Jefferson County School District, R-1

Support Services

TECHNICAL GUIDELINES

DIVISION 27 – COMMUNICATIONS

AUGUST 2022

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27 00 10 Communication Services – August 2021

- The purpose of this document is to provide guidelines, standards, and specifications for the installation of the various components of the communications cable plant for Jefferson County Colorado Public Schools District (hereinafter referred to as the District). Unless otherwise specified in writing, the contractor shall provide a warranty guaranteeing that all materials, installation, and workmanship meet specifications and are free from defects for a period of one year from the date of final acceptance. Labor and material needed to correct errors, replace parts, or perform repair shall be done at the contractor's expense.
- Work in this section is restricted to specific products of specific manufacturers that have been previously approved by the District; see Section 27 05 10 for the List of Acceptable Materials. Work in District buildings is to be done only by vendors that are pre-approved by the District.
- Coordination:
    1. Contract Documents must clearly define and specify responsibilities to furnish rough-in, cable installation, and connections. Tasks shall be performed as follows:
        a. Outlet boxes shall be installed by the Electrical Contractor
        b. Underground conduits leading into the MDF room shall be installed by the Electrical Contractor
        c. Empty raceway shall be installed by Electrical Contractor
        d. Punch down blocks shall be installed by the Data Cable Installation Contractor
        e. Equipment racks shall be installed by the Cabling Contractor
        f. Horizontal and riser data cable shall be installed by the Cabling Contractor
        g. RJ45 jacks shall be installed by the Cabling Contractor
        h. Fully loaded patch panels shall be installed by the Cabling Contractor
        i. RJ34 connectors shall be installed by the Cabling Contractor

- Project Management:

    1. The District shall designate one Project Manager for each site-specific project; this District Project Manager shall be the single point of contact for the Contractor. In general, the Project Manager (PM) for larger projects shall work for the Facilities and Construction Management Department, and the Project Manager for smaller projects shall be an employee of the Information Technology Department (ITPM).
    2. The contractor shall provide weekly written reports via email to the PM detailing progress.
    3. Requests for access to limited access or restricted areas shall be made the work day prior to the required access.
    4. Information critical to the completion of the task or project shall be communicated to the PM, as the requirement becomes known.
    5. Casual information shall be passed during the scheduled progress report.
    6. The vendor shall maintain the District facility in a neat and orderly manner during the installation of the cabling system.
    7. The District shall designate staging and storage areas for the contractor's materials.
    8. At the completion of work in each area, the vendor shall perform a final cleaning to remove any dust, debris, and trash prior to moving the installation crew to the next work area.

- Standards:

    1. In the absence of other information, standards of the following organizations apply:
        a. ANSI/TIA/EIA 568 C 1-2, Category 6
        b. ANSI/TIA/EIA-569 C Commercial Building Telecommunications Infrastructure Cabling Standard
        c. ANSI/EIA/TIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
        d. ANSI/EIA/TIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications
        e. Building Industries Consulting Services International (BICSI) Telecommunications Distribution Methods Manual (TDMM)

f. American with Disabilities Act (ADA) for non-construction/maintenance/service personnel using the system and components

g. Federal Section 504 for students with disabilities and those non-construction/non-maintenance/non-service personnel using the system and components as relevant for federally funded projects. Confirm with the District Project Manager

- General:

1. Twisted pair
2. Cables shall be installed with no splices.
3. Fiber Optic cable may be spliced in accordance with manufacturer's specifications and best-practices guidelines ONLY with written permission of the ITPM.
4. The cable minimum bend radius and maximum tension specifications shall never be exceeded. If, at any time and even for a moment, either of these specifications is exceeded, the installer shall replace the cable prior to final acceptance at no additional cost to the District.
5. Each and every cable shall be carefully and legibly labeled at both ends via tape labels or an indelible ink marking pen.
6. Horizontal cable runs shall be supported at intervals of five (5) feet or less.
7. At no point shall cables rest on acoustic ceiling grids or panels or any other systems such as structure, lighting, fire alarm, fire sprinkler systems, plumbing, roofing or heating ducts.
8. The communications cable plant shall be run in its own support system.
9. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware.
10. The cabling system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
11. Any bundle that has more than 5 cables in it shall be supported by a cable saddle or Arlington Loop.
12. Bundles with 5 or fewer cables may use bridle rings, J-hooks, or Arlington Loops.
13. Coordinate types and fire-ratings of penetrations with fire-rated assemblies identified on drawings and other divisions.

- Tracer Wire:

1. Reference Division 33 for type and size of tracer wire for underground utilities.
2. Install warning caution tape above underground utility lines.
3. Install at all underground utility and other lines, to run with each utility listed in this Division 27, including all underground conduits.
4. Standard Colors:
    a. Orange: Fiber Optic or telecommunications

27 05 00 Responsibility Matrix – August 2019

- Following is a matrix showing the various tasks and activities along with the party responsible for each task:

Paging System

TASK	IT Project Manager	District Project Manager	Commissioning Specialist	Facility Maintenance	Architect & Engineer	General Contractor
Validate Existing System				Optional		Required
Develop Specifications		Required	Required	Required	Required	
Plan Review		Required	Required	Required		
Product Submittal Review			Optional		Required	Required
Pre-Installation Meeting		Required	Required	Required	Required	Required
Day One Install			Required	Optional		Required
Periodic Inspection		Required	Required	Required	Required	

Rough-In		Required	Required	Required	Required	Required
Contractor End-to-End Test			Optional	Required	Required	Required
Final Inspection				Optional	Required	Required
System Certification		Required		Optional		
Agency Inspections						Required

Fire Alarm System

TASK	IT Project Manager	District Project Manager	Commissioning Specialist	Facility Maintenance	Architect & Engineer	General Contractor
Validate Existing System				Optional		Required
Develop Specifications		Required	Required	Required	Required	
Plan Review		Required	Required	Required		
Product Submittal Review			Optional		Required	Required
Pre-Installation Meeting						
Day One Install			Required	Optional		Required
Periodic Inspection		Required	Required	Required	Required	

Rough-In		Required	Required	Required	Required	Required
Annunciator Final Drawings		Optional			Required	Required
Contractor End-to-End Test			Optional	Required	Required	Required
Final Inspection				Optional	Required	Required
System Certification		Required		Optional		
Fire Department Checkout		Optional	Optional	Optional	Required	Required
Agency Inspections						Required

Telecommunications – Data Systems

TASK	IT Project Manager	District Project Manager	Commissioning Specialist	Facility Maintenance	Architect & Engineer	General Contractor
Validate Existing System	Required			Optional		Required
Develop Specifications		Required	Required	Required	Required	
Plan Review	Required	Required	Required	Required		
Product Submittal Review	Required		Optional		Required	Required
Pre-Installation Meeting	Required	Required	Required	Required	Required	Required

Day One Install			Required	Optional		Required
Periodic Inspection	Required	Required	Required	Required	Required	
Rough-In	Required	Required	Required	Required	Required	Required
Annunciator Final Drawings		Optional			Required	Required
Contractor End-to-End Test	Required		Optional	Required	Required	Required
Final Inspection	Required			Optional	Required	Required
System Certification	Optional	Required		Optional		
Fire Department Checkout		Optional	Optional	Optional	Required	Required
Agency Inspections						Required

END SECTION 27 05 00

27 05 10 List of Acceptable Materials – August 2019

- Items on this list are considered acceptable for use in District buildings wherever they meet all codes, standards, guidelines, and specifications for District Communication projects. Exceptions to these specific materials can only be made in writing by the IT Project Manager. Absent written authorization, the contractor shall use only district approved products. District Project Manager will provide the approved list of products and parts.

END SECTION 27 05 10

27 05 26 Grounding and Bonding for Communications Systems – August 2021

- Work in this section is restricted to specific products of specific manufacturers that have been previously approved by Jefferson County School District, R-1.
- See District's Technical Details Drawings.
- General Grounding and Bonding:
    1. All District facilities shall be equipped with a bonding backbone (TBB).
    2. The Electrical contractor shall supply and install all grounding to the Main Distribution Frame (MDF) and all Intermediate Distribution Frame (IDF) communications closets.
    3. This backbone shall be used to ground all cable shields, equipment, racks, cabinets, raceways, and other associated hardware.
    4. The TBB shall be installed independent of the building's electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA/EIA-607 TMGB.
    5. The Main Distribution Frame room in each building shall be equipped with a grounding bus bar (TGB).
    6. Each Intermediate Distribution Frame communications closet shall be provided with a TGB.
    7. The TGB shall be connected to the building electrical entrance grounding facility.
    8. The TGB and TBB are to provide a grounding system that is equal in potential to the building electrical ground system.
    9. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in any Communication Room shall be grounded to the respective TGB or TBB using a minimum #6 AWG stranded copper bonding conductor and compression connectors.
    10. Where metallic panels attached to the rack do not have sufficient metal-to-metal contact to provide an adequate path to ground, they shall be bonded to the rack using a minimum #14 AWG copper conductor.
    11. The copper conductor size shall be upgraded based on the largest power conductor feeding any rack mount equipment.
    12. The conductor shall be continuous. Components shall be grounded in a daisy chain fashion from top to bottom and bonded to the rack using an appropriate compression connector.

