to penetrate fire-rated barriers in accord with Section 07 84 00 – Firestopping.
L. Use at least 2- 4" conduits or as required for cable volume in lieu of cable tray where installation passes through rated walls. Install one additional capped metal sleeves for future cable through firestop-sealed cable tray penetration of fire and smoke barriers.
M. Cable tray connections or changes in direction and elevation shall use manufacturer's recommended fittings.
N. Install barriers to separate cables of different low voltage systems such as security, fire, communications, and data.
O. Install permanent covers on vertical tray runs in accord with NFPA 70, after installing cable. Install cover clamps per NEMA VE 2.
P. Install warning signs in visible locations on or above cable trays after cable installation as noted in Para. 2.05. Signs shall be located not more than 33' (10.06m) o,c. along length of cable trays, but not less than one per space.

Q. Cables in trays shall be single tiered wire baskets installed to allow 12" (30.4cm) of open space above and to accessible side of tray. Cable tray shall be 2" (5.1cm) deep wire basket tray with appropriate width dimensions as required by volume of cable planned for installation at time of construction, and account for 20 per cent future growth.
R. Cable trays shall extend up to MDF and IDF room walls to provide access to racks and walls in "T" design. IDF rooms may use single, straight cable tray in line with rack, provided it extends parallel to face of rack.
S. Install cable tray products within network rooms for vertical strain relief as needed while maintaining 20 percent additional capacity within support structure. Secure cables with Velcro-type straps at minimum of 36" (91.44cm), or as recommended by manufacturer to relieve vertical weight strain.

3.2 HANGERS AND SUPPORT DEVICES INSTALLATION

A. Support Devices.
   1. Obtain Owner's project Manager's permission before using powder-actuated anchors.
   2. Concrete Structural Elements: Use precast inserts, expansion anchors, powder-actuated anchors, or preset inserts.
   3. Steel Structural Elements: Use beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.
   4. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
   5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
   6. Solid Masonry Walls: Use expansion anchors or preset inserts.
   7. Sheet Metal: Use sheet metal screws.
   8. Weld support members or use hexagon-head bolted fasteners to present neat appearance with adequate strength and rigidity. Use spring lock washers under nuts.
B. Use appropriate hardware and parts to attach tray to permanent building structure (concrete columns or deck, structural steel, or other immovable structures capable of supporting cable tray). Parts shall be specifically designed and where possible UL-listed for final installed configuration:
   1. Comply with Section 26 05 29 – Hangers and Supports for Electrical Systems.
   2. Construct supports from channel members, threaded rods, or other appurtenances furnished by cable tray manufacturer.
   3. Arrange supports in trapeze or wall-bracket form as required by location.
   4. Place supports not to exceed maximum spans recommended by manufacturer.
   5. Utilize splice plates to allow full rated loads at mid span.
   6. Fasten cable tray supports to building structure. Arrange supports to prevent racking, twisting or misalignment from eccentric loading.
   7. Do not install more than one cable tray splice between supports.
   8. Make connections to equipment with flanged fittings fastened to cable trays and to equipment.
   9. Do not support cable tray from equipment enclosures. Support trays independently of fittings.
   10. Cable tray elements shall be supported with manufacturer's hardware to provide minimal profile. Suspension shoes and brackets shall be used in place of trapeze struts. Sharp corners and threaded rod shall not extend below the basket.
C. Install hangers and supports as required to adequately and securely support communications system components in neat and workmanlike manner, per NECA 1.
   1. Do not fasten support to pipes, ducts, mechanical equipment, or conduit.

2. Installer may use existing threaded rods for other utilities, if pre-approved by Owner’s Project Manager and is capable of supporting additional load and maintaining clearances.
3. Do not drill or cut structural members.
4. Installation of hangars and supports to suspended ceiling grid support system is not allowed.

D. J-hooks or sling-type supports shall be installed with wire from structure above from trays in corridors through one penetration in wall adjacent to each space being supplied with data and communications outlets.
1. Mount cables and supports at right angles from corridor to each space with manufacturer’s clamps.
2. Wire shall be painted orange prior to installation, to differentiate from ceiling grid support wires.
3. Wire shall not be used to support ceiling grid, as required by NFPA 70.

E. Support Category 6 cables with Cat 6 rated “J” hooks with wide base if supporting more than eight cables.

F. J-hook and sling-type supports shall be installed every 4-5’ (1.22-1.52m) on center for runs exceeding 30’ (9.14m). Runs from main or secondary corridors into classrooms and offices do not require support.

G. Close J-hook supports with manufacturer provided bars and not with cable ties. Do not use cable ties to strap cable to J-hook supports. Install cables under such strain as to require tying to supports.

3.3 CLEANING

A. Clean interior of cable trays, boxes to remove dust, debris, and other material.
B. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 27 05 53
IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Identification and labeling of system communication components including locations of each element of system and labeling of each component.
B. Cables and terminations shall be identified in accord with TIA/EIA 606 for labeling and numbering with cables terminated in alpha-numeric sequence at both origination and termination locations.

1.2 REFERENCES

A. See Section 01 42 00 – References for additional reference standards, abbreviations, definitions, and acronyms.
B. National Electric Code (NEC) 2017 Edition.
C. Telecommunications Industry Association (TIA)/Electronics Industry Association (EIA):
   1. TIA/EIA-606-A – Administrative Standard for Commercial Telecommunications Infrastructure.
   2. TIA-942 – Telecommunications Infrastructure Standard for Data Centers.
D. Building Industry Consulting Services International (BICSI):
   1. Telecommunications Distribution Methods Manual (TDMM).
   2. Information Transport Systems Installation Methods Manual (ITSIMM).
E. NFPA 70E, 2004 Edition – Standard for Electrical Safety in the Workplace.
F. St. Johns County School District Structured Cabling Standards V7.4.

1.3 QUALITY ASSURANCE

A. Labeling shall be handheld thermal transfer printer producing printed, crisp, clear, non-smearing, and legible labels.
B. Labels shall be durable for life of telecommunications system.
C. Telecommunication system warranty shall include 20-year labeling replacement due to illegible or detached labels.

1.4 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.
B. Product Submittals:
   1. Provide manufacturer's product information cut sheets and specifications with specific product number identified or filled out.
   2. Provide labeling lists for outlets, horizontal cables, and backbone cabling in Microsoft Excel format for planned identification labels in accord with TIA/EIA 606-A – Labeling Standards.
   3. Labeling lists shall be approved by Owner's Project Manager prior to start of communications installation.
C. Shop Drawings:
   1. Provide scaled drawings of floor plans indicating outlets with proposed identification label for each outlet. Each cable shall be terminated in alpha-numeric sequence at termination locations.

2. Provide riser diagrams for each Communications Room identified by FISH Room Number and backbone cable(s) by both room number and cable number.
3. Provide enlarged scaled drawings of each Communications Room indicating Rack Row and Number(s), with patch panel locations and number(s).
4. See Part 3 – Execution for additional instructions for labeling of racks and patch panels.

D. Project Record Documents:
1. See Section 01 78 00 – Closeout Submittals. See other specification sections for specific record document requirements for those sections.
2. Field deviations, changes and additions of telecommunications system from reviewed Shop Drawings shall be recorded on project field documents during construction and submitted to AE for review and compilation of final Record Documents (drawings, project manual, and cable manifest) which shall be submittal to Owner as part of final project closeout.
3. Cable manifest (spreadsheet in Microsoft Excel format) shall identify source, destination, pair/strand count, and labeling scheme used for each horizontal and backbone cable.
4. Project Record Documents shall only include Division 27 work scope and shall be submitted on one USB Flash Drive. See Section 01 78 00 – Closeout Submittals for required number of copies.

1.5 PROJECT REQUIREMENTS

A. OSP conduits shall provide access to MER and shall be labeled with same number at access point nearest property line and in MER.
B. Voice patch panels shall be labeled to indicate what ER is served.
C. Grounding and bonding system shall be labeled in accord with TIA/EIA-606.
D. In MDF and IDF rooms, copper patch panels shall be labeled. See St. Johns County School District Structured Cabling Standards, Version 7.
E. Fiber Patch Panels
1. MDF and IDF rooms shall have separate fiber enclosures for Single Mode and Multimode optical fiber cable. Each enclosure shall be labeled as such.
2. Fiber panels housed in enclosures shall have fiber labeled MM (multimode) or SM (single mode) from MDF to IDF rooms or to other locations, see St. Johns County School District Structured Cabling Standards, Version 7.
3. Provide one fiber enclosure housing in MDF or IDF for both MM and SM optical fiber cable. Panels in each enclosure shall be labeled either MM or SM depending on type of optical fiber cable terminated in panel.
F. WAO's shall be labeled as follows: See St. Johns County School District Structured Cabling Standards, Version 7.
G. Wireless access points shall be terminated in separate patch panel from other horizontal cables and shall be designated as "Wireless AP". At wireless access point, labeling shall be per St. Johns County School District Structured Cabling Standards, Version 7.
H. Project records shall be provided to Owner at project completion as part of closeout submittals identifying location and nomenclature of each item.
1. Documentation shall be on hard copy and on Flash Drive(s). Written documents shall be in Word format and include manufacturer's written product information.
2. Project record drawings shall be provided on Flash Drives to Owner in AutoCAD format and shall be AutoCAD Release 10 or later edition.
I. Comply with Section 01 78 00 - Closeout Submittals.

PART 2 PRODUCTS

2.1 HANDHELD LABELERS

A. Provide labels for ISP Cable, OSP (horizontal) cables, racks, grounding busbars and as indicated.
B. Size labels according to cable diameter and readability.
C. Labels shall be machine made, thermal transfer type, and self-adhesive.
D. Approved Manufacturers and Products:
   1. BMP41 as manufactured by Brady Worldwide, Inc., 6555 W. Hope Rd., Milwaukee, WI 53223, PO Box 2131, Milwaukee, WI 53201; Tel: 800-541-1686 Fax: 800-292-2289; Website: www.bradycorp.com.
   2. Rhino 5200 as manufactured by Dymo, a Div. of NewellRubbermaid, 3 Glenlake Parkway, Atlanta, GA 30328; Tel: 800-241-4324; Website: www.dymo.com.
   3. Spirit HD2100 as manufactured by HellermannTyton North America, 7930 N. Faulkner Rd., Milwaukee, WI 53224-9517; Tel: 800-537-1512; Fax: 800-848-9866; Website: www.hellermanntyton.us.
   4. PanTher LS8EQ as manufactured by Panduit. Website: www.panduit.com.

2.2 FACEPLATE, PATCH PANEL, AND WALL BLOCK LABELS

A. Faceplates, patch panels, and wall blocks shall have integral slot for insertion of device identification labels.
B. Where device does not have integral label insert, submit proposed labeling method.

2.3 GROUNDING AND BONDING CONDUCTORS

A. Warning Marker: non-metallic, machine made, preprinted as wrap-around marker (flag marker is not acceptable) as manufactured by Panduit, LTYK Grounding and Bonding Label Kit.
B. Identification Labels:
   1. Labels shall be self-laminating, machine made, and thermally printed.
   2. Label size varies with conductor size:
      a. 18-14AWG: 1" (2.54cm) x 0.75" (1.90cm) label.
      b. 12-10AWG: 1" (2.54cm) x 1.25" (3.18cm) label.
      c. 8-4AWG: 1" (2.54cm) x 2.25" (5.62cm) label.
      d. 2-1AWG: 1" (2.54cm) x 4" (10.1cm) label.
      e. 1/0-250kcmil: 1" (2.54cm) x 6.5" (16.21cm) label.
   3. Labels shall be Panduit S100X***VAC or S100X***VAT, where *** denotes second dimension based on wire size.
   4. Equivalent identification labels manufactured by Brady Worldwide, Inc. or Hellermann Tyton, Inc. are acceptable.

PART 3 EXECUTION

3.1 GENERAL

A. Comply with TIA/EIA-606-A – Administrative Standard for Commercial Telecommunications Infrastructure identification of communication devices, wiring, and system components.

B. Labels shall be physically accessible and easily read.
C. Communications rooms where cabling is terminated or originated are referred to in documents as MDF and IDF Rooms on floor plans and room finish schedules.
D Space numbers indicated on Dwgs are Owner's FISH (Florida Inventory of School Houses) numbers and shall be used to denote cable origination and termination points. FISH numbers have five digits (two digits for the building number followed by dash and three digits for space number).
E Sites will generally have one MDF room per site and each building will generally have one IDF room on each floor level unless the rooms on same floor exceed total cable run greater than 300' (90m) from IDF room.
F. Typical space number for MDF would be 02-114 (Bldg. 02, Space 114 on the first floor). IDF space would be 02-211 (Bldg. 02, space 211 on the second floor).

3.2 LABELING

Comply with St. Johns County School District Structured Cabling Standards, Version 6, in its entirety.

A. Telecommunications Rooms:
   1. MTR:
      a. A building MTR shall be labeled as follows:
         MTR-XXX

   Where XXX is the FISH number that will be permanently associated with the room. This label shall be permanently mounted in plain view on both the inside and outside of the door for easy identification.

   2. TR:
      i. A building TR shall be labeled as follows:
         TR-XXX

   Where XXX is the FISH number that will be permanently associated with the room. This label shall be permanently mounted in plain view on both the inside and outside of the door for easy identification.

B. Patch Panels:
   1. Patch panel labeling:
      i. Each patch panel shall be labeled with a number in the top left corner. This number shall be in ascending order from top left to right bottom.
      ii. each port on a patch panel in a MTR or TR shall be labeled with the room number and an uppercase letter, A-Z, that corresponds to the faceplate and port labels at the station side of each link.
      iii. Patch panels used to terminate copper backbone cabling shall be labeled in the top center of each panel using the following scheme:
         Ppair-MTRXXX-TRYYY

   Where P stand for the number of pairs in the cable and XXX is the FISH number of the MTR or TR the cable originates from and YYY is the FISH number of the TR the cable terminates.

C. Terminations for Patch Panels and 110-blocks.
   1. Utilize available inserts: print with inkjet or laser printer, including full labeling scheme.
   2. Example of Patch Panel and 110-block description: 114-1-A01, where 114 is room number, "01" is Rack #1, "A" is patch panel "A", and "01" is patch panel position (add "WAP" suffix for outlets to wireless access points.

D. Inside Plant (ISP) Horizontal Cabling:
      i. Each station cable shall be labeled 2" from the termination with a permanent, water-resistant, electronically generated, sticker type label, using the following scheme:

TRXXX-Y-nnnV

Where XXX stands for the FISH number of the TR that the cabling originates from and Y stands for the number of the patch panel on which the cabling terminates in TRXXX, and where nnn stands for the FISH number of the room the drop is located in and the V is a consecutive identifier (A, B, C, D, etc.) for each cable in the room. In the event that a single room contains more than 26 single connections, double letter designations shall be used to accommodate the connections over 26 (AA, BB, etc.).

E. Outside Plant (OSP) Horizontal Cabling:
   1. Label transition point (if utilized) as "COMMUNICATIONS OSP TRANSITION POINT".
   2. Label cables at transition point within 6" (152mm) at both termination ends.
   3. Example of OSP description: 114-01-A01, where 114 is Telecommunications Room number, "01" is Rack #1, "A" is patch panel "A", and "01" is patch panel position (add "WAP" suffix for outlets to wireless access points.

F. Faceplates:
   1. A WAO faceplate shall be labeled using the following scheme:
      Top of faceplate – TRXXX-Y

Where XXX stands for the FISH number of the TR that the cabling originates from and Y stands for patch panel # where the cabling terminates in TRXXX.

Each individual outlet on the faceplate – nnnV

Where nnn stands for the FISH number of the room the drop is located in and the V is a consecutive identifier (A, B, C, D, etc.) for each cable in the room, starting at the left side of the room and working clockwise. In the event that a single room contains more than 26 single connections, double letter designations shall be used to accommodate the connections over 26 (AA, BB, etc.).

G. Copper Backbone (between Telecommunications Rooms):
   (a) Copper backbone cabling shall be labeled on the cable jacket, using a permanent water and tear-resistant label, three times starting from the patch panel, wall block, or lightning protection and working down the cable at 12" increments using the following scheme:
   Ppair-MTRXXX-TRYYY

Where P stands for the number of pairs in the cable and XXX is the FISH number of the MTR or TR the cable originates from, and YYY is the FISH number of the TR the cable terminates in.

H. Fiber Backbone (between Telecom Rooms):
   (a) Fiber optic backbone cabling shall be labeled on the jacket using a permanent water and heat resistant label, three times starting from the termination tray and working down the cable at 12" increments using the following scheme:
   Pstrand-S/MM-MTRXXX-TRYYY

Where P stands for the number of strands in the cable and either S or M stands for single-mode or multi-mode fiber, and XXX is the FISH number of the MTR or TR the cable originates from and YYY is the FISH number of the TR the cable terminates in.

I. Wireless Access Point (WAP) WAOs shall be labeled on the biscuit box and on the T-bar of the drop ceiling directly below the biscuit box with a Yellow ¾" permanent label in plain view using the following scheme:

TRXXX-Y-WAP-RRR-V
Where XXX stands for the FISH number of the TR that the cabling originates from and Y stands for the number of the patch panel on which the cabling terminates in TRXXX, the WAP is a constant, the RRR is the FISH number of the room or corridor that the WAP is located in, and the V is a consecutive identifier (A, B, C, D, etc.) for each WAP located in the same room or corridor. In the event that a single area contains more than 26 wireless access points a double letter consecutive identifier shall be used to accommodate the WAPs over 26 (AA, BB, etc.).

J. Media Link Controller (MLC) WAOs shall be labeled on the cable using a permanent cable label using the following scheme:
TRXXX-Y-MLC-RRR-V
Where XXX stands for the FISH number of the TR that the cabling originates from and Y stands for the number of the patch panel on which the cabling terminates in TRXXX , the MLC is a constant, the RRR is the FISH number of the room or commons area that the MLC panel is located in, and the V is a consecutive identifier (A, B, C, D, etc.) for each MLC panel. In the event that a single building contains more than 26 MLC panels a double letter consecutive identifier shall be used to accommodate the WAPs over 26 (AA, BB, etc.).
Note: MLC cables will not be visible unless the MLC panel is removed from the wall. To see the cable label, remove the four screws which secure it to the wall to expose the cable.

3.3 PATHWAYS

A. Conduit
   1. Label exterior conduit as "COMMUNICATIONS" (unless otherwise noted) with text readable from standing position on finished floor.
   2. For wall stub-up locations, for future use, label end of stub-up conduit in Telecommunications (MDF and IDF) Rooms only.
   3. For overhead conduits, label both ends in Telecommunications (MDF and IDF) Rooms.
   4. For long runs of conduit that stub-up into Telecommunications (MDF and IDF) Rooms, label end of conduits in Telecommunications (MDF and IDF) Rooms with destination room name and number or locations without space numbers such as Elevators.
   5. Sleeves passing through single wall or floor do not have to be labeled, unless walls are fire rated.

B. Junction Boxes and Pull Boxes:
   1. Label exterior of junction boxes and pull boxes as "COMMUNICATIONS" with text readable from standing position on finished floor.

C. Firestop Locations:
   1. Communications firestop locations identified on Drawings shall be labeled on both sides of walls or floors. Comply with Section 07 84 00 – Firestopping.

3.4 GROUNDING

A. Label TMGB (Telecommunications Main Grounding Bus Bar) as TMGBB-XXX, where XXX indicates FISH room number where TMGB is located.

B. Label TGB (Telecommunications Grounding Bus Bar) as TGB-XXX, where XXX indicates room number where TGB is located.

C. Label grounding conductors within 12" (304mm) of both ends with warning marker and identification label.
   1. Identification label shall include source and destination of grounding conductor.

END OF SECTION

SECTION 27 11 13
COMMUNICATIONS ENTRANCE PROTECTION

PART 1 GENERAL

1.1. SCOPE OF WORK

A. Installation of over voltage and current protective devices for telecommunications cabling with surge protection modules for protection of cabling and equipment for MDF entrance cabling and cabling between buildings to IDF rooms.
B. Protective modules shall be installed in wall mounted enclosure and connected with #6AWG copper bonding conductor between protector ground lug and telecommunications equipment in MDF and IDF rooms.

1.2. REFERENCES

A. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.
B. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code.
C. American National Standards Institute/Telecommunications Industry Association/Electronic Industries Association (ANSI/TIA/EIA).
    1. ANSI/TIA/EIA-568-2006 – Standard for Installing Commercial Building Telecommunications Cabling.
    2. ANSI/TIA/EIA-568C – Commercial Building Telecommunications Cabling.
    3. ANSI/TIA/EIA-569C – Telecommunications Pathways and Spaces.
    4. ANSI/TIA/EIA-606A – Labeling Standards for Networks.
    5. ANSI/TIA/EIA-J-607A – Standard for Telecommunications Bonding and Grounding, Planning and Installation Methods for Commercial Buildings.
    6. ANSI/TIA/EIA-758B – Customer Owned Outside Plant Telecommunications Infrastructure Standards.
D. Underwriters Laboratories (UL).
    1. UL 497/497A – Protectors for Paired Conductor Communications Circuits.
    2. UL 1449 – Surge Protection Devices.
E. Building Industry Consulting Services International (BICSI):
    1. Telecommunications Distribution Methods Manual (TDMM).
    2. Information Transport Systems Installation Methods Manual (ITSIMM).
F. St. Johns County School District Structured Cabling Standards V7.4.

1.3. SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.
B. Product Submittals:
    1. Provide manufacturer's product data sheets and specifications with specific product number identified or filled out clearly marking specific products and model numbers.
    2. Provide product lists for each item specified.
C. Shop Drawings:
    1. Provide scaled drawings of floor plans and elevations of each MDF and IDF room indicating product layouts identifying each product.

1.5 QUALITY ASSURANCE

A. Comply with Section 01 45 00 – Quality Control.
B. Communication entrance protection equipment shall be UL approved.
C. Installer shall be authorized by manufacturer and certified to install listed products,

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Building Entrance Protector Enclosure shall be as manufactured by CommScope, Inc., 100 CommScope Place SE, Hickory, NC 28602; Tel: 828-324-2200; Fax: 828-918-1708; Website: www.commscope.com.
B. Protector modules shall be as manufactured by Circa Enterprises, Inc., 206, 5 Richard Way SW, Calgary, AB, T3E 7M8, Canada; Tel: 403-258-2011; Website: www.circaent.com.
C. Other manufacturers shall comply with Section 01 25 13 – Product Substitution Procedures.

2.2 BUILDING ENTRANCE TERMINALS (BET)

A. Building Entrance Terminal Enclosures:
   1. CommScope, Inc.: Systimax Model 489ACA1-xxx (25, 50, 100 or 200 pair protector module capacity where indicated).
   2. Splice Chamber: A-110 style with 110 block input and output.
   3. Fully enclosed housing covering terminations and modules.
B. Building Entrance Terminal Modules.
   1. Circa Enterprises, Inc.: Model 4B1S-300, utilizing positive temperature coefficient technology (PTC) with self-resetting current limiters.
   2. Solid state, UL approved.
   3. ISO 9002 Certified Manufacturer.
C. Other materials as required for complete and functioning telecommunications grounding system.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install equipment in accord with manufacturer's typed instructions.
B. Where protective devices are located in MDF and IDF rooms, locate protector on plywood backboard.
C. Label protector and outlet identifier in accord with Section 27 05 53 – Identification of Communication Systems and as indicated.
D. Install protective enclosures and grounding conductors neatly, aligned, plumb and level.

END OF SECTION

SECTION 27 11 16
COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

PART 1 GENERAL

1.1 SCOPE OF WORK

A. Supply and installation of cabinets, racks, frames, enclosures, anchorage attachments and accessories required for communications room equipment.

1.2 REFERENCES

A. See Section 01 42 00 – References, and Section 27 05 00 – Common Work Results for Communications Systems for additional reference standards, definitions, abbreviations, and acronyms.
B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2014 Edition.
C. St. Johns County School District Structured Cabling Standards V7.4.

1.3 QUALITY ASSURANCE

A. Comply with Section 01 45 00 – Quality Control.
B. Communications network installer shall be certified by equipment manufacturer. Installer shall have five continuous years' experience in telecommunications installations.
C. Installer shall have Registered Communications Distribution Designer (RCDD) on his staff to certify that installation is compliant with applicable industry standards and is installed in accord with contract documents.
D. Ground equipment racks in accord with Section 27 05 26 Grounding and Bonding for Communications Systems.

1.4 SUBMITTALS

A. Comply with Section 01 78 00 – Closeout Submittals.
B. Project Record Drawings shall be submitted indicating layouts of cabling locations and communications room layouts.

1.5 STORAGE AND HANDLING

A. Comply with Section 01 66 00 – Product Storage and Handling Requirements.
B. SCS Installer shall be responsible for coordinating storage of equipment at project with Contractor/CM in secure and conditioned space.
C. Protect equipment from environmental and physical damage from project delivery to Owner's final acceptance of project.
D. Installer shall have separate keying system for equipment storage spaces, MDT and IDF rooms, so that other building trades shall coordinate with the SCS installer for entrance to those spaces.
E. SCS installer and Contractor/CM shall be responsible for SCS vandalism, theft, or damage.

PART 2 PRODUCTS

2.1 MATERIALS

A. Approved Manufacturer's
   1. Chatsworth Products Inc., 701 Industrial Dr., New Bern, NC 28562. Tel: 252-514-2779; Fax: 252-514-2977; website: www.chatsworth.com.
   2. Panduit Corp., 17301 Ridgeland Ave., Tinley Park, IL 60477; Tel: 800-777-3300, 708-532-1800; Fax: 708-532-1811; Website: www.panduit.com.

B. Enclosures/Cabinets:
   1. Manufacturer: Hubbell
      a. Model #HSQ4838.
      b. Model RE4 and RE4X

C. Four Post Racks
   1. Manufacturer: Chatsworth Products Inc.
      a. Quadrarack™ Server Frame, Model #15053-703, 84" (213cm) H x 19" (48 cm) W x 29" D (73.7 cm), 45RMU, black with square punched hardware Kits #1261-001, as required.
   2. Manufacturer: Ortronics Corp.
      a. Mighty-Mo 10 Server Rack, Model #OR-MM107SVR, 84" (213cm) H, 19" (48 cm) W x 12.5" (30.5 cm) to 30" (76.2 cm) D (adjustable), 45 RMU, black.

D. Standard Racks
   1. Manufacturer: Chatsworth Products Inc.
      a. Model #: 55053-703, 84" (213cm) H x 19" (48cm) W x 29" D (73.7cm) W, 45RMU.
   2. Manufacturer: Ortronics Corp.
      a. Mighty-Mo 6 Cable Management Rack, Model #OR-MM6706, 84" (213cm) H, 19" (48 cm) W x 6.5" (16.5 cm) D, 45 RMU, black.

E. Rack Base Insulator Kit
   1. Manufacturer: Chatsworth Products Inc.
      a. Part #: 10605-019, 2 isolation plates and 4 isolation grommets.
   2. Manufacturer: Ortronics Corp.
      a. Part #: OR-MMIPK Isolation Pad Kit with 2 isolation plates and 4 isolation grommets.

F. Vertical Cable Management
   1. Manufacturer: Panduit, Corp.
      a. Model #: WMPVHC45E, 83" H x 4.24" W with Front and Real Duct, black, 45RMU ROHS with round head machine screws, wire retainers and covers.

G. Horizontal Cable Management
   1. Manufacturer: Panduit, Corp.
      a. Model #: WMPH2E, 3.5" (88.9mm) H x 19" (482.6mm) W x 8.9" (225.5mm) D; 2 Rack Space Manager, Front and Rear.

H. Fiber Connect Panel
   1. Manufacturer: Corning Corp.
      a. Corning Pretium Rack and Wallmount Enclosures
      b. Corning Pretium Unicam Connectors

I. Rack Mounted Interconnect Center (Fiber Cabinet)
   1. Manufacturer: Corning Corp.
      a. Corning Pretium Rack and Wallmount Enclosures
      b. Corning Pretium Unicam Connectors

J. Horizontal Cable Management Trays shall be 12” (30.4cm), 18” (56.4cm) or 24” (60.8cm) wide as required to support cable bundles not greater than 3” high across full panel width.
   1 Manufacturer: Ortronics, Corp.
      a. Telco Style Tubular Runway, Part # OR-TRT10-12B, black 12” (304mm) W x 9’-8.5” (2.96m) L, 115 lb/ft (172.5 kg/m) load rating. Stringers shall be 0.375” (9.5mm) W x 1.5” (3.81cm) D tubular steel, with 0.5” (1.27mm) W x 1.5” (3.81mm) D cross slats, 12” (304mm) o.c. Provide Part #OR-WRTRT-12B for rack supports at walls.
   2. Chatsworth Products, Inc.
      a. Part # 10250-712, 12” (304mm) W x 9’-11.5” (3.035m) L, 132 lb/ft (197.7 kg/m) load rating. Stringers and cross slats shall be 0.375” x 1.5” tubular steel, with cross slats, 12” (304mm) o.c.

K. Duplex Fiber Optic Patch Cords
   1. Owner Provided

L. Accessories.
   1. Manufacturer: Hellermann Tyton - Flexiform Grommet.
   2. Manufacturer: Middle Atlantic Products - protective grommet (GR-30).

PART 3 EXECUTION

3.1 INSPECTION

A. SCS installer shall inspect spaces where equipment is to be located. Immediately notify Contractor/CM of conditions that precludes successful equipment installation.
B. Buildings in which equipment is to be placed shall be thoroughly cleaned and shall have operating HVAC system to maintain temperature and humidity at conditions equal to final building occupancy.
C. Start of equipment installation shall be deemed installer’s acceptance of building conditions.

3.2 INSTALLATION

A. Install cabinets, racks, enclosures, and accessories in accord with manufacturer’s printed installation instructions where indicated.
B. Provide full louver door on front and back of equipment cabinets with one fan rack unit, and two 5” (127mm) grommet holes in each side and top protected with plastic or rubber edging.
C. Locate power outlet strips in equipment racks.
D. Provide wire management rings, ladder rack, brackets, wire management panels for neat and workmanlike installation.
E. Use Velcro cable ties in network rooms. No plastic or metal cable ties shall be used.
F. When configuring multiple racks in line, vertical cable management between racks shall be larger size, while smaller channels may be used at ends. Do not down-size end of racks.
G. Securely fasten side-by-side racks to each other using rack manufacturer’s standard hardware. Securely fasten all floor mounted racks to floor via isolation pads. Place to allow access from front and rear.
H. Bag and leave attached to rack unused mounting screws or other hardware upon completion.
I. Provide vertical cable management sized for no more than 40 percent fill.
J. Mount with minimum of 36” (914.4 mm) clear access behind and in front of rack/cabinets.
K. Ground rack/enclosure to TMGB/TGB with Grounding Wire.

END OF SECTION

SECTION 27 11 19
COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

PART 1 GENERAL

1.1. SCOPE OF WORK

A. Supply and installation of terminal blocks, patch panels, and accessories in equipment rooms to provide fully functional communications system.

1.2. REFERENCES

A. See Sections 01 42 00 – References and 27 05 00 - Common Work Results for Communications for additional reference standards, abbreviations, definitions, and acronyms.
B. NFPA (National Fire Protection Association): NEC 70, 2017 Edition.
C. St. Johns County School District Structured Cabling Standards V7.4.

1.3. QUALITY ASSURANCE

A. Comply with Section 01 45 00 – Quality Control.
B. Horizontal Copper Rack Terminations
   1. Horizontal cables for new construction shall be terminated in T568B pin/pair configuration. Terminate (punch down) four wiring pairs per jack port.
   2. Horizontal cables for existing buildings shall conform to existing termination scheme which may be either T568A or T568B.
   3. Cables shall be neatly dressed to respective patch panel and within rack cable management using Velcro cable ties and/or rack cable management loops. Cables shall not be bundled outside of rack but shall be loose and random in cable tray.
C. Fiber Rack Terminations
   1. Terminate fiber on rack mounted patch panel. Fiber-optic connecting hardware shall support individually terminated fibers onto connectors. Adapter panels shall be limited to single type of fiber (multimode or single mode).
   2. Terminate fiber in appropriately sized, rack mountable enclosures.
   3. Enclosures shall be lockable (if room access is not controlled) and shall be sealed design to prevent accumulation of dust, dirt, and moisture in panel.
   4. Optical patch panels shall meet ANSI EIA/TIA-568-A wiring standard for connecting hardware.
   5. Termination panels shall be mounted in top of rack or cabinet.

PART 2 PRODUCTS

2.1 MATERIALS

A. Approved Manufacturers.
   1. Panduit (patch panels), per St. Johns County School District latest approved Structured Cabling Guidelines.
   2. Corning (fiber optic connectivity), per St. Johns County School District latest approved Structured Cabling Guidelines.
B. Other manufacturers not listed shall comply with Section 01 25 13 - Product Substitution Procedures.

C. Category 6A Copper Patch Panels
   1. Panduit (patch panels), per St. Johns County School District latest approved Structured Cabling Guidelines.
D. Fiber Terminations
   1. Panduit
   2. Corning
      a. Approved fiber optic connectivity line: Corning Pretium Rack, wall mount enclosures and LIUs equipped with sufficient ports.
      b. Approved fiber optic connectivity line: Corning Pretium Unicam Connectors.
E. Patch Cords
   1. Panduit
   2. Corning.
F. Additional materials needed to properly terminate and secure cables, including but not limited to panel and plate connectors, grounding kits, strain-relief hardware, break-out kits, blank panels, and plates.

PART 3 EXECUTION

3.1 INSTALLATION

A. Horizontal Cable Rack Terminations.
   1. Horizontal cable shall be installed per manufacturer printed instructions to ensure manufacturer certified solution.
   2. Provide and install modular patch panels as indicated on Drawings.
   3. Terminate horizontal cables in T568A pin/pair configuration. All four pairs shall be terminated.
   4. Neatly dress cables to respective patch panel and within rack cable management using Velcro cable ties and rack cable management loops. Cables shall not be bundled outside of rack but shall be loose and random in cable tray.
   5. Provide identification labels for each cable in accord with Section 27 05 53 – Identification for Communications Systems.
B. Optical Fiber Rack Terminations
   1. Provide and install rack-mounted optical fiber housings where indicated.
   2. Terminate fibers using dual SC connector panels and plates, and fiber connectors.
   3. Place fiber slack neatly in fiber housing.
   4. Secure cable strength members to cable strain relief brackets or attachment points within fiber housing.
   5. Install blank panels and plates to fill empty locations within fiber housings.
   6. Install additional materials to properly terminate and secure inter-building and intra-building optical fiber cables, including panel and plate connectors, grounding kits, strain-relief hardware, break-out kits, blank panels, and plates.
   7. Provide identification labels for adaptors.
C. Wall Termination Fields
   1. Wall field terminations shall be installed per manufacturer's written instructions to ensure manufacturer certified solution.
   2. Install 110 blocks and protectors as indicated. Wall-mounted hardware, including cable management, shall be at or below 5'-6" (1.69m) from finished floor.
   3. Cable management troughs shall be installed for cross-connect wires to be installed within troughs. Wire management may be adjusted during installation, if approved by Owner's Project Manager.

4. Locate cable management as needed to accommodate conditions. Cable management shall remain continuous for cross-connects between protectors and 110 blocks.
5. Provide 6” (152mm) clear space above and below top and bottom of connecting hardware for cable handling.
6. Service loops shall be secured to wall as needed and in unobtrusive manner. Service loops shall not block access to other cables, utilities, or other accessed structures (e.g., shut-off values, meters, etc.). Service loops shall not rest horizontally on cable trays.
7. Wall fields shall be designed to minimize need to work behind equipment racks. Busbars and BETs shall be located behind equipment racks and 110 blocks shall be accessible.
8. Wall field elements and pathways within spaces shall maintain minimum 3 ft (92.3 cm) separation from electrical service panels.

3.2 LABELING

A. Terminal blocks, patch cords and patch panels shall be labeled in accord with Section 27 05 53 – Identification for Communications Systems.

END OF SECTION

SECTION 27 11 23
COMMUNICATIONS CABLE MANAGEMENT AND CABLE TRAYS

PART 1 GENERAL

1.1. SCOPE OF WORK

A. Labor, supervision, materials, equipment, and services for fully functional cable runway support system to include cable and wire mesh cable trays, hangers, supports, and accessories.

1.2 REFERENCES

A. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.
B. National fire Protection Association (NFPA):
   1. NFPA 70, 2017 Edition, National Electrical Code.
   2. NFPA 70B, 2013 Edition, Recommended Practice of Electrical Equipment Maintenance.
C. American National Standards Institute (ANSI):
   1. TIA/EIA-568A – Commercial Building Telecommunications Cabling Standard.
   2. TIA/EIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces; Rev. A, 1998, and relevant Addenda (ANSI/TIA/EIA-569).
   3. TIA/EIA-606-A – Administration Standard for Telecommunications Infrastructure of Commercial Buildings, 2002.
   4. TIA/EIA-607-A – Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2002.
D. National Electrical Manufacturer's Association (NEMA):
   1. NEMA VE 1 - Metallic Cable Tray Systems, 2002.
   2 NEMA VE 2 - Metallic Cable Tray Installation Guidelines.
E. Building Industry Consulting Industry, Inc. (BICSI): Telecommunications Distribution Methods Manual, 11th Edition, 2009.
G. St. Johns County School District Structured Cabling Standards V7.4.

1.3 QUALITY ASSURANCE

A. Comply with Section 01 45 00 Quality Control. Comply with Reference Standards indicated.
B. Cable runway shall be classified by Underwriter's Laboratory (UL).
C. Provide products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.
D. Cable trays, supports and related accessories shall be new, defect free, and from one manufacturer.

1.3 DESIGN CRITERIA

A. Provide ladder and wire cable tray sizes based on numbers and types of wire indicated not to exceed 50% of ladder and wire tray capacity.
B. Cable trays and supports shall be designed by Florida Registered Structural Engineer, based on cable loading, size and length of ladder or wire units, and support elements.

1.4 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.
B. Product Data: Submit manufacturer's descriptive literature for each cable tray system, tray support and attachment components, and accessories specified or indicated.
C. Shop Drawings:
   1. Submit runway layouts for each cable tray type and location, dimensions, support points, and finishes.
   2. Cable tray layouts, floor plans and sections shall be drawn to scale and shall include:
      a. Relationships between components and adjacent structural, electrical, and mechanical elements.
      b. Vertical and horizontal offsets and transitions.
      c. Clearances for access above and to side of cable trays.
      d. Vertical elevations of cable trays above floor or below bottom of ceiling structure.
   3. Provide manufacturer's catalog data for fastening systems.
D. Submit manufacturer's printed installation instructions for installation, including product storage, protection, and handling requirements.
E. Comply with Section 01 78 00 – Closeout Submittals: If variations from approved shop drawings occur during installation of raceway system, submit Project Record Documents indicating system installed based on final locations.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 66 00 – Product Storage and Handling Requirements.
B. Deliver and store cable trays, racks and accessories products in manufacturer's unopened packaging in clean dry area, protected from weather and construction traffic until installation.
C. Maintain storage area conditions for products in accord with manufacturer's printed instructions.

PART 2 PRODUCTS

2.1 APPROVED CABLE TRAY MANUFACTURES

A. Chatsworth Products Inc., 701 Industrial Dr., New Bern, NC 28562. Tel: 252-514-2779; Fax: 252-514-2977; Website: www.chatsworth.com
B. Cooper B-Line – USA, Division of Cooper Industries, PLC, 509 West Monroe St., Highland, IL 62249; Tel: 800-851-7415; Fax: 800-356-1438; Website: www.cooperindustries.com.
C. Cablofil, Division of Legrand, 8319 State Route 4, Mascoutah, IL 62258; Tele: 618-566-3230; Fax:618-566-3250; Website: www.legrand.us/cablofil.com.
D. Panduit, Corp.,18900 Panduit Dr., Tinley Park, IL 60478; Tel: 800-777-3300, 708-532-1800; Email: www.panduit.com.
E. Enrico International Corp., 34600 Solon Rd., Solon, OH 44139; Tel: 800-753-9221; Fax: 440-248-0723; Website: www.erico.com
F. Velcro USA, Inc., 406 Brown Ave., Manchester, NH 03103; Tel: 800225-0180; Fax: 603-669-9271; Website: Velcro.com.
G. Other manufacturers may submit for product substitution per Section 01 25 13 – Product Substitution Procedures.

2.2 WIRE BASKET CABLE TRAYS

A. Approved Products:
   1. ONTRAC® wire basket cable tray by Chatsworth Products, Inc.
   2. FLEXTRAY™ Wire Basket Cable Support System by B-Line – USA, Division of Cooper Industries, PLC.
   3 Cablofil Wire Basket Cable Tray by Legrand.

B. Wire Basket Cable Tray Design:
   1. Configuration: 2" (52mm) x 4" (104mm) wire mesh stainless steel with intersecting welded wire mesh and continuous longitudinal wires.
   2. Tray unit length: 10' (3.05m).
   3. Wire basket depth shall be minimum 2" (51mm) deep by minimum 12" (305mm) width, with width sized to support maximum 3" (76.2mm) diameter cable bundles in one row across cable tray.
   4. Tray wire shall be black polyester baked paint coated A36 steel bars.
   5. Fittings and hardware shall be as recommended by manufacturer for equipment and cable routing and support.
   6. Loading of trays shall not exceed manufacturer's load span criteria.

2.3 CABLE RUNWAYS

A. Approved Products:
   1. TELCO-STYLE cable runway by Chatsworth Products, Inc.
   2. REDI-RAIL™ ladder cable tray by Cooper B-Line – USA, Division of Cooper Industries, PLC:
   3. ITRAY ladder cable tray by PW Industries, Inc., Division of Legrand/Cablofil.

B. Cable Runway Design:
   1. Configuration: 1.5" (38 mm) high x 0.375" (9.53mm) wide x .065" (1.65mm) thick stringers with .5" (12.7mm) wide x 1" (25.4mm) wide x .065" (1.65mm) thick cross members welded to stringers at 9" (228.6mm) o.c.
   2. Tray unit length: 9'- 8.5" (2.959m).

2.4 J-HOOKS

A. Approved Products:
   1. Cable Hook Model BCH Series by Cooper B-Line – USA, Division of Cooper Industries, PLC for sizes as recommended by manufacturer for number of cables.
   2. Cable Hook: Caddy Cablecat Model CAT21, 32 or 64 by Enrico for sizes as recommended by manufacturer for number of cables.

2.5 CABLE TIES

A. Approved Products:
   1. Velcro® One-Wrap Ties, sized for cable bundles as recommended by manufacturer.
   2. Fire retardant cable ties shall be used in plenum environments.

2.6 ANCHORS AND FASTENERS

A. Accessories:
   1. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, and connectors.

2. Provide bushings or rubber edge trim as needed. Products shall be free of sharp edges or points that may damage cables.

B. Anchors and Fasteners:
1. Obtain permission from Owner's Project Manager before using powder-actuated anchors.
2. Concrete Structural Elements: Use precast inserts, expansion anchors, powder-actuated anchors, or preset inserts.
3. Steel Structural Elements: Use beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.
4. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
6. Solid Masonry Walls: Use expansion anchors or preset inserts.
7. Sheet Metal: Use sheet metal screws.

PART 3 EXECUTION

3.1 INSTALLATION

A. Verification of Conditions: Verify that substrates are prepared and ready to receive products specified.
B. Install components of raceway systems in accord with Drawings, Shop Drawings, and manufacturer's written installation instructions.
C. Do not exceed 50% cable fill.
D. See Section 27 14 00 – Communications Cabling for wiring installation.

3.2 CABLE TRAY SYSTEM

A. Install cable tray securely, in neat and workmanlike manner, per NECA 1.
B. Cut cable tray using manufacturer's equipment, if available from manufacturer. Smooth rough or jagged edges and points.
C. Arrange supports to prevent misalignment during wiring installation.
D. Fasten support to building structure and surfaces.
E. Cable tray elements shall be supported with manufacturer's hardware to provide minimal profile. Suspension shoes and brackets shall be used in place of trapeze struts. Sharp corners and threaded rod shall not extend below the basket.
F. Install cable trays maintaining following minimum clearance:
1. 12" (305mm) of unobstructed clearance above cable tray's highest plane
2. 6" (152mm) from source of EMI.
3. 12" (305mm) from heat source exceeding 104° F (40° C).
G. If cables rise to ceiling space of floor above network room greater than 12' (3.4m), install cable tray to relieve vertical weight from cables on each floor. Secure cables with Velcro-type straps as needed to relieve vertical weight strain.
H. Continuous support elements shall be bonded from ground to TMGB/TGB with grounding wire. Sections may be bolted together or tied together with grounding jumpers if support structure is approved by manufacturer as a grounding conductor.
I. Provide pull strings in cable trays.
J. Provide fittings or gaps with bonding jumpers to accommodate expansion and deflection where cable tray crosses expansion joints.
K. Cable tray shall not penetrate fire-rated barriers. Cable tray shall end within 18" (45.6cm) of fire-rated barriers. Cables shall use firestop assemblies or sleeves to penetrate fire-rated barriers.

L. Cable trays shall be installed in main corridors and in Communications Rooms. Cables running to other spaces shall utilize J-hooks.
M. Cable tray shall be single tiered wire basket installed to allow 12" (30.4cm) of open space above and to one side of tray. Cable tray shall be 2" (5.1cm) deep wire basket tray with appropriate width dimensions as required by volume of cable planned for installation at time of construction, and account for 20 per cent future growth.
N. Cable tray shall not be filled more than 50% capacity. Cable tray shall extend up to communications room wall to provide access to racks and walls in "T" design. Small rooms may use single, straight cable tray in line with rack, provided it extends parallel to face of rack.
O. Use at least 2- 4" conduits where cable trays intersect with fire rated walls. Openings in conduit and between conduits and fire wall shall be protected in accord with Section 07 84 00 – Firestopping. Additional conduits may be required as cable volume dictates. Determination of conduits requirements shall be coordinated with Owner's Project Manager.
P. Install cable tray products within network rooms for vertical strain relief as needed while maintaining 50% additional capacity within support structure.
Q. Secure multiple cables in bundles with Velcro-type straps at minimum of 36" (91.5cm), or as recommended by manufacturer to relieve vertical weight strain.
R. Use appropriate hardware and parts to attach tray to permanent building structure (concrete columns or deck, structural steel, or other immovable structures capable of supporting cable tray). Parts shall be specifically designed and where possible UL-listed for final installed configuration.

3.3 HANGERS AND SUPPORT DEVICES

A. Attachment Devices.
   1. Obtain Owner's project Manager's permission before using powder-actuated anchors.
   2. Concrete Structural Elements: Use precast inserts, expansion anchors, powder-actuated anchors, or preset inserts.
   3. Steel Structural Elements: Use beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.
   4. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
   5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
   6. Solid Masonry Walls: Use expansion anchors or preset inserts.
   7. Sheet Metal: Use sheet metal screws.
   8. Wood Elements: Use stainless steel wood screws.
B. Install cable supports above concealed ceilings using rigid support to structural element or by attaching directly to structural element.
C. Install hangers and supports as required to adequately and securely support electrical system components in neat and workmanlike manner, per NECA 1.
   1. Do not fasten support to pipes, ducts, mechanical equipment, or conduit.
   2. Installer may use existing threaded rods for other utilities, if pre-approved by Owner's Project Manager and is capable of supporting additional load and maintaining clearances.
   3. Do not drill or cut structural members.
   4. Installation of hangars and supports to suspended ceiling grid support system in not allowed.
D. J-hooks may be installed with suspended ceiling grid wire with manufacturer clamps, provided:
   1. Wire shall be painted orange prior to installation, to differentiate from ceiling grid support wires.

2. Wire shall not be used to support ceiling grid, as required by the NEC.

E Weld support members shall use hexagon-head bolted fasteners to present neat appearance with adequate strength and rigidity. Use spring lock washers under nuts.

F. Support Category 6 cables with Cat 6 rated “J” hooks with wide base if supporting more than eight cables.

H. J-hook type supports shall be installed every 4-5’ (1.2-1.5m) on center for runs exceeding 30’ (9.12m). Runs from main or secondary corridors into classrooms and offices do not require support.

I. Close J-hook supports with manufacturer provided bars and not with cable ties. Do not use cable ties to strap cable to J-hook supports.

J. Bundled cabling shall be tied with cable ties at 36” (914mm) o.c. Fire retardant cable ties shall be used in plenum environments.

3.4 CLEANING AND PROTECTION

A. Clean interior of cable trays, cables, anchorage devices, and wall ties to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finishes.

C. Protect wire from damage. Replace entire cable if damaged.

END OF SECTION

SECTION 27 11 26
COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS

PART 1 GENERAL

1.1. SCOPE OF WORK

A. Supply and installation of rack mounted battery backup and surge protection for power outage or interruption, and transient voltage surge protection for rack mounted electronic equipment.

1.2 REFERENCES

A. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.
B. National Fire Protection Association (NFPA):
   1. NFPA 70, 2011 Edition, National Electrical Code.
   2. NFPA 70B, 2013 Edition, Recommended Practice of Electrical Equipment Maintenance.
C. American National Standards Institute (ANSI):
   1. TIA/EIA-568A – Commercial Building Telecommunications Cabling Standard.
   2. TIA/EIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces; Rev. A, 1998, and relevant Addenda (ANSI/TIA/EIA-569).
   3. TIA/EIA-606-A – Administration Standard for Telecommunications Infrastructure of Commercial Buildings, 2002.
   4. TIA/EIA-607-A – Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2002.
D. Building Industry Consulting Service International (BICSI): Telecommunications Distribution Methods Manual, 11th Edition, 2009.
E. St. Johns County School District Structured Cabling Standards V7.4.

1.3 QUALITY ASSURANCE

A. Comply with Section 01 45 00 Quality Control. Comply with Reference Standards indicated.
B. Provide products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.

1.4 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.
B. Product Data: Submit manufacturer's descriptive literature for rack mounted power protective devices, components, and accessories specified or indicated.
C. Provide manufacturer's catalog data sheets for power protective devices.
D. Submit manufacturer's printed installation instructions for installation, including product storage, protection, and handling requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 66 00 – Product Storage and Handling Requirements.
B. Deliver and store power protective devices and accessory products in manufacturer's unopened packaging in clean dry area, protected from weather and construction traffic until installation.
C. Maintain storage area conditions for products in accord with manufacturer's printed instructions.

PART 2 PRODUCTS

2.1 APPROVED SURGE PROTECTOR MANUFACTURES

A. Tripp Lite, Inc., 1111 W. 35th St., Chicago, IL 60609; Tel: 773-869-1111; Fax: 773-869-1329; Website: www.tripplite.com.
B. Leviton Network Solutions, 2222 – 222nd St., Bothell, WA 98021-4416; Tel: 800-824-3005; 425-486-2222; Website: www.leviton.com.
C. Other manufacturers may submit for approval of products per Section 01 25 13 – Product Substitution Procedures.

2.2 RACK MOUNTED SURGE PROTECTORS

A. Approved Products:
   1. Model #DRS-215 by Tripp Lite, Inc.
   2. Model #5500-102 by Leviton Network Solutions, Inc.
B. Design Specifications:
   1. Rated Line Voltage: 120V.
   2. Maximum Line Current: 20A.
   3. Maximum Continuous Line Voltage: 135V.
   4. Operating Frequency Range: 50-60Hz.
   5. Circuit Type: Staged Multi Component Series.
   6. Maximum Single-Pulse Transient Current (8x20 µs. Amps Peak): 33,000A.
   7. Peak Surge Current: 72kA.
   8. EMI/RFI Noise Rejection @ 100Hz – 30MHz: -10 to -35dB.
   9. Cat A Ringwave (6v, 200A, 100HKz): 190V.
   10. Cat B Ringwave (6v, 500A, 100HKz): 210V.
   11. Cat B Impulse (6kV, 3kA, 8x20 µs): 310V.
   11. Clamping Voltage (8x20 µs @ 500A): 330V.
   12. Operating Temperature Range: -10°C to 60°C.
   13. Dimensions (H x W x D): 1.75" (mm) x 19" (mm) x 4.55" (mm).

2.3 RACK MOUNTED BATTERY BACKUP POWER UNITS

A. Approved Products:
   1. Orion Power Systems/Tripp Lite.
B. Design Specifications:
   1. Input Voltage: 0-164 Vac.
   2. Input Voltage (on-line operation): 75-164 Vac.
   3. Output Voltage: 105-128 Vac.
   4. Nominal Input Frequency: 50 or 60Hz (autosensing).
   5. Input Protection: Resettable Circuit Breaker.
   6. Frequency Limits ((on-line operation):50 or 60 Hz. +/- 6Hz.
   7. Transfer Time: <2ms (typical).
   8. Maximum Load: 1920W.
   9. On-battery output voltage: Default 117 Vac (User selectable at 108, 113 &117 Vac).
   10. On-battery frequency: 50 or 60 Hz, +/- .5Hz.
   11. On-battery wave shape: True Sine Wave.
   12. Protection: Overcurrent and short circuit protected, latching shutdown on overload.
   13. Surge Energy Rating: 500 J.

14. Surge Current Capability: 13kAmps total.
15. Surge Response Time: 0 ns (instantaneous) normal mode; <5ns common mode.
16. Surge voltage let-through: <0.5%.
17. Noise Filter: Normal and common mode EMI/RFI suppression.
18. Battery Type: four 12 V 12 Ah (spill proof, maintenance free, sealed lead-acid).
19. Battery Life: 3 years.
20. Recharge Time: 5 hrs. (from total discharge).
21. 10 Base-T surge protection let-through: <5%.
22. Telephone line surge protection let-through: <1%.
23. Operating Temperature: 32° F to 104° F (0° C to 40° C).
24. Electromagnetic immunity: IEC 801-2 level IV, 801-4 level IV, 801-5 level V.
25, Audible noise at 1 m (3.3’): <45dBA.
26. Size: 5.25” (13.4 cm) high x 17” (43.2 cm) wide x 16” (40.7 cm) deep.
27. Weight (net): 95 lbs. (43 kg).

2.4 ANCHORS AND FASTENERS

A. Accessories:
   1. Provide manufacturer’s standard screws, clamps, brackets, and connectors.
   2. Provide bushings or rubber edge trim as needed. Products shall be free of sharp edges or points that may damage cables.

PART 3 EXECUTION

3.1 INSTALLATION

A. Verify that racks are prepared and ready to receive power protective products specified.
B. Install power protective devices and components in accord with Drawings, Shop Drawings, and manufacturer’s printed installation instructions.

3.2 OPERATION

A. Comply with Section 27 05 00 – Common Work Results for Communications.
B. Test units to verify power protective devices operate properly and as intended.

3.3 CLEANING AND PROTECTION

A. Clean exposed surfaces.
B. Protect equipment from damage until project’s final acceptance.

END OF SECTION

SECTION 27 15 00
COMMUNICATIONS CABLING

PART 1 GENERAL

1.1. SCOPE OF WORK

A. Single copper and multi-pair copper, fiber optical channel solution, riser rated cabling as required for horizontal cable and backbone fiber and copper distribution cable required for complete and fully functional communications system.

1.2 QUALITY ASSURANCE

A. Comply with NFPA 70 - National Electrical Code; National Fire Protection Association; 2017 Edition.
B. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.
C. See Section 01 45 00 – Quality Control for additional requirements.
D. Project shall utilize only those materials outlined below except in the instances where there is not a part number listed or where owner’s project manager has approved a substitution through the standard product substitution process.
E. Cabling indicated shall be rated for plenum or riser locations, and as indicated for given environment.
F. Comply with St. Johns County School District Structured Cabling Standards V7.4.
G. Cabling contractors shall possess Panduit PCI and Corning NPI/EWP manufacturer certificates.

1.3 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures and Section 01 78 00 – Closeout Submittals.
B. Product Data: Submit data for each specified product in accord with Section 01 33 00 – Submittal Procedures, and Section 27 05 00 – Common Work Results for Communications Systems.

1.4 WARRANTY

A. Manufacturer and SCS installer shall warranty Cat 6 structured cabling system for end-to-end channel model installation covering applications assurance, cable, connecting hardware and labor cost for repair and replacement for twenty (20) years from date of project’s substantial completion.
B. See Sections 01 78 00 – Closeout Submittals and 27 05 00 – Common Work Results for Communications for additional warranty requirements.

1.5 DELIVERY, STORAGE AND HANDLING

A. Comply with Section 01 66 00 – Product Storage and Handling Requirements.
B. Protect products from damage during delivery, storage, and installation. Replace damaged products at no added cost to Owner.

PART 2 PRODUCTS

2.1 CABLE MANUFACTURERS

A. Approved Cable Manufacturers:
   1. Belden DataTwist 2400 (non-bonded or bonded pair) (minimum).
   2. Belden 10GXW12 (Riser, non-bonded) and 10GXW13 (Plenum, non-bonded) (WAP ONLY)
   3. Panduit Tx6 (minimum).
   4. General GenSpeed 6000 (minimum).
B. Other manufacturers not listed shall comply with Section 01 25 13 - Product Substitution Procedures.

2.2 COPPER HORIZONTAL CABLING

A. Category 6 Cabling Channel Performance shall meet following performance specifications for Data/Voice Drops:

Frequency	10 MHz	100 MHz	200 MHz	250 MHz	Units
Insertion Loss	6.3	21.3	31.5	35.6	Db
NEXT	56.6	39.9	34.8	33.1	Db
PSNEXT	54.0	37.1	31.9	30.2	Db
ELFEXT	43.3	23.3	17.2	15.3	Db
PSELFEXT	40.3	20.3	14.2	12.3	Db
Return Loss	19	12	9	8	Db
Delay	<555	N/A	N/A	N/A	N/Sec
Delay Skew	<50	N/A	N/A	N/A	NSec

2.3 COPPER BACKBONE CABLING

A. 25 Pair (minimum) Copper backbone (Riser/Tie) telephone cabling shall be provided between MDF and IDF locations, continuous runs with no splices with ground shields at each end.
   1. Building Interior Locations:
      a. General Cable Corporation: CMR Category 3, 25 Pair, Part #2133033.
      b. Hitachi Cable America, Inc.: Part #39228-50.
   2. Outside Plant (direct burial) Locations:
      a. General Cable Corporation: Part #PE89 Type, Category 3, 25 Pair, Part #7525785.
      b. Superior Essex Cable: Caspic®-FSF RDUP PE-89, Cat 3, 25 Pair, Part # 09-97-92.
B. Category 3 Cabling Electrical Characteristics:

Frequency	Ins. Loss	Next Loss	ACR	Structural Return Loss	Units
1	2.6	41.3	38.7	12.0	dB/100m
4	5.6	32.3	26.7	12.0	dB/100m
8	8.5	27.8	19.3	12.0	dB/100m
10	9.7	26.3	16.6	12.0	dB/100m
16	13.1	23.2	10.1	10.0	dB/100m

C. Multi-Pair Cable Specifications:
   1. Gage: 24 AWG.
   2. DC Resistance: 27.3W/1000' (8.96W/100m), maximum.
   3. Mutual Capacitance (at 1khz).
   4. Impedance: 100W (25 pair).
   5. Buried/Underground Attenuation (db/1,000' [305m]) at 1.0 MHz: 6.4 (25 pair), maximum.
   6. Aerial Cable Attenuation (db/1,000' [305m]) at 1.0 MHz: 6.7 (25 pair), maximum.

2.4 OPTICAL FIBER (Single Mode) CABLING

A. Single Mode Fiber Construction:
   1. Number of fibers: 12 strands from MDF to IDF rooms.
   2. Core/Cladding: 8.3/125 microns.
   3. Buffering: 900 microns.
   4. Fiber shall be optimized for 10Gbps VCSEL system OM3/OM4. Fiber shall exceed TIA/EIA 568-B.3 and 10Gigabit Standards.
   5. Sheath construction: Non-metallic.
   6. Termination: Blue SC connectors.

B. Minimal Optical Specifications:

Fiber Type	SM 8.3/125
Wavelength	1310/1550
Maximum Attenuation (Db/Km)	.5/.5
Minimum Bandwidth (MHz.Km)	Unlimited
Gigabit Ethernet Min. Distance (m)	5000/NA

C. Single mode Fiber Optic Cable:
   1. Corning

2.5 OPTICAL FIBER (Multimode) CABLING

A. Multimode Fiber Construction:
   1. Number of fibers: 24-strand from MDF to IDF rooms, and 4 strand from IDF rooms to D2FO (communications outlet) locations.
   2. Core/Cladding: 50/125 microns.
   3. Buffering: 900 microns.
   4. Fiber shall be optimized for 10Gbps VCSEL system OM3/OM4. Fiber shall exceed TIA/EIA 492.AAAC, and IEEE 802.3 10Gigabit Standards.
   5. Sheath construction: Non-metallic.

B. Minimal Multimode Fiber Specifications:

Fiber Type	MM 50/125
Wavelength	850/1300
Maximum Attenuation (Db/Km)	3.5/1
Minimum Bandwidth (MHz.Km)	1500/500
Gigabit Ethernet Min. Distance (m)	900/600

C. Multimode Fiber Optic Cable:
   1. Corning

PART 3 EXECUTION

3.1 PROJECT COORDINATION

A. Comply with Section 01 31 00 – Project Coordination. Contractor/CM shall coordinate and conduct meeting with cabling installer and affected trades to plan, organize and facilitate timely and orderly work to minimize project delay and work interference between trades.
B. Existing facility operations shall not be interrupted by communications installer's work activities. Active cable plant associated with specific work activities beyond construction area shall not be disrupted.
C. Circumstances (e.g., voice cutovers) that require service disruptions in existing facilities shall be scheduled with as much notice as possible. Service disruptions, if needed, shall be coordinated by Owner's Project Manager.

3.2 CABLING INSTALLATION

A. Work shall be installed per manufacturer's printed instructions to ensure certified channel solution.
B. Install plenum or non-plenum cable types, where indicated based on environmental conditions.
C. Install horizontal cable in star topology with WAO's connected by cable directly to floor distributor.
D. Horizontal cabling shall be terminated in IDF room on same floor as WAO's. Exceptions may be made, if approved in advance, by Owner's Project Manager.
E. Cables routed through floors (poke-thrus, conduits, floor boxes, etc.) to utilize ceiling space on the level below may be routed to network room on adjacent floor (approved deviation from BICSI methodologies).
F. Install cables, WAO's, and network room equipment installation in accord with methodologies contained in latest BICSI Telecommunications Distribution Methods Manual and Information Transport Systems Installation 5th Addition unless noted otherwise for cable attachments, firestopping, cable routing, equipment rack grounding & bonding, pulling tensions, and EMI protection methods.
G. Cables placement in conduit shall not exceed fill capacities per ANSI/EIA/TIA-569.
H. Upon entering floor distributor, separate cabling according to service application (voice, data, life safety and security), and extend around interior perimeter of room via specified cabling tray, and then routed to floor at furthest point of appropriate service backboard for voice, data, video systems.
I. Smaller network rooms with cable tray extending directly from wall penetration to rack need not encircle room. Provide 5' (1.524m) cable service slack. Added cables shall follow established path.
J. Provide 12" (305 mm) of cable slack in in-wall, surface-mounted, and raceway boxes, provided manufacturer's bend radius is not exceeded. Some of slack may be pulled back into junction boxes, raceways, cable trays, or concealed ceiling space. Slack beyond outlet box shall be easily pulled out of box and shall not be secured with cable ties or otherwise secured beyond box.
K. Each type of material (fiber optic cable, equipment rack components and termination hardware) shall be selected and installed to be compatible with manufacturer's warranty.
L. Cables shall be one continuous piece without splices.

M Cables may be installed within existing conduits, wire-ways or spaces if approved by Owner's Project Manager, where cables do not exceed conduit or junction box capacity. Cabling components and faceplates shall be new.

N. Voice and data cables shall be color coded throughout building.
   1. Standard voice cables: green.
   2. Standard data cables: yellow.
   3. Security, fire, building automation device, or audio/visual controller: white.
   4. Wireless access point: blue.

O. Install 1200 lb. pull strings with horizontal cables as cables are pulled.

P. Specify placement of horizontal cables in cable trays in random overlapping fashion. Cable ties in cable tray shall not be used, except as needed to maintain bend radii when changing directions. Plastic cable ties shall not be used.

Q. Install horizontal cable free of surface damage, kinks, twists, and with NO visible anomalies.

R. Cables shall be labeled and documented as specified in Section 27 05 53 – Identification of Communications Systems.

S. Copper horizontal cable lengths:
   1. Horizontal cables from IDF room to WAO's, shall not exceed 295' (90 m).
   2. Horizontal cables used for patch cords and cross-connect jumpers in MDF and IDF rooms, shall not exceed 16' (4.88 m).
   3. Provide 33' (10.6 m) allowance for combined length of patch cords and cables used to connect equipment at WAO and in MDF and IDF rooms.
   4. Total length for components shall not exceed 328' (100 m).

T. Each horizontal data cable provided to individual WAO shall consist of 4-pair 100-ohm, Category 6, UTP cable except for WAP WAO which shall consist of Category 6A, UTP cable as noted below and in St. Johns County School District Structured Cabling Standards V7.4.
   1. Install the following cables to WAO's per St. Johns County School District Structured Cabling Standards V7.4:

WAO Location	Qty Cat 6 Voice Cables	Qty Cat 6 Data Cables
Administrative (AWAO)	1	1
Teacher (TWAO)	1	1
Workroom (SWAO)	1	1
Classroom Resource (CWAO)	-	2
Media Center (MWAO)	-	4
Kitchen (KWAO)	2 (Shuttered)	1
Wireless Access Point (WAP)	-	**1 (Cat6 A)**
Cafeteria (PWAO)	2 (Shuttered)	-
Classroom AV (AVWAO)	1	-

U. Coordinate with other trades to complete work above ceilings and below raised floors prior to ceiling tile and floor panel installation.

V. Cabling shall not be exposed, except when in cable tray or within IDF and MDF rooms. Raceway shall be used in corridors to individual spaces where conduit shall run perpendicular into spaces and to WAO locations.

END OF SECTION

SECTION 27 15 43
COMMUNICATIONS FACEPLATES AND CONNECTORS

PART 1 GENERAL

1.1. SCOPE OF WORK

A. Wall outlet faceplates for single and multiple gang wall plates for wall and ceiling locations indicated to provide complete and functioning communications system.

1.2. REFERENCES

A. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.
B. National Fire Protection Association (NFPA): NFPA 70, National Electrical Code, 2017 Edition.
C. St. Johns County School District Structured Cabling Standard V7.4.

1.3. DESIGN REQUIREMENTS

A. Wall Outlets:
   1. Communication outlets containing copper services shall be equipped with 4-position modular jacks (RJ45 type).
   2. Communication outlets containing fiber services shall be equipped with SC type connections for multi mode or single mode cabling terminations.
   3. Outlet/connector box shall provide space for fiber cable connection with minimum 1.18" (30mm) bend radius and 3.28' (1m) cable coils for termination.
   4. Outlet boxes where indicated shall be sized to accommodate both copper and fiber cabling.
   2. Outlets shall consist of single and multiple outlets with corresponding sized wall plates as indicated. Provide blank module inserts for unused modules. Module types shall be as indicated.
B. Floor Outlets:
   1. Multi-service floor outlets shall have single gang wall plate for communications inside floor box with blank module inserts for unused module locations.
C. Modular furniture outlets shall have modular furniture faceplate capable of housing four 8-position modular connectors, with blank module inserts for unused module locations.
D. Surface mounted boxes and raceway outlets, power pole outlets and faceplates are only allowed for use in retrofitting existing facilities.
E. Four pair wiring assignments for modular jacks shall be per T568A wiring pin assignments and as indicated.
F. Fiber Optic Outlets and Terminations within rack/wall mounted interconnect enclosures:
   1. Shall be terminated SC for both single mode and multi-mode strands.
G. See Section 27 05 53 – Identifications for Communications Systems for outlet labeling.

1.4 QUALITY ASSURANCE

A. Provide single channel solution for project using materials listed in St. Johns County School District Structured Cabling Standard V7.4.
B. Systems installer shall be certified and trained by manufacturer to install listed products.

C. Installer shall maintain Registered Communications Distribution Designer on staff to supervise and direct installation.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's data sheets for specified products in accord with Sections 01 33 00 –Submittal Procedures.
B. Shop Drawings:
   1. Provide scaled drawings (not less than 1/8" = 1'-0") indicating location and type/part number of faceplates to be used. Information may be included with submittal for drawing requirements required in Section 27 05 53 – Identification of Communications Systems.
   2. Drawings shall show locations, mounting heights, typical installation details for data outlets in each space.
   3. Faceplates, connector modules, blank plates, specific outlet designator, wire and outlet type shall be identified and follow same nomenclature noted in Communications System Drawings.
C. Comply with Section 01 78 00 – Submittal Procedures for Project Record Drawings, Warranties, and other closeout documents.

1.6 DELIVERY, STORAGE AND HANDLING

A. Comply with Section 01 66 00 – Product Storage and Handling Requirements.
B. Protect products from damage during delivery, storage, and installation. Replace damaged products at no added cost to Owner.

1.7 WARRANTY

A. Structured Cabling System (SCS) shall be provided by manufacturer for channel configuration including cable, jacks, patch cords, patch panels specifically approved for channel configuration with manufacturer's components.