13. Insulated wires used for grounding purposes shall have green insulation.
14. Bare copper wires shall be identified at each termination point with a wrap of green electrical tape.
15. The TBB shall be designed and approved by a licensed engineer.
16. The TBB shall be installed in accordance with best industry practices.
17. A licensed electrician shall perform installation and termination of the main bonding conductor to the building service entrance ground.

END SECTION 27 05 26

27 05 28 Pathways for Communications Systems (Data and Voice) – August 2015

- Work in this section is restricted to specific products of specific manufacturers that have been previously approved by Jefferson County School District, R-1 Telecommunications Department.
- Coordination
    1. Empty raceway for special systems may or may not be under separate contract.
    2. See Data, Communications and Alarm Diagram.
    3. Contract Documents must clearly define and specify responsibilities to Furnish Rough-In / Install / and Connect:
        a. Outlet boxes – by Electrical Contractor
        b. Punch down blocks – by Cabling Contractor
        c. Equipment racks – by Cabling Contractor
        d. Empty raceway – by Electrical Contractor
        e. Cable – by Cabling Contractor
        f. RJ11 connectors – by Cabling Contractor
        g. RJ45 connectors – by Cabling Contractor
        h. F connectors for video connection – by Cabling Contractor
- In the absence of other information, standards of the following organizations apply:

1. ANSI/TIA/EIA 568A-6, Category 6
2. ANSI/TIA/EIA-568A Commercial Building Telecommunications Cabling Standard
3. ANSI/EIA/TIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces
4. ANSI/EIA/TIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
5. ANSI/EIA/TIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications
6. Building Industries Consulting Services International (BICSI) Telecommunications Distribution Methods Manual (TDMM)

- Cabling

1. Cables shall be installed in continuous lengths from origin to destination (no splices) unless specifically addressed in this guideline.
2. The cable's minimum bend radius and maximum pulling tension shall not be exceeded.
3. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the vendor prior to final acceptance at no cost to the District.
4. All cable shall be labeled at both ends via tape labels and/or a indelible ink marking pen and in a manner agreed upon by the District and the installer.
5. Support horizontal cables at a maximum of five-foot intervals.
6. At no point shall cable(s) rest on acoustic ceiling grids or panels or any other support systems such as structural members, lighting, fire alarm, plumbing, or heating ducts.
7. Cable plant will be run in its own support system.
8. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware.
9. The cabling system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
10. Any bundle that has more than 5 cables in it will be supported by a cable saddle or Arlington Loop.

a. Bundles with 5 or less cables may use either bridle rings, J-hooks, or Arlington Loop.

- Submittals

1. Cable and supports:

a. Product data

END SECTION 27 05 28

27 05 43 Underground Ducts and Raceways for Communications Systems – August 2015

- Work in this section is open to any product or material meeting the requirements of this section and the requirements of Division 26 Electrical as well as any requirements of the service providers that shall be using the conduits such as Century Link or Comcast.
- Requirements of Division 26 Electrical apply
- Underground Conduit:

1. Two 4-inch conduits from Century Link's pedestal to the school's MDF.

a. 200 pound calibrated mule tape installed inside of each conduit.

b. One 1.5 inch innerduct with 200 pound calibrated mule tape installed inside of the innerduct.

c. If the outside end of the conduits is open, that is, not inside closed pedestals or boxes, it shall be capped with a suitable cover so that water and critters cannot get in to the conduit.

2. One 2-inch conduit from Comcast's pedestal to the school's MDF.

a. 200 pound calibrated mule tape installed inside of the conduit.

b. If the outside end of the conduits is open, that is, not inside closed pedestals or boxes, it shall be capped with a suitable cover so that water and critters cannot get in to the conduit.

3. MDF to temporary modular classroom vault or pad.

a. One two (2) inch conduit with 200 pound calibrated mule tape installed inside of the conduit.

b. Location to be coordinated with Division 26 Electrical

c. If the outside end of the conduits is open, that is, not inside closed pedestals or boxes, it shall be capped with a suitable cover so that water and critters cannot get in to the conduit.

END SECTION 27 05 43

27 05 53 Identification for Communications Systems – August 2015

- Work in this section is open to any product or material meeting the requirements of this Technical Guideline.
- Labeling:
  1. Labeling is required to clearly and legibly identify all components of the communications system including but not limited to: Racks, punch fields, cables, patch panels, and jacks.
  2. The labeling system in the closets for backbone cable shall designate the cable's origin and destination and a unique identifier for the cable within the system.
  3. Racks and patch panels shall be clearly and legibly labeled to identify the location within the cabling system infrastructure.
  4. Horizontal cables shall be clearly and legibly labeled within 2 inches of the end of the jacket at both the patch panel end and the jack end of the cable.
  5. The faceplate of the jack at which horizontal cables are terminated in the classroom, office, or work area shall be clearly and legibly labeled with the same cable number as the jack on the patch panel.
  6. All labeling information shall be recorded on the as-built drawings and all test documents.
  7. The District's labeling standard for each cable and face plate is as follows:
     a. The second position denotes the closet where services originate; the MDF is always "0" and "1", "2", "3"' etc. represent the various IDF rooms.
     b. Thus, the first data cable in the MDF would read D-0-1, the second cable would read D-0-2 and continue numerically on the patch panel. The first data cable in the third IDF would read D-3-1, the second D-3-2, etc.

END OF SECTION 27 05 53

27 08 00 Commissioning of Communications General Cable Testing – August 2015

- Work in this section is restricted to specific products of specific manufacturers that have been previously approved by Jefferson County School District, R-1.
- General Cable Testing
    1. All cables and termination hardware shall be tested to detect defects in manufacture and installation and to verify cable performance after it has been installed.
    2. The contractor shall verify that ALL conductors of EACH cable are usable prior to system acceptance.
    3. Testing can be completed by the installing contractor; third party testing is not required.
    4. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and jacks shall be replaced, not repaired.
    5. If testing is performed by the contractor a report shall be submitted by the contractor identifying the tests performed, results of the tests, and performance data resulting from the tests, including performance data for all drops. This shall be submitted prior to the punch-list phase of the project.
- Installation Warranty:
    1. The contractor shall warrant the cabling system against defects in materials, installation methods, and workmanship for a period of no less than one year from the date of system acceptance.
    2. The warranty shall cover all labor and materials necessary to correct any defective portion of the system and to demonstrate performance within the original installation specifications after repairs are completed.
- Cable Plant Warranty:
    1. The contractor shall issue a warranty on the installed cable plant, which guarantees materials, installation methods, and workmanship on all components used in the system for no less than one year from the date of acceptance.
    2. The warranty shall guarantee a minimum of 350 MHz for all Cat 6 cables.
    3. The warranty shall guarantee a minimum of 100 MHz for the backbone copper cables.

4. The multimode fiber optic portions of the cabling system shall be guaranteed to a minimum of ten (10) Gigabits per second for runs of less than 300 meters (982.4 feet). Multimode fiber optic cable runs of greater than 300 meters shall be guaranteed to run at up to one (1) Gigabit per second.

- Copper Cable Testing:

  1. Testing can be completed by the installing contractor; third party testing is not required.
  2. If testing is performed by the contractor a report shall be submitted by the contractor identifying the tests performed, results of the tests, and performance data resulting from the tests, including performance data for all drops. This shall be submitted prior to the punch-list phase of the project.
  3. The continuity of each conductor of every cable shall be tested.
  4. Twisted-pair cables shall be tested for continuity, cable length, proper installation, pair reversals, shorts, opens, and data performance.
  5. The test shall be recorded as pass/fail as indicated by the test set in accordance with the manufacturers recommended procedures, and associated with the appropriate cable identification number and circuit or pair number.
  6. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.