PART 2 PRODUCTS

2.1 FACEPLATES

A. Modular Faceplates:
   1. Panduit:
      a. Model #CFPSE4EI.

2.2 CONNECTOR MODULES

A. Cat 6 / Cat 6A Modular Jacks (including both station and telecommunications rack side):
   1. Yellow: Data; Panduit Model #CJ688TGYL
   2. Green: Voice; Panduit Model #CJ688TGGR
   3. Blue: Wireless; Panduit Model #CJ6X88TGBU
   4. Red: Telco provider demark extension; Panduit Model #CJ688TGRD
   5. White: Building controls including security; fire alarm, BMS, EMS, classroom A/V Model; Panduit #CJ688TGIW.
B. dFiber Optic Connectors:
   1. Corning Pretium Unicam Connectors
   2. Single Mode – Dark Blue

3. Multi-Mode – Aqua

PART 3 EXECUTION

3.1 PROJECT COORDINATION

A. Facility operations shall not be interrupted by communications installer's work activities. Active cable plant associated with specific work activities beyond construction area shall not be disrupted.
B. Circumstances (e.g., voice cutovers) that require service disruptions in existing facilities shall be scheduled with as much notice as possible. Service disruptions, if needed, shall be coordinated by Owner's Project Manager.
C. Work area outlets shall comply with ADA requirements for placement. Utility rooms and mechanical spaces are not required to follow ADA guidelines and locations shall be placed as indicated or as relocated in consultation with AE and Owner's Project Manager.

3.2 FACEPLATE AND CONNECTOR INSTALLATION

A. Outlets shall be terminated in T568A pin/hair configuration. All four pairs shall be terminated.
B. Project in new facilities shall not use surface-mount boxes except for as outlined in SECTION 27 21 33. In existing facilities surface-mounted boxes may be used if boxes are shallow, wall-mounted boxes with outlets on side, not on face, of box.
C. Install outlet modules where indicated. Immediately notify Contractor/CM of conditions preventing outlet box installation where indicated. Contact Owner's Project Manager if project has no Contractor/CM.
D. Terminate outlets in T568A pin/pair configuration. All four pairs shall be terminated.
E. Provide and install blank modules in faceplates, as required.
F. Wall phone installations.
    1. Install 4-conductor plate, connecting blue conductor to red terminal, blue and white conductor to green terminal. Wrap remaining conductors around cable jacket. Do not trim these conductors back to jacket.
    2. Owner acknowledges this is deviation from ANSI/TIA/EIA and BICSI requirements and acknowledges this installation is not within parameters of approved manufacturers' solutions for voice cabling.
G. Cover outlet openings and shutters with masking tape if other construction is taking place in area. Tape shall be applied with sufficient pressure to ensure up to 60 days of adhesion. Tape shall not wrap around edges of faceplate or surface-mount box.
H. Install outlets in neat and professional manner per industry standards.
I. Install outlets where indicated.
J. Label outlets as indicated and in accord with Section 27 05 53 – Identification for Communications Systems.
K. WAO's shall be installed per manufacturer printed installation instructions to ensure certified channel solution.

END OF SECTION

SECTION 27 16 19
COMMUNICATIONS PATCH CORDS, STATION CORDS, AND CROSS CONNECT WIRE

PART 1 GENERAL

1.1. SCOPE OF WORK

A. Stations cords, patch cords and connectors for communications cabling for communications system in sizes, types and locations indicated.

1.2. REFERENCES

A. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.
B. National Fire Protection Association (NFPA): NFPA 70, National Electrical Code, 2017 Edition.
C. St. Johns County School District Structured Cabling Standards V7.4.

1.3. DESIGN REQUIREMENTS

A. Provide single channel solution for project.
B. Wall Outlets:
   1. Communication outlets containing copper services shall be equipped with 8-position modular jacks (RJ45 type).
   2. Communication outlets containing fiber services shall be equipped with SC type connections for multi mode or single mode cabling terminations.
   3. Outlet/connector box shall provide space for fiber cable connection with minimum 1.18” (30mm) bend radius and 3.28’ (1m) cable coils for termination.
   4. Outlet boxes where indicated shall be sized to accommodate both copper and fiber cabling.
   5. Outlets shall consist of single and multiple outlets with corresponding sized wall plates as indicated. Provide blank module inserts for unused modules. Module types shall be as indicated on T-Drawings.
C. Floor Outlets: Multi-service floor outlets shall have single gang wall plate for communications inside floor box with blank module inserts for unused module locations.
D. Modular furniture outlets shall have modular furniture faceplate capable of housing four 8-position modular connectors, with blank module inserts for unused module locations.
E. Surface mounting boxes and raceway outlets, power pole outlets and faceplates are only allowed for use in retrofitting existing facilities.
F. Four pair wiring assignments for modular jacks shall be per T568A wiring pin assignments and as indicated.
G. See Section 27 05 53 – Identifications for Communications Systems for outlet labeling.

1.4 QUALITY ASSURANCE

A. Comply with Section 01 45 00 – Quality Control.
B. Systems installer shall be certified and trained by manufacturer to install listed products.
C Installer shall maintain Registered Communications Distribution Designer on staff to supervise and direct installation.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's data sheets for specified products in accord with Sections 01 33 00 –Submittal Procedures.
B. Shop Drawings:
   1. Provide scaled drawings (not less than 1/8" = 1'-0") indicating location and type/part number of faceplates to be used. Information may be included with submittal for drawing requirements required in Section 27 05 53 – Identification of Communications Systems.
   2. Drawings shall show locations, mounting heights, typical installation details for data outlets in each space.
   3. Connector modules, specific outlet designator, wire and outlet type shall be identified and follow same nomenclature noted in Communications Symbol Legend on T-Drawings.
C. Comply with Section 01 78 00 – Submittal Procedures for Project Record Drawings, Warranties, and other closeout documents.

1.6 DELIVERY, STORAGE AND HANDLING

A. Comply with Section 01 66 00 – Product Storage and Handling Requirements.
B. Protect products from damage during delivery, storage, and installation. Replace damaged products at no added cost to Owner.

1.7 WARRANTY

A. Structured Cabling System (SCS) shall be provided by manufacturer for channel configuration including cable, jacks, patch cords, patch panels specifically approved for channel configuration with manufacturer's components.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURES

A. Panduit Corp., 17301 Ridgeland Ave., Tinley Park, IL 60477; Tel: 800-777-3300, 708-532-1800; Fax: 708-532-1811; Website: www.panduit.com.

2.2 MODULAR WORKSTATION CORDS

A. Data workstation cords and patch cords shall be black, double ended, 4-pair, UTP, T568A/B, clear boot, with round, 24 AWG copper, stranded conductors insulated with high density polyethylene and jacketed with flame retardant PVC.
B. Cords shall be component part of CAT 6 channel solution.
C. Workstation Cords:
   1. Owner Provided

2.3 DATA PATCH CORDS

A. Owner Provided

2.4 FIBER OPTIC CONNECTORS

A. Fiber Optic Adaptor shall be Multimode SC, Angled adaptor, one-piece construction.

B. Adapter shall maintain 0.5" (12.7mm) center spacing when mounted in optical fiber communications outlet. Multimode adapters shall be gray color.
C. Owner Provided

2.5 CROSS CONNECT WIRE

A. Panduit

PART 3 EXECUTION

3.1 PROJECT COORDINATION

A. Facility operations shall not be interrupted by communications installer's work activities. Active cable plant associated with specific work activities beyond construction area shall not be disrupted.
B. Circumstances (e.g., voice cutovers) that require service disruptions in existing facilities shall be scheduled with as much notice as possible. Service disruptions, if needed, shall be coordinated by Owner's Project Manager.
C. Work area outlets shall comply with ADA requirements for placement. Utility rooms and mechanical spaces are not required to follow ADA guidelines and locations shall be placed as indicated or as relocated in consultation with AE and Owner's Project Manager.

3.2 FACEPLATE AND CONNECTOR INSTALLATION

A. Outlets shall be terminated in T568A pin/hair configuration. All four pairs shall be terminated.
B. Project in new facilities shall not use surface-mount boxes. In existing facilities surface-mounted boxes may be used if boxes are shallow, wall-mounted boxes with outlets on side, not on face, of box.
C. Install outlet modules where indicated. Immediately notify Contractor/CM of conditions preventing outlet box installation where indicated. Contact Owner's Project Manager if project has no Contractor/CM.
D. Terminate outlets in T568A pin/pair configuration. All four pairs shall be terminated.
E. Provide and install blank modules in faceplates, as required.
F. Wall phone installations.
    1. Install 4-conductor plate, connecting blue conductor to red terminal, blue and white conductor to green terminal. Wrap remaining conductors around cable jacket. Do not trim these conductors back to jacket.
    2. Owner acknowledges this is deviation from ANSI/TIA/EIA and BICSI requirements and acknowledges this installation is not within parameters of approved manufacturers' solutions for voice cabling.
G. Cover outlet openings and shutters with masking tape if other construction is taking place in area. Tape shall be applied with sufficient pressure to ensure up to 60 days of adhesion. Tape shall not wrap around edges of faceplate or surface-mount box.
H. Install outlets in neat and professional manner per industry standards.
I. Install outlets where indicated.
J. Label outlets as indicated and in accord with Section 27 05 53 – Identification for Communications Systems.
K. WAO's shall be installed per manufacturers written instructions to ensure certified channel solution.

END OF SECTION

SECTION 27 18 00
COMMUNICATIONS TESTING

PART 1 GENERAL

1.1. SCOPE OF WORK

A. System validation testing for voice and data communications cabling and connecting hardware for verification that structured cabling system has been installed properly and performs as specified.
B. Communications system validation testing shall in accord with ANSI/TIA 568.B.1, for Category 6 Structured Cabling System (SCS).

1.2. QUALITY ASSURANCE

A. Comply with Section 01 45 00 – Quality Control.
B. Comply with St. Johns County School District Structured Cabling Standards V7.4.
C. Installed voice and data communications systems to verify that cable has been installed and functions properly.
D. Perform validation testing on horizontal and backbone cabling testing in accord with ANSI/TIA/EIA-568-B.1, TIA/EIA-568-B.2, TIA/EIA-568-B.3, TIA/EIA-TSB-140, TIA/EIA-526-14-A, TIA/EIA-526-7, and CAT6 addendum for copper cabling.
E. Third Party Testing: Owner may elect to employ independent testing and certification firm to provide testing of all or part of Structured Cabling System.
F. SCS installer shall set wring tester for channel configuration for DATA which includes patch cord, patch panel, UTP Cable, work-area jack and work area cord, with permanent link configuration for VOICE.
G. SCS installer's RCDD shall sign off on copper and fiber optic cable test results, indicating that cable testing procedures and cables testing are in compliance with contract documents and referenced standards.

1.3. SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.
B. Comply with Section 01 78 00 – Closeout Submittals.
C. Provide list of test equipment proposed for certification testing for review prior to testing.
D. Provide names of personnel performing testing. Personnel shall have attended training program in operation of specified manufacturer's equipment and shall provide certificates demonstrating successful completion of training.
E. Test Results:
   1. Provide Owner's Project Manager with printed and electronic forms (sent to Cabletests@stjohns.k12.fl.us) of test results as noted in Part 3 Execution.
   2. Test results shall be unedited and as presented by tester's software. Provide software from tester's manufacturer with test results to enable viewing of test results in native format.

1.6 PROJECT CONDITIONS

A. Owner reserves right to be present during testing.

B. For additions and renovations to existing occupied facilities, testing of existing and active connections is likely to be restricted until after normal working hours. Owner's Project Manager will determine if testing can occur during normal business hours.
C. Testing shall occur only after channel is installed. If channel components are moved or re-positioned after testing, retest cables, faceplates, and other components in final position.

1.7 WARRANTY

A. Warranty: Comply with Section 27 05 00 – Common Work Results for Communications, Para. 1.09.
B. Manufacturer shall provide 20-year Channel Performance Warranty for complete communications system.
   1. Manufacturers shall warranty worst-case performance data for installed cabling system, and performance data indicated in warranty documents/certificate.
   2. Twenty (20) year warranty for Cat 6 structured cabling system shall provide for end-to-end channel model installation which covers applications assurance, cable, connecting hardware, and labor cost for repair or replacement.
   3. Warranty shall indicate compliance with Margin claimed by manufacturers over Cat 6 channel specifications on transmission parameters across entire frequency range of 1-250 MHz as indicated in manufacturer's catalogs and product literature.
C. SCS installer shall provide 3-year warranty for communications system installation to include materials and labor warranty for replacement of defective installation or equipment including cables, jacks, patch cords, patch panels, devices and cabling.
D. Date of warranty period shall begin from date of project's substantial completion.

PART 2 PRODUCTS

2.1 APPROVED TESTING EQUIPMENT

A. Approved Copper Cable Testing Equipment Manufacturer's:
   1. Agilent Technologies, Inc., Electronic Test & Measurement Div., P.O. Box 4026, Englewood, CO 80155-4026; Tel: 800-829-4444; Fax: 800-829-4433; Website: www.agilent.com.
   2. Fluke Networks, Inc., 6920 Seaway Blvd., Everett, WA 98203; Tel: 425-446-4519; Website: www.flukenetworks.com.
   3. IDEAL Industries, Inc., Becker Place, Sycamore, IL 60178; Tel: 800-435-0705; Fax: 800-533-4484; Website: www.idealindustries.com.
   4. JDS Uniphase Corp., Wavetek Div., 430 N. McCarthy Blvd., Milpitas, CA 95035; Tel: 408-546-5000; Fax: 408-546-4300; Website: www.jdsu.com.
B. Approved Fiber Optic Cable Testing Equipment Manufacturer's:
   1. Agilent Technologies, Inc., Electronic Test & Measurement Div., P.O. Box 4026, Englewood, CO 80155-4026; Tel: 800-829-4444; Fax: 800-829-4433; Website: www.agilent.com.
   2. Fluke Networks, Inc., 6920 Seaway Blvd., Everett, WA 98203; Tel: 425-446-4519; Website: www.flukenetworks.com.
   3. IDEAL Industries, Inc., Becker Place, Sycamore, IL 60178; Tel: 800-435-0705; Fax: 800-533-4484; Website: www.idealindustries.com.
   4. Anritsu Company, Inc., GN NETTEST Div., 1155 East Collins Blvd., Suite 100, Richardson, TX 75081; Tel:.972-644-1777; Fax: 972-671-1877; Website: anritsu.com.
   5. AFL Global, Inc., Noyes Test and Inspection Div., 170 Ridgeview Center Dr., Duncan, SC 29334; Tel: 800-235-3423; Fax: 864-433-0333; Website: www.aflglobal.com.

6. Tektronix, Inc., 14200 SW Karl Braun Dr., P.O. Box 500, Beaverton, OR 97077; Website: www.tek.com.
7. JDS Uniphase Corp., Wavetek Div., 430 N. McCarthy Blvd., Milpitas, CA 95035; Tel: 408-546-5000; Fax: 408-546-4300; Website: www.jdsu.com.

C. Other test equipment manufacturers shall submit requests for product substitution in accord with Section 01 25 13 – Product Substitution Procedures.

PART 3 EXECUTION

3.1 GENERAL

A. Owner reserves right to be present during testing.
B. Provide required test equipment and personnel necessary to support certification and validation tests indicated and in accord with Section 01 45 00 – Quality Control.
C. Fail, fail*, Pass*, or Warning test result yields Fail result for channel or permanent link under test. To achieve overall Pass condition, result of each individual test shall be Pass. Test results shall come from tester with permanently enabled marginal reporting feature.
D. Test result shall indicate compliance with margin claimed by manufacturer over Cat 6 channel specifications for frequency range of 1-250 MHz as indicated in manufacturer's catalogs and product literature.
E. Cabling test results for large projects such as new schools and large scale additional and renovations shall include each horizontal coper location and each backbone fiber strand and must be submitted in triplicate in both of the following forms (three each CD/DVD media):
   1. Hard Copy: Shall be neatly contained in a 3-ring binder. The cover of the binder shall be printed with, at a minimum, the following information, St Johns County school construction name, school address, cabling contractor and their project manager's name, and date of cabling completion. The three-ring binder must have tabbed dividers labeled with the TR that the tests originated separating each TR's tests from the others.
   2. Digital- CD or DVD media may be used and the files must be in the native database format of the tester used for testing and certification. (Tab delimited, .CSV files, excel spreadsheets, or other non-native file formats will not be accepted). The CD or DVD media must have a computer generated label that includes at a minimum, the following information: St Johns County school construction name, school address, cabling contractor and their project manager's name, and date of cabling completion. In addition to the test results in native format each CD/DVD shall also contain an installable copy of all necessary proprietary viewing software for the tester format used in the certification.

3.2 CATEGORY 6 COPPER CABLE TESTING

A. Category 6 field testing shall be performed with approved Level III balanced twisted-pair field test device. Testing and certification of horizontal cabling shall be performed using the permanent link method. All copper backbone cabling shall be tested for continuity.
B. Installed category 6 channels shall comply with ANSI/TIA/EIA standards for Category 6. Use cable manufacturer's test standards if more stringent.
C. Category 6 balanced twisted-pair horizontal and backbone cables shall not exceed 90 m (295 ft) for basic link, and 100 m (328 ft) for channel shall be tested per ANSI/TIA/EIA-568-B.2. Test parameters include wire map plus ScTP shield continuity (when present), length, NEXT loss (pair-to-pair), NEXT loss (power sum), ELFEXT (pair-to-pair), ELFEXT loss (power sum), return loss, insertion loss, propagation delay, and delay skew.
D. Copper riser cabling for VOICE shall be tested for length, continuity, polarity, checks and wire map.

3.3 COPPER TEST EQUIPMENT

A. Balanced twisted-pair field testers shall be factory calibrated each calendar year by field test equipment manufacturer as stipulated by manuals provided with field test unit. Calibration certificate shall be provided to Owner's Project Manager for review prior to start of testing.
B. Set testers to correct cable, by manufacturer and name, to ensure correct parameters are used during testing. Test settings selected from options provided in field testers shall be compatible with installed cable under test.
C. Level III balanced twisted-pair field test device. Scanners shall be in good working order and have current calibration stickers from manufacturer-approved calibration facility.
D. Balanced twisted-pair field testers shall be factory calibrated each calendar year by field test equipment manufacturer as stipulated by manuals provided with field test unit.
E. Set tester manufacturer's cable and name, to ensure using correct parameters during testing. Test settings selected from options provided in field testers shall be compatible with installed cable under test.

3.4 CATEGORY 6 TESTING

A. Category 6 testing shall be performed with approved Level III balanced twisted-pair field test device. Scanners shall be in good working order with current calibration stickers from manufacturer's approved calibration facility.
B. Installed Category 6 channels shall comply with ANSI/TIA/EIA standards or use cable manufacturers test standards to certify total solution installed, if more stringent.
C. Category 6 balanced twisted-pair horizontal and backbone cables shall not exceed 90 m (295 ft) for basic link, and 100 m (328 ft) for channel shall be 100 percent tested in accord to ANSI/TIA/EIA-568-B.2.
D. Provide test results indicating CAT 6 cable tests in text files on flash drive(s), and two print copies in 3-ring binders. Provide text files for each building. Each test page shall be separated by standard page break (one test per page).
E. Cat 6 Channel Performance Testing Requirements shall meet or exceed following:

Frequency	10 MHZ	100 MHZ	200 MHZ	250 MHZ	UNITS
Insertion Loss	6.3	21.3	31.5	35.6	DB
NEXT	56.6	39.9	34.8	33.1	DB
PSNEXT	54.0	37.1	31.9	30.2	DB
ELFEXT	43.3	23.3	17.2	15.3	DB
PSELFEXT	40.3	20.3	14.2	12.3	DB
Return Loss	19.0	12.0	9.0	8.0	DB
Delay	<555	N/A	N/A	N/A	NSec
Delay Skew	<50	N/A	N/A	N/A	NSec

F. Calculations shall be derived from tests and provide results for following:
   1. Continuity.
   2. Polarity checks.
   3. Wire map.
   4. Attenuation.
   5. PSNEXT.
   6. PSFEXT.
   7. ELFEXT.

8. PSELFEXT.
9. ACR.
10. Installed length of CAT 6 cable.

G. Correct cable NVP shall be entered into test equipment to ensure proper length and attenuation readings. Cables not in accord with EIA/TIA 568B, Category 6 tests shall be identified to AE and RCDD for corrective action. Cable replacement shall be at no additional cost to Owner.
H. Data jacks in each outlet shall be tested for CAT 6 compliance in channel configuration to verify integrity of conductors and correctness of termination sequence indicated.
I Prior to testing UTP runs, test equipment shall be calibrated per manufacturer's printed guidelines. Correct cable NVP shall be entered into test equipment to ensure proper length and attenuation readings.

3.5 FIBER OPTIC TEST EQUIPMENT

A. Optical fiber test equipment shall be factory calibrated (with date of last calibration) as recommended by field test equipment manufacturer. Manufacturer's calibration certificates shall indicate equipment name and serial number and shall be provided for review prior to start of testing.

3.6 OPTICAL FIBER CABLING TESTING

A. Optical fiber horizontal and backbone cabling shall be verified in accord with ANIA/TIA/EIA-568-B.1 with Addendum for fiber optic cabling testing and shall be tested and certified using BICSI Tier 2 method for testing optical fiber.
B. Each strand in fiber optic cables shall be tested for correctness of termination, overall transmission loss, and defects using approved Optical Time Domain Reflectometer (OTDR) and power meter. A launch cable that is 200m in length shall be used for all OTDR tests.
C. Tests shall be performed for reach stand of fiber in two-way averaging measurement of fiber. Engineer of record shall be notified at least one week prior to testing to allow his observation of testing optical fiber strands for insertion loss and length and bi-directional OTDR tests on OSP optical fiber strands.
D. Test for insertion loss at 850 nm and 1300 nm per TIA/EIA-526-14 method B, one jumper reference. System loss measurements (both calculated and measured) shall be provided for 50/125mm multimode cabling in at least one direction.
E. Test for insertion loss at 1310 and 1550 for single mode cabling in at least one direction using Method A.1 (1-jumper) test procedure as specified in ANSI/TIA/EIA-526-7.
F. Acceptable losses shall calculate allowable attenuated loss based on final installed length, attenuation coefficient, and connector loss per attached chart.
G. Fiber Optic links compliance tests with following loss budget for link types:

Fiber Insertion Loss			
Link Type	Loss (dB)	Wavelength (nm)	Length (m)
Horizontal, MM	≤2.0	850 or 1300	≤90
Backbone, MM	≤3.5/km + 0.75/conn +0.3/spl	850	≤2000
	≤1.5/km + 0.75/conn +0.3/spl	1300	≤2000
Backbone, SM	≤1.0/km + 0.75/conn +0.3/spl	1310	≤3000
	≤1.0/km + 0.75/conn +0.3/spl	1550	≤3000
Centralized, MM	≤3.3	850 or 1300	≤90

H. Channel attenuation for Gigabit Ethernet shall be per IEEE 802.3z as noted below:

Maximum Channel Attenuation (dB)			
Fiber Type	50/125µ		
1000BASE-SX	3.2		
1000BASE-LX	4		

I. Test Reports:
   1. Certification report shall be provided listing both calculated and measured loss for each fiber optic strand and submitted with test results as noted above. Cable lengths shall be verified with OTDR or Light Source/Power Meter with length testing capacity.
   2. Provide printed and electronic forms of tests results. Test results shall be unedited and as presented by tester's software. Supplemental summaries may be provided to Owner's Project Manager. Provide Fiber performance calculation worksheets and fiber link attenuation records as illustrated in Section 21 (Figures 21.14 and 21.15) of BICSI Telecommunications Cabling Installation Workbook, Technician, 2nd Edition.
   3. Test reports shall indicate fiber wavelength, fiber and cable manufacturer's part numbers, type, attenuation, bandwidths specifications, and measurement direction.

J. Test optical fiber strands for insertion loss and length. Perform bi-directional OTDR tests on OSP optical fiber strands. OTDR trace(s) shall be in project closeout submittals.

K. Calculate allowable attenuated loss based on final installed length, attenuation coefficient, and connector loss.

L. Immediately remediate strands testing above calculated limits.

M. Owner reserves right to have third party testing to confirm test results. Remediate, at Contractor's expense, strands exceeding calculated limits by third party testing.

3.7 COMMUNICATIONS AND GROUNDING SYSTEM TESTING

A. See Section 27 05 26 – Grounding and Bonding for Communications Systems.

B. Testing shall be performed for impedance of bonds of grounding system, including cable armor bonding to ground. Impedance of two-point bonding test across any bond shall not exceed 0.1 ohm. Remediate bond(s) over limit or which contribute to total impedance exceeding 0.1 ohm from any point in network room to busbar in that room.

C. Bonds installed shall be tested for impedance with earth ground resistance test in its two-point setup (LEM Handy GEO tester, or approved tester). Place QA label (with date and inspector) in proximity to each bond tested.
D. Test grounding conductors, once installed, for current. Measure AC and bi-directional DC current. Report AC current over 1 Amp. Report any DC current, in either direction, over 500 milliamps.

END OF SECTION

SECTION 27 21 33
DATA COMMUNICATIONS WIRELESS ACCESS

PART 1 GENERAL

1.1. SCOPE OF WORK

A. The exact quantity and placement of Wireless Access Point WAOs will be determined by building size and layout. It should be assumed that ALL areas of every building shall require complete, full, and redundant coverage. Required areas include but are not limited to; the gym, auditorium, cafeteria, media center, all administrative spaces, and all classroom and learning spaces, outlying PE buildings, etc.
B. SJCSD requires that a wireless WAO is installed in every room (including but not limited to classrooms, conference rooms, storage rooms, offices, kitchen, etc) of the building with common areas such as gym, cafeteria and auditorium receiving additional locations based on size
C. Signal strength requirements shall be built around current best practice standards for a heavily utilized enterprise class wireless LAN that will support both data and wireless IP telephony. AP quantity and placement shall be optimized for signal density with the target signal-to-noise-ratio (SNR) of -67dB

1.2. REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017 Edition.
B. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.
C. IEEE 802.11-2020 Edition.
D. St. Johns County School District Structured Cabling Standards V7.4.

1.3. SUMBITTALS

A. See Section 01 42 00 – References for additional reference standards, definitions, abbreviations, and acronyms.
B. Comply with Section 01 33 00 – Submittal Procedures.
C. Comply with Section 01 78 00 – Closeout Submittals.
D. Provide manufacturer’s product data sheets, product installation instructions and warranty.
E. Provide manufacturer’s certification of installer’s qualifications.

1.5 QUALITY ASSURANCE

A. Comply with Section 01 45 00 – Quality Control.
B. Comply with ANSI/TIA/EIA standards and as noted in Section 01 42 00 – References.
C. Installer shall be certified by manufacturer as authorized installer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Approved Manufacturers:
   1. Cisco Meraki wireless access point hardware
   2. Cisco Meraki antennae

3. Oberon Wireless Enclosures

2.2 MATERIALS

A. Wireless access point (WAP)
   1. Cisco Meraki MR46, MR 56 and MR86 as specified by owner project manager

PART 3 EXECUTION

3.1 INSTALLATION

A. Install single data outlet for each wireless access point location and use 2-port surface mount biscuit box (Panduit part # CBXS2EI-A) per Section 27 15 00 - Communications Cabling.
B. Coordinate final placement of wireless access points with Owner’s Project Manager.

END OF SECTION

SECTION 27 32 23
ELEVATOR TELEPHONES

PART 1 GENERAL

1.1. SCOPE OF WORK

A. Wiring and Communication devices in elevator cabs as required by regulatory agencies having jurisdiction.

1.2. REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017 Edition.
B. See Section 01 42 00 – References for additional reference standards, definitions, acronyms, and abbreviations.

PART 2 PRODUCTS

2.1 APPROVED CABLE MANUFACTURERS

A. Approved Cable Manufacturers:
   1. Belden
   2. Panduit
   3. GenSpeed
B. Other manufacturers not listed shall comply with Section 01 25 13 - Product Substitution Procedures.

2.2 COPPER CABLING

A. Unshielded twisted pair, 4-pair 100-ohm, Category 6, riser, green.
   1. Belden DataTwist 2400 (non-bonded or bonded pair) (minimum)
   2. Panduit TX6 (minimum)
   3. Generatl GenSpeed 6000 (minimum)

B. Cable Specifications:

   1. Gage: 23 AWG.
   2. DC Resistance: 9.38W/328’ (100m), maximum.
   3. Mutual Capacitance: 5.6 nF/100m.
   4. Capacitance Unbalance: <330 pF/100m.
   5. Characteristic Impedance (ohms): 1-100 MHz: 100+/- 15%; 100-55 MHz: 100 +/- 22%.
   6. Delay Screw: ≤ 35ns.

2.3 TELEPHONES

A. Telephone handset(s) shall be provided by Vendor.

PART 3 EXECUTION

3.1 INSTALLATION

A. Cable shall be installed in conduit in elevator machine room. Conduit nor cabling shall be exposed. Conduit shall be installed by electrical contractor and run within walls to recessed outlet box mounted in wall as indicated and located less than 12” (304 mm) from elevator equipment. Coordinate pathway installation with elevator contractor.
B. Leave 20 ft (6.09 m) coil of cable at end of pathway to be terminated by elevator contractor.
C. Label cable where it enters room in accord with Section 27 05 53 – Identification for Communications Systems.
D. Cable installer shall terminate cable with single voice module for testing purposes. Module will likely be removed by elevator contractor. No faceplate or box is required at this location.

END OF SECTION

SECTION 27 41 00
SATELLITE TV DISTRIBUTION SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 PERFORMANCE REQUIREMENTS

A. Purpose: Provide all labor, materials, equipment, and services necessary and required to provide and test a Television System. Any material not specifically mentioned in these specifications but required for proper performance and operation is to be provided.
B. System Description
   1. Install and test a complete Television System (hereinafter called "system") as described herein and/or as required to provide all functions/operations/features. Provide a complete, balanced, and operable television distribution as outlined in these specifications and as described on the contract drawings.
   2. Circuit routing for this system is not shown on the contract drawings. Provide and install all raceways, wiring and cabling required for a complete and fully functional system as intended by these specifications.
      a. Provide and install a properly sized flush mounted outlet box for every device with appropriate raceway to accessible location above the ceiling.
      b. Where allowed by applicable codes, standards and these specifications wire/cable may be installed in bridle rings, cable tray, and other acceptable pathways. Contractor is to size and route cables, bridle rings, and pathways to accommodate the proper installation of the system cabling. Where raceways are required, they are to be sized, installed, etc. to comply with all applicable codes, standards, and applicable sections of these specifications.
      c. In locations where cable or wiring is not accessible after completion of the project, and in non-ceiling areas, and in exposed locations, cabling is to be installed in appropriate raceway system complete to concealed/accessible location and/or termination equipment.
      d. T-tapped cabling is not acceptable.
   3. The television distribution system is to be based upon a cabling system employing (minimum) RG11 trunk cables feeding strategically located communications closets. The contractor is to install the cabling infrastructure in such a manner that all television outlets are to have a substantially equal signal level.
      a. Cabling from each TV outlet is to be dedicated and continuous back to the individual systems room(s) television equipment rack. Interior feeder lines are to be RG-6 coaxial cable. Contractor is to properly terminate each device according to the manufacturer's recommendations. "Daisy Chaining" is unacceptable.
      b. Provide cabling, RG11 and raceways from the SATV provider's demarc in the MDF room to the television "head-end" and from the television "head-end" to the SATV distribution equipment in the MDF.
      c. Provide audio/video cabling, RG6 and raceways from the television "head-end" to the control panel/room and from the control panel/room to the television "head-end".

d. The system is to be significant bandwidth to include all frequencies from the sub-band through the hyper-band (5 MHz – 750 MHz). The signal level at each outlet is to be between +13 to +6 dBV throughout a bandwidth from 5 MHz to 750 MHz.
e. The system is to allow the school to control channels as shown on the contract drawings or a specified in these specifications through the use of filters and agile channel modulators. The modulators and filters are to be tuned to FCC channels in accordance with the local SATV provider's frequency allocations.
f. All active components (except remote in-line amplifiers and sub-channel modulators and diplexers) are to be mounted in the head-end equipment rack(s).
g. Carrier to noise ratio: Not less than 43 dB measured at the most remote outlet from main amplifier or lowest output whichever provides lowest signal. Method of measuring to be by insertions of CW signals at visual carrier frequency and strength of +3 dBmV at each channel in use at input of first amplifier of system. Difference between RMS noise signal and CW visual carrier is then measured at most remote or lowest level tap and ration expressed in dB.
h. System internal echoes are to be below visibility on cross hatch or bar generator pattern displayed at any receiver from signal inserted at proper level into systems amplifier. No cable to exhibit a loss greater than 6 dB at 550 MHz.

4. System to include but not be limited to:
   a. SATV Service/Utility Entrance: Provide complete as required by satellite Cable Company including raceways.
   b. Backbone Pathway: Conform to EIA/TIA 569 using conduit, cable tray, backboards, etc.
   c. Horizontal Pathway: Conform to EIA/TIA 569 using raceway, bridle rings, sleeves, backboards, and cabinets.
   d. TV Outlets: TV outlets including "F" connector for television distribution tap.
   e. Raceways, outlet boxes, cabinets, identification, etc.: Conform to applicable sections of these specifications.
   f. Terminal Backboards and/or Cabinets: Conform to applicable sections in these criteria and project specifications. Size as recommended by manufacturer/installer to house all equipment, terminations, etc. Provide terminal cabinets and/or terminal boards sized to house terminating devices and surge equipment.
   g. Equipment Cabinets/Racks: Size as recommended by manufacturer/installer to house all equipment, terminations, etc.
   h. Terminations: Terminate all wire/cable per manufacturer's recommendations.
   i. Termination Hardware: Provide complete as required to terminate all wire/cabling.
   j. Wiring/Cabling: Complete television distribution cable/wire throughout facility buildings and site. System is to utilize backbone coax and copper as necessary for inter-building and intra building connections per manufacturer. Wiring is to be independent from wiring of other systems. System contractor is to provide all wiring required for a complete and operational system.
   k. Patch cords
   l. Cross connect cables
   m. Surge suppression
   n. Provide audio/video pre-wire from modulators to DVD/VCR connections on rack shelves.
   o. Miscellaneous Equipment: Portable sub-channel processor for remote origination.
   p. Distribution Equipment: All amplifiers, taps, splitters, directional couplers, etc.
5. System Head-End equipment is to be installed in its own equipment cabinet/rack(s).
6. System distribution equipment is to be installed on systems terminal boards in building systems rooms.

7. Special requirements for Cable Routing and Installation:
    a. The majority of the system wiring in any building will be installed above ceilings. All cabling used throughout this project is to comply with the requirements as outlined in the National Electrical Code (NEC). All cabling is to bear CMP and/or appropriate markings for the environment in which they are installed.
    b. Fire/Smoke Stopping is covered under Division 7 Section Firestopping.
    c. The system contractor is to be responsible for any damage to any surfaces or work disrupted as a result of his work. Repair of surfaces, including painting, is to be included as necessary.
    d. Special emphasis is to be placed on system shielding and radio frequency interference (RFI) integrity.
8. Backbone cable is to be installed in appropriate raceway system.
    a. Coordinate all work with all applicable section and divisions of these criteria and the project specifications.
9. Provide a complete TV/Video distribution system design with his submittals, for review as specified in the project specifications prior to the commencement of any work.
10. Surge Suppression
    a. The contractor is to have equipment installed on the AC voltage supply and other lines taking care to arrest damaging electrical transient and spikes which can cause damage to the components of the system, including remote monitors connected to remote outlets.
    b. See Specification Section Surge Suppression Equipment for surge suppression equipment required for 120 VAC and above circuits.
    c. Provide all materials, labor and auxiliaries required to furnish and install complete surge suppression for the protection of building television distribution system from the effects of induced transient voltage surge and lightning discharge.
    d. Provide surge suppression equipment at the following locations:
        i. On each conductor pair and cable sheath entering or leaving a building.
        ii. On each video cable entering or leaving a building.
    e. In other locations where equipment sensitivity to surges and transients requires additional protection beyond that inherent to the design of the equipment. Where equipment being protected has internal surge suppression equipment, the surge protection equipment herein specified is required to be installed in addition to internal equipment protection.
11. Operating Instructions: These instructions are to be permanently affixed to head-end equipment cabinet.
12. Coordination with the local provider for subscriber cable television as well as all labor and materials to hook new system to subscriber cable television provider is to be the contractor's responsibility.
13. System is to be expandable to add the following features in the future, if not already present:
    a. Media Retrieval
    b. Remote diagnostics via modem
    c. Equipment and/or software to generate usage statistic reports
    d. DVD players to support DVD disks
    e. Access to local area network
    f. Audio/Video from a production studio

C. System Operation
1. Provide for reception of monochrome (black and white) and color TV with stereo audio transmission (at every outlet).
2. System is to perform in the following manner:

a. Meet or exceed all requirements as set forth in the FCC Rules Part 76.
b. Deliver a minimum signal level of +6 dBmV on cable TV Channels 2 through 80 and sub-band T-7 through T-13 to each receiving outlet from the school head-end position. System is to have provisions for expansion of the system to 750 MHz.
c. Be capable of transmitting RF modulated signals from the head-end on selected VHF channels ranging from 5 MHz – 750 MHz. All passive devices in the system are to have a bandwidth of 5 to 750 MHz with a flatness response of ±2 dB.
d. Be capable of transmitting a live signal originating from the head-end position or any TV outlet in the system.
e. Meet all detailed requirements of contract system drawings and schematics.
f. Capable of delivering a signal of +13 dB to +6 dB @ 75Ω to all receiving outlets. The difference between any two adjacent outlets is not to exceed 2 dB. Isolation between any two outlets is to be better than 28 dB in the sub-band through the super-band (7 MHz – 300 MHz). Isolation in the hyper-band (300 MHz – 750 MHz) is to be greater than 20 dB.
g. Capable of transmitting up to 750 MHz so that subsequent expansion to additional channels will require modification of head-end equipment only. System signal tilt is not to exceed 7 dB. All amplifiers are to have a minimum of +15 dB at the inputs in all configurations.
h. All equipment is to be rated 105-130V, 60 Hz, AC operation, UL listed.
i. Be capable of transmitting modulated audio/video signals in a reverse direction from any TV outlet ranging from 5 – 48 MHz.
j. System Design Minimum: 43 dB carrier-to-noise ratio and -45 dB (0.5%) cross modulation level at output of the last amplifier in the distribution system.
k. Be capable of entirely suppressing selected incoming subscriber cable television channels and then utilizing them for school programming (local origination).
l. Adjustable taps are not acceptable.
m. All audio patch connectors are to appear at 3-wire balanced ¼" jacks. Inserting a patch cord allow cable access in 2 directions. Wiring terminations are to pass through eyelets provided on jacks, tack soldering is not considered acceptable. All audio patch jacks are to be Trompeter #MT-389 or approved equal.
n. All video patch connections are to appear as "sleeve" type jacks with field wiring connectors being a BNC type. Inserting a patch cord is to allow cable access in 2 directions. All video patch jacks are to be a Trompeter #J14 or J14W series or approved equal.
o. All audio/video patch panels are to be a Trompeter #JSI-40 or approved equal.

3. The system radiation is not to be in excess of the following values:
   a. 5 to 54 MHz -15 mv/m @ 100 ft.
   b. 54 to 216 MHz -20 mv/m @ 100 ft.
   c. 216 to 750 MHz -15 mv/m @ 100 ft.
4. The system is to be configured to distribute all programming provided by the SATV Company. Channels are to be blocked to facilitate replacement with in-house channels.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Show evidence that they maintain a fully equipped service organization capable of furnishing adequate inspection and service to the system including replacement parts.
      a. Installation is to be performed by or under the supervision of the factory-authorized organization.

b. All basic electronic equipment is to be listed by Underwriters Laboratories, Inc., and is to be products of a single manufacturer of established reputation and experience.
   i. The manufacturer is to have supplied similar apparatus to comparable installations rendering satisfactory service for at least three years.
c. Manufacturer and model numbers are given throughout these criteria with the intention of establishing a standard of quality and operation.
   i. All equipment is to be new materials.

2. Surge Suppression
   a. All surge suppression devices are to be manufactured by a company normally engaged in the design, development, and manufacture of such devices for electronics/communications systems equipment.
   b. The surge suppressor manufacturer is to offer technical assistance through support by a factory representative and local stocking distributor.
3. Acceptable Manufacturers:
   a. Distribution equipment
      i. Basis of Design: Blonder-Tongue
      ii. Acceptable Substitutions: Pico-Macom
   b. Surge suppression equipment
      i. Atlantic Scientific
      ii. EDCO

1.4 SUBMITTALS DURING CONSTRUCTION

A. Product Data and Samples:
   1. In addition to project requirements the contractor is to submit:
      a. Narrative of operation of system as provided. (Submittal will not be reviewed by the A/E without this narrative)
      b. Manufacturer's data on all products, including but not limited to catalog cut sheets, roughing-in diagrams, installation instructions, operation and maintenance manuals, and typical wiring diagrams and risers, equipment rack elevations.
      c. System performance calculations.
      d. Installation/layout shop drawings on the television system as a whole, showing the interrelationship and position of all components and input/output levels. Contractor is to provide signal levels, in dB, at each entrance and exit point of every active and passive device to allow both the engineer as well as the owner to determine that the system has been properly designed.
      e. A components identification system and the corresponding component, conduit, or wire. Component symbols are to be as shown on the project drawings.
      f. A detailed step-by-step testing procedure for a component-by-component system functional checkout and test.
      g. Submit point-to-point wiring diagrams and block diagrams of system to be installed.
      h. At the time the contractor/subcontractor submittals are distributed, copies are to be sent to the Owner from the contractor/subcontractor.
   2. Submit Product Data for each type of suppressor:
      a. Dimensions
      b. Means of mounting.
      c. Compliance with UL Standards referenced
      d. Compliance with IEEE Standards referenced
      e. Design type (Hybrid, MOV)
      f. Size of wire leads
      g. Warranty

h. Performance data showing compliance with performance as specified herein
i. Complete schematic data on each suppressor type indicating component values, part number, conductor sizes, etc.
j. Manufacturer’s certified test data o each suppressor type
k. Test data from an independent test laboratory.

B. Warranty Requirements:
1. Refer to Division 01 Section “Warranties”
2. Warrant the equipment, cable and installation to be new and free from defects in material and workmanship, and will, repair or replace any equipment found to be defective for a period of three (3) years and one (1) year for cable and installation from the date of Final Completion.
a. No charges are to be made by the installer for any labor, equipment or transportation during this period to maintain functions.
3. Respond to trouble calls within twenty-four (24) hours after receipt of such a call.
4. Surge Suppression
a. Warranted to be free from defects in materials and workmanship for a period of five (5) years.
b. Any suppressor, which shows evidence of failure or incorrect operation during the warranty period, is to be repaired or replaced by the manufacturer and installer at no cost to the owner.

C. Extra Materials:
1. Provide as extra material items to the audio/visual system, (10) 24” long 3 wire audio patch cords and (10) 24” long 75Ω video patch cords.

PART 2 PRODUCTS

2.1 MATERIALS, PRODUCTS, EQUIPMENT, MANUFACTURED UNITS

A. General
1. Provide all equipment required performing all operations, functions and/or features included in this section even though not specifically noted or specifically noted or specified herein.

B. Active Devices
1. Broadband Distribution Two-Way Amplifier
a. The push-pull hybrid amplifier is to have 33dB of operational gain and still retain low distortion characteristics. The amplifier is to have plug-in modules for reverse-passive and reverse-active sub-band returns.
b. The amplifier is to have -30dB input and -30dB output test points. The amplifier is to have optional plug-in flat attenuators and/or plug-in cable equalizer pads.
c. The amplifier is to have the following minimum electrical specifications:
i. FREQUENCY RANGE: 47-750 MHz forward, 5-30 MHz reverse
ii. GAIN: 31dB
iii. FLATNESS: ± 1.0 dB
iv. GAIN CONTROL RANGE: 15 dB
v. SLOPE CONTROL RANGE: 10 dB
vi. RETURN LOSS INPUT: 13dB
vii. RETURN LOSS OUTPUT: 13 dB
viii. NOISE FIGURE: 9.0 dB
ix. HUM MOD: -65 dB forward and reverse
x. OUTPUT LEVEL: 44 dBmV
xi. CTB: -55 dB

xii. X-MOD: -58 dB
xiii. 2nd ORDER INTERMOD: -68 dB

d. The amplifier is to be Blonder-Tongue 540073 BIDA 750-30, with 5411 series Flat Attenuator Plug-in, a 5417 series Cable Equalizer Plug-in, a 54071 return filter plug-in, and a 5402 Return Amplifier Plug-in.

2. Broadband Indoor Rack Mount Hybrid Distribution Amplifier
   a. The hybrid amplifier is to have 33 dB of operational gain and still retain low distortion characteristics.
   b. The amplifier is to have -30 dB input and -30 dB output test points. The amplifier is to have optional plug-in flat attenuators and/or plug-in cable equalizer pads.
   c. The amplifier is to have the following minimum electrical specifications:
      i. FREQUENCY RANGE: 40-750 MHz
      ii. GAIN: 32 dB
      iii. FLATNESS: ± 1.0dB
      iv. GAIN CONTROL RANGE: 15 dB
      v. SLOPE CONTROL RANGE: 10 dB
      vi. RETURN LOSS INPUT: 14 dB
      vii. RETURN LOSS OUTPUT: 14 dB
      viii. NOISE FIGURE: 9.0dB
      ix. HUM MOD: -65 dB
      x. OUTPUT LIVEL: 44 dBmV
      xi. CTB: -55 dB
      xii. X-MOD: -58 dB
      xiii. 2nd ORDER INTERMOD: -68 dB
   d. The amplifier is to be Blonder-Tongue 5500-73 RMDA 750-30
3. MPEG-2 HD ENCODER
   a. The HD Encoder accepts up to four (4) high-definition (HD) programs from any of the following inputs: 2xHDMI (unencrypted), 2xHD-SDI, and 4xComponent, MPEG-2 encoded outputs are available in the following formats simultaneously: 4xQAM, 4x GigE (1000Base-T Ethernet), and 4xASI.
   b. The encoder will allow the operator to (i) assign one (1) or two (2) programs to each QAM output channel and (ii) to individually turn on/off each of the four (4) adjacent QAM output channels
   c. Comprehensive remote monitoring and control is accomplished using any standard web browser via a front-panel 10/100BaseT Ethernet connection.
   d. The encoder shall have the following minimum electrical specifications:
      i. HDMI Video Input: 2x HDMI
      ii. HD-SDI Video Input: 2x BNC
      iii. Component Video Input: 4 sets 3x RCA for Video (Y, Pb, Pr)
      iv. Component Analog Audio Input: 4 sets 2x RCA (L, R)
      v. Component Digital Audio Input: 4 sets 1x RCA (PCM)
      vi. QAM Output: 1x "F" Female (rear panel; up to 4x RF QAM channel Combined).
      vii. QAM Output Modulation Modes: 16, 32, 64, 128, and 256
      viii. QAM Output Frequency Range: 54 to 1002 MHz
      ix. QAM Output Tuning: SATV Channel Selectable (Ch 2 to158)
      x. QAM Output Return Loss: 14dB typical
      xi. ASI Output: 4x BNC (front panel)
      xii. ASI Output Format: DVB-ASI
      xiii. GigE Output: 1x RJ45
      xiv. GigE Output Standard: 1000Base-T Ethernet

e. General
   i. Dimensions: 19.0 x 18.125 x 1.75 inches
   ii. Power: 115-230 VAC, 60/50Hz (Fuse:3.0 A, 250VDC, Slo Blo)
   iii. Power Dissipation: 60 W
   iv. Operating Temperature: 32 to 122 °F (0 to 50 °C)
   v. Operating Humidity: 0 to 96% RH @ 35°C max, non-condensing
f. The encoder is to be Blonder-Tongue HDE-2H/2S-QAM

4. Headend Distribution Amplifier
   a. Fully integrated digital and analog combiner and distribution amplifier.
   b. Front panel accessible gain and slope controls
   c. Combiner Attenuator for adjustment control of digital signals.
   d. The Headend Distribution Amplifier shall have the following minimum electrical specifications:
      i. Frequency Range: 47-860 dB
      ii. Gain: 22 dB
      iii. Flatness: +/- 1.0 dB
      iv. Input Return Loss: 14 dB
      v. Output Return Loss: 14 dB
      vi. Output Level 38/44 dBmV
      vii. Power Requirements: 105-130 VAC
      viii. Power Consumption: 23.5 watts
      ix. Dimensions: 19" W x 1 ¾" H x 10 ¾" D
   e. The Headend Distribution Amplifier shall be Blonder-Tongue HDS-8-860-20.

C. Passive Devices
   1. Passive Combiner Network
      a. The channel combiner is to have twelve (12) input broadband ports for combining modulators and/or processors in the head end. The combiners are to use radiation proof passives. The combiners are to have a -20 dB test point for testing the signals without interruption of service.
      b. The combiner is to have the following minimum electrical specifications:
         i. FREQUENCY RANGE: 5-100 MHz
         ii. INSERTION LOSS INDIVIDUAL: 18Db
         iii. RETURN LOSS (INPUT): 26 dB (5-40 MHz), 20 dB (40-1000 MHz)
         iv. SLOPE: 1.5 dB
         v. RETURN LOSS (OUTPUT): 9 dB (5-40 MHz), 65 dB (40-1000 MHz)
         vi. ISOLATION (BETWEEN ADJACENT PARTS): 38 dB
         vii. ISOLATION (BETWEEN ANY PORT): 55 dB (5-40 MHz), 65 dB (40-1000 MHz)
         viii. FLATNESS: ±0.2 dB
         ix. IMPEDANCE: 75Ω
      c. The combiner is to be Blonder-Tongue model OC-12d, Stock #5953
   2. Radiation Proof Hybrid Splitters
      a. Splitters used in systems, which obtain their signals from a SATV feed, are to comply with FCC specifications concerning radiation shielding. Housings are to be sealed and weatherproofed. Splitters may be two, four, or eight port devices.
      b. Specifications:

	BANDWIDTH	THRULOSS (MAX)	ISOLATION (min)	RETURN LOSS	RADIATION SHIELDING
2 PORT	5-750 MHz	3.5 dB (5-500 MHz) 4.5 dB (600-750 MHz)	27 dB	17 dB	> -80 dB
4 PORT	5-750 MHz	7.2 dB (5-500 MHz) 8.5 dB (600-750 MHz)	27 dB	18 dB	> -80 dB
8 PORT	5-750 MHz	12.0 dB (5-450 MHz) 14.0 dB (600-750 MHz)	27 dB	14 dB	> -80 dB

c. The splitter is to be Blonder-Tongue model CVS-2 #4082, CVS-4 #4084, or CVS-8 #4088.

3. Radiation Proof Directional Coupler One (1) Port (test port)
   a. Directional couplers used in systems, which obtain their signals from a SATV feed are to comply with FCC specifications concerning radiation shielding. Housings are to be sealed and weatherproofed.
   b. Specifications:
      i. FREQUENCY RANGE: 5-1000 MHz
      ii. TAP VALUES: 4-6-9-12-16-20-24-27 and 30 dB
      iii. THRULOSS: 3.5 – 0.5 dB dependent upon tap value
      iv. ISOLATION: 18 – 40 dB dependent upon tap value
      v. INPUT RETURN LOSS: 12-18 dB dependent upon tap value
      vi. TAP DOWN LOSS: 3 – 30 dB dependent upon tap value
      vii. RADIATION SHIELDING: > -80 dB
   c. Directional coupler is to be Blonder-Tongue model CRT Series Stock #4029 Series ("T" type), or DCW Series Stock #4489 Series ("L" type).
4. SATV Power Passing Outdoor Directional Couplers
   a. The SATV power passing outdoor directional couplers are to comply with FCC specifications concerning radiation shielding. Housings are to be corrosion-proof sealed and weatherproofed. The units are to be suitable for either pedestal or strand mounting and have entry ports that accept industry standard 5.8-24 fittings. The directional couplers are to be available in several values.
   b. All hardware is to be stainless steel.
   c. Fused output ports.
   d. Specifications:
      i. FREQUENCY RANGE: 5-1000 MHz
      ii. TAP VALUES: 8-12-16 dB
      iii. THRULOSS: 1.2 dB to 4.3 dB @ 50 to 500 MHz depending on tap value, 1.4 to 4.5 dB @ 500 to 1000 MHz depending on tap value.
      iv. ISOLATION: 25 dB @ 50 to 500 MHz; 24 dB @ 500 to 1000 MHz
      v. RETURN LOSS: 20 dB @ 50 to 500 MHz, 18 dB @ 500 to 1000 MHz
      vi. RADIATION SHIELDING: > -80 dB
      vii. POWER PASSING: 10 amp all ports
      viii. IMPEDANCE: 75 Ω, all ports
      ix. FUSING: 15 amp

e. The power passing directional coupler is to be Blonder-Tongue model TLS-b Series Stock #3850, 3851, 3855 or 3856.

5. SATV Power Passing Outdoor Directional Multi-taps
   a. The SATV power passing outdoor directional multi-taps are to comply with FCC specifications concerning radiation shielding. Housings are to be aluminum with corrosion protection sealed and weatherproofed. The units are to be suitable for either pedestal or strand mounting and have entry ports that accept industry standard 5/8-24 fittings. The directional multi-taps are to be available in several values and two, four, or eight port versions.
   b. All hardware to be stainless steel
   c. Units to include terminations as required.
   d. Specifications:

	FREQUENCY RANGE MHz	TAP VALUES dB (Lo–Hi)	THRULOSS dB (Lo – Hi)	ISOLATION TAP – TAP	ISOLATION OUT - TAP	POWER PASSING THRU-LINE	RADIATION SHIELDING
2 PORT	5 – 1000	3.5 - 32	0.4 – 4.2	24 dB @ 2-10 MHz 26 dB @ 10-550 MHz 24 dB @ 550-1000 MHz	20–45 dB	6.0 amp	> -80 dB
4 PORT	5 - 1000	8 - 35	0.5 – 4.2	24 dB @ 2-10 MHz 26 dB @ 10-550 MHz 24 dB @ 550-1000 MHz	22–47 dB	6.0 amp	> -80 dB
8 PORT	5 - 1000	11 - 38	0.5 – 4.1	24 dB @ 2-10 MHz 26 dB @ 10-550 MHz 24 dB @ 550-1000 MHz	27–49 dB	6.0 amp	> -80 dB

   e. The power passing directional multi-tap are to be Blonder-Tongue model TLS-2C #4051, TLS-4C #4052, or TLS-8C #4055 all with DMT-TP (4798) terminations.

6. Custom Multi-channel Deletion Filter Network
   a. Provide a rack mounted custom multi-channel deletion filter network allowing the blockage of channels 68 thru 78 and reinsertion of locally generated programming.
   b. Specifications:
      i. PASSBANDS: 5-485.75 MHz [Sub-band, SATV CH 2-67 and CH 95-99]; 553.25-1000 MHz [SATV CH 79-94 and CH 100-158].
      ii. LOSS: 8 dB approximate at 485.75 and 553.25 MHz.
      iii. STOPBAND: 487.25-551.75 MHz [SATV CH 68-78].
      iv. STOPBAND ATTENUATION: 50 dB min./55 dB typical.
      v. IMPEDANCE: 75 Ω.
      vi. CONNECTORS: F (female).

vii. MOUNT: Rack panel mount for indoor use.
viii. SIZE: 19" x 22.75" [13 RU] x 10.5".
ix. OPERATING TEMPERATURE: 23° C ± 5° C.

c. The custom multi-channel deletion filter is to be as manufactured by Multicom, 1076 Florida Central Parkway, Longwood 32750 model 7964-68/78(1000).

7. Outlets
   a. Wall Taps
      i. Taps are to be capable of mounting in a standard electrical wall outlet box.
      ii. Stainless steel, feed thru.
      iii. Outlets are to have "F" connector for television distribution system. Provide/install blank inserts or resistor off unused "F" connection with 75Ω resistor cap for unused positions on outlet(s).
   b. Jumper Cable
      i. Contractor/Installer is to provide one fabricated jumper cable for each outlet to the following specification. Transformer not required for cable-ready TV's
      ii. Receiving Outlets – length 8 ft.
      iii. Cable: Type RG/59 cable: Blonder-Tongue #BTF-591 Hex.
      iv. Connectors: Two "F" male connectors; Blonder-Tongue #BTF-56 Hex.
      v. Transformer: 75 to 300 ohm; Blonder-Tongue #4005.
      vi. Data Cables: Provide all cables as recommended by system manufacturer.
8. Test Points – Test points are to be configured by drilling supplied blank rack panels and mounting "F" barrels on them. These test points are to be terminated.
   a. "F" Barrel: Blonder-Tongue #GF-81C (3689)
   b. "F" Termination: Blonder-Tongue #BTF-591 Hex; #BTF-56 Hex; #BTF-110 Hex.
9. Switches
   a. Coaxial switches are to be two input, one output with a band pass of 5 to 750 MHz. The switch must self terminate unused input.
   b. RETURN LOSS: 20 dB @ 5-216 MHz, 16 dB @ 216-550 MHz
   c. IN SECTION LOSS: 0.1 dB @ 5-216 MHz, 0.3 dB @ 216-550 MHz
   d. ISOLATION: 90 dB @ 5-54 MHz, 80 dB @ 54-216 MHz, 60 dB @ 216-550 MHz
   e. Blonder-Tongue ZAB-2 (#4217)
10. DVD/VHS Recorders/Players
    i. BY OWNER
11. Cables/Connectors – TV Distribution
    a. All cables are to be 100% factory swept tested to 1 GHz. Certification is to be available for each reel.
    b. If cable is used in a plenum environment it is to be UL listed for plenum application.
    c. All underground or below slab cable runs are to be of the flooded type
    d. Cable:
       i. RG/6 Series Drop Cable: West Penn #25841 or accepted substitution
       ii. RG/11 Series (Indoor Trunkline): West Penn #25821 or accepted substitution
       iii. RG/11 Series, Flooded (Outdoor Trunkline): Belden #9764 or accepted substitution
       iv. RG/59 Series (Head-end Wiring): Belden #9167; Comm/Scope #F5995V; Times Fiber Inc. #2345
    e. Connectors:
       i. "F" Series:
          a) RG/59 Head-end cable: Blonder-Tongue #BFT-591 Hex
          b) RG/6: Blonder-Tongue #BFT-56 Hex
          c) RG/11: Blonder-Tongue BFT-110 Hex
       ii. "G" Series, for RG/59: Blonder-Tongue #PG-59

iii. BNC Series, for RG/59: King Electronics Co., Inc. #KC 59-294; Trompeter, Inc. #UPL-220-013; Amphenol #31-4321; AMP, Inc #225395-2.
iv. UHF Series, for RG/59: King Electronics Co., Inc. #KU 59-54; Amphenol #83-59 DCP.
v. EIAJ 8 Pin Plugs: Hirose Electric, USA, Inc. #E8P, 1300 Series.
vi. RCA/Phono Plugs: Male plug is to be two conductors, shielded, solder type. Plug is to have cable clamp and screw on handle. Example Switchcraft #3502P2.
vii. Phono Plug: Male ¼" plug is to be two conductors, shielded, solder type. Plug is to have cable clamp strain relief feature and screw-on brass and nickel-plated handle. Example: Switchcraft #288
viii. Miniature Phono Plug: Male plug is to be two conductors, shielded, solder type. Plug is to have cable clamp strain relief feature and screw-on brass and nickel-plated handle. Example: Switchcraft #780
ix. Ground Blocks: Grounding blocks are to be "f" female type and accept 18-22 AWG center conductors.

f. Adapters: LRC #GB-81
i. Dual female to mate two (2) male "F" or "G" connectors: Blonder-Tongue #GF-81C
ii. Female type "F" to 5/8" entry port with integral center pin: Blonder-Tongue
iii. Duval male adapter for 5/8" entry housings: Blonder-Tongue #B-KS-KS-M

g. Terminators:
i. Male "F" type: Blonder-Tongue #BFT-TP
ii. Male "F" type with DC Block: Blonder-Tongue #FBT

h. In-Line Attenuators:
i. FREQUENCY RANGE: 10 to 890 MHz
ii. ATTENUATION VALUES: 3, 6, 10, 12, 20 dB
iii. IMPEDANCE: 75 Ω
iv. RETURN LOSS: 28 dB @ 10 – 50 MHz, 22 dB @ 50 – 300 MHz, 20 dB @ 300 – 470 MHz, 18 dB @ 470 – 890 MHz.
v. MANUFACTURER: Blonder-Tongue: #FAF (female-to-female); #FAM (female-to-male).

12. Cables/Connectors
a. Provide all cables, connectors, terminators, etc. as recommended and required by the manufacturer.
b. All cables, connectors, and terminators are to comply with applicable requirements of these design criteria (where used).

13. Conduit
a. Conduit, coupling, and connectors are to be as specified in other sections of this design criteria except that EMT fittings are to be steel, compression type connectors, Insulated bushings with separate lock nuts on conduits entering panel cabinets. Fittings are to be of all steel construction.
b. All conduit, etc. for the data portions side of the media system are to comply with applicable requirement of Section 27 26 26.

14. Wiring Duct
a. Wiring duct is to be snap-in slot design. Color to be Gray.
b. Wire Mold G-4000 Series.

15. Flat Screen Television/Monitor:
i. BY OWNER

16. Equipment Racks
    a. Equipment rack at head-end is to accept standard free standing 19" wide electronic equipment or wall mounted to ¾" fireproof plywood in a system room. The cabinet is to have drilled and tapped equipment mounting rails. The rack is to have equipment-mounting height of 77-1/8" with 24-1/2" depth. Provide quantity of racks with interconnections as required to have all equipment shown on drawings and/or as specified in these design criteria. Racks are to be provided without doors or fans.
    b. Location:
        i. K-8 Schools: CCTV Studio Control Room
    c. Provide equipment housing as required to protect and mount head-end equipment.
    d. Construct from heavy gauge steel and be finished in satin black.
    e. Each equipment rack is to include side panels, lockable louvered rear doors, and top and bottom panels unless otherwise noted.
    f. Heat-producing components such as power amplifiers, are to be mounted with one 1 ¾" vent panel installed between units. Fill all other unused portions of rack front sections with matching blank panels.
    g. Power distribution within the racks is to be supplied via AC outlet strips, Atlas Sound ACS-1.
    h. Each equipment rack is to include a heavy-duty roller truck, Atlas Sound RCK-25.
    i. Each equipment rack is to include a rack work light, Atlas Sound RWL-1.
    j. Equipment rack is to be Atlas Sound 544-25 (quantity as required).
17. Surge Suppression
    a. TV Distribution
        i. Must be UL 497B listed and labeled.
        ii. Input and Output Connections: 75 Ω Type F or UHF Type.
        iii. Plug-in Replaceable modular design or individually mounted units.
        iv. Fail short/Failsafe.
        v. Surge Capacity: 10 KA with 8 x 20µs waveform.
        vi. Insertion Loss: 1 dB max at 900 MHz
        vii. Manufacturer: Leviton #51020-WM
    b. Terminations
        i. Provide terminals sized for circuits required on project.

PART 3 EXECUTION

3.1 ERECTION TOLERANCES

A. General
1. Install a complete and operational system.
2. Complete installation is to be as recommended by equipment manufacturer.
3. Install equipment in a neat and workmanlike manner.
4. Install in accordance with manufacturer's instructions.
5. Connect cable television service in accordance with cable utility instructions.
6. Upon completion, the system is to be clean, properly adjusted, and in perfect operating condition.
7. The system is to be free of any audible components of hum, noise, or distortion.
8. Equipment power wiring and grounding is to conform to the latest edition of the National Electrical Code and applicable local codes.
9. All equipment except in-line pads are to be suitably mounted in cabinets or other solid supports. All equipment is to be securely mounted in enclosures or special-mounting devices made for the purpose.

10. Equipment suspended by its coaxial connection is not acceptable.
11. Final connections, balancing, adjustments, testing, etc. are to be performed by factory trained technicians.
12. All equipment and associated wiring are to be installed in a neat manner and firmly secured in the equipment rack/cabinet with appropriate hardware or to ceiling/wall.
13. Adequate ventilation for the equipment installed in equipment racks is to be provided to maintain manufacturers specified heat tolerances for the installed equipment.
14. All equipment racks are to be properly grounded to meet NEC code requirements and to prevent electromagnetic or electrostatic interference.

B. Outlets
   1. General: Install outlets where indicated on the drawings. Install devices in outlets so that same orientation is used throughout project.
   2. Outlets: Install per applicable section of these criteria (i.e., outlet boxes, floor boxes, etc.) and as recommended by device manufacturer.
   3. Wall Plates: Wall plates are part of this criteria only when serving a single television ("F" connector blanks); where the broadcast cable is part of the classroom technology the wall plate becomes the responsibility of Section 27 41 16 – Integrated Audio-Video Systems and Equipment.

C. Cable Installation
   1. Cables/wiring is to be installed in a complete conduit raceway system unless specifically specified otherwise:
      a. Installation of systems cable/wire may be by means of bridle rings and cable trays where acceptable to authority having jurisdiction, complies with all codes/standards, and complies the requirements of both Section 27 26 26 and these specifications.
      b. Where allowed by applicable codes, standards and these specifications wire/cable may be installed in bridle rings, cable trays, and other acceptable pathways. Contractor is to size and route cables, bridle rings, and pathways to accommodate the proper installation of the system cabling. Where raceways are required, they are to be sized, installed, etc. to comply with all applicable codes, standards and applicable sections of these specifications.
      c. In locations where cable or wiring is not accessible after completion of the project, and in non-ceiling areas, and in exposed locations, cabling is to be installed in appropriate raceway system complete to concealed/accessible location and/or termination equipment.
   2. All runs of cable are to be of continuous length except for interfacing with equipment items.
      a. All exterior connections, except those in weatherproof boxes, are to be sealed with heat shrinkable tubing.
      b. Grounding blocks are to be used for cable type changes only, and noted on record drawings. Cable splices are not allowed.
   3. At head-end, all cables are to be marked "TO" followed by cable designation and "FROM" followed by cable origination point. (Example: "TO CHANNEL 3 MODULATOR VIDEO IN; FROM VCR #3 VIDEO OUT") Cables are to be of custom cut length to fit each installation situation/requirement. Loose cables are to be tie-wrapped to form cable harnesses to interface with equipment in a neat and orderly fashion.
   4. Conduit are not to contain more than 4 cables each nor be filled beyond 50% of its cross-sectional area.
   5. Cable contained in any single conduit run are to have the same direction of signal flow. If RF signals on the cables carry like channels these signals must be identical.

6. Cable runs between buildings are to be underground. Exit and entry points are to be in cabinets or boxes. There are to be no aerial runs regardless of length for installation of cable for permanent buildings.
7. All underground cable runs are to be flooded and in conduit.
    a. Underground runs are to be at a minimum depth of 18 inches. Where sprinkler systems are present, the cable is to be run below the level of pipes.
    b. All equipment (including splitters, taps and grounding blocks) are to be located above grade.
8. Cable runs must be contained separate from AC (alternating current) cable.
9. RG/59 should not be used anywhere in the system backbone except for patch cords at head-end and patch cord from the outlet "F" connector to the TV set user.
10. RG/11, as a minimum, is to be used for all main trunks.
11. RG/6, as a minimum, is to be used for all drops.
12. Cable is to be adequately supported.
13. Install connectors specifically designed for the type cable used.
14. Do not bundle input cables with output cables.
    a. Maintain physical separation between input and output cables as much as practical.
15. Each outlet is to be served as a dedicated cable back to the communications outlet.
16. Tap-offs will not be accepted, and TV outlets cannot be looped from room to room.

D. Grounding, bonding, etc.
1. Provide proper grounding of television system components and wiring.
2. Bond outdoor components to lightning protection system.
3. Install lightning protection system for all antennas and antenna supports to comply with NFPA 780, UL and LPI.

E. Equipment Location
1. Head-end equipment is to be placed as shown on the contract drawings and as indicated by these criteria.
2. All splitters, taps, grounding blocks and line extenders not mounted in the head-end equipment racks are to be mounted in cabinets, boxes, pedestals, and terminal boards.
3. All directional coupler connections to trunk line are to be located/installed in junction box with accepted cable bushing for cable entry/exit.
4. Location of TV Outlets
    a. Receiving outlet mounting height is to be as indicated on the contract drawings, no more than 24" from an AC outlet. These receiving outlets are to be labeled "TV".
5. Outlets and cabinets are to be flush mounted wherever practical.
6. AC outlets are to be located inside boxes and cabinets, which house electrical equipment. AC power is to be provided to meet equipment requirements.

F. Equipment Labeling/Cable Identification
1. Engrave laminate labels are to be installed on all equipment.
2. Provide permanent cable markers on all cables, at terminal cabinets, at equipment cabinets, and at antenna.
3. All switches, jacks, and receptacles are to be clearly, logically and permanently marked.

G. Television System
1. Install all equipment as recommended by manufacturer.
2. All head-end system equipment is to be located at one centralized location as indicated on the contract drawings. Install head-end equipment in television system equipment cabinet/rack as specified in this document.
3. Install distribution equipment at systems terminal boards in systems rooms located on the drawings. Under no circumstances shall the Contractor install backbone distribution equipment anywhere else other than in a systems room.

4. Install equipment at each TV monitor location as required to control TV monitor on-off, select channel, provide infrared remote control for TV operation.
5. Test and align system as required for a complete and operating system as specified herein.