- Copper Data Cable Length:

  1. The installed length of each Category 6 cable shall be measured from termination point to termination point using an automated test device.
  2. The length of any Category 6 cable shall be no longer than 90 meters (295.2 feet). This means the actual total overall length of each contiguous fixed cable itself, NOT the linear distance between, for example, the jack and the IDF.
  3. Cable lengths shall be recorded, and associated with the cable identification number and circuit or pair number.
  4. For multi-pair cables, the longest pair length shall be recorded as the length of the cable.

- Copper Performance Verification:

  1. The actual performance of each cable shall be tested using an automated test set.
  2. Category 6 cable test results shall be automatically evaluated using the most up to date criteria from the ANSI/EIA/TIA-568C 1-2 standards.

3. Test results shall be printed directly from the test unit or from a download file using an application from the Test equipment manufacturer.-
4. The printed test results shall include all tests performed, the expected test result and the actual test result achieved.
5. If testing is performed by the contractor a report shall be submitted by the contractor identifying the tests performed, results of the tests, and performance data resulting from the tests, including performance data for all drops. This shall be submitted prior to the punch-list phase of the project.

- Fiber Optic Testing:

1. Testing can be completed by the installing contractor; third party testing is not required
2. Multimode optical fiber terminations shall be tested in accordance with ANSI/EIA/TIA-568-B.3-H.
3. Panel to panel and panel to outlet multimode fiber optic cables shall be tested in accordance with ANSI/EIA/TIA-568-C.1-2 and ANSI/EIA/TIA-526-14,
4. All test jumpers shall be the same fiber core size and connector types as the cable system.
5. When testing, the light source or Optical Time Domain Reflectometer must operate in accordance with ANSI/EIA/TIA-526-14A for multi-mode fiber optic cable.
6. If testing is performed by the contractor a report shall be submitted by the contractor identifying the tests performed, results of the tests, and performance data resulting from the tests. This shall be submitted prior to the punch-list phase of the project.

- Inspection Phases:

1. The ITPM and PM shall make periodic inspection of the project in progress. Such inspections do not relieve the Contractor from the responsibility of meeting the specifications.
2. One inspection shall be performed at the conclusion of cable pulling, prior to closing of the ceiling to inspect the method of cable routing and support, and the fire-stopping of penetrations.
3. A second inspection shall be performed at completion of cable termination to validate that cables were dressed and terminated in accordance with ANSI/TIA/EIA specifications for jacket removal and pair untwist, compliance with manufacturer’s minimum bend radius, and that cable ends are dressed neatly.

- Final Inspection:

1. Upon completion of the project, the PM shall perform a final inspection of the installed cabling system with the vendor's project foreman. This inspection does not relieve the Contractor from the responsibility of meeting the specifications.
2. The final inspection shall be performed to validate that all horizontal and backbone cables were installed as defined in the drawing package, and that the installation meets the aesthetic expectations of the District.

- Test Verification and System Performance:
  1. If testing is performed by the contractor a report shall be submitted by the contractor identifying the tests performed, results of the tests, and performance data resulting from the tests, including performance data for all drops. This shall be submitted prior to the punch-list phase of the project.
  2. Upon receipt of the test documentation, consisting of the printed test results of each cable tested, the District reserves the right to perform spot testing of a representative sample of the cabling system to validate test results and that the cable meets specifications.
  3. Printed test results shall identify each cable tested and match installed cable designations.
  4. If significant discrepancies are found, the vendor shall be notified for resolution.
  5. During the four-week period between final inspection and delivery of the test and as-built documentation, the District may activate the cabling system to validate operation.
- Final Acceptance:
  1. Final acceptance shall not occur until all of the following are complete:
  2. Installation, in-progress, and final inspections are complete.
  3. The District has received and verified the test and as-built documentation.
  4. The cable has performed successfully for a four-week period.

END SECTION 27 08 00

27 11 00 Communications Cable and Equipment Rooms – August 2021

- Work in this section is restricted to specific products of specific manufacturers that have been previously approved by Jefferson County School District, R-1.
- General:

1. The Main Distribution Frame (MDF) room is where the Century Link and other service provider cables from the outside connect to the inside building cable plant. Intermediate Distribution Frame (IDF) rooms are the telephone closets inside the building. Work in this section is restricted to specific products of specific manufacturers that have been previously approved by Jefferson County School District, IT Infrastructure Department; see Section 27 05 10 for the list of acceptable materials

- Backboards:

    1. The MDF and IDF room cable termination backboards shall be solidly attached to the walls of the room as follows:
    2. New, unused, unpainted plywood.
    3. Fire-retardant treated.
    4. Size: ¾" x 48" x 96"
    5. Provided by General Contractor.

- Racks:

    1. Racks shall be securely attached to the concrete floor using ½ inch bolt hardware.
    2. Racks shall be grounded and/or bonded to the telecommunications ground bus bar in accordance with current NEC codes, provided by Electrical Contractor.
    3. Left over rack mount screws (#12-24) not used for installing fiber panels and other hardware shall be screwed into the rack in open spaces for future use and left with the rack upon completion of the installation.
    4. Termination fields shall be mounted per Data, Communications and Alarm Diagram.

- Acceptable Patch Cable Colors:

    1. Blue patch cables are to be used for devices requiring a typical data connection such as printers, copiers, credit card readers, etc.
    2. Purple patch cables are to be used for all power over Ethernet telephones only.
    3. Black patch cables are to be used for all power over Ethernet wireless access point devices only.
    4. Brown patch cables are to be used for cameras only.
    5. All listed cable colors are to be used for designated devices only and should be a minimum length of 5 feet.

- Coordination:

  1. All material shall be supplied and installed by the pre-qualified vendor.

- Voice Termination:

  1. Any voice communications that are VOIP carried on CAT 6 cable terminated to a data patch panel are considered Data Cable and shall use the Data Cabling and Termination specifications below.

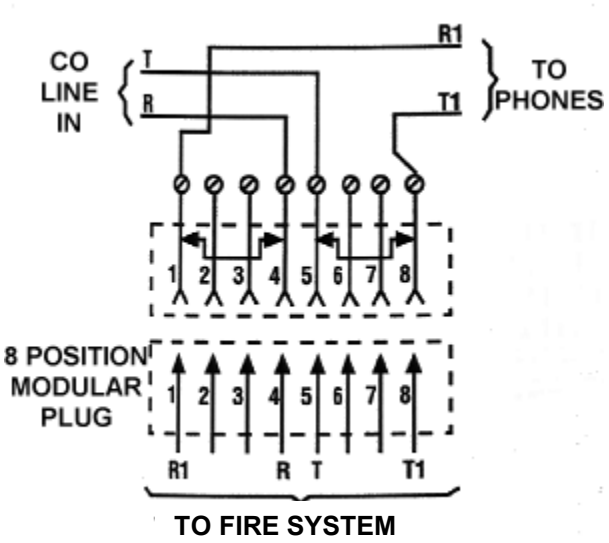
  2. Voice cross connects for POTS lines shall be made by the District's Telecommunications Staff.

     a. If additional 66 blocks are required, they shall be installed by the District's Telecommunications Staff.

     b. Frames shall be oriented so that backbone frames are located on the left and horizontal frames are located on the right of the termination field when facing the backboard.

     c. Cross-connects and cross-connect wire shall be provided by District's Telecommunications Staff.

  3. Where specified, RJ31x jacks shall have the following pinout:



- Data Cabling and Termination:

  1. Data cables in the MDF and IDFs shall terminate into rack-mounted Category 6 data patch panels.

2. Horizontal data and voice cabling shall be connected using patch cords from the horizontal Category 6 data patch panels to the network equipment within the same or adjacent racks.
3. Horizontal data and voice patch panels shall be contained in 19" x 7' rack(s).
4. All equipment racks shall include horizontal and vertical management hardware, both front and rear, to properly and neatly dress horizontal cables and patch cords.
5. Patch panels shall be fully loaded 24 or 48 modular jack ports, wired to T568B.
6. Patch panels shall be fully loaded and equipped with horizontal management panels (front) and cable support bars (rear), to properly and neatly dress, terminate, and manage the installed cables and provided patch cords.