H. Surge Suppression
1. General
   a. Install surge suppression device on all 120-volt power sources to equipment.
   b. Install surge suppression device on all cable entering and/or leaving a building at terminal board and/or cabinet.
   c. Bond surge and suppression device to building ground system as recommended by manufacturer.
   d. Extreme care is to be taken by contractor to assure a properly surge protected system.
   e. Surge protection equipment must be selected by contractor to match the equipment being protected including wire sizes, operating volts, amps, and circuit impedance.
   f. Installation of surge protection equipment and its grounding must be per manufacturer's recommendations to assure short and proper ground paths.
2. Equipment Installation
   a. Install surge suppression equipment per manufacturer's recommendation at each wire terminal as indicated elsewhere in these criteria.
   b. Install surge suppression equipment terminal cabinets, etc. as required to facilitate installation of surge protection equipment and terminal points. Increase size of terminal cabinets (from that shown on drawings) to size required to facilitate installation of surge suppression equipment and terminal blocks.
   c. Locate surge suppression equipment in terminal cabinet nearest main equipment cabinet (TVEC).
   d. Coordinate with Division 26 contractor to assure that surge suppression for 120 VAC power circuit and surge suppression required by this section are installed in same terminal cabinet and bonded together.
3. Ground Installation
   a. Ground Bus Connections
      i. Provide "local" ground bus in each terminal cabinet housing surge protection equipment (with lugs, etc. as required).
      ii. Bond "local" ground bus to terminal cabinet with minimum #6 copper wire.
      iii. Connect terminal cabinet "local" ground bus to "systems" ground bus installed per Section 26 05 26 with minimum #6 copper insulated wire (unless otherwise noted) in conduit.
      iv. Note that "systems" ground bar is also to be used for power transformation ground (480V to 208V) where applicable.
   b. Surge suppression equipment grounding
      i. Connect each surge suppressor to local ground bus in terminal cabined with wire sized as recommended by manufacturer.
      ii. Coordinate with Section 26 05 26 contractor to assure that 120 VAC power source/supply surge suppressor is also grounded to same local ground bus as surge suppressors provided in these criteria.
   c. Conductors
      i. Bends in excess of 90 degrees in any grounding conductor are not to be permitted.
      ii. Do not bundle unprotected conductors with protected conductors.
      iii. Conductors are to be kept as short as possible.
      iv. Conductors are to be secured at 12" intervals with an accepted copper clamp
      v. Grounding conductors are to be properly connected to the building service ground by accepted clamps.

d. Grounding Connectors
    i. Connectors, splicers, and other fittings used to interconnect grounding conductors, bond to equipment or grounding bars, are to be accepted by NEC or UL for the purpose.
    ii. All connectors and fittings are to be of the Nicopress crimp or compression set screw type.
    iii. Special treatment to fittings lugs, or other connectors of dissimilar materials are to be applied to prevent electro-galvanic action.

4. Isolation of cable shields
    a. Cable shields are to be suitable protected at each outlet to avoid incidental contact with grounded elements of the building structure. Shield continuity is to be maintained throughout the entire cabling system. Referenced to the building ground system is to be at the Systems Equipment Room via the Systems Ground Bus Bar.
    b. Isolation of the shields is to be individually verified by resistance measurements as connections are made.

3.2 FIELD QUALITY CONTROL

A. System balance test is to employ a Sadelco Model 7600 Digital Field Strength Meter or accepted equivalent. A 17" screen size color receiver, a broadband white noise generator with an output from 5 to 750 MHz. All test equipment is to bear a calibration seal from a recognized lab, which is dated within 6 months of the date of demonstration.
    1. All test data is to be in writing and turned over to the Owner or the Owner's Representative upon the following:
        a. Proof is to be provided showing that test equipment has been calibrated within six (6) months of system testing date.
        b. Measurement is to be made at the combined output of the head-end system and at every TV outlet location.
        c. The level of each channel's picture and sound carrier is to be measured and recorded for every TV outlet location.
    2. All levels are to be within ±1 dB from design levels specified.
        a. In no case are the levels measured to exceed the maximum output rating for the employed head-end amplifier(s) or the distribution amplifier(s) throughout the campus.
    3. The level difference between channel picture carriers is not to exceed 2 dB for adjacent channels nor 6 dB between the strongest and weakest channel normally carried.
    4. Inspect all sites for SATV signal strength. Provide necessary amplification to assure adequate input gain to the head-end for all channels. When and where necessary, contractor is to supply conduit, outlet boxes for SATV cable installation. SATV outlets at the head-end are to be labeled "SATV".

B. Adjusting:
    1. Adjust work under the supervision of the manufacturer's field service personnel.
    2. Adjust each antenna using field strength meter to orient it for maximum signal reception.
    3. Adjust amplifier gain and make other system adjustments to achieve specified output levels at each outlet.
    4. Adjust tap values at all devices as required to provide specified performance.

3.3 DEMONSTRATION

A. The contractor is to prepare and submit a written test plan that will demonstrate the system's operation and critical component operation functionality.

B. Provide systems demonstration.
C. Demonstrate system operation and provide a two-hour video taped instruction with manufacturer's training personnel to school personnel upon all aspects of the SATV system from the head-end to the user TV.
D. Conduct a walking tour of project and briefly describe function, operation, and maintenance of each component.
E. Include demonstration of color television operation and specified written signal level at twenty-five outlets selected by Owner or the Owner's representative.
F. The contractor/installer is to execute a proof of performance for television system in the presence of designated school board personnel. The contractor is to furnish calibrated test equipment necessary for proof. Recommended test equipment is: (2) ½" VHS VCRs; (2) color receiver monitors; (1) field strength meter; required cables and adapters; (2) ½" VHS test tapes. Test equipment is to remain property of contractor.
G. Contractor is to furnish all recorded signal measurements in writing at time of performance test and demonstration.
H. Test and Demonstration:
    1. Testing and demonstration is to be documented for the Engineer and the Owner. Upon completion of this testing cited below, a Document of Certification is to be furnished by the Contractor and signed by the Contractor, Engineer of Record, and the Owner or the Owner's Representative. Three (3) copies of this Certification are to be signed for all parties.
    2. Before project acceptance, conduct the following test and demonstration:
        a. The system is to be tested and demonstrated to operate in accordance with the requirements of these criteria.
        b. Test the performance of the system in the presence of the Electrical Engineer of Record and an authorized representative of the Owner.
        c. Furnish all equipment and personnel required for the tests.
    3. Should such a test and demonstration of performance show that the contractor has not properly balanced the system and that picture degradation is present or that output is not as specified, the contractor is to make all necessary changes or adjustments and a second performance test and demonstration is to be conducted.
        a. Should a second performance test and demonstration fail, the contractor is to correct the system deficiencies under the supervision of the Owner's technical staff at no cost to the Owner.
I. In service Training: Provide the Owner with a training program designed to make all administrative users familiar with the operation of the TV System. The Contractor is to instruct four (4) personnel designated by the Owner in the proper use, basic care, and maintenance of the equipment. Such training is to be provided as an integral component of the system.

END OF SECTION

SECTION 27 41 01
EDUCATIONAL MULTI-MEDIA SYSTEM

PART 1 GENERAL

NOT USED

PART 2 PRODUCTS

2.1 MATERIALS, PRODUCTS, EQUIPMENT, MANUFACTURED UNITS

A. General
   1. Provide all equipment required performing all operations, functions and/or features included in this section even though not specifically noted or specifically noted or specified herein.

B. Rack-Mount System Server (RM-126X Server)
   1. The server shall come pre-loaded with SAFARI Montage® OS and appropriate number of Core Content hard drives to satisfy the systems needs.
   2. Specifications:
      a. Manufacturer: Dell
      b. CPU: Hex-Core Intel Xeon processor
      c. CPU Cores (total): 6
      d. CPU Threads (total): 12
      e. CPU Speed: 2.0-2.5 GHz
      f. Cache: 15 MB
      g. Memory: 16 GB
      h. Drive Bays: 12
      i. Drives Included: SAS 15 K OS Drive; SATA 7.2 Content Drive
      j. Network Ports: 4
      k. Network: 100/1000 Mbps
      l. Chassis: 2U Rack-Mount
      m. Power: Hot-swappable 750 W Power Supply; 120VAC/10A, 220VAC/5A
      n. Dimensions:
         i. Height: 8,89 cm (3.50”)
         ii. Width: 44.45 cm (17.50”)
         iii. Depth: 71.12 cm (28.00”)
      o. Environmental:
         i. Operating: 10° to 35° C (50° to 95° F)
         ii. Storage: - 40° to 70° C (- 40° to 158° F)

C. Stand-Alone Video Encoder
   1. Educational Multimedia Video Encoders shall be powerful and ultra reliable, solid state, “out of the box” devices designed for use in IP Television, Digital Signage, and Digital Media encoding and distribution systems.
   2. Encoders shall encode incoming digital or analog video signals to an H264 or MPEG2 network stream at either a High Definition (HD) or Standard Definition (SD) resolution and shall stream it over an IP network to any workstation running the system remote client software.
   3. Encoder’s unique multi-format input circuitry shall allow users to input content in a wide variety of video and PC formats. In addition, the Encoder shall have an onboard rendering engine providing the ability to upscale SD inputs to HD resolution.

4. Encoder shall operate reliably on its own with configuration and stream setup from front panel controls and LCD status display or through the unit's browser-based configuration pages.
5. Unit shall be a hot swappable blade that is used in conjunction with an Encoder Chassis. The blade shall have IP network/RS232/USB control interfaces and shall be built around an ultra reliable dual-core engine running under Linux.
6. Unit shall have the following technical characteristics
    a. Communications and Control
        i. Network: Ethernet 10/100 BaseT RJ-45 modular jack with integrated LED's
        ii. Mode of Operation: Stand-alone
        iii. IP Setup and Control: Configuration via on-board browser/remote status monitoring information; IP/RS232 control protocol to operate with 3rd party Touch Panel Controllers
        iv. RS232: Serial port, up to 115200 baud for input source device control via IP network.
        v. Software Updates: Can be loaded either through an IP connection to an HTTP server or by inserting a USB key.
    b. Video Encoding
        i. H.264 Main Profile @ Level 4
        ii. Supported bit rates SD to 5 bps: HD to 12 Mbps
        iii. MPEG-2 Main profile @ High Level
        iv. Supported bit rates SD to 8 Mbps; HD to 15 Mbps
        v. Unicast or multicast transport streams
        vi. Constant and variable bit rate encoding
    c. Audio Encoding
        i. MPEG-1 layer 2
        ii. MPEG-4 AAC LC
    d. Video Inputs
        i. HDMI 1.3 Digital: 480i/576i to 1080P60
        ii. TPbPr: 480i/576i or 1080P60
        iii. VGA: 540 x 480 to WUXGA; 920 x 1200
        iv. S-Video: PAL/NTSC/SECAM
        v. CVBS: PAL/NTSC/SECAM
    e. Audio Inputs
        i. HDMI digital stereo audio
        ii. Analogue stereo audio, line level, 3.5mm jack
    f. Power: 18 watts from Chassis
    g. Approvals: FCC Part 15, CD, CB
7. Provide with plug-in power supply
8. Provide and install stand-alone Encoders for the Owner's use for:
    a. TV Production Studio
    b. Remote Broadcast capability
9. Manufacturers
    a. Basis of Design
        i. Safari Montage SAF120845HB MPEG2+4 Multi-Format Stand-Alone Encoder or acceptable substitution.

D. Network Digital Video Recorder
1. The system shall provide for Network Digital Video recording. Recording shall be both schedulable and on-demand. The on-demand recording shall be accomplished via one-button recording. Recording shall be automatically uploaded onto the video file server. A total of four simultaneous recordings are required.

2. The N-DVR shall record direct-input data streams from the encoder appliance. Those recordings shall be catalogued and archived according to LDAP identification and user associations by group or school.
3. The N-DVR shall record a channel or direct data stream from the encoder appliance but allow restricted playback only to those users who initially requested the recording.
4. The recording infrastructure shall allow Administrators to permit or restrict recording of broadcast media based upon the program's rating – assigned by the Parental Guidelines Rating System (US). The system shall disallow attempted recordings of programs rated above a user's administratively determined maturity level.
5. The recordings and media artifacts of the N-DVR shall conform to the IMS Global standards for meta-data input. The media artifacts shall be transferrable to and usable by any IMS Global – Common Cartridge Compliant Learning Management System or Moodle.
6. The N-DVR recordings and media artifacts shall be automatically converted into a H.264/AAC hinted stream. The N-DVR shall be responsible for transferring this recorded media artifact to the primary Learning Object Repository. Of the recordings (data files) produced by the recording and storage process, at least one must be compatible for playback via any mobile platform.
7. The N-DVR shall facilitate various playback bit-rates of recorded artifacts. Retrieval and delivery of these artifacts shall be dependent on the user's login scenario – including LDAP credentials, presence within or outside of the local area network (LAN), whether or not the user is browsing on a mobile device and internal data throughput capabilities. The media playback bitrate of the recorded media shall also be selectable in order to accommodate network overhead concerns.
8. The N-DVR shall automatically create and assign a thumbnail image to visually represent the content of the recording.
9. All media artifacts and recordings (data files) from the N-DVR shall be assumable into the same meta-data infrastructure and provide for the same state standards and common core correlations as other media within the LMS.
10. Media artifacts and recordings (data files) produced by the N-DVR shall be editable and able to be segmented in order to highlight, tag and otherwise identify where key learning concepts exist within the recording. The complete N-DVR and recording management system shall allow teachers and end-users to integrate only those key learning concepts into a digitally managed scope and sequence.
11. The N-DVR appliance shall work cooperatively with a real-time channel guide, allowing users to schedule recordings directly from the guide – on demand or on schedule.

E. Four Post Equipment Rack
1. Equipment rack at head-end is to accept standard free standing 19" wide electronic equipment. The cabinet is to have drilled and tapped equipment mounting rails. The rack is to have equipment-mounting height of 81 1/4" with 30" depth. Provide quantity of racks with interconnections as required having all equipment shown on drawings and/or as specified in these design criteria. Racks are to be provided without doors or fans.
2. Location:
   a. K-8 Schools: MDF Room (Main Distribution Frame) and CCTV Control Room
3. Provide equipment housing as required to protect and mount head-end equipment.
4. Construct from heavy gauge steel and be finished in satin black.
5. Equipment rack is to include side panels, lockable louvered rear doors, and top and bottom panels unless otherwise noted.
6. Heat-producing components such as power amplifiers, are to be mounted with one 1 ¾" vent panel installed between units. Fill all other unused portions of rack front sections with matching blank panels.

7. Power distribution within the racks is to be supplied via AC outlet strips, Atlas Sound ACS-1.
8. Each equipment rack is to include a heavy-duty roller truck, Atlas Sound RCK-30.
9. Equipment rack is to be Atlas Sound 544-30 (quantity as required).

F. Uninterruptable Power Supply
   1. Provide a rack mounted 1500 VA UPS mounted in the Safari Montage Server Rack.
      a. Output Power Capacity: 1000watts/1500 VA
      b. Nominal Output Voltage: 120 V
      c. Output Connections: (6) NEMA 5-15R
      d. Nominal Input Voltage: 120 V
      e. Input Connections: NEMA 5-15P
      f. Cord Length: 8 feet (2.44 meters)
   2. Basis of Design
      a. APC Smart-UPS
         i. Manufacturer's part number: SMT 1500RM2U or engineer approved equal.

G. Broadband Distribution Two-Way Amplifier
   1. The push-pull hybrid amplifier is to have 33dB of operational gain and still retain low distortion characteristics. The amplifier is to have plug-in modules for reverse-passive and reverse-active sub-band returns.
   2. The amplifier is to have -30dB input and -30dB output test points. The amplifier is to have optional plug-in flat attenuators and/or plug-in cable equalizer pads.
   3. The amplifier is to have the following minimum electrical specifications:
      a. FREQUENCY RANGE: 47-750 MHz forward, 5-30 MHz reverse
      b. GAIN: 31dB
      c. FLATNESS: ± 1.0 dB
      d. GAIN CONTROL RANGE: 15 dB
      e. SLOPE CONTROL RANGE: 10 dB
      f. RETURN LOSS INPUT: 13dB
      g. RETURN LOSS OUTPUT: 13 dB
      h. NOISE FIGURE: 9.0 dB
      i. HUM MOD: -65 dB forward and reverse
      j. OUTPUT LEVEL: 44 dBmV
      k. CTB: -55 dB
      l. X-MOD: -58 dB
      m. 2^{nd} ORDER INTERMOD: -68 dB
   4. The amplifier is to be Blonder-Tongue 540073 BIDA 750-30, with 5411 series Flat Attenuator Plug-in, a 5417 series Cable Equalizer Plug-in, a 54071 return filter plug-in, and a 5402 Return Amplifier Plug-in.

H. Radiation Proof Hybrid Splitters
   1. Splitters used in systems, which obtain their signals from a CATV feed, are to comply with FCC specifications concerning radiation shielding. Housings are to be sealed and weatherproofed. Splitters may be two, four, or eight port devices.

2. Specifications:

	BANDWIDTH	THRULOSS (MAX)	ISOLATION (min)	RETURN LOSS	RADIATION SHIELDING
2 PORT	5-750 MHz	3.5 dB (5-500 MHz) 4.5 dB (600-750 MHz)	27 dB	17 dB	> -80 dB
4 PORT	5-750 MHz	7.2 dB (5-500 MHz) 8.5 dB (600-750 MHz)	27 dB	18 dB	> -80 dB
8 PORT	5-750 MHz	12.0 dB (5-450 MHz) 14.0 dB (600-750 MHz)	27 dB	14 dB	> -80 dB

3. The splitter is to be Blonder-Tongue model CVS-2 #4082, CVS-4 #4084, or CVS-8 #4088.

I. Radiation Proof Directional Coupler One (1) Port (test port)
   1. Directional couplers used in systems, which obtain their signals from a CATV feed are to comply with FCC specifications concerning radiation shielding. Housings are to be sealed and weatherproofed.
   2. Specifications:
      a. FREQUENCY RANGE: 5-1000 MHz
      b. TAP VALUES: 4-6-9-12-16-20-24-27 and 30 dB
      c. THRULOSS: 3.5 – 0.5 dB dependent upon tap value
      d. ISOLATION: 18 – 40 dB dependent upon tap value
      e. INPUT RETURN LOSS: 12-18 dB dependent upon tap value
      f. TAP DOWN LOSS: 3 – 30 dB dependent upon tap value
      g. RADIATION SHIELDING: > -80 dB
   3. Directional coupler is to be Blonder-Tongue model CRT Series Stock #4029 Series ("T" type), or DCW Series Stock #4489 Series ("L" type).

J. Outlets
   1. Wall Taps
      a. Taps are to be capable of mounting in a standard electrical wall outlet box.
      b. Stainless steel, feed thru.
      c. Outlets are to have "F" connector for television distribution system. Provide/install blank inserts or resistor off unused "F" connection with 75Ω resistor cap for unused positions on outlet(s).
   2. Jumper Cable
      a. Contractor/Installer is to provide one fabricated jumper cable for each outlet to the following specification. Transformer not required for cable-ready TV's
      b. Receiving Outlets – length 8 ft.
      c. Cable: Type RG/59 cable: Blonder-Tongue #BTF-591 Hex.
      d. Connectors: Two "F" male connectors; Blonder-Tongue #BTF-56 Hex.
      e. Transformer: 75 to 300 ohm; Blonder-Tongue #4005.
      f. Data Cables: Provide all cables as recommended by system manufacturer.

K. Test Points – Test points are to be configured by drilling supplied blank rack panels and mounting "F" barrels on them. These test points are to be terminated.
   1. "F" Barrel: Blonder-Tongue #GF-81C (3689)
   2. "F" Termination: Blonder-Tongue #BTF-591 Hex; #BTF-56 Hex; #BTF-110 Hex.

L. Switches
   1. Coaxial switches are to be two input, one output with a band pass of 5 to 750 MHz. The switch must self terminate unused input.
      a. RETURN LOSS: 20 dB @ 5-216 MHz, 16 dB @ 216-550 MHz
      b. IN SECTION LOSS: 0.1 dB @ 5-216 MHz, 0.3 dB @ 216-550 MHz
      c. ISOLATION: 90 dB @ 5-54 MHz, 80 dB @ 54-216 MHz, 60 dB @ 216-550 MHz
      d. Blonder-Tongue ZAB-2 (#4217).

M. Cables/Connectors – TV Distribution
   1. All cables are to be 100% factory swept tested to 1 GHz. Certification is to be available for each reel.
   2. If cable is used in a plenum environment it is to be UL listed for plenum application.
   3. All underground or below slab cable runs are to be of the flooded type
   4. Cable:
      a. RG/6 Series Drop Cable: West Penn #25841 or accepted substitution
      b. RG/11 Series (Indoor Trunk line): West Penn #25821 or accepted substitution
      c. RG/11 Series, Flooded (Outdoor Trunk line): Belden #9764 or accepted substitution
      d. RG/59 Series (Head-end Wiring): Belden #9167; Comm/Scope #F5995V; Times Fiber Inc. #2345
   5. Connectors:
      a. "F" Series:
         i. RG/59 Head-end cable: Blonder-Tongue #BFT-591 Hex
         ii. RG/6: Blonder-Tongue #BFT-56 Hex
         iii. RG/11: Blonder-Tongue BFT-110 Hex
      b. "G" Series, for RG/59: Blonder-Tongue #PG-59
      c. BNC Series, for RG/59: King Electronics Co., Inc. #KC 59-294; Trompeter, Inc. #UPL-220-013; Amphenol #31-4321; AMP, Inc #225395-2.
      d. UHF Series, for RG/59: King Electronics Co., Inc. #KU 59-54; Amphenol #83-59 DCP.
      e. EIAJ 8 Pin Plugs: Hirose Electric, USA, Inc. #E8P, 1300 Series.
      f. RCA/Phono Plugs: Male plug is to be two conductors, shielded, solder type. Plug is to have cable clamp and screw on handle. Example Switchcraft #3502P2.
      g. Phono Plug: Male ¼" plug is to be two conductors, shielded, solder type. Plug is to have cable clamp strain relief feature and screw-on brass and nickel-plated handle. Example: Switchcraft #288
      h. Miniature Phono Plug: Male plug is to be two conductors, shielded, solder type. Plug is to have cable clamp strain relief feature and screw-on brass and nickel-plated handle. Example: Switchcraft #780.

N. Ground Blocks: Grounding blocks are to be "f" female type and accept 18-22 AWG center conductors.

O. Adapters: LRC #GB-81
   1. Dual female to mate two (2) male "F" or "G" connectors: Blonder-Tongue #GF-81C
   2. Female type "F" to 5/8" entry port with integral center pin: Blonder-Tongue
   3. Dual male adapter for 5/8" entry housings: Blonder-Tongue #B-KS-KS-M.

P. Terminators:
   1. Male "F" type: Blonder-Tongue #BFT-TP
   2. Male "F" type with DC Block: Blonder-Tongue #FBT.

Q. In-Line Attenuators:
   3. FREQUENCY RANGE: 10 to 890 MHz
   4. ATTENUATION VALUES: 3, 6, 10, 12, 20 dB
   5. IMPEDANCE: 75 Ω

6. RETURN LOSS: 28 dB @ 10 – 50 MHz, 22 dB @ 50 – 300 MHz, 20 dB @ 300 – 470 MHz, 18 dB @ 470 – 890 MHz.
7. MANUFACTURER: Blonder-Tongue: #FAF (female-to-female); #FAM (female-to-male).

R. Cables/Connectors
1. Provide all cables, connectors, terminators, etc. as recommended and required by the manufacturer.
2. All cables, connectors, and terminators are to comply with applicable requirements of these design criteria (where used).

S. Conduit
3. Conduit, coupling, and connectors are to be as specified in other sections of this design criteria except that EMT fittings are to be steel, compression type connectors, Insulated bushings with separate lock nuts on conduits entering panel cabinets. Fittings are to be of all steel construction.
4. All conduit, etc. for the data portions side of the media system are to comply with applicable requirement of Section 27 26 26.

PART 3 EXECUTION

3.1 ERECTION TOLERANCES

A. General
1. Install a complete and operational system.
2. Complete installation is to be as recommended by equipment manufacturer.
3. Install equipment in a neat and workmanlike manner.
4. Install in accordance with manufacturer's instructions.
5. Connect cable television service in accordance with cable utility instructions.
6. Upon completion, the system is to be clean, properly adjusted, and in perfect operating condition.
7. The system is to be free of any audible components of hum, noise, or distortion.
8. Equipment power wiring and grounding is to conform to the latest edition of the National Electrical Code and applicable local codes.
9. Equipment suspended by its coaxial connection is not acceptable.
10. Final connections, balancing, adjustments, testing, etc. are to be performed by factory trained technicians.
11. All equipment and associated wiring are to be installed in a neat manner and firmly secured in the equipment rack/cabinet with appropriate hardware or to ceiling/wall.
12. Adequate ventilation for the equipment installed in equipment racks is to be provided to maintain manufacturers specified heat tolerances for the installed equipment.
13. All equipment racks are to be properly grounded to meet NEC code requirements and to prevent electromagnetic or electrostatic interference.

B. Outlets:
1. General: Install outlets where indicated on the drawings. Install devices in outlets so that same orientation is used throughout project.
2. Outlets: Install per applicable section of these criteria (i.e., outlet boxes, floor boxes, etc.) and as recommended by device manufacturer.

C. Cable Installation
1. Cables/wiring is to be installed in a complete conduit raceway system unless specifically specified otherwise:
   a. Installation of systems cable/wire may be by means of bridle rings and cable trays where acceptable to authority having jurisdiction, complies with all codes/standards, and complies the requirements of both Section 27 26 26 and these specifications.

b. Where allowed by applicable codes, standards and these specifications wire/cable may be installed in bridle rings, cable trays, and other acceptable pathways. Contractor is to size and route cables, bridle rings, and pathways to accommodate the proper installation of the system cabling. Where raceways are required, they are to be sized, installed, etc. to comply with all applicable codes, standards, and applicable sections of these specifications.
c. In locations where cable or wiring is not accessible after completion of the project, and in non-ceiling areas, and in exposed locations, cabling is to be installed in appropriate raceway system complete to concealed/accessible location and/or termination equipment.

2. All runs of cable are to be of continuous length except for interfacing with equipment items.
3. Cable runs must be contained separate from AC (alternating current) cable.
4. RG/59 should not be used anywhere in the system backbone except for patch cords at head-end and patch cord from the outlet "F" connector to the TV set user.
5. RG/11, as a minimum, is to be used for all main trunks.
6. RG/6, as a minimum, is to be used for all drops.
7. Cable is to be adequately supported.
8. Install connectors specifically designed for the type cable used.
9. Each outlet is to be served as a dedicated cable back to the communications outlet.
10. Tap-offs will not be accepted, and TV outlets cannot be looped from room to room.

D. Grounding, bonding, etc.
1. Provide proper grounding of television system components and wiring.
2. Bond outdoor components to lightning protection system.

E. Equipment Location
1. Head-end equipment is to be placed as shown on the contract drawings and as indicated by these criteria.
2. All splitters, taps, grounding blocks and line extenders not mounted in the head-end equipment racks are to be mounted on terminal boards.
3. Location of TV Outlets
a. Receiving outlet mounting height is to be as indicated on the contract drawings, no more than 24" from an AC outlet. These receiving outlets are to be labeled "TV".
4. Outlets are to be flush mounted wherever practical.
5. AC power is to be provided to meet equipment requirements.

F. Equipment Labeling/Cable Identification
1. Engrave laminate labels are to be installed on all equipment.
2. Provide permanent cable markers on all cables, at terminal cabinets, at equipment cabinets, and at antenna.
3. All switches, jacks, and receptacles are to be clearly, logically, and permanently marked.

G. Television System
1. Install all equipment as recommended by manufacturer.
2. All head-end system equipment is to be located at one centralized location as indicated on the contract drawings. Install head-end equipment in television system equipment cabinet/rack as specified in this document.
3. Install distribution equipment at systems terminal boards in systems rooms located on the drawings. Under no circumstances shall the Contractor install backbone distribution equipment anywhere else other than in a systems room.
4. Install equipment at each TV monitor location as required to control TV monitor on-off, select channel, provide infrared remote control for TV operation.
5. Test and align system as required for a complete and operating system as specified herein.

H. Surge Suppression
   1. General
      a. Install surge suppression device on all 120-volt power sources to equipment.
      b. Install surge suppression device on all cable entering and/or leaving a building at terminal board and/or cabinet.
      c. Bond surge and suppression device to building ground system as recommended by manufacturer.
      d. Extreme care is to be taken by contractor to assure a properly surge protected system.
      e. Surge protection equipment must be selected by contractor to match the equipment being protected including wire sizes, operating volts, amps, and circuit impedance.
      f. Installation of surge protection equipment and its grounding must be per manufacturer's recommendations to assure short and proper ground paths.
   2. Equipment Installation
      a. Install surge suppression equipment per manufacturer's recommendation at each wire terminal as indicated elsewhere in these criteria.
      b. Install surge suppression equipment terminal cabinets, etc. as required to facilitate installation of surge protection equipment and terminal points.
      c. Coordinate with Division 26 contractor to assure that surge suppression for 120 VAC power circuit and surge suppression required by this section are installed in same terminal cabinet and bonded together.
   3. Ground Installation
      a. Ground Bus Connections
         i. Provide "local" ground bus in each terminal cabinet housing surge protection equipment (with lugs, etc. as required).
         ii. Bond "local" ground bus to terminal cabinet with minimum #6 copper wire.
         iii. Connect terminal cabinet "local" ground bus to "systems" ground bus installed per Section 26 05 26 with minimum #6 copper insulated wire (unless otherwise noted) in conduit.
         iv. Note that "systems" ground bar is also to be used for power transformation ground (480V to 208V) where applicable.
      b. Surge suppression equipment grounding
         i. Connect each surge suppressor to local ground bus in terminal cabined with wire sized as recommended by manufacturer.
         ii. Coordinate with Section 26 05 26 contractor to assure that 120 VAC power source/supply surge suppressor is also grounded to same local ground bus as surge suppressors provided in these criteria.
      c. Conductors
         i. Bends in excess of 90 degrees in any grounding conductor are not to be permitted.
         ii. Do not bundle unprotected conductors with protected conductors.
         iii. Conductors are to be kept as short as possible.
         iv. Conductors are to be secured at 12" intervals with an accepted copper clamp
         v. Grounding conductors are to be properly connected to the building service ground by accepted clamps.
      d. Grounding Connectors
         i. Connectors, splicers, and other fittings used to interconnect grounding conductors, bond to equipment or grounding bars, are to be accepted by NEC or UL for the purpose.
         ii. All connectors and fittings are to be of the Nicopress crimp or compression set screw type.

iii. Special treatment to fittings lugs, or other connectors of dissimilar materials are to be applied to prevent electro-galvanic action.

4. Isolation of cable shields
   a. Cable shields are to be suitable protected at each outlet to avoid incidental contact with grounded elements of the building structure. Shield continuity is to be maintained throughout the entire cabling system. Referenced to the building ground system is to be at the Systems Equipment Room via the Systems Ground Bus Bar.
   b. Isolation of the shields is to be individually verified by resistance measurements as connections are made.

3.2 DEMONSTRATION

A. The contractor is to prepare and submit a written test plan that will demonstrate the system's operation and critical component operation functionality.
B. Provide systems demonstration.
C. Conduct a walking tour of project and briefly describe function, operation and maintenance of each component.
D. Test and Demonstration:
   1. Testing and demonstration are to be documented for the Engineer and the Owner. Upon completion of this testing cited below, a Document of Certification is to be furnished by the Contractor and signed by the Contractor, Engineer of Record, and the Owner or the Owner's Representative. Three (3) copies of this Certification are to be signed for all parties.
   2. Before project acceptance, conduct the following test and demonstration:
      a. The system is to be tested and demonstrated to operate in accordance with the requirements of these criteria.
      b. Test the performance of the system in the presence of the Electrical Engineer of Record and an authorized representative of the Owner.
      c. Furnish all equipment and personnel required for the tests.

3.3 CATV

SJCSD CATV Headend Recommended Hardware List
Recommended hardware list for SJCSD CATV headends with digital antenna cable signal and TV studio feed combined for internal school broadcast. Does not include coaxial cabling. Does not include distribution needs to classroom.
Replace with current hardware if appropriate.
Last Updated: August 2019.

1	BLO6281	Blonder Tongue AQT8-QAM/IP ATSC/QAM Transcoder 8x8 VSB/QAM inputs, 8XQAM/IP outputs
1	BLO6364	Blonder Tongue SDE-4AV-QAM MPEG-2 SD Encoder 4XAV-1XQA – 1XQAM, 1SASI, 1XGIGE out
1	BLO6364PRO	Blonder Tongue HDE-HVC-PRO
1	BLO5791	Blonder Tongue HPC-8 Headend Passive Combiner
1	BLO1908	Blonder Tongue SCVS-8 Splitter, 8-way L
1	PICTA25	Pico 25db AMP
1	LED-1906HDMTR	Tote Vision 19" LED HD Rackmount monitor w/ tuner
1	PDC-915R-6	Middle Atlantic 9 Outlet 15a Power Distribution
1	ERK-3520LRD	Middle Atlantic Stand-Alone Rack 35RU
5	A200P	AverTV Hybrid TVBox 13
1	J105HI	High Band Antenna
1	WL14-69/S	Antenna, Single UHF Log, CHS 14-69, 11dBi Gain
1	ZHLSJS	ZHLSJ; Band Separator/Combiner; Low & FM/High, Z-Line Series
1	SP250	Site Pro 1 Cantilever Wall Mounts (2 Mounts 2-3/4" Standoff) https://www.sitepro1.com/store/cart.php?m=product_detail&p=684

END OF SECTION

SECTION 27 41 16
INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.
   1. Including but not limited to:
      a. Section Conduit
      b. Section Data Communications Integration Requirements
      c. Section School Intercom System
      d. St Johns County School District – Structured Cabling Standards – V7.

B. Standards - Conform to the requirements of the following:
   1. TIA/EIA-568-B.1 “Commercial Building Telecommunications Cabling Standard”, CSA T529.
   2. TIA/EIA-568-B.2-1 "Transmission Performance Specifications for 4-pair 100Ω Category 6 Cabling".
   3. TIA/EIA-569 “Commercial Building Standard for Telecommunications Pathways and Spaces”, CSA T530.
   4. TIA/EIA-606 “Administration Standard for Telecommunications Infrastructure of Commercial Buildings”, CSA T528.
   5. TIA/EIA-607 “Commercial Building Grounding/Bonding Requirements”.
   6. TSB-67 “Transmission Performance Specification for Field Testing of Unshielded Twisted Pair Cabling Systems”.
   7. TIA/EIA TSB-72 “Centralized Optical Fiber Cabling Guidelines”.
   8. TIA/EIA PN-3398 TSB-75 “Additional Horizontal Cabling Practices for Open Offices”.
   9. ANSI/NFPA 70 National Electrical Code, CSA C22.1.
   10. BICSI Telecommunications Distribution Methods Manuals
   11. BICSI Telecommunications Installation Manuals
   12. County Codes and Regulations.
   13. Underwriters Laboratories (UL)
   14. FCC -Federal Communications Commission
   15. ADA Requirements
   16. Occupational Safety and Health Regulations (OSHA)
   17. National Fire Protection Association (NFPA)
   18. Florida Statutes and Administrative Rules
   19. Cabling System Certified Cabling Catalog
   20. American Society for Testing and Materials (ASTM)
   21. EIA/TIA-492AAAA - Detail Specification for 62.5 Micrometer Core Diameter/125 Micrometer Cladding Diameter Class 1a Multimode, Graded Index Optical Waveguide Fibers.
   22. EIA/TIA TSB-36 - Technical Systems Bulletin, Additional Transmission Specifications for Unshielded Twisted Pair Cables.
   23. EIA/TIA TSB-40-A - Technical Systems Bulletin, Additional Transmission Specifications for Unshielded Twisted Pair Connecting Hardware.
   24. Florida DMS/DOC - General Facility Requirements for Telecommunications Systems
   25. LPC - Lightning Protection Code (NFPA-780).
   26. UL Certified - UL's LAN Cable Certification Program.

27. UL 910 - Test for Flame Propagation and Smoke Density Values for Electrical and Optical Fiber Cables Used in Spaces Transporting Environmental Air.
28. UL 1666 - Test for Flame Propagation Height of Electrical and Optical Fiber Cables Installed Vertically in Shafts.
29. UL 1449, 3rd Edition – Standard for Safety, Transient Voltage Surge Suppressors.
30. UL 497, UL 497A, UL 497B
31. ANSI - American National Standards Institute
32. NEMA - National Electrical Manufacturer's Association
33. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

1.2 PERFORMANCE REQUIREMENTS

A. General: Provide an Audio-Video System for classroom and Extended Learning Area. The system is to provide the delivery of audio/video signals to a wall mounted interactive panel from either a local NTSC HDTV Tuner or an owner supplied computer located in the room. The system will consist of but not limited to the following.
   1. Classroom, Extended Learning Area
      a. Sound reinforcement system
      b. NTSC HDTV Tuner-Owner Provided
      c. Interconnecting cabling ~~and wall interface plates~~
      d. Wireless Display Device – Owner Provided

      Reference - St. Johns County School District Structured Cabling Standards V7.4.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:
   1. The installer is to demonstrate proof of full capability of providing 24-hour service for emergency calls, after-hours service arrangers and provide the telephone number being used for such service.
B. Manufacturers Qualifications
   1. All components supplied are to be from manufacturers having a minimum of three (3) years of documented experience specializing in manufacturing the products required for completion of this project.
C. 90 days prior to Substantial Completion, a meeting shall be called with the approved Integration Contractor, CM, and the Owner for the purpose of verification of the projector selected.

1.4 SUBMITTALS

A. Adherence to Specifications: Manufacturers and/or products are listed in no order of preference and only referenced as acceptable. Single manufacturer names means that no other manufacturer's product is accepted without written approval from St Johns County School District and the Engineer. These manufacturers represent major components and are not intended to be comprehensive. Shop drawings and/or samples for all products not listed must be submitted for approval. Also, an explanation in detail giving the reason(s) why and how the proposed items will meet the specifications and will not be considered an exception and submit adequate information to support this claim. St Johns County School District reserves the right to be the sole judge of what is equal or equivalent. These changes, if approved by the OWNER and the ENGINEER, must be issued in a WRITTEN ADDENDUM not later than seven (7) days prior to bid opening date.

B. Submittals required prior to the commencement of work: Include manufacturer's cut sheets for all proposed equipment including, but not limited to, the following:
   1. Provide a complete listing of all components, materials and services required for a complete and fully operational system. List the manufacturer, model and serial number (by room location), quantity provided, and short description of each item. Include manufacturer's catalog cuts.
   2. Provide product specifications for each component and detail drawings for overall system/subsystem design. Highlight all required features and performance data and clearly indicate any deviations from design criteria, accompanied by an explanation of associated losses in system capability. This information is to include, but not limited to, a full description of any signal limitations.
   3. Provide verification of appropriate required Dealerships, Training Certificates, State of Florida and local Licensing, plus Liability and Worker's Comp Insurance.
   4. Provide details regarding and Conditions or Exceptions, if any, for installer to successfully complete contract within design criteria and price quotation.
   5. At the close of the project turn over to the owner all installation and instruction manuals.

C. As-Built Documentation
   1. Provide as-built documentation in accordance with Division 01.
   2. As part of the "As-Built" documentation provide a list of equipment serial numbers by room number at the completion of the installation.

D. Warranty Requirements:
   1. Refer to Division 01 Section "Warranties".

PART 2- PRODUCTS

2.1 MATERIALS, PRODUCTS, EQUIPMENT, MANUFACTURED UNITS

A. Multi-media Integration System:
   1. The multi-media integration system shall be MS-550 Amplifier as manufactured by Audio Enhancement or owner approved alternate.

B. Miscellaneous:
   1. Cable Marker Labels: All labels are to be machine printed or typed and permanently attached to the cables.
   2. Signal Quality: All system components are to maximize signal quality at the projectors. System designs failing to deliver specified bandwidth to any point of the system will not be acceptable.
   3. Security Fasteners: Provide security-type fasteners for all open area equipment.
   4. Projector Mount Adapter Plate: The PMC 340 Projector Mount Adapter Plate is furnished under this Specification Section; installed (Division 26 to coordinate location with Technology Integrator) under Division 26. Division 26 contractor is to provide enough "slack" in the flex conduit for movement of tile kit one ceiling tile in any direction.
   5. Supplies and Materials: Provide all necessary installation hardware, cabling, connectors, and wall plates with connector interface.

C. Reference - St. Johns County School District Structured Cabling Standards V7.4.

2.2 CAFETORIUM A/V EQUIPMENT

A. Ceiling mounted projector (Owner furnished; Contractor installed.

B. Projector Screen
   1. Motorized screen with switch/lever located behind stage and in sound room
      a. Size:

i. Minimum of 100" H x 160" W
b. Aspect Ratio:
i. Projector screen is 16:10 aspect ratio.
c. Installation:
i. Projection screen is to be recessed ceiling mounted above stage using the manufacturer's ceiling bracket.

C. Inputs
1. 4 HDMI inputs
a. Located in following locations:
i. Centered on stage wall at 16" AFF.
ii. Above counter in sound room.
iii. Behind stage on left and right at 48" AFF.

D. HDMI Switcher
1. Switcher capable of handling 4 inputs and pushing out to the projector.
2. Switcher to be located in cafetorium a/v rack located in sound room.

E. Wall Plate Control Panel
1. Panel to power projector on/off.
2. Control panel to toggle between HDMI inputs
a. Location of Control Panel
i. In location above counter in sound room.

F. All components must incorporate into Cafetorium Sound System.

PART 3 – EXECUTION

3.1 ERECTION TOLERANCES

A. General:
1. Provide and make connections to all specified system equipment as required for a complete and working system.
2. Install all equipment in accordance with manufacturer's instructions.
3. Securely mount equipment plumb and square in place. Where equipment is installed in cabinets, provide mounting bolts in all equipment fastening holes. Mounting bolts are to be provided with nylon washers between bolt heads and equipment.
4. Install all electronic equipment in appropriate equipment cabinets and/or racks.
5. Install equipment ensuring appropriate ventilation to meet manufacturer's requirements.
6. Confirm the polarity and phasing of system components before installation. Connect to maintain uniform polarity and phasing.
7. All wiring is to be free from ground loops, shorts, opens and reversals.
8. Neatly tie all electronic cables within equipment cabinets, housings, and terminal cabinets with nylon cable ties or Velcro fasteners at not more than 12" intervals. Install in accordance with the latest EIA installation standards. FLEXO-WRAP Heavy Wall (HW 1 ½" black) or equal is to be used to bundle cables.

B. T568B wiring pin out configuration is to be used for all jack and patch panel terminations. T568A is to be the standard for Extron PoleVault® System twisted pair wiring ONLY.

C. Plenum Spaces and cable routing: The majority of PDS wiring is installed above ceilings. All communications cabling used throughout is to meet the requirements as outlined in the National Electrical Code (NEC) article 800. In ducted "air return" applications, and cable run in conduit the cable is to bear CMR, MPR or OFNR (RISER) and/or appropriate marking. In non-ducted return air applications or as required by local and/or state code requirements cable is to bear CMP, MPP or OFNP (plenum) markings. Verify with state and local code enforcement officers where plenum and non-plenum cables are required. All cables are to bear the appropriate markings of the environment in which they are installed.
D. Labeling: Provide System cables individually labeled at each end.

3.2 FIELD QUALITY CONTROL

A. Field Testing:
   1. Testing of Wiring Accuracy
      a. Measure and adjust for optimum signal quality and minimum signal loss for all audio, video and ~~RGB~~ signals using appropriate test equipment and standardized testing procedures.
      b. Measure and adjust for optimum signal-to-noise ratio and headroom of the system electronics.
      c. Measure and adjust systems to eliminate clipping, hum, noise, and RFI interference.
      d. Check the quality of each signal at its source and measure against the quality of the signal at various points of its transmission through the system and especially as it is displayed. Correct for any significant signal distortion or loss.
      e. Use appropriate devices and/or test equipment.
   2. Testing and Demonstration
      a. Upon completion of the system installation notify the Owner that the system is ready for testing and demonstration.
         i. At this time, provide all system documentation; also, all Component and System warranties are to be presented to the Owner for prior evaluation. All measurements, test results, instrumentation certifications must also be submitted prior to final testing and demonstration.
         ii. The Owner, at his option, may select a specific time and date suitable to all parties and have a representative in attendance during the final testing and demonstration.
      b. Conduct all tests and demonstrations in the presence of the Owner.
      c. Demonstrate all system functions to perform as specified at each system installation.
      d. Test and demonstrate the systems to equal or exceed the specified system criteria.
      e. Upon request of the Owner, repeat any of the specified system tests at the final testing.
      f. At the end of the testing and demonstration of a system, turn over all equipment cabinet keys and non-installed equipment to the Owner's designated representatives.

3.3 DEMONSTRATION

A. Provide eight hours on-site training sessions and instruction to the Owner's designated representatives in the setup configuration, operation and use of all systems and associated equipment
   1. All instruction and training are to be given after completion of the installation and testing.
   2. The manufacturer shall provide a comprehensive training outline for the Owner & Engineer to review within 90 days of substantial completion.
   3. Arrange instruction and training sessions at the Owner's convenience. A minimum of one training session will be provided.

4. Provide operating and users guides to the Owner's representatives at training session.
5. Training sessions are to be video recorded with master and two (2) copies MPEG 4 format turned over to owner at the completion of the training session.

END OF SECTION

SECTION 27 41 32
LOCAL AREA SOUND SYSTEM – GYMNASIUM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 01, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. This Section includes the following:
   1. The work required under this section shall include all labor, materials, equipment and services necessary for and reasonably incidental to, the furnishing and installation of completely coordinated Gymnasium Sound System as shown on the drawings and specified herein. The system shall be of the distributed type.
   2. All microphones, microphone stands, wire and accessory items to provide a complete and functional system.
   3. Systems shall be completely operable and comply with design objectives. Where a functional specification is listed or where more than one manufacturer is listed, the option to use such equipment provided that all aspects of the specification are met. Where two or more units of the same class of equipment are required, only a single manufacturer is to be used, but individual classes of equipment may be the products of different manufacturers. All equipment must be compatible.
   4. Additional equipment accessories or incidentals required to fulfill the intent of these specifications, whether or not specifically mentioned herein, shall be provided without claim for additional payment, being understood that a complete operational system is required.
   5. All cable shall be installed in conduit unless otherwise noted.

1.3 PROJECT SITE VISITATION

A. Review installation requirements prior to permanently installing equipment and/or making mechanical or electrical connections.
B. Coordinate meeting and requirements to ensure presence of parties concerned.

1.4 SUBMITTALS

A. Product Data: Include the following:
   1. Power amplifiers.
   2. Digital Signal Processor.
   3. Feedback Eliminator.
   4. Microphone and headset.
   5. Mixer(s).
   6. Wireless microphone.
   7. Paging adapter.
   8. Equipment cabinet and rack.

9. CD Player
10. Loudspeakers.
11. Microphone and auxiliary outlets.

B. Shop Drawings:
1. Equipment Details: Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location of each field connection.
2. Included with the Shop Drawings for this Specification Section shall be EASE documentation verifying the proper Loudspeaker placement and aiming as prepared by the successful contractor. EASE documents for Direct and Total Coverage at 4 kHz, 2.5 kHz and 250 Hz shall be provided to show proof of performance. In addition, ALCONS (Intelligibility) Plots shall be provided at 2 kHz.
3. Equipment Details: Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location of each field connection.
4. Wiring Diagrams: Power, signal, and control wiring. Include the following:
a. Identify terminals to facilitate installation, operation, and maintenance.
b. Single-line diagram showing interconnection of components.
c. Cabling diagram showing cable routing.

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

D. Qualification Data: For Installer.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For public address and music equipment to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations: The work of this section to be performed by a contractor actively engaged in the installation and service of these systems for at least 5 years. Proof of such activities including list of installations completed within the last three years shall be furnished with submittal drawings. The contractor shall show satisfactory evidence, upon request, that they maintain a fully equipped service organization capable of furnishing adequate inspection and service to the system, including replacement parts. The contractor shall be prepared to offer a service contract for the maintenance of the system after the guarantee period.

B. The installer shall present proof substantiating their affiliation as an authorized dealer for the products being submitted. The authorized contractor shall produce evidence that they have a fully experienced and established service organization for at least five years and proven satisfactory installations during that time. The authorized distributor/installer shall provide warranty and service work within 4 hours of notification of such requirements.

C. While alternate manufacturers are presented for each device, alternate products submitted to shall be of equal or greater performance to be considered for use on the project. When an alternate device is chosen, the contractor shall complete a "Request for Substitution" form and submit to SJCSD Design Department for acceptance.

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

E. Comply with the following codes and standards:
   1. NFPA 70 (National Electrical Code)
   2. Electronics Industries Association – 160 for Sound Systems
   3. Electronics Industries Association – 299A for Speakers
   4. Electronics Industries Association – 310C for Racks, Panels, and associated equipment.
   5. Underwriters Laboratories – 50 for Enclosures.

1.6 TESTING

A. Provide complete testing equipment recommended by the equipment manufacturer and conduct factory approved load testing and any testing hereinafter specified. Submit three copies of all test procedures and test results for the following:
   1. Provide Impedance readings on the Speaker Circuits after installation is complete. Log this data on the "As Built" Drawings.
   2. Verify any Input or Output cable is free from grounds prior to system initialization and provide a written log of this test.
   3. Perform Real Time Analysis of the Main Loudspeakers after Balancing and Equalization of the system is complete. Provide a color graph showing the results from the Acoustic Coverage Test for 20 Hz to 20 k Hz at five (5) locations in the Auditorium.
   4. Provide printed record of final Digital Signal Processor configuration. In addition, provide a digital record of this configuration along with the manufacturer's installation software for the associated Digital Signal Processor configuration software.

1.7 TRAINING SERVICE

A. Provide minimum of eight hours of classroom instructions for system, not necessarily consecutive time periods. Schedule times with Owner's authorized representative.

1.8 PROJECT CONDITIONS

A. Provide products that are suitable for the environment which they are intended to be installed. Comply with all manufacturer's ambient temperature adjustment factors and installation requirements.

1.9 COORDINATION

A. Coordinate installation of all equipment, devices, conduit, wiring, supports, etc. with all project conditions.

PART 2 – PRODUCTS

2.1 MIXER (Rack)

A. Number of inputs: 8 Channels.
B. Number of outputs: 1 channel Main selectable to Microphone Level / 1 Channel Aux
C. Rack mount bracket.
D. Line/Mic input with screw terminal connection. 4 priority level muting. Provide one for each mic/line input. Design selection Bogen MIC1S and TBL1S as shown.

E. Provide separately mounted voice activated relay to provide mute contact from sensing the intercom system. Provide in NEMA 1 enclosure. Provide power supply for card as required. Design selection: Bogen VAR1 w/ PRs40C.
F. Frequency Response: 20 Hz to 20,000 Hz +/- 1 dB.
G. Crosstalk: better than -90 dB.
H. Compression Threshold Adjustment Range: +/- 20dB.
I. Compressor Ratio Adjustment Range: 0 to 100 Percent.
J. Maximum Voltage Gain: 96 dB.
K. Design Selection:
    1. Bogen VMIX.
    2. Equal by TOA or BIAMP Systems

2.2 GYMNASIUM MIXER (Portable Rack)

A. Number of inputs: 8 Channels.
B. Number of outputs: 1 channel Main selectable to Microphone Level / 1 Channel Aux
C. Rack mount bracket.
D. Frequency Response: 20 Hz to 20,000 Hz +/- 1 dB.
E. Crosstalk: better than -90 dB.
F. Compression Threshold Adjustment Range: +/- 20dB.
G. Compressor Ratio Adjustment Range: 0 to 100 Percent.
H. Maximum Voltage Gain: 96 Db.
I. Design Selection:
    1. Bogen CAM8Pro.
    2. Equal by Shure or BIAMP Systems

2.3 GYMNASIUM FEEDBACK ELIMINATOR FOR MIXING CONSOLES "M" BUSS

A. Number of Channels: 1 channel.
B. Number of Filters: 12 per channel.
C. Frequency Response: 20 to 20,000 Hz.
D. THD: .005% at 1 kHz.
E. Dynamic Range: > 105 dB.
F. Design Selection:
    1. Sabine Inc. FBX1200
    2. Equals by DBX Professional Products or Architectural Acoustics.

2.4 GYMNASIUM DIGITAL SIGNAL PROCESSOR

A. Number of Inputs: 2 Channels.
B. Number of Outputs: 4 Channels.
C. Frequency Response: 20 Hz to 20,000 Hz +/- .5 dB.
D. Signal to Noise: Greater than 90 dBu.
E. THD + N: Less than .009%.
F. Max Delay: 1356 ms.
G. Filters: 12 Band per Channel.
H. Amplifier Sense Returns Required.
I. Design Selection:
    1. Apogee Sound International DLC24

2. Equal by BSS Audio or Architectural Acoustics

2.5 GYMNASIUM POWER AMPLIFIER

A. Features: Dual Channel Amplifier with MOSFET technology, rear panel level controls, advanced clip eliminator and adjustable speed cooling fans.
B. Frequency Response: 20 to 20,000 Hz (+/- 1 dB).
C. THD: .1 % at rated frequency response.
D. Controls: Rear Level Adjustment, Subsonic Filter, Stereo/Bridge control.
E. Power at rated Frequency Response with associated Total Harmonic Distortion
   1. Bleachers: 635 Watts RMS at 4 Ohms.
F. Design Selection:
   1. Apogee Sound International CA-4000 Bleacher Loudspeaker Amplifier
   2. Equal by QSC Audio or Crown International

2.6 GYMNASIUM BLEACHER LOUDSPEAKERS

A. Speaker Size and Type: One 12" Permanent Magnet Cone-type Low Frequency Driver treated with Ferrofluid and One 1.75" Voice Coil with 1" Exit Horn Loaded Compression Driver treated with Ferrofluid with a 90 Degree X 45 Degree Dispersion.
B. Power Rating: 200 Watts Continuous/800 Watts Peak.
C. Frequency Response: 58 Hz – 20kHz (+/- 3dB).
D. Speaker Impedance: 8 ohms.
E. Sensitivity: 99 dB at 1 meter at 1-watt input.
F. Design Selection:
   1. Apogee Sound International AFI-4W
   2. Equal by JBL Professional or Community Professional Loudspeakers.

2.7 GYMNASIUM WIRELESS MICROPHONE / HEADSET (Qty 2)

A. Frequency Response: 50 to 15,000 Hz +/- 2 dB.
B. RF Sensitivity: <2.5µV -105 dBm for 12 dB SINAD, typical.
C. Switchable Frequencies: 960.
D. Frequency Range: 470-494, 494-518, 518-542, 472-596, 638-662, 702-726, 794-806, 800-820, 838-865, 806-810 and 740-752 MHz.
E. Antenna Impedance: 50 ohms.
F. Image Rejection: >70dB.
G. THD: .5% Typical.
H. Microphone: Cardioid Dynamic Handheld Microphone.
I. Antenna Splitter: Provide as shown on the project drawings.
J. Design Selection:
   1. Shure SLX24/SM58 (qty. 2)
   2. Equal by Sennheiser Electronic Corporation or Telex Communications.

2.8 GYMNASIUM CD PLAYER

A. Compatibility: CD-R/RW with MP3 Playback.
B. Frequency Response: 20 to 20,000 Hz.
C. THD: .007%.

D. Channel Separation: 90 dB or more.
E. Design Selection:
    1. Denon DN-C615
    2. Equal by Sony or Tascam.

2.9 GYMNASIUM SCHOOL INTERCOM INTERFACE

A. Description: Interface to receive signal from the 25 Volt Intercom system to trigger a relay to mute the sound system.
B. Design Selection:
    1. Bogen VAR1 with matching power supply
    2. Equals by Radion Design Lab or Biamp Systems.

2.10 GYMNASIUM EQUIPMENT HOUSINGS

A. Main Equipment Rack:
    1. Construction: 16 Gauge Steel
    2. Mounting Rails: 11 Gauge Steel
    3. Size: 21 RU with 20 in. Usable Depth
    4. Included Accessories: associated vent panels, blank panels and drawers shown.
    5. Design Selection:
        a. Middle Atlantic DWR 21-22
        b. Equal by Lowell Manufacturing or Atlas Sound.
B. Main Equipment Rack Accessories:
    1. Sequential Power Control
        a. Timing Selections: Six (6)
        b. Intervals: 1, 3 or 6 second
        c. Indicators: Front Panel Digital AC Mains Voltage and Current Meter
        d. Design Selection:
            i. Atlas Sound ECS-6RM with ECS-KSW6 Key Switch
            ii. Equal by Lowell Manufacturing or Middle Atlantic Products
    2. Power Control Modules
        a. Power Rating: 20 Amp Power Conditioner and Spike Suppressor
        b. Mounting: Mounted in Cabinet
        c. Quantity: As required by current draw of equipment in cabinet
        d. Design Selection:
            i. Atlas Sound ECM-20SH
            ii. Equal by Lowell Manufacturing or Middle Atlantic Products
    3. Temperature Control
        a. Mounting: Provide Equipment Cabinet Manufacturers Fan Kit
        b. Accessories: Include thermostat control
        c. Design Selection:
            i. Middle Atlantic DWR-FK22 with FC-4-1C Fan Thermostat
            ii. Equal by Lowell Manufacturing or Atlas Sound.
C. Portable Equipment Rack
    1. Construction: Lightweight polyethylene
    2. Mounting Hardware: Front and Rear Rack Rails
    3. Transportable: Included Recessed Wheels and Pull Out Handle
    4. Design Selection:

a. Gator Cases GRR-8L
b. Equal by SKB Cases or Anvil

2.11 GYMNASIUM WALL MICROPHONE OUTLETS

A. Switchcraft D3F connector mounted on a stainless steel plate or accepted equivalent.
B. Design Selection:
   1. Radio Design Lab DS-J1
   2. Equal By Pro Co Sound or Whirlwind.

2.12 GYMNASIUM WALL AUXILIARY OUTLETS

A. Construction: RCA and 1/8" Stereo connector mounted on a stainless-steel plate or accepted equivalent.
B. Design Selection:
   1. Radio Design Lab DS-CIJ3
   2. Equal by Pro Co Sound or Whirlwind.

3.1 PA SYSTEM FOR PE SHELTER

A. This list contains main components for the P.A. system for the Courtyard and PE Shelter:
   1. One (1) Gator CRC-BASE-10 10RU Portable Rack.
   2. One (1) Atlas AP-S16 Power Distribution Panel.
   3. One (1) Bogen M600 2-Channel, 600 watts per channel power amplifier.
   4. One (1) Bogen VMIX Power Vector Mixer.
   5. Two (2) Bogen MIC1S Mic Input Module.
   6. One (1) Bogen SAX1R Stereo Aux Module.
   7. One (1) Bogen PEQ1R Parametric Equalizer Output Module.
   8. One (1) Bogen DCM290P 5-disc CD player w/MP3.
   9. Two (2) Bogen UDMS16HH Wireless Handheld Mics.
   10. Two (2) Apogee AMT-15 Loudspeakers.
   11. Two (2) Apogee ATS70GB Speaker Stands.
   12. Two (2) Bogen SF4 Mic Stands.

3.2 FM ASSISTIVE LISTENING SYSTEM (Permanent)

A. Provide Telex ST-300 Transmitter with 30 dB gain, 58 dB S/N, 120 volt ac, 60 Hz electrical input with switchable audio input microphone, line and 70 v line with attenuator, single transmitting channel selected from any one of sixteen frequencies: Telex ST-300 with rack mount kit RM-S ½ wave antenna HGA-1 and wall plaque WP-1. Provide Remote Antennas and Extension Cables for locations as shown on the drawings or as required to cover the space and manufacturers recommended surge protection.
B. Provide quantity of Telex SR400 17 Channel Receivers with volume control, on/off switch, external jack for audio out and charger, receiving frequency to match transmitting frequency to meet ADA requirements. <2% distortion. S/N >60dB. Provide with rechargeable NiCad batteries. Telex SR 400. Provide Telex NL-4S Neck Loop Assemblies for the quantity of Hearing Aid compatible indicated and Telex SEB-1 Earbuds for the remaining quantities or receivers as indicated in the chart below and as based upon the occupancy of the space.

Capacity of Seating in Assembly Area	Minimum Number of Required Receivers	Minimum Number of Required Receivers Required to be Hearing-aid Compatible
50 or less	2	2
51 to 200	2, plus 1 per 25 seats over 50 seats[1]	2
201 to 500	2, plus 1 per 25 seats over 50 seats[1]	1 per 4 receivers[1]
501 to 1000	20, plus 1 per 33 seats over 500 seats[1]	1 per 4 receivers[1]
1001 to 2000	35, plus 1 per 50 seats over 1000 seats[1]	1 per 4 receivers[1]
2001 and over	55 plus 1 per 100 seats over 2000 seats[1]	1 per 4 receivers[1]

[1] or fraction thereof

C. Provide quantity of Telex BC-100 Battery Chargers to support 50% of the receivers at a given time.

3.3 SYSTEM ACCESSORIES

A. The following system accessories shall be provided new and in unopened cartons to the Owner:
   1. Dynamic hand-held CARDIOID microphones with stand adapter equal to Shure SM-58S (2 ea.).
   2. Telescoping microphone stands equal to Atlas MS-12CE (2 ea.).
   3. Twenty-five-foot and fifty-foot microphone cables, male connector one end, female connector opposite end. Cable equal to Belden 8412, connectors equal to Switchcraft A3 series (2 ea.).

3.4 SYSTEM WIRING

A. Microphone/Input circuits – shielded – twisted pair 22 (7x30) .135" OD 200 Volts West Penn No. 452.
B. Speaker circuits 8 ohm – 2 conductor – twisted pair 12 (19x25) .269" OD 300 Volts West Penn No. 227.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wiring Method: Install wiring in raceways. Make final connections to the amplifier with non-metallic fitting to isolate any building noise from the amplifier. Transition to non-metallic conduit for the last 6" if non-metallic fitting is not available.
B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess. Use lacing bars in cabinets.
C. Control-Circuit Wiring: Install number and size of conductors as recommended by system manufacturer for control functions indicated.
D. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.
E. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

F. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.
G. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.
H. Wall-Mounting Outlets: Flush mounted.
I. Conductor Sizing: Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than No. 12 AWG and conductors from microphone receptacles to amplifiers not smaller than No. 22 AWG.
J. Weatherproof Equipment: For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.
K. Speaker-Line Matching Transformer Connections: Make initial connections using tap settings indicated on Drawings.
L. Connect wiring according to Division 26 Section "Conductors and Cables."

3.2 GROUNDING

A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.
C. Install grounding electrodes as specified in Division 26 Section "Grounding and Bonding."

3.3 IDENTIFICATION

A. Install permanent typed labels on all cables and wiring to identify input, output, zone, and speaker numbers.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
B. Perform the following field tests and inspections and prepare test reports:
    1. Schedule tests with at least seven days' advance notice of test performance.
    2. After installing public address and music equipment and after electrical circuitry has been energized, test for compliance with requirements.
    3. Operational Test: Perform tests that include originating program and page messages at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and that system is free of noise and distortion.
    4. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:
        a. Disconnect microphone at connector or jack closest to it and replace it in the circuit with a signal generator using a 1000-Hz signal. Replace all other microphones at corresponding connectors with dummy loads, each equal in impedance to microphone it replaces. Measure signal-to-noise ratio.
        b. Repeat test for each separately controlled zone of loudspeakers.
        c. Minimum acceptance ratio is 50 dB.

5. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 50, 200, 400, 1000, 3000, 8000, and 12,000 Hz into each preamplifier channel. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 3 percent total harmonics.
6. Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each zone. For spaces with seated audiences, maximum permissible variation in level is plus or minus 2 dB. In addition, the levels between locations in the same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.
7. Power Output Test: Measure electrical power output of each power amplifier at normal gain settings of 50, 1000, and 12,000 Hz. Maximum variation in power output at these frequencies must not exceed plus or minus 1 dB.
8. Signal Ground Test: Measure and report ground resistance at public address equipment signal ground. Comply with testing requirements specified in Division 26 Section "Grounding and Bonding."

C. Retesting: Correct deficiencies, revising tap settings of speaker-line matching transformers where necessary to optimize volume and uniformity of sound levels, and retest. Prepare a written record of tests.
D. Inspection: Verify that units and controls are properly labeled, and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.
E. The system shall be guaranteed for a period of one year from date of final acceptance.

3.5 STARTUP SERVICE

A. Delete first paragraph below if factory-authorized service representative is not required.
B. Engage a factory-authorized service representative to perform startup service.
C. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.
D. Complete installation and startup check according to manufacturer's written instructions.

3.6 ADJUSTING

A. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.
B. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain public address and music equipment. Refer to Division 1 Section "Demonstration and Training."
B. The Owner shall be furnished with four brochures that provide written operating instructions for the system, wiring diagrams and maintenance notes.

END OF SECTION

SECTION 27 41 33
LOCAL AREA SOUND SYSTEM – MULTI-PURPOSE/STUDENT DINING AND P.E. PAVILION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

A. This Section includes the following:
   1. The work required under this section shall include all labor, materials, equipment and services necessary for and reasonably incidental to, the furnishing and installation of completely coordinated Portable Sound System as shown on the drawings and specified herein. The system shall be of the distributed type.
   2. All microphones, microphone stands, wire and accessory items to provide a complete and functional system.
   3. Systems shall be completely operable and comply with design objectives. Where a functional specification is listed or where more than one manufacturer is listed, the option to use such equipment provided that all aspects of the specification are met. Where two or more units of the same class of equipment are required, only a single manufacturer is to be used, but individual classes of equipment may be the products of different manufacturers. All equipment must be compatible.
   4. Additional equipment accessories or incidentals required to fulfill the intent of these specifications, whether or not specifically mentioned herein, shall be provided without claim for additional payment, being understood that a complete operational system is required.
   5. All cable shall be installed in conduit unless otherwise noted.
B. The sound system for the cafeteria, and the gym must be designed separately for each of the three spaces since each is different in size, volume, and use.
C. Sound system must fully integrate with full A/V system – mounted projector

1.3 PROJECT SITE VISITATION

A. Review installation requirements prior to permanently installing equipment and/or making mechanical or electrical connections.
B. Coordinate meeting and requirements to ensure presence of parties concerned.

1.4 SUBMITTALS

A. Product Data: Include the following:
   1. Power amplifiers.
   2. Digital Signal Processor.
   3. Microphone and stand.
   4. Wireless microphone.
   5. Paging adapter.

6. Equipment cabinet and rack.
7. CD Player
8. Loudspeakers.
9. Microphone and Microphone/Monitor outlets.
10. Custom Multi-Circuit Cables (Snakes).
11. Mixing console.

B. Shop Drawings:
   1. Equipment Details: Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location of each field connection.
   2. Included with the Shop Drawings for this Specification Section shall be EASE documentation verifying the proper Loudspeaker placement and aiming as prepared by the successful contractor. EASE documents for Direct and Total Coverage at 4 kHz, 2.5 kHz and 250 Hz shall be provided to show proof of performance. In addition, ALCONS (Intelligibility) Plots shall be provided at 2 kHz.
   3. Wiring Diagrams: Power, signal, and control wiring. Include the following:
      a. Identify terminals to facilitate installation, operation, and maintenance.
      b. Single-line diagram showing interconnection of components.
      c. Cabling diagram showing cable routing.

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

D. Qualification Data: For Installer.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For public address and music equipment to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations: The work of this section to be performed by a contractor actively engaged in the installation and service of these systems for at least 10 years. Proof of such activities including list of installations completed within the last three years shall be furnished with submittal drawings. The contractor shall show satisfactory evidence, upon request, that they maintain a fully equipped service organization capable of furnishing adequate inspection and service to the system, including replacement parts. The contractor shall be prepared to offer a service contract for the maintenance of the system after the guarantee period.

B. The installer shall present proof substantiating their affiliation as an authorized dealer for the products being submitted. The authorized contractor shall produce evidence that they have a fully experienced and established service organization for at least five years and proven satisfactory installations during that time. The authorized contractor shall provide warranty and service work within 4 hours of notification of such requirements.

C. While alternate manufacturers are presented for each device, alternate products submitted to shall be of equal or greater performance to be considered for use on the project. When an alternate device is chosen, the contractor shall complete a "Request for Substitution" form and submit per Division 01.

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

E. Comply with the following codes and standards:
   1. NFPA 70 (National Electrical Code)
   2. Electronics Industries Association – 160 for Sound Systems
   3. Electronics Industries Association – 299A for Speakers
   4. Electronics Industries Association – 310C for Racks, Panels, and associated equipment.
   5. Underwriters Laboratories – 50 for Enclosures.