- Installation Requirements:

1. Copper termination and management hardware shall be installed in the following manner:
    a. Pair untwist at the termination shall not exceed one-quarter inch for Enhanced Category 6 connecting hardware.
    b. Bend radius of the cable in the termination area shall not be less than 4 times the outside diameter of the cable.
    c. Cables shall be neatly bundled and dressed to their respective panels or blocks.
    d. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
    e. The cable jacket shall be as close as possible to the termination point.
    f. Each cable shall be clearly labeled on the cable jacket behind the patch panel.
2. Communications Cable Management, Data Racks and Ladder Racks:
    a. The COM rooms shall have racks, ladder racks and required cable mounting hardware.
    b. The MDF shall have a minimum of 2 racks.
    c. Each IDF shall have a minimum of 1 rack.
    d. Racks shall be placed in a manner that shall allow for clearance of 4 ½ feet in the back and 3 feet in front.

e. If one mounting rail of the rack is placed against a wall, the mounting rail shall be no closer than 6 inches from the wall to allow room for vertical management.

f. Multiple racks shall be placed side by side with room for vertical wire management with 6 inches between wire management.

g. MDF and IDF layout must be reviewed and approved by ITPM at DD, CD, and pre-construction.

END SECTION 27 11 00

27 13 00 Communications Backbone Riser Cabling – August 2021

- Work in this section is restricted to specific products of specific manufacturers that have been previously approved by Jefferson County School District, R-1.
- Backbone cabling connects the MDF to the various IDF rooms, and sometimes IDF rooms to other IDF rooms. Backbone cabling is also sometimes called vertical cabling, cross-connect cabling, riser cabling, or inter-closet cabling. Backbone cabling consists of not only the cables that connect the telecommunications rooms, equipment rooms, and building entrances but also the cross-connect cables, mechanical terminations, or patch cords used for backbone-to-backbone cross-connection.
- Backbone riser cables shall be unbroken with no splices between the MDF and the final IDF. That is, if a backbone riser cable passes through an intermediate IDF to get to its final termination IDF room, the unbroken cable shall simply pass through the intermediate IDF; it shall not be cut or spliced.
- Communications Copper Backbone Cabling:
  1. The standard for voice backbone cabling shall be 24 AWG 25-pair Category 3 rated unshielded twisted pair.
  2. The cable shall meet UL 1581 VW-1 fire safety standard.
  3. The cable shall Meet ANSI/EIA/TIA 568-C.2, ISO/IEC 11801 performance requirements.
  4. Grounding shall meet the requirements as defined in J-STD-607-A, the Commercial Building Grounding and Bonding Requirements for Telecommunications.
  5. The pathways and spaces to support backbone cabling shall be designed and installed in accordance with the requirements of TIA-569-C.1-2. Care must be

taken when running backbone cables to avoid sources of EMI or radio frequency interference.

6. Voice backbone cables shall be terminated on wall mounted Telco split 66 punch down blocks.

- Communications Optical Fiber Backbone Cabling:

1. One orange 62.5/125 12-strand multimode armored and plenum rated fiber optic backbone cable shall be installed from the data MDF to each of the IDFs.
2. A fiber warning label shall be attached to the cable every 24 feet.
3. Fiber slack shall be neatly coiled within the fiber termination panel. No slack loops shall be allowed external to the fiber panel.
4. Fiber slack shall be neatly coiled within the fiber termination panel. No slack loops shall be allowed external to the fiber panel.
5. Each cable shall be individually attached to the respective termination panel by mechanical means. The cable's strength member shall be securely attached the cable strain relief bracket in the panel.
6. Each fiber cable shall be stripped upon entering the termination panel and the individual fibers routed in the termination panel.
7. Each cable shall be clearly labeled at the entrance to the termination panel. Cables labeled within the bundle shall not be acceptable.
8. Dust caps shall be installed on the connectors and couplings at all times unless physically connected.
9. All individual fibers shall be terminated with LC connectors on both ends.
10. Fiber optic cables shall be terminated in the data MDF and IDFs in rack mount patch panels.
11. Providing protection to the terminated fibers.
12. The enclosures shall provide CommScope (or equivalent) "Paired LC" interfaces. Rack mounted optical fiber enclosures shall support up to 24-ports in a one rack unit (1.75") space.
13. Each patch panel shall have a slide out tray, which slides forward to allow easy access to the fibers for maintenance and installation.
14. The District requires fiber to be installed using an armored plenum product; therefore, the use of inner-duct is not necessary.

END SECTION 27 13 00

27 15 00 Horizontal Communications Cabling – August 2015

- Work in this section is restricted to specific products of specific manufacturers that have been previously approved by Jefferson County School District, R-1.
    1. Horizontal cabling runs from the MDF or IDF to the classroom, office, or work area. Horizontal cabling include the following:
        a. all horizontal communications cable shall be Cat 6.
        b. Outlet jacks in the office, classroom, or work area must be rated the same as the cable; Cat 6 rated jacks for Cat 6 cable.
        c. Cable supports
- Materials:
    1. Indoor plenum-rated four pair Cat 6 unshielded twisted pair, 23 AWG solid copper-stranding cable with rip cord. The cable shall meet or exceed the following standards:
        a. NEC/(UL) Specification CMR
        b. NEC Article: 800
        c. NFPA 70
        d. ISO/IEC 11801 Class E performance requirements
        e. CMP (NFPA 262, UL 910)
        f. ISO/IEC 11801 ed 2.1 (2008) Class D
        g. Category 6 - TIA 568.C.2
        h. NEMA WC-63.1 Category 6, UL Verified to Category 6
        i. UL Flame Test: UL 1666 Vertical Riser
        j. C(UL) and CSA Flame Test: FT4
        k. IEEE Flame Test: 1202
- Cat 6 cable shall be terminated in the classroom, office, or work area telecommunication outlet to a Cat 6 rated RJ45 jack with correct matching cover plate.
- Cat 6 cable shall be terminated in the communications closet to a 24 or 48-port Cat 6 rated rack-mounted patch panel.
- Installation Requirements:
    1. The cable jacket shall be as close as possible to the termination point.
    2. See Section 27 05 53 for labeling requirements.
    3. Both ends of the cable are to be terminated in the T568B configuration.

END SECTION 27 15 00

27 16 00 Communications Connecting Cords, Devices and Adapters – August 2022

- Work in this section is restricted to specific products of specific manufacturers that have been previously approved by Jefferson County School District, R-1.
- Telecommunication Outlets
    1. Each Cat 6 cable in the office, classroom, or work area locations specified on the plans or drawings shall be terminated with a Cat 6 rated RJ45 jack.
    2. Each CAT 6 cable shall be terminated on an 8-position, 8-conductor CAT 6 Universal jack.
    3. Jack faceplates shall be mounted into single or dual gang boxes. Box eliminators, surface mount boxes and floor monuments shall be provided by the electrical sub-contractor.
- Modular Furniture Outlets:
    1. The faceplate shall be the one specified by the modular furniture manufacturer.
    2. Faceplates shall be mounted in the appropriate knockouts in the furniture channel.
- Wall Outlets:
    1. Wall plates shall be front loading CommScope Uniprise SL Series.
    2. Each jack shall be labeled in accordance with Section 27 05 53.
    3. The faceplate label shall be covered by a clear plastic insert.
    4. CommScope part numbers per Section 27 05 10.
        a. Single-gang Faceplate, white color
        b. Dual-gang Faceplate, white color
        c. Quad-gang faceplate, white color
        d. Blank, 1.5 Unit Module, almond color
        e. F-Connector Insert for Module
        f. LC Connector Insert for Module
        g. Blank Insert for Module
- Installation Requirements:

1. Cables shall be coiled and supported in the ceiling if adequate space is present to house the cable coil without exceeding the manufacturer's specified bend radius or cable tension.
2. No cable shall be placed on ceiling tiles.
3. No more than 12" of slack shall be stored in a wall box, modular furniture raceway, or insulated walls. At no time shall any cable exceed the manufacturer's specified bend radius or cable tension.
4. Excess slack may be neatly coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.
5. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/EIA/TIA-568-B document.
6. Pair untwist at the termination shall not exceed one-fourth inch for Category 6 connecting hardware.
7. Bend radius of the cable in the termination area shall never be less than four times the outside diameter of the cable.
8. The cable jacket shall be as close as possible to the termination point.

- Communications Patch Cords, Station Cords and Cross Connect Wire:
  1. See Section 27 05 10 for the list of acceptable materials
  2. Patch cords used at the data rack and at the workstation shall be rated the same as the horizontal cable, Category 6, as appropriate.
  3. Patch cords shall be factory-assembled by the manufacturer of the cable.
  4. Each workstation shall require one Enhanced Category 6 patch cord.
  5. At the patch panel, the contractor shall provide patch cords to connect network equipment to the correct jack cable.
  6. For every jack installed by the contractor, there shall be a patch cord rated the same as the cable, Cat 6, as appropriate, with an RJ45 connector on each end supplied by the contractor. There shall be an equal number of 3, 4, and 6 foot cords provided.
  7. In the workstation area, 6, 10, and 12-foot patch cords shall be provided in equal amounts of each length.
  8. Vendor shall provide stock of each size patch cord.
  9. Each wireless access point location shall require one 2-ft. Enhanced Category 6 patch cable.
- Wireless Access Point Communication Cabling:

1. Provide Category 6 cable in the ceiling in the center of each specified room, terminated with a plenum-rated surface mount box.
   a. To facilitate the current and future wireless local area network, the contractor shall pull a new Category 6 cable to the center of the ceiling or specific location. Each cable shall be terminated with a plenum rated surface mount box.
   b. The District Project Manager will identify classrooms, office spaces, and common areas that require the installation of a WAP.
      (1) The final wireless design drawings shall be reviewed and approved by a District Wireless Engineer.
   c. Surface mount boxed shall be neatly and legibly labeled above the ceiling with the drop number corresponding to the patch panel number.
   d. All wireless AP's must have a label with data jack number of the cable to which it is attached. The cable drop number shall be neatly printed in a large enough font size on the wireless access point in a location that can be easily seen by someone standing on the floor below the wireless access point.
   e. Terminate the cable in a new CAT 6 patch panel in the nearest data closet MDF or IDF. Leave ten feet (10-ft.) of service loop above the ceiling in the classroom or office for future flexibility and a six foot (6') service loop in the data closet.
   f. All cables shall be tested and the test results provided to the District Project Manager.
   g. Although every classroom and some office and common areas shall have a cable in the center of the ceiling, not all rooms shall initially get a wireless access point device. District Project Manager shall specify the rooms in which wireless access point devices are to be installed.
   h. Classrooms that are notated to have data installed for future WAPs should have a green dot placed on the ceiling grid below the area where the cable is terminated.
   i. The District shall provide all wireless access points. The vendor will be required to install the wireless access points at the direction of the District unless otherwise noted.
   j. Normally the devices will be new in a box, however, there may be situations where the devices have been previously installed. The vendor shall install these wireless access point devices in accordance with the manufacturer's instructions in the locations specified by the District.
   k. All outside wall penetrations shall have a sleeve, bushing and shall be weather-tight.
   l. The cabling contractor/vendor shall provide a Category 6 plenum rated 2-ft. patch cord for each wireless access device location.

END SECTION 27 16 00

27 16 50 Video Projector Cabling Mounting – August 2017

- Work in this section is restricted to specific products of specific manufacturers that have been previously approved by the District; see Section 27 05 10 for the List of Acceptable Materials. Work in this section is limited to vendors that have been pre-approved through the Audio/Video bid.
- Acceptable Installation and Wiring Methods:
    1. General:
        a. All are to be installed to manufacturer's instructions.
    2. Electrical cord from projector must plug in at either a duplex outlet at 84" AFF next to the location of the wall mount arm or below the smart board into an outlet within 24" of the device.
- Lightspeed Topcat audio system.
    1. 955 Access System with Flexmike, Sharemike, (1) TCA multimedia ceiling speaker
    2. Topcat 955 Access Media Connector sound system with paging interrupt and speaker. This installation is most commonly a ceiling mount installation.
- Installation Requirements:
    1. Cables shall be coiled and supported in the ceiling if adequate space is present to house the cable coil without exceeding the manufacturer's specified bend radius.
    2. No cable shall be placed on ceiling tiles or light fixtures.
    3. All cable shall be supported to structure via the use of a beam clamp with an appropriately sized saddle or Arlington loop.
    4. No more than twelve inches (12") of slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls, and the cable must never exceed the manufacturer's specified bend radius.
    5. Excess slack may be neatly coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable, but the coil may NOT rest on a light fixture.

6. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/EIA/TIA-568-C document, manufacturer's recommendations, and best industry practices.
7. Pair untwist at the termination shall not exceed one-fourth inch (1/4") for Category 6 connecting hardware.
8. The Bend radius of the cable in the termination area shall never be less than four times the outside diameter of the cable.
9. The cable jacket shall be maintained as close as possible to the termination point.

- Interactive Board Installation Height Specifications:
  1. Kindergarten through 3rd Grade – The top of the board shall be 74" AFF
  2. 3rd Grade through 6th Grade – The top of the board shall be 77" AFF
  3. 7th Grade through 12th Grade – The top of the board shall be 80" AFF
  4. Short throw assemblies (arm and projector) shall be installed 1 to 2" above the Smart board or whiteboard leaving minimum 80" from the floor to the bottom of the projector
- Warranty:
  1. The contractor shall warrant that all products, materials, and installation are guaranteed to be free from defects in material, installation procedure, and workmanship after final acceptance of installation, for the period defined in the provisions of the District Technical Guidelines.
  2. If requested, the Installer shall make up to three (3) on-site visits without additional cost to the District to make system adjustments during the first year. The first year begins on the date of final acceptance, and ends 365 days later.
  3. On-premise maintenance shall be provided at no cost to the District, unless damage or failure is caused by misuse, abuse, neglect, or accidents.

END SECTION 27 16 50

27 51 13 Paging System (Mass Notification System) – August 2021

Note: This section is presented in its entirety. It is suggested that the engineer cut and paste from this section to create a project specific specification section edited for each project.

SECTION 27 51 13 PAGING SYSTEM

PART 1 – GENERAL

Paging system shall be defined as a mass notification system, and will be installed building wide. This system may be zoned.

1.1 RELATED DOCUMENTS

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

Division 26 Sections

1.2 SUMMARY

This Section includes equipment for amplifying, distributing, and reproducing sound signals on up to nine output channels separately or as an all call.

1.3 DEFINITIONS

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

1.4 PERFORMANCE REQUIREMENTS

System Functions: Include the following:

1. The Terms "Listed" and "Labeled": As defined in the latest adopted version of the National Electrical Code.

2. Selectively connecting separate zones to different signal channels.

3. Paging system shall override and/or mute existing performance sound systems such as gyms, auditorium, cafeteria, weight rooms, wrestling rooms, and other rooms as necessary.4. Communicating simultaneously to all zones regardless of zone or channel switch settings.

5. Paging by dialing an extension from any local telephone instrument and speaking into the telephone.

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

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

1.5 SUBMITTALS

A. Product Data: For each type of equipment.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location of each field connection.

1. Console layouts.

2. Control panels.

3. Rack arrangements.

4. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring. Identify terminals to facilitate installation, operation, and maintenance. Include a single-line diagram showing cabling interconnection of components. (MDF 66 block wiring diagrams with paging zone connections and IDF 66 block wiring diagrams with paging interconnecting wiring diagrams of connections to the MDF).

5. System Installation Diagrams: Showing all speaker locations, wiring routes used to each speaker, identification of cable and wiring pair used at each speaker, and end termination.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements. Include record of final speaker-line matching transformer-tap settings, and signal ground-resistance measurement certified by Installer. Provide certification of completion of installation and service training. Include calculations, charts and test data necessary to demonstrate that the system components deliver the specified signals and power levels at the required points and locations.

D. Maintenance Data: For equipment to include in maintenance manuals specified in Division 1.

1. Four copies of complete operational instructions shall be furnished complete with record drawings.

2. Include part numbers and names, addresses and telephone numbers of parts source.

1.6 QUALITY ASSURANCE

A. The contractor shall be an established communications and electronics contractor who has had and currently maintains a locally run and operated business for at least five consecutive years.

B. The paging system must provide satisfactory sound levels in all areas of the school, inside and outside, where installed.

C. It must be capable of processing paging inputs from the school's telephone system and from the system's administrative phone (direct connected) installed in the school's office area.

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.

E. Comply with NFPA 70.

F. Comply with UL 50.

1.7 CAPABILITIES

A. Elementary and Middle School Systems must be capable of:

Paging all speakers at the same time.

Separately page each of the 2 individual zones of the school (Zone Page), as identified by the District.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

Paging System Manufacturers: Subject to compliance with requirements and interface with existing facility equipment, products that may be incorporated into the work shall be as manufactured by Bogen Company:

1. Paging System: Bogen PCM-2000 System to include the following:

a. Power Supply: PCM-PS2, 1 each per school

b. Telephone Interface Module: PCM-TIM, 1 each per school

c. Central Processing Module: PCM-CPU, 1 each per school

d. Zone Module: PCM-ZPM, 2 each per school

2. Desk Set Telephone: 2500 located in office, 1 each per school with direct connection to the paging system

3. Inside Speaker Amplifiers: Bogen TPU-250

   a. Elementary Schools: 1 each per school

   b. Middle Schools: 2 each per school

   c. High Schools: 3 each per school

4. Outside Horn Amplifiers:

   a. Either 1 ea. Bogen TPU-250 or 1 ea. Bogen TPU-100 depending on outside horn quantity

5. Uninterruptible Power Supply (UPS):

1400VA, 1200 Watt stand-by power – 1 each per school

TrippLite SMART1500TSU

2.2 PAGING SYSTEM EQUIPMENT

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

B. Equipment: Modular type, using solid-state components, fully rated for continuous duty, unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.