1.6 TESTING

A. Provide complete testing equipment recommended by the equipment manufacturer and conduct factory approved load testing and any testing hereinafter specified. Submit three copies of all test procedures and test results for the following:
   1. Provide Impedance readings on the Speaker Circuits after installation is complete. Log this data on the "As Build" Drawings.
   2. Verify any Input or Output cable is free from grounds prior to system initialization and provide a written log of this test.
   3. Perform Real Time Analysis of the Main Loudspeakers after Balancing and Equalization of the system is complete. Provide a color graph showing the results from the Acoustic Coverage Test for 20 Hz to 20 k Hz at five (5) locations in the Multipurpose Room.
   4. Provide printed record of final Digital Signal Processor configuration. In addition, provide a digital record of this configuration along with the manufacturer's installation software for the associated Digital Signal Processor configuration software.

1.7 TRAINING SERVICE

A. Provide minimum of eight hours of classroom instructions for system, not necessarily consecutive time periods. Schedule times with Owner's authorized representative.

1.8 PROJECT CONDITIONS

A. Provide products that are suitable for the environment which they are intended to be installed. Comply with all manufacturer's ambient temperature adjustment factors and installation requirements.

1.9 COORDINATION

A. Coordinate installation of all equipment, devices, conduit, wiring, supports, etc. with all project conditions.

PART 2 – PRODUCTS

2.1 PERFORMANCE MIXING CONSOLE

A. Number of mic/line inputs: 16 channels (balanced XLR and ¼" phone jacks)
B. Number of outputs: 3 main (LRM) and 6 Aux Sends
C. Frequency Response: 20 to 50,000 Hz
D. THD: <.003%
E. Phantom power: + 48 VDC
F. Channel Equalizer: 4 Band, 2 Sweep EQ

G. Faders: 100 mm
H. Balanced Outputs: Main Outputs and first four Aux sends equipped with true balance option
I. Design Selection:
    1. Allen and Heath WZ3 16:2
    2. Equal by Soundcraft, Studer or Midas.

2.2 GENERAL USE MIXER

A. Number of mic/line inputs: 6 Balanced ¼" and XLR
B. Number of outputs: 3 main (LRM) and Aux
C. Frequency Response: 20 Hz to 20 k Hz
D. THD: < .05% @ +4 dBu
E. Phantom Power: +48 VDC
F. Channel Equalizer: 2 Band on each Input
G. Balance Outputs: Pseudo Balanced on L, R and Transformer Balanced on Mono Output
H. Design Selection:
    1. Ashly MX-406
    2. Equal by Soundcraft, Studor or Midas.

2.3 DIGITAL SIGNAL PROCESSOR

A. Number of Inputs: 3 channels
B. Number of Outputs: 6 Channels
C. Frequency Response: 20 to 20, 000 Hz +/- .1 dB
D. Connectors: XLR
E. Maximum Input Level: + 20 dBu
F. Input Impedance: 10 k Ohms
G. Digital Sampling: 40 bit 96 kHz
H. Dynamic Range: >115 dB (unweighted 20 Hz to 20 kHz)
I. Output Impedance: 50 ohms
J. Maximum Output Level: +20 dBu
K. Connector DB9F and 10/100 Ethernet Port
L. Design Selection
    1. Sabine NAV360-ER-U
    2. Equal by BSS Sound or BIAMP Systems

2.4 POWER AMPLIFIERS

A. Features: Dual Channel Amplifier, front panel level controls, advanced clip eliminator and adjustable speed cooling fans.
B. Frequency Response: 20 to 20,000 Hz (+/- 1 dB)
C. THD: .02 % at rated frequency response
D. Controls: Front Level Adjustment, Low Frequency Filter, Stereo/Bridge control
E. Design Selection:
    1. QSC Audio Products, LLC RMX4050HD Main Loudspeaker Amplifier (1)
    2. QSC Audio Products, LLC RMX1850HD Delay Amplifier (1)
    3. Equals by Crown Audio, Inc. or Apogee Sound International.

2.5 LOUDSPEAKERS MAIN (QTY 2)

A. Speaker Size and Type: One 15" Permanent Magnet Cone-type Low Frequency Driver treated with Ferrofluid and One 3" Voice Coil with 2" Exit Horn-loaded Compression Driver treated with Ferrofluid with a 90 Degree X 40 Degree Dispersion.
B. Power Rating: 400 Watts Continuous/1600 Watts Peak
C. Frequency Response: 46Hz – 20 kHz (+/-3dB)
D. Speaker Impedance: 8 ohms
E. Sensitivity: 98 dB at 1 meter with 1-watt input
F. Mounts: Manufactures recommended Yoke Mounting Accessory
G. Design Selection:
    1. Apogee Sound International AFI-8W.
    2. Equal by JBL Professional or Renkus-Heinz.

2.6 DELAY LOUDSPEAKERS (QTY 2)

A. Speaker Size and Type: One 8" Permanent Magnet Cone-Type Low Frequency Driver treated with a Waterproofing Compound, One 6.5" Permanent Magnet Cone-Type Mid Frequency Driver treated with a Waterproofing Compound and one 1.5" Voice Coil, 1" exit horn-loaded compression driver treated with Ferrofluid.
B. Power Rating: 225 Watts Continuous/900 Watts Peak
C. Frequency Response: 62 Hz – 20kHz (+/- 3dB)
D. Speaker Impedance: 8 ohms
E. Sensitivity: 94 dB at 1 meter at 1-watt input
F. Design Selection:
    1. Apogee Sound International AFI-WA
    2. Equal by JBL Professional or Renkus-Heinz.

2.7 PORTABLE MONITOR LOUDSPEAKERS (QTY 2)

A. Speaker size and type: One 15: Differential Drive low frequency driver and one 1" Throat Diameter compression driver.
B. Power Rating: 450 Watts/900 Peak
C. Frequency Response: 42 Hz – 18 kHz (+/- 3 dB)
D. Inputs: Line Level and Microphone Input Compatibility
E. Design Selection:
    1. JB: EON 515
    2. Equal by Mackie or DAS Audio.

2.8 HANDHELD WIRELESS MICROPHONE TRANSMITTER SUPER-CARDIOID AND RACK MOUNTABLE RECEIVER (QTY 3)

A. Frequency Response: 50 to 15,000 Hz +/- 2 dB.
B. RF Sensitivity: <2.5µV -105 dBm for 12 dB SINAD, typical.
C. Switchable Frequencies: 960.
D. Frequency Range: 470-494, 494-518, 518-542, 472-596, 638-662, 702-726, 794-806, 800-820, 838-865, 806-810 and 740-752 MHz.
E. Antenna Impedance: 50 ohms.
F. Image Rejection: >70dB.

G. THD: .5% Typical.
H. Microphone: Cardioid Dynamic Handheld Microphone.
I. Design Selection:
    1. Shure SLX24/SM58
    2. Equal by Sennheiser Electronic Corporation or Telex Communications.

2.9 WIRELESS MICROPHONE RACK MOUNTABLE RECEIVER ANTENNA SPLITTER AND REMOTE ANTENNA (QTY 1 ANTENNA SPLITTERS WITH 2 ANTENNA)

A. Antenna Distribution as manufactured by the Wireless Microphone system manufacturer.
B. Design Selection:
    1. Shure UA844SWB with UA-820 Antennas
    2. Equal by Sennheiser Electronic Corporation or Telex Communications

2.10 WALL MICROPHONE OUTLETS / CUSTOM MULTI-CIRCUIT CABLES (SNAKES) / MONITOR PLATES

A. Microphone/Monitor Plates
    1. Quantity: Locations as shown on the project drawings
    2. Connection: Neutrik D Series Black Female Connector for Microphone Connections
    3. Connector: Locking Neutrik ¼" TRS on Monitor Connections
    4. Material: Anodized Aluminum (Black or Clear as chosen by owner)
    5. Labeling: Engraved labeling.
B. Booth Mounted Mixer Custom Multi-Circuit Cables with Matching Interface Plate
    1. Quantity: Number of Inputs and Devices as shown on the drawings
    2. Length: Length of each snake as shown on the drawings or 50 Feet Minimum
    3. Labeling on Plate: Engraved or Silk Screened
    4. Labeling on Snake: Shrink Labeled to match input plate location and numerical sequence for output connections
    5. Connectors: Neutrik N Series Nickel Male Connector for Microphone Connections and Amphenol M Series for TRS connections.
C. Design Selection:
    1. Custom Plate/Snakes by Pro Co Sound, Inc.
    2. Equal by RCI Custom Products or Whirlwind

2.11 FM ASSISTIVE LISTENING SYSTEM (Permanent)

A. Provide Telex ST-300 Transmitter with 30 dB gain, 58 dB S/N, 120 volt ac, 60 Hz electrical input with switchable audio input microphone, line and 70 v line with attenuator, single transmitting channel selected from any one of sixteen frequencies: Telex ST-300 with rack mount kit RM-S ½ wave antenna HGA-1 and wall plaque WP-1. Provide Remote Antennas and Extension Cables for locations as shown on the drawings or as required to cover the space and manufacturers recommended surge protection.
B. Provide quantity of Telex SR400 17 Channel Receivers with volume control, on/off switch, external jack for audio out and charger, receiving frequency to match transmitting frequency to meet ADA requirements. <2% distortion. S/N >60dB. Provide with rechargeable NiCad batteries. Telex SR 400. Provide Telex NL-4S Neck Loop Assemblies for the quantity of Hearing Aid compatible indicated and Telex SEB-1 Earbuds for the remaining quantities or receivers as indicated in the chart below and as based upon the occupancy of the space.

Capacity of Seating in Assembly Area	Minimum Number of Required Receivers	Minimum Number of Required Receivers Required to be Hearing-aid Compatible
50 or less	2	2
51 to 200	2, plus 1 per 25 seats over 50 seats[1]	2
201 to 500	2, plus 1 per 25 seats over 50 seats[1]	1 per 4 receivers[1]
501 to 1000	20, plus 1 per 33 seats over 500 seats[1]	1 per 4 receivers[1]
1001 to 2000	35, plus 1 per 50 seats over 1000 seats[1]	1 per 4 receivers[1]
2001 and over	55 plus 1 per 100 seats over 2000 seats[1]	1 per 4 receivers[1]

[1] or fraction thereof

C. Provide quantity of Telex BC-100 Battery Chargers to support 50% of the receivers at a given time.

2.12 CD PLAYER

A. Frequency Response: 20 to 20 K Hz
B. S/N Ratio: 107 dB
C. Channel Separation 90 dB
D. Compatibility: CD-R/RW Playback Compatibility
E. Outputs: Headphone, Coaxial RCA, and Analog
F. Pitch Control: +/- 12%
G. Playback: MP3
H. Design Selection:
    1. Denon DN-C615
    2. Equals by Sony or Tascam.

2.13 SCHOOL INTERCOM INTERFACE

A. Description: Interface to receive signal from the 25 Volt Intercom systems and trigger a relay to mute the sound system.
B. Design Selection:
    1. Bogen VAR1 with matching power supply
    2. Equals by Radio Design Lab or BIAMP Systems

2.14 EQUIPMENT HOUSINGS

A. Equipment Rack
    1. Construction: 16 ga. Welded frame
    2. Mounting Rails: 11 ga. CRS adjustable
    3. Size: 24 RU 23 ½" in. usable depth
    4. Included accessories: vent panels, Bland Panels and Front Door
    5. Design Selection:

a. Atlas Sound WMA24-23 with SFD24
b. Equal by Lowell Manufacturing or Middle Atlantic Products

B. Rack Accessories:
1. Sequential Power Control
a. Timing Sections: Six (6)
b. Intervals: 1, 3 or 6 second
c. Indicators: Front Panel Digital AC Mains Voltage and Current Meter
d. Design Selection:
i. Atlas Sound ECS-6RM with ECS-KSW6 Key Switch
ii. Equal by Lowell Manufacturing or Middle Atlantic Products
2. Power Control Modules (Quantity 3)
a. Power Rating: 20 Amp Power Conditioner and Spike Suppressor for all Equipment accept Digital Signal Processor and amplifier supporting Rear Delayed Loudspeakers.
b. Power Rating: 15 Amp Power Conditioner and Spike Suppressor for Digital Signal Processor
i. Wire Fire Alarm Form C Relay and Intercom Relay to disable during Alarm or Intercom Event
c. Power Rating: 15 Amp Power Conditioner and Spike Suppressor with Key Switch for disabling the amplifier supporting the Rear Delayed Loudspeakers when not required.
d. Quantity: As required by current draw of equipment in cabinet
e. Design Selection:
i. Atlas Sound ECM-20SH/ECM-15SH
ii. Equal by Lowell Manufacturing or Middle Atlantic Products

2.15 SYSTEM ACCESSORIES

A. The following system accessories shall be provided new and in unopened cartons to the Owner:
1. Dynamic hand-held CARDIOID microphones with stand adapter equal to Shure SM58S (4 ea.).
2. Telescoping microphone stands equal to Atlas MS-12CE (4 ea.).
3. Twenty-five-foot microphone cables, male connector one end, female connector opposite end. Cable equal to Belden 8412, connectors equal to Switchcraft A3 series (6 ea.).
4. Fifty-foot microphone cables, male connector one end, female connector opposite end. Cable equal to Belden 8412, connectors equal to Switchcraft A3 series (4 ea.).
5. Dual ear covering, sealed, supra-aural, stereo, dynamic headphones equal to AKG Model K77 (1 ea.)

2.16 SYSTEM WIRING

A. Microphone/Input circuits – shielded – twisted pair 22 (7x30) .135" OD 200 Volts West Penn No. 452.
B. Speaker circuits 8 ohm – 2 conductor – twisted pair 12 (19x25) .269" OD 300 Volts West Penn No. 227.

PART 3- EXECUTION

3.1 INSTALLATION

A. Wiring Method: Install wiring in raceways. Make final connections to the amplifier with non-metallic fitting to isolate any building noise from the amplifier. Transition to non-metallic conduit for the last 6” if non-metallic fitting is not available.
B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess. Use manufactures recommended harnesses in cabinets.
C. Control-Circuit Wiring: Install number and size of conductors as recommended by system manufacturer for control functions indicated.
D. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.
E. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
F. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.
G. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.
H. Wall-Mounting Outlets: Flush mounted.
I. Conductor Sizing: Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than No. 12 AWG and conductors from microphone receptacles to amplifiers not smaller than No. 22 AWG.
J. Weatherproof Equipment: For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.
K. Speaker-Line Matching Transformer Connections: Make initial connections using tap settings indicated on Drawings.
L. Connect wiring according to Section Building Wire and Cable.

3.2 GROUNDING

A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.
C. Install grounding electrodes as specified in Section Grounding and Bonding.

3.3 IDENTIFICATION

A. Install permanent typed labels on all cables and wiring to identify input, output, zone and speaker numbers.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
B. Retain one of three paragraphs below.
C. Perform the following field tests and inspections and prepare test reports:
   1. Schedule tests with at least seven days' advance notice of test performance.
   2. After installing public address and music equipment and after electrical circuitry has been energized, test for compliance with requirements.
   3. Operational Test: Perform tests that include originating program and page messages at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and that system is free of noise and distortion.
   4. Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each zone. For spaces with seated audiences, maximum permissible variation in level is plus or minus 2 dB. In addition, the levels between locations in the same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.
   5. Power Output Test: Measure electrical power output of each power amplifier at normal gain settings of 1,000 Hz.
   6. Signal Ground Test: Measure and report ground resistance at public address equipment signal ground. Comply with testing requirements specified in Section Grounding and Bonding.
   7. Retesting: Correct deficiencies, revising tap settings of speaker-line matching transformers where necessary to optimize volume and uniformity of sound levels, and retest. Prepare a written record of tests.
   8. Inspection: Verify that units and controls are properly labeled, and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.
   9. The system shall be guaranteed for a period of one year from date of final acceptance.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
B. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.
C. Complete installation and startup check according to manufacturer's written instructions.

3.6 ADJUSTING

A. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.
B. Occupancy Adjustments: When requested within 12 months of date of Final Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain public address and music equipment. See paragraph 1.7.A above.
B. The Owner shall be furnished with four (4) brochures that provide written operating instructions for the system, wiring diagrams and maintenance notes.

END OF SECTION

SECTION 27 51 16
INTERCOM SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION

A. The requirements of the contract documents, including the General and Supplementary General Conditions and Division 1 - General Requirements shall apply to the work of this section.
B. At the time of proposal, any exceptions taken to these specifications, all variances from these specifications and all substitutions of operating capabilities or equipment called for in these specifications shall be listed in writing and forwarded to the Architect / Engineer. Any such exception, variances or substitutions which were not listed at the time of bid and are identified in the submittal, shall be grounds for immediate disapproval without comment.

1.2 SCOPE OF WORK

A. The work covered by this section of the specifications shall include all material, labor, wiring, hardware, software, firmware, and programming to install a complete and operating system as described herein and shown on the drawings. It shall be complete with all necessary materials, labor, hardware, software, firmware, and programming specifically tailored for this installation. It shall be possible to permanently modify the software on site by using a system administrator software network interface.
B. The intent of this specification is to maximize communications between the classroom and administrative areas utilizing VoIP Technology while enhancing school safety and reducing maintenance, operational, and installation cost. Additionally, this specification provides for a teacher discreet personal alert system integrated into the classroom microphone and must be a fully managed and complete system from a single manufacturer.
C. Provide a combined educational presentation system, consisting of a classroom sound amplification system (CSAS), teacher discreet personal alert system. Each system shown in the plans, in classrooms or any teaching station shown, is a complete distinct and individual system as specified herein.
D. Under this specification, the system shall provide a complete VoIP Communication System for the Administrative, Classroom, Cafeteria, Library, Common, and Recreational areas as indicated on the drawings.
E. The Communication System shall provide VoIP distribution of intercom, overhead paging, emergency paging, class change time tones, emergency tones and program material.
F. Any and all miscellaneous materials, labor, hardware, software, firmware, and programming that is not listed in this specification section that is required to provide a complete and operating system shall be provided as part of the scope of work for this installation.
G. The work covered by this section of the specifications shall be coordinated with any and all trades that are affected by the installation of this system. All work is to be complete and as required and specified elsewhere under these project specifications.
H. Qualified respondents must submit proof of certification and qualifications, including personnel resumes, and copies of relevant certificates. Required Certifications to be considered:
    1. SAFE System Certified Installer
    2. SAFARI Montage Installer Certification
    3. SAFARI Montage Certified Instructional Trainer
    4. RCDD
    5. CTS
    6. VIEWpath Certified Installer.

I. All of the actual required system components and cabling are not shown or specified as this varies between acceptable manufacturers and suppliers. It shall be the responsibility of the contractor to obtain this information from the acceptable supplier and or manufacturer and include cost of same in his bid.

1.3 APPLICABLE CODES AND STANDARDS

A. All devices of the system as necessary shall be listed by UL (Underwriters Laboratory). All components of the system shall bear the UL label.
B. The system shall be installed in strict accordance with all the requirements of the National Electric Code.
C. The system shall be installed in strict accordance with the requirements of the Americans with Disabilities Act (ADA).
D. The system shall be installed in strict accordance with the requirements of all other applicable codes as well as all Federal, State, and local codes.

1.4 RELATED DOCUMENTS

A. Secure any and all required permits and approvals prior to installation.
B. Inclusions
   1. The provisions of the Conformed General Conditions and Special Conditions and the Sections included under Division 01 - General Requirements, are included as a part of this Section as though bound herein.
C. Drawings
   1. The Drawings prepared for this Project are an outline to show where apparatus must go in order to harmonize with the building and installations of the various trades. Work must be installed in accordance with the Drawings insofar as possible. Drawings shall be carefully checked during the course of bidding and construction. If discrepancies, errors, or omissions are discovered prior to or during the construction phase, the contractor is responsible to notify the Architect immediately for interpretation or correction. The contractor is responsible for taking necessary measurements, including clearances for equipment that is to be furnished. The Architect/Engineer shall reserve the right to make minor location changes of equipment where such adjustments are deemed desirable from an appearance or operational standpoint. Such changes will be anticipated sufficiently in advance to avoid extra work or unduly delay progress on the Project.

1.5 RELATED WORK

A. The contractor shall coordinate work in this section with all related trades that the system affects or integrates with. Work and / or equipment provided in other sections and related to the system shall include, but not be limited to the following:
   1. Section 01 11 00 - Summary of Work.
   2. The provisions of the General Conditions, Supplementary Conditions, and Sections included under Division 27 00 00 - Technology General Requirements.
   3. Refer to Audio/Video Control E4.4X detail drawings on the electrical plans' sheets for additional information and installation requirements.
   4. Section 07 84 00 - Firestopping.
   5. Section 01 25 00 - Substitution Procedures.

B. Submittals: Furnish to the Architect/Engineer complete equipment submittal technical specification sheets and shop drawing submittals in .pdf format for this system including but not limited to the following:
   1. A material list with the quantity of each piece of equipment, names of manufacturers, model numbers and the technical data information on all equipment the contractor proposes to install. This material list is to be broken out and listed by Specification Section, per piece of equipment. If a piece of equipment is needed but not listed in this specification section, it shall be listed in the area of the submittal it pertains to. The technical information is to be a piece of the manufacturers printed literature that is produced by the equipment manufacturer. Internet web page listings will not be accepted. Provide a description of any special installation procedures that will differ from what is specified or shown on drawings.
   2. Complete system circuit diagrams of the entire system, point to point on scaled floor plans scaled to match that of the scale of the project documents. The shop drawings are required to clearly illustrate how all components relate to each other and how they interconnect to each other. A complete point to point wiring diagram of any and all panels and how they interconnect with all the components and or devices that are part of the system as well as any ancillary devices that are being provided by other trades. All cable runs are to be shown on the shop drawing submittals. Cable tags shown on the shop drawing submittals shall correspond with cable tags that are located inside equipment enclosures as well as documented on the as-built drawings. The shop drawing submittals shall include scaled drawings of all racks, panels, consoles, and special assemblies. The shop drawing submittals shall include all circuit numbers for all cables and terminal connections as well as how they are labeled. Each drawing shall have a descriptive title and all subparts of each drawing shall be completely described. All drawings shall have the name of the project, Architect / Engineer and contractor in the title block. The floor plans, room names and numbers for the submittal drawings are to match that of the project documents. The symbols used on the submittal drawings are to match that of the project documents. The only information to be shown on the submittal drawings for this Specification Section is information that pertains to the system that is being submitted on.
   3. Provide a custom detailed description of the operation of the submitted system for this particular installation and a statement listing every technical and operational parameter wherein the submitted equipment varies from what was originally specified. If the submitter fails to list a particular variance and his submittal is accepted; but subsequently, deemed to be unsatisfactory because of the unlisted variance, the submitter must replace or modify such equipment at once without cost to the Owner. A letter or certificate from the manufacturer stating that the system contractor is an authorized distributor and installer of the submitted equipment shall be supplied.
   4. The contractor shall be responsible for providing to the Architect / Engineer any and all additional information required and as deemed necessary by the Architect / Engineer for submittal and shop drawing submittal review.

1.6 QUALITY ASSURANCE

A. This specification section shall be a one (1) manufacturer responsibility or as specified herein with no exceptions. Any variances to this specification item shall be submitted to the Architect / Engineer ten (10) working days prior to proposal for review by the Architect / Engineer. The equipment manufacturer for this specification section to have been in business and manufacturing the specified equipment for a minimum of ten (10) years.

B. The contractor must be the factory authorized and factory certified distributor and installer of the equipment to be provided for this specification section. The installation contractor's factory certification is to be submitted to the Architect / Engineer as part of the contractor's subcontractor and material list at the time of the bid as well as with the shop drawing submittal.
C. The contract for the systems described herein will be assigned to the general contractor for the building construction. The intercommunication system contractor shall coordinate all work and work sequencing with the general contractor.
D. Owner and Architect / Engineer Inspections: The Owners technology staff and Architect / Engineer will provide advising as requested. The Owners technology staff will inspect the project as the work progresses. Prior to final acceptance of the work, the Contractor shall make arrangements with the appropriate authorized Owner personnel to inspect the construction areas, both to ensure satisfactory completion of the work and to ensure complete cleanup and restoration of areas affected by the work. Temporary protection, coverings, and structures shall be removed at or before time of inspection.

1.7 CIRCUITING GUIDELINES

A. All wiring shall be listed for the intended purpose. The cabling shall be Cat. 6 minimum for all connections from the IDF to the classroom and or zone origination point. All classrooms shall be homerun to each local IDF that serves that area. There shall be no cabling required from the IDF to the MDF as this is accomplished through the shared or dedicated network devices and infrastructure. All interior wiring shall be in accordance with construction guidelines suggested by the Manufacturer, including the speaker and the call-in switch.
B. The Integrated classroom amplifier and Paging/Intercom shall provide connection for a talkback microphone in the room and call-in switch in each classroom location. This device shall allow the teacher to easily initiate an intercom call through the VOIP system.
C. Each office / administrative space to have a dedicated intercom paging circuit or network connection to the intercom paging system head-end equipment or remote network intercom expander to provide 2-way communications from the administrative console (s) or building telephone system handset to each office / administrative space individually.
D. Each corridor / common space (cafeteria, gymnasium, auditorium, etc.) to have dedicated speaker circuits to the intercom paging system head-end or remote network intercom expander to provide 1-way communications from the administrative console (s) or building telephone system handset to each corridor / common space individually.
E. Each paging horn to have dedicated speaker circuit to the intercom paging system head-end or remote network intercom expander to provide 1-way communications from the administrative console (s) or building telephone system handset to each paging horn individually.
F. All wiring shall be in accordance with the Manufacturer's specifications.

1.8 SEQUENCE OF OPERATIONS

A. The ability to be distributed via a fiber 10/100/1000mB switched, VLAN enabled network or 10/100/1000mB switched stand-alone intercom network. It shall be possible to eliminate the need for copper feeder cables between the Main and Intermediate distribution frames through the use of fiber optics.
B. Shall have SIP Integration to connect all talk-paths to the VoIP phone system of choice. This integration shall give the phone system vendor the option of utilizing their existing VOIP console, or any other VOIP system, including hosted VOIP systems to manage the 2-way communications to the classrooms.
C. Direct dialed, two-way communication from all administrative telephones to any location equipped with a talkback speaker or audio system with room microphone.

D. Automatic or manual gain control on intercom speech to assure constant talkback speech level.
E. System shall interface with any VoIP telephone system, utilizing SIP integration thus allowing the school (s) to upgrade or replace their telephone system without suffering a requirement to replace, or lose any feature of, their internal communications (intercom) system. Any system that limits system features based upon any selected telephone system and is not SIP interfaced shall not be acceptable.
F. Automatically sound a tone or play a pre-page WAV file over any loudspeaker connected for two-way communication to alert the classroom teacher that this 2-way call has been established. This is intended to prevent unauthorized monitoring.
G. Distribution of emergency announcement (s) from any authorized telephone to all areas furnished with a loudspeaker. Emergency announcements shall have the highest system priority.
H. Distribution of general announcements from any administrative telephone, staff telephone, or classroom telephone. The system shall be capable of providing all-call, group call, or multiple group call groups.
I. Classroom speakers or audio systems with room microphone shall be software assignable to any or all paging groups.
J. Provide the ability to define and archive up to 99-time tone schedules with up to two hundred fifty-five (255) events per schedule. Each scheduled event shall be capable of controlling any one of six (6) internal tones; user selected custom audio/voice phrases, audio from any of three (3) auxiliary sources or up to forty (40) relays for building control. Each scheduled audio event shall be distributable to any audio groups. Schedule administration, modification and creation functions must be available through administration PC software and web access on remote computers and mobile devices.
K. Provide 1-, 2-, 3- or 4-digit numbering plan, thus allowing the classroom speaker and the classroom telephone to be the same architectural number.
L. The WAV or MP3 files shall be activated via the administration software, telephone and / or telephone system and / or pushbuttons.
M. The WAV or MP3 files shall have the ability to be broadcast via a schedule for any day of the week or time of the day. They shall also have the ability to be broadcast for any duration of time and repeat number of plays with the ability to select how long the duration is between each repeated broadcast.
N. The WAV or MP3 files shall also have the ability to be a part of the class change tones within the system. These files shall be able to replace any tone within the class change schedules as to offer the flexibility of customizable tones and or phrases in this class change mode.
O. The WAV or MP3 files shall be programmable as to replace the hands-free alert tone, repeated alert tone, or the all-call alert tones.
P. All admin access path ports shall be integrated via SIP protocol. This integration shall be seamless and easy to meet all standards as set forth in SIP type interfacing. The VoIP Phone System Call Manager shall be used to manage these ports for control and management thus reducing moves, adds, and change costs.
Q. System shall have the capability of distributing audible pages as well as tones (emergency, class change, etc.) generated from the intercom system through the VoIP classroom telephones with the classroom telephones being grouped in with the intercom system paging groups / zones.
R. It shall be possible without the cost of additional hardware/software to incorporate a LAN / WAN district wide paging system by means of the built in VoIP district Paging Adapter or district software. This adapter shall give the district the ability to page each school independently, as a group of schools, or all schools.
S. Work Included

1. The Work covered under this Section of the specifications consists of furnishing all labor, equipment, supplies and materials, and in performing all operations as necessary for the fully complete installation of the A/V control system in accordance with the Specifications and the accompanying Drawings, except as specifically noted otherwise.
2. The Work shall include, but not be limited to, the following:
   a. Furnish and install conductors and cables as specified.
   b. Furnish and install enclosures as specified.
   c. Furnish and install A/V control equipment as specified.
   d. Furnish, install, and terminate copper cabling as required and specified.
   e. Furnish and install connectors (terminate cable) as specified.

T. Refer to the electrical drawings for room locations and installation details.

1.9 WARRANTY

A. The manufacturer and installation contractor shall guarantee the system, equipment and all its components for a minimum of one (1) year from date of final acceptance of the system as documented by the Architect/Engineer. This guarantee shall cover the replacement of all parts and labor to replace the same made necessary by normal usage and wear.

B. Upon completion of the installation of the system, the contractor shall provide to the Architect / Engineer and Owner a signed written statement, on company letterhead, substantially in form as follows: "The undersigned, having engaged as the Intercom paging system contractor for the Marilyn Moore Middle School building project confirms that the system was installed in accordance with the wiring diagrams, instructions and directions provided by the manufacturer."

C. Contractor shall repair, adjust, and/or replace, whichever the Owner and or Architect / Engineer determines to be in its best interests, any defective equipment, materials, or workmanship, as well as such parts of the work damaged or destroyed by such defect, during warranty period, at the contractor's sole cost and expense.

D. In the event that any of the equipment specified, supplied, and/or installed as part of the work should fail to produce capacities or meet design specification as published or warranted by the manufacturer of the equipment involved or as specified in this document, the contractor shall, in conjunction with the equipment manufacturer, remove and replace such equipment with equipment that will meet requirements without additional cost to the Owner.

1.10 INSTALLING CONTRACTOR QUALIFICATIONS

A. Installing contractor must have a minimum of three (3) years previous experience installing complete audio and video systems and be certified by the equipment manufacturer so as to be capable of providing a certified, warrantable system.

B. Full-time regular employees of the successful, pre-qualified technology Contractor must perform all Work on this Project. In the event a subcontractor is used/required for any part of the Project, the subcontractor shall also be a pre-qualified technology Contractor.

1.11 TRAINING AND INSTRUCTION FOR OWNER MAINTENANCE

A. A training program including a minimum of four (4) hours on the use of the system will be provided to the Owner to use at their discretion. A full and complete overview of the system will be included in this training as well as any literature required by the Owner to allow complete and total use of the system by the Owner's designated staff. System maintenance requirements for the equipment will also be documented and turned over to the Owner. This training will be recorded and archived in CD/DVD format and turned over to the Owner for archiving purposes. The Contractor will provide any required materials and staff to record the training.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The following manufacturers are approved to submit proposals for this project:
   1. Audio Enhancement.

2.2 FUNCTIONAL REQUIREMENTS

A. To provide the Owner with the maximum flexibility, this Specification is intended to be a performance specification built around specific equipment, wiring infrastructure. These components will hereafter be referred to as the Audio/Video Control System.
B. The equipment and cabling portion of this System (equipment and cabling) shall be certified by the manufacturer for no less than three (3) years for performance, materials, and workmanship. Rapid Run Cables or equivalent are required to come with a Life Time warranty against manufacturing defects. Cables are to be plenum rated as required. Contractors are to supply systems that meet or exceed the functional requirements herein. The Contractor shall guarantee all other system components, not included in the Manufacturer three (3) year warranty and labor required to meet the Scope of Work defined in this specification for a period of two (2) years after final acceptance by the Owner. This guarantee shall cover the replacement of all parts and labor to replace same made necessary by normal usage and wear.
C. When installing the Audio/Video Control System, the Contractor shall install the MS550 Amplifier in a 2 x 2 ceiling plenum enclosure such as a Premier GB-AVSTOR3 on shelf above interactive panel. In all cases, the Contractor responsible for the work included in Section 27 41 16.51 shall cooperate with the Contractor responsible for the work included in the Data/Telephone Premise Wiring System Specification Section to resolve all issues of availability. of, and access to, the multi-use ceiling mounted enclosure without causing impact to the project schedule or adding cost to the project. The General Contractor, Electrical Contractor, Data/Telephone Low Voltage Contractor and all other subcontractors shall work to ensure that the multi-use ceiling mounted enclosure and associated data cable are installed and available to the Contractor responsible for the work included in Section 27 41 16.51 when that work is scheduled to be performed.
D. The A/V System Distribution Cable shall be installed in a continuous path between the A/V Wall Plates and the Short Throw Projector. Easy disconnect points shall be provided at the wall plate and the projector so that alternate configurations of wall plates or flying leads can be installed or replaced at any time. The control system shall NOT require that the A/V System Distribution Cable be routed to the Multi Use Ceiling Mounted Enclosure.
E. The A/V System Distribution Cable shall be labeled at both ends in such a way as to identify the location of the termination within the room (wall, casework, floorbox, etc.).

F. The Speaker Cable shall be labeled at both ends in such a way as to identify the location of the speaker within the room (Two Speaker Left / Right; Four Speaker - Left-Front, Left-Rear, Right-Front, Right-Rear).

G. The Audio/Video Control System shall be fully functional thirty (30) days prior to the substantial completion of the construction Project. A Proof of Performance Test shall be performed prior to acceptance of the System and shall include audio and video testing of selected classrooms, conference rooms and any other locations where an Audio/Video Control System has been installed.