C. POWER AMPLIFIERS

1. Comply with EIA SE-101-A.

2. Mounting: Wall mounted.

3. Output Power: 25Volts, 250Watts.

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

5. Minimum Signal-to-Noise Ratio: 60 dB, at rated output.

6. Total Harmonic Distortion: Less than 3 percent at rated power output from 50 to 12,000 Hz.

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

D. SPEAKERS: Paging speakers: Mixture of lay-in (ceiling), speaker/clock combinations, flush-mounted paging horns, surface-mounted paging horns, and wall surface mounted speakers as required in the various locations:

Ceiling Lay-in speakers: Valcom Clarity S-521B (5 watt)

Preferred installation at existing and at all new installations where acoustical suspended ceilings occur.

Speaker/clock combination speakers: Bogen S86T725

Existing systems only

3. Surface-mounted speaker horns: Bogen SPT-15A

Gymnasiums, Cafeterias, Auditoriums, and exterior

Include wire-guards for Gymnasiums.

4. Flush-mounted horn with backbox: Bogen FMH15T Horn with BBFM6 Backbox.

5. Wall-mounted speakers: Bogen WBS8T725

Existing conditions and areas without suspended ceilings

6. Surface ceiling mounted speakers: Bogen MB8TSQ with rough-in can and baffle

Existing conditions

7. Pendant Mount Speakers: SoundTube RS62-EZ (Black or White)

a. For open ceiling areas.

E. SPEAKER WIRE: 2 Conductor 20 AWG, CMP, Bare Copper (BC), Twisted, Stranded, Gray or White.

1. Acceptable Manufacturers:

a. Beldon 6400UE

b. West Penn 25222B

c. Approved Equivalent

2. When speaker wires terminate in an IDF, extend to the MDF using 25 pair cable. Install wire labels on both ends of each wire/cable installed.

F. TELEPHONE INTERFACE MODULE (TIM): Arranged to accept voice signals from telephone system (extension dialing access) to automatically provide amplifier input and broadcast through paging speakers in preselected zones.

G. MOUNTING: Install as per details shown on the drawings. Wall mount amplifiers and auxiliary equipment on a plywood backboard in a neat organized manner. All cables shall be bundled, supported on the backboard, and routed in neat vertical and horizontal lines.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install equipment to comply with manufacturer's written instructions. System shall be capable of an all system speaker page as well as an individual zoned page for each of the paging zones identified in the drawings.

B. Paging System Wiring Method: Each speaker shall be wired in the system by a continuous homerun to the MDF or IDF in the vicinity of the speaker. Connect new paging system to building speakers using existing wiring where possible. Arrange wiring and terminations to create zones as indicated on the drawings or as directed by school personnel. Speakers will not be daisy-chained in the plenum except for speakers in Corridors. All other speakers will have their own cable running to the closest IDF or MDF room. Outside speakers must be homerun to nearest IDF or MDF.

C. Terminate wiring from the speakers in the MDF/IDF on the A-B side of a 66 block (see Division 27). Extend speaker wires that are first terminated in an IDF to the MDF from the C-D side of the 66 block and terminate on the A-B side of the 66 block in the MDF. Use bridge clips for connection from the A-B side of the 66 blocks to the C-D side. Connect the outputs from the paging system to the C-D side of the 66 blocks in the MDF.

D. Extend one pair of paging system wires from the paging system to each of the performance sound systems for emergency override, wherever they occur. Wires are not to be terminated at the sound systems, label each end of each pair as to their purpose.

E. Extend one 20/2 cable from the paging system to the master clock for time/tone interface.

F. System cabling shall be supported by cable support (per Div. 27) above ceilings, where ceilings exist, and tight to structure where structure is exposed. Drop cable at speaker location. Provide conduit sleeves where cable penetrates walls, and provide fire seal for all penetrations through fire rated barriers.

G. Paging speakers shall be set for 25volt operation and adjusted or tapped as follows:.

1. Hall speakers: 1 watt

2. Room speakers: ½ watt

3. Gym speaker horns: 15 watt

4. Cafeteria speakers: 2 ½ watt

5. Outside speaker horns: 7 ½ watt

6. Install head end equipment in the MDF as shown on the drawings

H. Identification of Conductors and Cables: Apply wire and cable marking tape (see Div. 26) to designate wires and cables to identify media in coordination with system wiring diagrams. Provide labels for all existing cables at termination points where labels do not exist.

1. Identify and label with approved final room designations.

Label all 66-blocks. Label room numbers or termination points on 66-block. Provide a laminated 66-block diagram for each 66-block with the final room designations or termination points, attached to the wall above the 66-blocks.

System shall be separated into 2 zones:

Inside (Zone A on 1st ZPM module [Zone 1])

Outside (Zone B on 1st ZPM module [Zone 2])

2nd ZPM is a Spare

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.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installations, including connections. Report results in writing.

B. Operational Test: Perform tests that include originating program and page material at microphone inputs, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and freedom from noise and distortion.

C. Commissioning: 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.

D. Provide all required testing apparatus and factory-trained personnel specified to successfully complete the test. (Third party testing is NOT required).

E. Prior to energizing or testing the system, ensure the following:

1. All products are installed in a proper and safe manner per the manufacturer's instructions.

2. Insulation and shrink-tubing are present where required.

3. Dust, debris, etc., are removed

4. Cable is dressed, routed and labeled, connections are consistent with requirements

5. All labeling has been provided

6. Electronic devices are properly grounded

F. 25V Speaker Test:

1. Play music or other distinctive audio signal through all speakers.

2. Walk all rooms and other speaker locations.

3. Verify that each speaker is operating and that there are no significant changes in volume levels from one speaker to the next.

4. Verify that the extent of coverage is consistent with the areas indicated on the drawings.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain equipment as specified below:

B. Provide one 2-hour session to train Owners maintenance personnel and a total of two hours - to train school staff on programming equipment for starting up and shutting down, troubleshooting, servicing, and maintaining equipment. Include proper use of the system which covers operation using the telephone system and the administrative phone

1. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."

2. Schedule training with Owner, through Engineer, with at least seven days' advance notice.

3.5 WARRANTY

A. The contractor shall warrant that all materials and installation shall be guaranteed to be free from defects in material and workmanship after final acceptance of installation for the period defined in the provisions of Division 01.

END SECTION 27 51 13

27 51 16 Public Address Sound Systems – August 2021

- Work in this section is restricted to specific products of specific manufacturers and model numbers that have been previously approved by Jefferson County School District, R-1.
- Section Includes:
    1. Public Address Rooms:
        a. Independent sound system for public performances and meetings in:
            (1) Gymnasium
            (2) Multipurpose room
            (3) Auditorium
            (4) Vocal Music
            (5) Instrumental Music
            (6) Commons
            (7) Cafeteria
- See Data, Communications and Alarm Diagram.
- In the absence of other information, standards of the following organizations apply:
    1. Electrical Components complying with applicable requirements of NFPA 70 "National Electrical Code" including, but not limited to:
        a. Article 250, Grounding
        b. Article 300, Part A., Wiring Method
        c. Article 310, Conductors for General Wiring
        d. Article 725, Remote Control, Signaling Circuits
        e. Article 800, Communications Systems
    2. Underwriters Laboratories (UL) 50 as applicable.
- Submittals
    1. Product Data: Required
        a. Equipment prints

b. Full electronic wiring diagrams

c. Specification sheets including cable types.

2. Shop Drawings: Required

   a. Detailed wiring diagrams for power, signal and control that clearly differentiate between manufacturer installed wiring and field installed wiring.

   b. Identify wires at termination points to facilitate installation, operation and maintenance.

   c. Detail programmable electronic communications network system including but not limited to the following:

      (1) Detailed One Line Drawings

      (2) Equipment Cabinet Arrangement

   d. System field wiring diagrams showing typical connections for all equipment.

   e. Manufacturer's complete service notes and drawings detailing all interconnections.

   f. Riser diagram for the system showing in technically accurate detail all connections and interconnections.

   g. Test Reports:

      (1) Include calculations, charts and test data necessary to demonstrate that the system components deliver the specified signals and power levels at the required points and locations.