2.3 EQUIPMENT

A. Intercom Paging System:
   1. Shall be SIP Integrated to the VoIP telephone system.
   2. Shall utilize a shared data network (VLAN enabled) or dedicated network as means of distribution for all voice overhead paging, emergency paging, emergency tones, intercom, and class change tones.
   3. Shall be capable of accessing remote classrooms (trailers, temporary classrooms etc.) via IP Talkback Speakers or room audio system with room microphone. This shall provide intercom, class change tones, emergency tones, and normal / emergency paging via a wireless or wired network to these remote locations.
   4. Exterior speakers shall be capable of being on separate zones and programmed separately.
   5. Provide pre-alert tone to classroom for intercom calls and general announcements.
   6. Ability to produce user defined tone signals for time tones or emergency tones.
   7. Ability to control wireless or wired clocks provided by others.
   8. Ability to sync system time to the local network NTP time server
   9. Ability to select the tone on an all-call basis from any, or selected, administrative telephones.
   10. Provide an Ethernet port, which will give ability to monitor operations and functions of the systems.
   11. Provide web-based off-site programming and diagnostics of the system. It shall also be capable of determining basic circuit faults.
   12. The system shall be capable of simultaneous conversations between administrative ports.
   13. The system shall have a Windows® based PC administration programming tool which allows the administrative personnel to easily manage Audio Sources, Class Change schedules, paging groups, time updates, holiday schedules and day/night mode operation from their desktop PC. Systems that require propriety consoles, special LCD displays or solely utilize DTMF for changes to perform these functions shall not be acceptable.
   14. System shall provide calendar-based scheduling up to one year in advance.
   15. The system shall be programmable via Ethernet or direct COM port cable connection.
   16. The system shall provide 2-way handsfree communication in each classroom.
   17. Provide call confirmation tone at speaker when an intercom call is placed.
   18. The system can automatically broadcast page emergency instructions throughout an entire school when an alarm (e.g., lockdown, lockout, security, fire) is tripped or manually activated. The emergency instructions are preprogrammed and require no user intervention. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.
   19. The platform shall provide the ability to initiate school safety paging announcements, evacuation tones and take cover tones from any telephone within the facility or outside the facility to any other location within the facility or district.

20. IP-enabled two-way voice communication shall be available from any provided telephone or administrative console through any speaker in the system. This shall allow hands-free communication to any classroom or any individual loudspeaker unit. A programmable pre-announce tone shall sound immediately before the intercom path is opened and a supervisory tone shall continue to sound at regular intervals when speaker monitoring is active, complying fully with all privacy legislation. Pre announce tone and supervisory tones shall be disabled during designated emergencies automatically.
21. Provide Emergency Override On Board Voice Messaging.

B. Intercom Paging System Equipment Rack:
1. Middle Atlantic ERK-4425 or equal.

C. Intercom Paging System Expansion:
1. Expansion of the intercom system shall be capable of expanding utilizing standard network hardware. Any system that requires proprietary expanders or proprietary switches shall not be considered.

D. Intercom Paging System Power Supply:
1. Power shall be supplied through the standard shared network data switches. Systems that require a separate power supply for the paging system hardware shall not be considered.

E. Intercom Paging System On-Line UPS Battery Back-Up System:
1. UPS system to provide a minimum of one (1) hour of battery backup.

F. Intercom Paging System Administrative Console: (Audio Enhancement SAFE Commander Software)
1. The administrative console shall be capable of operating on a standard windows environment and shall be able to run on a physical or virtual machine.
2. The administrative virtual console is to be customizable, flexible and provide full access to the intercom paging system.
3. The administrative console shall be available via a software console, or web-based console
4. The administrative console shall be capable of being any administrative computer.
5. Functionality to provide full access to all features such as all call, paging groups, emergency tones, control music, WAV file distribution, test rooms, crisis mode, schedules, etc.

G. Intercom Paging System Push to Talk Microphone – Admin Office
1. Provide a Push to Talk Microphone with Network Interface at the administrative office.
2. Push to Talk Microphone Network Interface shall be Audio Enhancement MS-250.

2.4 COMPONENTS

A. Intercom Paging System Standard / Emergency Call-In Switch with Volume Control:
1. The "Normal" call switch shall be a momentary pushbutton style switch with an accommodation to prevent accidental activation.
2. The unit shall be compatible with single gang electrical boxes.

B. Common Area Zones
1. Provide 1 Network Interface for each common area zone defined on the drawings. Common area zone network interface shall be Audio Enhancement MS250 – no substitutions
2. Provide a 70 Volt amplifier and appropriate number and style of speakers to adequately cover each common area zone as defined by the drawings.

C. Intercom Paging System Ceiling Speaker. Speaker Style shall be appropriate to the manufacturer selected. Speaker specifications:
1. Provide complete distributed ceiling mounted speaker system (Metal back box, speaker, grill, etc.). number as required (minimum 4, no cluster) with performance and safety features as follows:

a. Frequency Range: 70 Hz to 15 kHz (-10dB)
b. Frequency Resp: 100 Hz to 14 kHz +/- 3dB
c. Power Handling: 50 Watts continuous
d. Driver type: 4 in. (102 mm) Cone
e. System type: Tuned and vented
f. Sensitivity: 88 dB 1 Watt/1 Meter.
g. Impedance: 8 Ohms nominal
h. Mounting: Integrated C-Clamp
i. Plenum rating: Speaker back can meet UL2043 criteria for plenum installation
j. Terminals: All metal spring terminals
k. Dimensions: Depth 5.8 in. (147.3 mm)
l. Grill Diameter: 8.5 in. Dia. (216 mm)
m. Mounting hole: 7.0 in. (178 mm)
n. Weight: 3.0 lbs. (1.36kg)

D. Intercom Paging System Surface Ceiling Speaker:
1. The ceiling flush mounted speaker shall consist of speaker, volume settings and round grille.
2. The speaker assembly, housing and hardware shall be electrically and acoustically matched for a frequency response of 60 Hz to 12 kHz.
3. The speaker element shall be cone type with 5 oz (142 g) ceramic magnet.
4. Diameter of speaker cone shall be 8.0" (20.32cm) with 2.0" (5.08 cm) whizzer cone.
5. Voice coil diameter shall be .75" (1.91 cm).
6. The grille shall be constructed of steel, finished in semi-gloss white enamel.
7. Maximum dimensions of the grille shall be: 13.0" (33.02 cm) diameter x 3.0" (7.62 cm) deep.
8. Shipping weight shall be approximately 3.75 lbs (1.7 kg).

E. Intercom Paging System Surface Wall Speaker:
1. Wall speaker shall consist of a speaker, volume settings and sloped baffle.
2. The speaker, housing and hardware shall be electrically and acoustically matched for a frequency response of 60 Hz to 12 kHz.
3. The speaker shall be 8" (20.32 cm) in diameter and have a ceramic magnet weighing 5 ounces.
4. The voice coil shall be .75" (1.91 cm) in diameter.
5. Voice coil impedance shall be 45 ohm.
6. Operating temperature shall be -20 to + 55 °C (-40 to + 131 °F).
7. The baffle shall be constructed of gray painted steel with a black cloth grille.
8. Maximum dimensions of the housing shall be 10.13" (25.73 cm) H x 12.31" (31.27 cm) W x 4.63" (11.75 cm) D.
9. Approximate weight is 4.25 lbs (1.91 kg).

F. Intercom Paging System Paging Horn:
1. Shall a weather-resistant, high efficiency reentrant type horn speaker.
2. Shall be equipped with an amplifier and externally accessible volume control.
3. Shall include an adjustable swivel base.
4. The frequency response shall by 275 Hz to 14 kHz.
5. Dispersion shall be 90° horizontal and 90° vertical.
6. Sound pressure level shall be 121 dB measured at 4 feet (1.22 m) on axis with an input to the amplifier module being -10 dBm at 1 kHz.
7. Distortion shall be less than 2.0% at rated output of 15 watts RMS.
8. Input impedance shall be 600 ohms nominal.
9. The amplifier shall operate on a -24 Vdc nominal, positive ground power supply.
10. Operating current shall be 900 mA at -24 Vdc

11. Operating temperature shall be -4 to 131 °F (-20 to 55 °C).
12. Operating humidity shall be 0-95% noncondensing.
13. Dimension of the horn shall be 8" (20.3 cm) W x 8" (20.3 cm) H x 9:" (22.9 cm) D.
14. Weight shall be approximately 4.0 lbs (1.8 kg).

G. Safe System & Network Paging Interface - (Audio Enhancement, MS250):
   1. Provide a Network Interface with performance as follows:
      a. Full Duplex, Hands Free communications on Intercom Call
      b. Amplifier powered only by the POE power source for emergency paging applications
      c. Mounting Bracket as required
      d. Connections – The following connections must be available:
         i. 2 Line Output – 1 Terminal Block, 1 - 3.5mm Jack
         ii. 2 External I/O Connections – Terminal Block
         iii. RJ45 for POE Network Connection
      e. 1 speaker connection
         i. The system must provide a speaker connection which is powered exclusively by the POE power from the network
      f. Network Connection
         i. The system must have a network connection with POE power.
         ii. POE must be present on the system in order to provide power for the amplifier during a power emergency
      g. Integrated Network Based Communications
         i. The System must support the following protocols:
            1) Directed UDP
            2) Unicast Audio
            3) Multi-Cast Audio
            4) SIP
      h. The system must have integrated SIP communications and be able to communication bi-directionally with any VOIP communications system that follows the standard SIP protocols.
      i. The system shall also have the ability to operate with multi-cast IP messages as well.

H. Classroom Sound Reinforcement System: (Audio Enhancement MS550 System – No Substitutions)
   1. A classroom sound reinforcement system shall be installed in all areas of the building as shown on the drawings and as listed in the specifications.
   2. Classroom sound reinforcement system shall be fully interfaced to the intercom paging system.
   3. The output of the intercom paging system shall directly interface to the classroom sound reinforcement system.
   4. The sound reinforcement system shall be capable of integration with the facility intercom/paging system. This integration must allow the wireless microphone to place a call-in to the facility communication system. All sound reinforcement systems must allow the facility intercom/paging system to directly mute them. The Receiver Module must have the capability to sense a paging signal from the facility communications system. When a page has been sensed, the classroom sound system must mute local audio to facilitate hearing the facility page. The sound reinforcement systems must be equipped to allow the installer to choose either a signal (e.g. page to classroom) based classroom sound reinforcement system override or a settable 5~30 second timer-based classroom sound reinforcement system override.

5. This integration shall give positive control when interfaced to the classroom sound reinforcement system within the system as to cut off or duck all sources within the classroom when an intercom or page announcement is made from anywhere within the school.
6. The intercom paging system speakers have the option of being part of the speakers utilized for the classroom sound reinforcement system.
7. The intercom paging system speakers may be connected to receive audio from any of the in-room sources or only receive audio from the intercom paging system.
8. The classroom sound reinforcement system shall be either in-wall or shelf mounted anywhere within the classroom.
9. The infrared sensor shall be capable of being mounted directly to the speaker utilizing Cat. 5/5e/6/6e cable.
10. Each microphone input shall have a carrier detect indicator to verify the input is active.
11. The microphone inputs shall have class of service programming as to allow ducking or cut off when an all call or emergency page is detected from the intercom paging system.
12. The classroom sound reinforcement system shall have a low level output to connect to self-amplified speakers or other audio equipment if needed. This output shall have a volume control.
13. The classroom sound reinforcement system shall have an emergency cut-off input that when interfaced to the fire alarm relay contact output shall silence all audio devices within the room in the event of a fire as to help lower the overall decibels levels to help the students and staff hear the audible fire alarm tones / instructions within that room.
14. The classroom sound reinforcement system shall be capable with interfacing to future classroom cameras to capture lesson video and audio together on one recording.
15. The Wireless Microphone shall provide a button to mute the classroom sound system. The Wireless Microphone must be capable of adjusting the volume of external audio sources that are connected to the Main Control Unit. The Wireless Microphone must be powered by a single rechargeable battery. The Wireless Microphone must be able to operate for up to a typical eight (8) hour workday on a single charge.
16. Each classroom sound reinforcement system shall include but not limited to the following components:
    a. Infrared receiver / amplifier
    b. Two (2) wireless microphones with rechargeable NiMH or LiON batteries
    c. Four (4) ceiling speaker
17. CLASSROOM SOUND AMPLIFICATION SYSTEM (CSAS) EQUIPMENT:
    1. AMPLIFIER - Audio Enhancement MS550 Amplifier:
        a. Provide a Receiver/Amplifier with ability to provide functions described above with performance as follows:
            i. Audio Power: 16 watts RMS per channel on mains powered amplifier
            ii. 1% percent THD across full frequency range of amplifier.
            iii. Frequency Response: 40 Hz to 20 kHz
            iv. Power Requirements: 24VDC 2.5 Amp
            v. Signal-to-noise: >65dB
            vi. Integrated mounting tabs
            vii. Certified for installation directly in Plenum Spaces.
        b. Controls:
            i. The primary control of the system must be done through the teacher microphone.
            ii. The following functions must be available via USB connection for setup during installation.
                1) Input Control for multi-media sources and mixed IR sources
                2) Equalizer Controls

3) Discreet Output volume controls for each input

c. RS-232 Control
   i. Provide RS-232 control of the amplifier, and an additional RS-232 port which provides pass through control of a downstream device such as a projector
   ii. RS-232 processor must be capable of differentiating between commands destined for the amplifier, and responding to those commands, and commands intended for the downstream and passing those commands through to the secondary RS-232 port
   iii. Command passes through must be bi-directional

d. Connections – The following connections must be available:
   i. 4 Multi-Media inputs
   ii. Dedicated Line output – for Assistive Listening Device Connection
   iii. 2 independent speaker connections

2. INTEGRATED INFRARED SENSOR / RECEIVER – IR SATELLITE:
   a. The Integrated Infrared Sensor/Receiver will be an independent system, with all necessary electronics to support the infrared receiving functionality mounted in the ceiling. The sensor/receiver will be connected to the amplifier through a universal twisted pair cable, using balanced audio connections. Power for the infrared sensor receiver will be provided through the same cable as the balanced audio connections.
   b. The sensor receiver will provide the following functionality. These features must be included on board the sensor/receiver, and not require any external support to perform these functions.
      i. Dual Channel Infrared reception
      ii. Auxiliary Input
      iii. Remote control of both infrared channels, and the auxiliary input from the teacher microphone
      iv. Public address system mute terminals – This is a contact closure connection when closed, it mutes the audio output from the sensor/receiver
   c. Advanced Feedback Blocker
      i. The system shall have the ability to actively control feedback. This shall be done via an analog circuit that provides up to five active filters to control specific frequencies,
      ii. The Feedback Blocker shall also have the ability to lower the overall of the system by up to 6dB, during a user error situation where the overall system gain is manually turned up too high
      iii. The Feedback Blocker system shall automatically remove the filtering upon resolution of the user-initiated error condition
      iv. The Feedback Blocker shall be of an analog design – in order to avoid the detrimental effects of digital sampling, only analog systems shall be considered in order to implement this feature.
   d. Audio Output
      i. The system shall have the ability to provide both 3 independent audio signals (Ch 1, Ch 2, and Aux) or with the change of a DIP switch, provide a mixed signal.
      ii. The system shall provide an audible tone when the remote volume control on the teacher microphone is used. It will also provide a low & high output level, and an on/off selection via a DIP switch setting
      iii. The system shall have the capability of attenuating its output level by -10 dB with a DIP switch setting
   e. Emergency Alert Contacts
      i. The system shall provide a trigger signal when the teacher presses and holds a button on her transmitter for more than 2 seconds.

ii. The system shall be capable of providing a visual indication of 3 red LED's when the teacher initiates a trigger signal
iii. The system shall also be capable of receiving a trigger acknowledgement signal back from an external source and altering the visual indicator from 3 red LED's to 2 Green and 1 red LED.

f. Control System Integration
i. The system shall have on board the capability of being controlled via RS-232 protocol.
ii. The system shall also have the capability of broadcasting RS-232 commands when the teacher presses the up/down volume controls on their microphone
iii. Power Requirements: 24Vdc, Power Supplied from the amplifier.
iv. Receiving Frequencies: 2 selectable frequencies: 2.3 MHz and 2.8 MHz.
v. Receiver Type: Tuned Radio Frequency (TRF)
vi. Signal-to-noise: >80Db.

3. External Sensor(s}
a. The system must be capable of operating in a standard classroom without the addition of any external sensors
b. For larger spaces, the system must be capable of support up to 4 additional infrared sensors
i. Mounting Bracket as required
ii. Controls: System must have available the following controls
iii. Channel 1 Volume Control – Fully controllable from the teacher microphone remotely through the Infrared system
iv. Channel 2 Volume Control – Fully controllable from the teacher microphone remotely through the Infrared system
v. Auxiliary Input Volume Control – Fully controllable from the teacher microphone remotely through the Infrared system

4. 4-Channel Body Pack Transmitter (Audio Enhancement Infrared Enhanced Teardrop Microphone):
a. Provide a 4-channel body pack transmitter with performance as follows:
i. Sub-carrier frequencies: 4 selectable frequencies from 2.00 MHz to 4.00 MHz
ii. Audio distortion: <1.0% (±40kHz deviation @ 1kHz)
iii. Integrated microphone.
iv. Internal charger circuit.
v. Built-in infrared emitters.
vi. Power button functionality
1) Power on – turns the microphone on when microphone is off, and button is pressed
2) Mute – mutes the microphone when pressed and released once microphone is turned on
3) Power Off – push and hold to turn power off
4) Function (F) Button Features
5) F2 Functionality – Provides security alert when button is pressed and held for more than 2 seconds
6) F1 Functionality – Provides simple logic signal on F1 terminals on the back of the Satellite
vii. External Inputs
viii. Provide an input for an external microphone
ix. Provide an input for a stereo auxiliary input (Mixed to Mono in microphone)

x. Microphone Element – The teacher microphone shall utilize a 10mm microphone element to insure optimum frequency response and maximum pickup of teacher's voice.
xi. Power 1 - "AA" NiMH Batteries (Systems using 2 batteries will not be considered)
xii. Provide remote volume control for the system from the teacher's transmitter
xiii. Volume control via the infrared wireless microphone system to allow the teachers to remotely adjust their own volume level.
xiv. Volume control for the other channel from the teacher's microphone
xv. Volume control for the auxiliary inputs
xvi. 'F' (Function) Button – Provide remote control functionality that allows for enabling additional multi-use functions from the teacher microphone.

b. Smart Sensor Charging Circuit
i. Charging circuitry in microphone must have the ability to sense what type of battery has been placed in the microphone. The charging circuitry must also carefully manage the charge and dis-charge cycles of the batteries to maximize battery life.
ii. A system that simply senses voltage present on a 3rd contract is not acceptable; the charging circuitry must be able to distinguish between NiMH, NiCD and Alkaline batteries.

5. 4-channel handheld transmitter (Audio Enhancement Infrared Handheld Microphone):
a. Sub-carrier frequencies: 4 selectable frequencies from 2.00 MHz to 4.00 MHz
b. Integrated microphone
c. Internal charger unit.
d. Power 1 - "AA" NiMH Batteries (Systems using 2 batteries will not be considered)
e. 1/8" (3.5mm) auxiliary input connection - Provide an input for a stereo auxiliary input (Mixed to Mono in microphone)
f. Operational Modes – the handheld microphone must be equipped with two operational modes
g. Push-to-Talk Mode – the user simply depressed the power button to talk, and when released the microphone automatically turns off – this provides for a number of separate microphones to be used consecutively and greatly reduces the chance of channel interference
h. Power-On Mode – The user depresses the power button, and slide is vertically into the on position – this holds the microphone in the on state for continuous operation
i. Microphone Element – The Handheld microphone shall utilize a 10mm microphone element to insure optimum frequency response and maximum pickup of teachers voice.
6. Smart Sensor Charging Circuit
a. Charging circuitry in microphone must have the ability to sense what type of battery has been placed in the microphone. The charging circuitry must also carefully manage the charge and dis-charge cycles of the batteries to maximize battery life.
b. A system that simply senses voltage present on a 3rd contract is not acceptable; the charging circuitry must be able to distinguish between NiMH, NiCD and Alkaline batteries.

2.5 CABLE

A. Intercom System Cabling:
1. West Penn
2. Belden

3. General Cable
4. Mohawk

2.6 TEACHER DISCREET PERSONAL ALERT SYSTEM (BASIS OF DESIGN – AUDIO ENHANCEMENT SAFE SYSTEM)

A. SAFE System Controller (Audio Enhancement – SAFE Controller)
   1. Provide a system administration and management appliance as part of the teacher personal alert system. This appliance shall be powered solely by POE provided by the school's network. This will insure that the system will be maintained during a power outage based on the district provided uninterruptable power supplies.
   2. The SAFE System Controller shall periodically pole every device which is part of the SAFE System. It shall monitor every device on a schedule not to exceed 200 seconds.
   3. The SAFE System Controller shall maintain a log of all network transactions, including failed polling of a device.
   4. The SAFE System Controller shall manage all network transactions regarding the SAFE System. The Controller shall be responsible for alerting the MS1000 when a SAFE Alert has occurred.
   5. The SAFE System Controller shall provide a robust e-mail service, which will allow the unit to notify appropriate response personnel when an alert occurs, or when part of the SAFE System is offline.

B. Administration Notification Box (Audio Enhancement – MS-1000)
   1. Provide an alert system for the front office of the school. Provide a minimum of 1 system per building or as specified. All systems shall have the following features:
      a. Capable of receiving and distinguishing XML messages from every classroom alert system in the school
      b. Connections
         i. 24 Volts Power
         ii. Network Connection
         iii. Dry Contact Relay Connections – Provide connections for Normally Closed, Normally Open, and Common for each of the relays provided with the system.
      c. Controls
         i. Alarm Reset/Test Button
         ii. Up & Down arrow to scroll through alerts
         iii. Alarm Cancel
         iv. Dry Contract Relays
            1) Provide 3 double pole, double throw dry contact relays, which are activated upon receiving an alert message.
      d. Indicators
         i. Power – LCD Illumination
         ii. 2-Line LCD Display – Displays location and date/time of alert that is received
         iii. Audible Alarm
         iv. Visual Alarm (strobe).

PART 3 - EXECUTION

3.1 INSTALLATION

A. The entire system shall be installed in a workmanlike manner, in accordance with approved manufacturers wiring diagrams and these specifications. The contractor shall furnish all conduits, cable tray, surface raceway, wiring, outlet boxes, junction boxes, cabinets etc. as well as all required miscellaneous materials and labor necessary for the complete installation of the cable support / pathway system.
B. Wiring may be opened wired in cable tray or "J" hooks above accessible suspended lay-in ceilings. Wiring in walls or exposed on walls shall be enclosed in EMT conduit. Cable to be supported at a minimum of every 5’.
C. A nylon pull string is to be installed in each conduit / surface raceway run.
D. Any locations where flexible metal conduit has to be used, it is to terminate to a junction box on both ends and be securely anchored for proper support.
E. Conduit indications in the drawings are a minimum standard.
F. All equipment shall be mounted with sufficient clearance for observation, servicing, testing and accessible from either the floor or ladder. If any device is installed in a location that is deemed inaccessible by the Owner and or Architect / Engineer, it will be moved to an accessible location by the contractor at no additional cost to the Owner.
G. The contractor shall supply access panels where required and as defined by the Architect / Engineer. Contractor to notify the Architect / Engineer immediately if this issue arises during construction.
H. All penetration of floor slabs and firewalls shall be fire stopped in accordance with all Federal, State, and local codes.
I. All wiring shall be color coded per National Electrical Code requirements and standards.
J. All conduit ends are to have plastic grommets to protect cable from damage due to sharp edges on the conduit.
K. Mounting heights and mounting requirements are to be as shown on the drawings.
L. All junction boxes shall be clearly marked and labeled for easy identification. Flexible connectors shall be used for all devices mounted in suspended lay-in ceiling panels. All conduits, outlet boxes, junction boxes and panels shall be securely installed and anchored with appropriate fittings and connectors to insure positive grounding throughout the entire system.
M. No wiring except that of this system is to be installed in this systems cable support / pathway system.
N. Wiring splices are to be made only in designated junction boxes and tagged on both sides of the junction. The junction is to be made on clearly labeled, insulated terminal strip. Transposing or changing the color-coding of the cable is not permitted. Wire nut connectors are not acceptable. System cable and the 120vac power cable are to be in separate conduits.
O. It shall be the responsibility of the contractor to wire and connect ancillary devices to this system as listed in this specification section.
P. Any circuits leaving the building to the outside will be protected by the appropriate transient protection devices as required by the manufacturer to avoid damage to the system if transient surges are inducted on to these circuits (i.e., lighting strikes).
Q. Contractor to provide in-wall bracing support for all devices that are to be wall mounted to walls that are not masonry block walls.
R. All devices are to be protected throughout the entire project. All devices are to be kept free of construction dirt and debris during the entire project. The contractor will be responsible for replacing at no additional cost to the Owner any devices that are deemed dirty or unsuitable for use by the Owner and or Architect / Engineer throughout the entire project.

S. All cabling and devices are to be labeled with type written labels. Device labels and cable labels are to match the labeling information that is documented on the as-built drawings. Contractor to coordinate labeling schemes and labeling requirements with A/E prior to commencing with final labeling. Labeling system is to be by Brady or Panduit.

3.2 FIELD QUALITY CONTROL

A. The system shall be installed and fully tested as listed in these specifications. The system shall be demonstrated to perform all features and functions as listed in these specifications at a minimum.

3.3 TESTING

A. Reports of any field-testing during the system installation shall be forwarded to the Owner and Architect / Engineer for review and comment.

B. Each individual system operation on a circuit-by-circuit basis shall be tested for its complete operation. Any devices that are to be connected to the system will be tested as specified. Device locations and address / circuit numbers are to be documented on the as-built drawings as well as the wiring configuration of the device circuits. Device locations will be field verified by the contractor and are to include any costs in the bid that is relating to all devices being connected to the system. The procedure for testing the entire system shall be set forth in these specifications and with the consent and approval of the Architect / Engineer, Owner and equipment manufacturer. Confirm testing requirements with the Owner and Architect / Engineer prior to commencing with system testing.

C. Perform the tests and adjustments necessary to assure the satisfactory quality and level of performance of the system under normal operating conditions.

D. Establish the normal settings for all controls and devices for all system operational and functional features and record the same for future reference. All levels shall be set and recorded in the as-built documentation for optimum system performance.

E. The installation technician from the installer / manufacturer shall perform all system tests as specified. Perform all tests in the presence of the Owner, Architect / Engineer and any designated personnel as deemed necessary by the Owner or Architect / Engineer. This test must be performed with the devices at their operational location and under normal operational conditions. Bench or default settings for devices are not acceptable. All test and test report costs are to be included in the contractors bid. A checkout report will be generated by the installation technician and submitted to the Owner and Architect. The report shall include but not be limited to the following:
   1. A complete list of all equipment installed with corresponding serial numbers.
   2. Indication that all equipment is properly installed, functions, and conforms to the specifications.
   3. Serial numbers, locations by device and model number for each installed device.
   4. Technician’s name specified certification credentials and date of system test.
   5. Any additional information as deemed necessary by the Owner and or Architect / Engineer.

F. A substantial completion test will be performed before the final test and acceptance of the system by the Owner and Architect / Engineer. At the time of the substantial completion system test, provide to the Owner or his representative an oral explanation of the operation and maintenance of the system. Before starting the tests and adjustments listed above, the contractor shall submit the following to the Owner and the Architect / Engineer for review during the substantial completion test:
   1. Preliminary as-built wiring diagrams of the entire system.
   2. Preliminary copy of the operation and maintenance manuals.

3. Preliminary copy of the system test report form.

G. If no system performance issues arise during the substantial completion test that need to be repaired by the installation contractor, this can be approved as the final system test by the Owner and or Architect / Engineer. If there are performance issues that arise that do need to be repaired, another complete and comprehensive system test will be scheduled and performed to show that the necessary repairs have been properly addressed. These tests will be performed at no cost to the Owner until a time that the system is shown to be in complete operating condition as approved by the Owner and Architect/Engineer.

3.4 DOCUMENTATION AND TRAINING

A. After the final system test and the Owner and Architect / Engineer has accepted the system to be in the proper operating condition, the contractor shall compile and provide to the Owner three (3) complete operation and maintenance manuals and three (3) sets of as-built drawings on the completed system to include but not be limited to the following:
   1. Operating and maintenance instruction sheets for each piece of equipment showing the proper operation and maintenance of the system component.
   2. Individual factory issued operation and maintenance catalog brochures of all equipment and components that were installed as part of the system. Advertising brochures, submittal data sheets and operational materials are to also be included but shall not be used in lieu of the required technical manuals.
   3. Complete as-built wiring diagrams and floor plan drawings of the complete system installation showing how the system was installed. These drawings are to include any devices that are connected to the system with their address / circuit number documented as well as the wiring configuration of all device circuits. The as-built drawings will be an updated and revised copy of the submittal drawings showing all modifications made during the installation of the system. A copy of the as-built drawings in electronic format on CD/DVD generated in AutoCAD Release 2014 or higher will be forwarded on to the Owner and Architect / Engineer for archiving in the operation and maintenance manuals.
   4. A statement of guarantee including the date of the termination of the warranty as well as the phone number of the person to be called in the event of equipment failure.
   5. A cover letter, for the above-mentioned tests, certifying the entire system and its components, application and installation meets or exceeds the recommendations of the manufacturer, all applicable code requirements, and test specifications.

B. The final and installed version of the system software will be provided to the Owner on a CD/DVD for storage in the operation and maintenance manuals. These manuals shall be used for final check out of the system.

END OF SECTION

SECTION 27 53 13
WIRELESS CLOCK SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 01, General Requirements, are included as a part of this Section as though bound herein.
B. Standards – Conform to the requirements of the following:
   1. Federal Communications Commission FCC Part 15 – Code of Federal Regulations
   2. NFPA 70E – Standard for Electrical safety in the Workplace
   3. IEEE 802.3af - [1998], Standard for Information Technology – Telecommunications and Information Exchange Between Systems
   4. Bluetooth wireless technology standard 4.1.
C. Licensing:
   1. The system must operate in accordance with a “Radio Station Authorization”, Form FCC 601–LM, granted by the Federal Communications Commission (FCC). License will be issued to and held by the Owner.

1.2 DESCRIPTION

A. Provide a wireless clock system that continually synchronizes clocks throughout the campus.
B. The system shall provide wireless time from a master time source. This time source shall be from the clock of a defined NTP server that the transmitter can access via the owner’s Ethernet. Hard wiring will not be required to the clocks installed for the system. Clocks shall automatically adjust for Daylight Saving Time in locations where DST is observed.
C. The system shall have an internal clock reference so that a failure to detect the master time source shall not result in the clocks failing to indicate time.
D. The system shall incorporate a “fail-safe” design so that failure of any component shall not cause failure of the system. Upon restoration of power or repair of failed component, the system shall resume normal operation without the need to reset the system or any component thereof.

1.3 WARRANTY

A. Provide a one (1) year manufacturer’s warranty on all receivers, transmitters and clocks beginning from the date of final completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Primex Wireless (XR clock and BC100-E bridge.

2.2 EQUIPMENT

A. General: The system shall include a wireless transmitter with Ethernet port for NTP time input, a surge suppressor/battery backup, and a mounting shelf. Unit shall obtain current time via NTP through the Ethernet port. The clock system shall transmit time continuously to all clocks in the system.
B. Bridge: Unit shall obtain current time from UTC/NTP through the Ethernet port. The unit shall transmit time continuously to all clocks in the system.
    1. Bridge shall meet the following specifications:
        a. Enclosure: ABS plastic with 2 AA batteries
        b. Display: Liquid crystal display (LCD), with LED status indicator (green, yellow, red)
        c. Mounting: Keyhole slot with lock down screw holes in back panel for wall mount; or surface mount with supplied dual-lock adhesive mounting strips
        d. Configuration: configured from system software or locally at device with supplied device configuration software
        e. Backup Battery power: 3.0V Primex Lithium/Iron Disulfide Battery Pack or two standalone 1.5V lithium AA batteries. Use of alkaline batteries is not recommended.
        f. Local memory storage capacity; configuration data for up to 1400 Bluetooth clocks.
        g. Environment: Operating Temperature Operating range: 0° C to 50° C (32° F to 122°F)
        h. Certifications: FCC, CE, and IC compliant
        i. Technology: 802.11 Wireless.
C. Power Supply:
    1. Input: 120 VAC, 50/60 Hz.
D. Surge Protector/Battery Backup (included)
    1. Input: 120-volt AC 60 Hz +/- 1 Hz
    2. Output: 120-volt AC, 500 VA, 300 watts
    3. Surge Energy Rating: 365 joules.
E. Clocks (traditional analog): Clocks 12-1/2 inch or 16-inch diameter as selected. Clocks shall be wall mounted with polycarbonate frame and lens; Face shall be white. Hour and minute hands shall be black with red sweep second hand. Color and finish as selected by the Architect.
    1. 12-1/2” and 16” clocks shall be battery operated and have a 5-year battery life.
    2. Clock shall be capable of automatically adjusting for Daylight Saving Time. An ON/OFF switch located on the transmitter shall disable this function if desired.
    3. Time shall be automatically updated from the transmitter once per day.
    4. Clocks shall remember time during changing of batteries
    5. Analog clock receivers shall be as follows:
        a. Receiver power: battery, supplied by manufacturer, installed by contractor.
    6. If transmitter stops transmitting valid time signals due to power failure, the clocks will continue to function as accurate quartz clocks until a valid time signal is decoded.
F. Wire guards: Provide wire guards for clocks located in Gymnasium or other areas as designated by the owner.
    1. A wire guard 14 by 14 inches shall be provided for nominal 12 1/2-inch diameter analog clocks.
    2. A wire guard 18 by 18 inches shall be provided for nominal 16-inch diameter analog clocks

PART 3 EXECUTION

3.1 INSTALLATION

A. General:
   1. Install all equipment in accordance with manufacturer’s instructions.
   2. Install equipment ensuring appropriate ventilation to meet manufacturer’s requirements.
   3. Securely mount equipment plumb and square in place.

B. Coordination:
   1. Coordinate installation with all existing conditions.
   2. Hardware shall be surface mounted to facilitate connections to relays for third-party systems.

3.2 FIELD QUALITY CONTROL

A. Field Testing:
   1. Check the quality of signal and adjust locations as required.

B. Testing and Demonstration:
   1. Upon completion of the system installation notify the Owner that the system is ready for testing and demonstration.
      a. At this time, provide all system documentation; also, all Component and System warranties are to be presented to the Owner for prior evaluation.
      b. The Owner, at his option, may select a specific time and date suitable to all parties and have a representative in attendance during the final testing and demonstration.
      c. Conduct all tests and demonstrations in the presence of the Owner.
      d. Demonstrate all system function to perform as specified.

3.3 DEMONSTRATION

A. Provide two four (4) hour on-site training sessions and instruction to the Owner’s designated representatives in the set-up, operation, and use of all system equipment.
   1. All instruction and training is to be given after completion of the installation and testing.
   2. Arrange instruction and training sessions at the Owner’s convenience.
   3. The manufacturer shall provide a comprehensive training outline for the Owner & Engineer to review within 90 days of substantial completion.
   4. Provide operating and users’ guides to the Owner’s representatives at training sessions.
   5. Training sessions are to be video recorded with master and two (2) copies (MPEG 4 format) turned over to owner at the completion of the training session.

END OF SECTION