3. Certificates:

   a. Copy of UL listing cards for the proposed system

   b. A signed statement from the equipment supplier that the system has been wired, tested and functions properly according to the specifications.

4. Manufacturer Instructions:

   a. Four copies of complete operational instructions shall be furnished complete with record drawings.

   b. Include part numbers and names, addresses and telephone numbers of parts source.

5. Commissioning:

a. Submittals listed above, updated to record status.

6. Demonstration and training:

   a. Provide a factory authorized representative to present a 2-hour demonstration on site to the school staff about the major features, common functions and routine operation of each component.

   b. Present one in-depth 2-hour session of technical classroom training, on-site, by a factory trained representative of the equipment manufacturer for selected District technicians on the functions, trouble diagnosis and proper maintenance of the installed equipment.

   c. Furnish each member of the class a copy of the manufacturers' applicable training manuals.

   d. Schedule the demonstration and training sessions with the District project manager at least ten days in advance.

7. Warranty

   a. Guarantee all materials and installation to be free of defects in material and workmanship after final acceptance of installation for the period defined in the provisions of Division 01.

   b. Provide on-the-premise maintenance at no cost for the warranty term.

   c. Within one year of date of acceptance, provide up to three on-site assistance visits to adjust sound levels, reset matching transformer taps and adjust controls to suit actual occupied conditions.

- Maintenance

  1. Local service by factory-trained personnel of the specified equipment from an authorized distributor of all equipment specified under this section.

- Amplifier

  1. Crown Dual Channel or approved equivalent.

  2. No greater than 19 inches wide, 5 inches high and 26 inches deep.

  3. Audio output of a minimum of 250 watts RMS with a total harmonic distortion of .05% maximum at 1 kHz rated power.

     a. Output regulation .5 dB (direct); 1.0 dB (Transformer).

  4. Amplifier must meet load requirements

- Mixers

1. Behringer RX1202FX or Soundcraft Ui-16
2. Complete input and mixing facilities for minimum 8 low impedance microphone inputs and auxiliary inputs.
3. Auxiliary programs input such as CD players and recorders are considered as part of this guideline.
    a. Include CD player with BlueTooth with remote control (IR).
        (1) Product previously approved by Jefferson County School District, R-1 is Tascam CD-200BT with the IR control.
4. Complete input and mixing facilities for microphone inputs and auxiliary inputs
    a. Input overload circuit which permits microphone signals of up to 1 volt to be reproduced without any discernible increase in distortion.
    b. Capable of reproducing microphone signal levels above 1 volt magnitude without overloading; or rely upon a gain switch to accommodate high signals

- Signal Processor:
    1. Elementary School
        a. Shure DFR22
            (1) Include all circuitry and controls necessary to provide complete system equalization for optimum sound reproduction and maximum gain before feedback.
                (a) Equalizer filters: 1 octave bandpass type having an individual range of 12 dB.
                (b) Front and back panels will have user lockout controls.
    2. Middle School and High School
        a. Shure DFR22 or Symetrix or QSC Core Processors depending upon system design
            (1) Include all circuitry and controls necessary to provide complete system equalization for optimum sound reproduction and maximum gain before feedback.
            (2) Equalizer filters: 1 octave bandpass type having an individual range of 12 dB.
        b. Front and back panels will have user lockout controls

- Speakers:
  1. Sound Tube HP890i, HP129a, or CM800i, or District approved equivalent.
     a. Monitors: EV-SX300/MB200 or District approved equal.
  2. Self-contained loud speakers manufactured by manufacturers previously approved by Jefferson County School District, R-1.
  3. Numbers of speakers used depend on the physical area to be covered.
  4. All hanging speakers will have a minimum of two support cables, rated to support 10 times the speaker weight.
  5. All Elementary and Middle School Gymnasiums will utilize hanging speakers manufactured by SoundTube; model number will depend on the area to be covered.
  6. High School Gymnasiums and High School & Middle School Auditoriums will utilize horn-loaded speaker cabinets. Number and size of speakers used will depend on physical area to be covered.
- Microphones:
  1. Handheld microphones:
     a. Shure SM58LC
     b. With stand and 25 foot microphone cable each.
  2. Wireless microphones systems:
     a. Audio Technica ATW 3000 series or Shure SLXD / ULXD or Sennheiser G4 Series.
     b. Two (2) per stage and gymnasium.
  3. Hanging microphones:
     a. Shure MX 202BP/C
     b. Three (3) per stage.
  4. Microphone jacks:
     a. Non-latching Female XLR
        (1) Switchcraft Model D3FD or approved equivalent
     b. Flush mounted.
- Power Conditioner and Sequencer

1. Furman Model Furman CN-2400S
    a. Keyed off/on switches
    b. Standard rack mountable

- Cables
    1. Speaker Circuits
        a. Homerun station wiring in individually jacketed cables
        b. Cables 14 AWG conductors; plenum rated
    2. Microphone cables:
        a. Minimum of 22 AWG, plenum rated and each jack homerun to sound cabinet
    3. All microphone jacks will be Switchcraft Model D3FD Non-Latching or District approved equal.
- Equipment Rack:
    1. Acceptable products:
        a. Middle Atlantic DWR-35-22
        b. Lowell LWBR-3532
    2. Wall mount, swing-out with front locking door
    3. Louvered front
- Source Quality Control
    1. Listed by Underwriter's Laboratories under UL Standard 1459.
    2. All items of equipment, including wire and cable, shall function as a complete system.
    3. Experimental equipment will not be acceptable.
    4. The proposed system must be demonstrable at a local customer’s facility.
- Execution Summary
    1. Install system in a well-ventilated location with adequate heat rejection and in accordance with NFPA 70, other applicable codes, and manufacturer’s written instructions.
    2. Provide necessary transient protection on the AC power feed to the system.

3. Install low voltage wiring within cable supports above accessible ceilings and in raceways where Inaccessible or in exposed areas.
4. Install in conduit within inaccessible ceiling and wall spaces.
5. Use UL listed plenum cable.
6. Do not install system cabling and high voltage wiring within the same raceway.
7. Carefully match input and output impedances and signal levels at signal interfaces.
8. Provide matching networks where required.
9. Provide adequate length of conductors within enclosures.
10. Neatly bundle, tie and trim the conductors to terminal points with no excess.
11. Provide 12 inch minimum separation between cables to speaker-microphones and adjacent parallel power and telephone wiring.
12. Make splices, taps and terminations on numbered terminal punch blocks in junction, pull and outlet boxes, terminal cabinets and equipment enclosures.
13. Use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams
14. Cable supports are mandatory where routed through plenum ceiling areas.

- Grounding
  1. Equipment grounding connections are required for communications network systems rack.
  2. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.
  3. Ground equipment and cable shields to eliminate shock hazard and to minimize to the greatest extent possible ground loops, command mode returns, noise pickup, cross talk and other impairments.
- Installation Schedule
  1. Individual schools may vary depending on design and layout.
  2. Typical Elementary Gym/Stage:

Quantity	Component

4	SoundTube HP890i-WH Speakers (Gym)
2	SoundTube CM-800i Ceiling Speakers (Stage)
1	Behringer RX1202FX Rack Mixer or Soundcraft Ui-16
1	Crown CDi-1000 Power Amplifier
1	Shure DFR22 Signal Processor
2	Shure SM58S Microphones
3	Shure 202BP/C Microphones (for stage)
3	25’ Microphone Cables
2	Audio Technica ATW-3212/C510 Handheld Wireless
1	Audio Technica ATW-R3210 Body Pack
1	Audio Technica BP894xCH-TH
1	Middle Atlantic DWR-35-22
1	Middle Atlantic VFD-35
1	Middle Atlantic UD2
1	Furman CN-2400S Power Sequencer
2	Round Base Mic Stand
2	Boom for mic stand
1	ART AVDIBox
1	3.5mm Cable
1	Tascam CD-200BT
1	RDL ST-VP2 Automatic Ducking Module
1	RDL PS24A Power Supply
1	RDL TX-70A Paging System Interface
4	Horizon SP-1NC3FD-L-1-0 Wall Plate (non-latching XLR wall plate)
1	Horizon Rack Panel w/4 Non-Latching XLR Jacks
1	Xantech WL85 J-Box IR Receiver
1	Xantech 789-44PS/RP Connecting Block w/PS

1 Xantech 283D Emitter

3. Typical Elementary Cafeteria:

4 SoundTube CM-800i Celing Speakers

1 Behringer RX1202FX Mixer

1 Crown CDi-1000 Power Amplifier

1 Shure DFR22 Signal Processor

2 Shure SM58S

3 25’ Microphone Cables

2 Audio Technica ATW-3212/C510 Handheld Wireless

1 Audio Technica ATW-R3210 Body Pack

1 Audio Technica BP894xCH-TH

1 Middle Atlantic DWR-35-22

1 Middle Atlantic VFD-35

1 Middle Atlantic UD-2

1 FurmanCN-2400S Power Sequencer

2 Round Base Mic Stand

2 Boom for Mic Stand

1 ART AVDIBox

1 3.5mm Cable

1 Tascam CD-200BT

1 RDL ST-VP2 Automatic Ducking Module

1 RDL PS24A Power Supply

1 RDL TX-70A Paging System Interface

2 Horizon SP-1NC3FD-L-1-0 Wall Plate

1 Horizon Rack Panel w/4 Non-Latching XLR

1 Xantech WL85 J-Box IR Receiver

1 Xantech 789-44PS/RP Connecting Block w/PS

1 Xantech 283D Emitter

4. Typical Middle School Gyms: Same as Elementary School Gyms with the following exceptions:

   9 SoundTube HP890i-WH speakers

   No SoundTube CM-800i speakers

   No Shure MX202-BP/C Microphones

5. Middle School Cafetoriums: Same as Elementary Gyms with the following exceptions:

   5 SoundTube HP890i-WH speakers

6. High School system components are designed for each facility's needs. Coordinate with the District Project Manager.

- Acceptable Installer

  1. Installation and start-up are required to be under the direct supervision of a local contractor meeting the following criteria:

     a. Regularly engaged in installation, repair and maintenance of such systems.

     b. Established sound systems, communications and electronics contractor that has had, and currently maintains, a locally run and operated business for at least five years.

     c. Local authorized distributor of all specified equipment for a single source of responsibility and shall provide documents proving such.

     d. Provide written proof that his firm is adequately staffed with factory-trained technicians for all of the specified equipment.

- Acceptable Supplier

  1. Factory authorized distributor meeting the following criteria:

     a. Full responsibility to honor the manufacturer's warranty.

     b. Show satisfactory evidence, upon request, that the supplier maintains a fully equipped service organization capable of furnishing adequate inspection, training and service to the system.

c. Availability of necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being supplied.

d. Accredited by the proposed equipment manufacturer(s) and prepared to offer a service contract for system maintenance on completion of the warranty period.

e. Provide the names, locations and cite five recent successful installations in the area.

- Field Quality Control

1. Provide the services of a factory authorized service representative to supervise the field assembly, connection of components and the testing and adjustment of the system.

2. Check-out and final connections to the system shall be made by a factory trained technician in the employ of the manufacturer of the products installed.

END SECTION 27 51 16

27 51 30 Classroom Sound Reinforcement System – August 2017

- Permanently Installed Systems
  1. New and Major Renovations
- Portable Systems
  1. Existing Areas
- Acceptable Manufacturers:
  1. Lightspeed
     2. Basis of Design:
        a. 955 Access System with Flexmike, Sharemike, (1) TCA multimedia ceiling speaker
        b. Topcat 955 Access Media Connector sound system with paging interrupt and speaker. This installation is most commonly a ceiling mount installation.
- Installation: Manufacturer certified or approved installers.
- Warranty: 1 year
- Testing and Commissioning: Prior to acceptance, test full range of all systems with District Project Manager present. Ensure system does not interfere with other facility components, such as PA system, wireless systems, and others.
- Training: Provide complete system training to District School and Maintenance Staff, including operation and maintenance.

- System shall function without audible distortion, hum, buzz, or rattle under normal operating conditions.
- System Components (Permanently Installed Wireless System)
  1. General:
     a. Speaker system with flat panel technology and multimedia speaker mounted in ceiling with wireless media connector.
     b. Media Connector with power supply. Wireless audio transceiver powered with USB connector. Wireless communications access technology shall be coordinated with other wireless communications access technologies present in the facility to avoid interference and conflict. Tone control with audio inputs and audio outputs.
  2. Speaker amplifier with power supply
     a. In-ceiling wireless audio base station with power supply.
     b. Wireless media connection: Coordinate with other wireless communications access technologies present in the facility to avoid interference and conflict.
  3. Controls:
     a. Master microphone volume control, tone control, audio input volume control
     b. Connections:
        - Direct AC main power input, optional DC power input, audio input
        - Optional page mute input
  4. Pendant Microphone
     a. Pendant-style audio transceiver with lanyard and wireless communication.
     b. Audio distortion < 1%
     c. Rechargeable battery pack and charging cradle and cable
     d. USB connection for charging and audio, or other as approved
     e. On/Off/Mute switch
     f. Push button for registration with system wireless components
  5. Shared microphone
     a. Handheld audio transceiver with wireless communication technology and integral rechargeable battery pack.
     b. Audio distortion < 1%.
     c. Uni-directional microphone
     d. Audio input
     e. Charging jack
     f. On/Off/Mute switch
     g. Push button for registration with system wireless components
     h. Cradle charger for shared microphones
     i. Capacity: 2 microphones
- System Components (Portable Systems):

1. Lightweight and portable plug-and-play tabletop system consisting of an audio base station with speaker. Built-in wireless or blue tooth capabilities. Portable microphones.
   a. Pendant Microphone: Pendant-style audio transceiver with lanyard and wireless communication. Audio distortion < 1%. Rechargeable battery pack and charging cradle and cable. USB connection for charging and audio, or other as approved. On/Off/Mute switch. Push button for registration with system wireless components.
   b. Shared microphone: Handheld audio transceiver with wireless communication technology and integral rechargeable battery pack. Audio distortion < 1%. Uni-directional microphone. Audio input. Charging jack. On/Off/Mute switch. Push button for registration with system wireless or blue tooth components. Cradle charger for 2 shared microphones.

END SECTION 27 51 30

27 53 13 Clock and Program Systems – April 2020

- System Description:

1. An integrated, system for originating and distributing time and time correction signals and for programming and initiating audible program signals. Components display time at various locations, provide programmed audible signals, and operate remote switching. The system transmits time and program signals from a master control unit to indicating clocks, signal equipment, and remote switching devices over clock and program system wiring.

2. A basic wireless timekeeping system:

   a. System controller

   b. Built-in or external transmitter

   c. Transmitter antenna

   d. Means of receiving time synchronization (Ethernet SNTP) analog or digital clocks

   e. Components for expanding the system and its operations

      (1) Capable of synchronizing clocks and computers throughout the facility on a daily basis.

3. Installation Locations: Typical locations identified in the District Technical Details Drawings.

- System Synchronization:

    1. System shall synchronize all clocks to each other. System shall utilize Ethernet (SNTP) technology to provide atomic time to components.

        a. Systems for new school facilities shall not require hard wiring for its components except for AC power.

        b. Systems for existing facilities must interface with existing wired clock systems.

        c. Clocks shall automatically adjust for Daylight Saving Time per the Daylight Saving time settings in the system controller.

        d. Analog Clocks shall synchronize to +/- 1 second of the master clock displayed time.

- System Requirements:

    1. The system shall include an internal real time clock reference so that failure of the SNTP signal shall not cause the clocks to fail in indicating the correct time.

    2. The system shall incorporate a “fail-proof” design so that a temporary power interruption shall not cause failure of the system. Upon restoration of power, the system shall resume normal operation.

    3. Analog clocks shall be battery operated or 110VAC powered. (unless 24VAC already exists onsite)

    4. System shall include a minimum of 4 relays, in addition to the clock relays, to control inside and outside bells and other devices.

    5. System instruction manual and equipment shall be available for building site transmitter signal reception diagnosis.

- Quality Control:

    1. System manufacturer and vendor shall be responsible for a complete and operating system, including constructability, functionality and maintainability of the system components.

    2. Manufacturer must be able to provide:

        a. Battery operated Wireless Analog clocks

        b. AC powered 120v Wireless Analog and Digital clocks

        c. AC powered 24v Wireless Analog clocks

3. Training: On-site system training from a qualified factory representative to include troubleshooting. Include both maintenance and end user. Provide operation and maintenance manual.

- Regulatory Requirements:

1. System Controller, Transmitter, and Receiver shall comply with Part 90 of FCC rules as follows:

   a. Devices must not cause harmful interference.

   b. Transmitter frequency shall be governed by FCC Part 90.35

   c. Transmitter output power shall be governed by FCC Part 90 and 74.

2. System shall be installed in compliance with Authorities Having Jurisdiction.

- Submittals:

1. Product Data: Submit complete catalog data for each component describing physical characteristics and method of installation.

2. Shop Drawings: Complete set of project-specific shop drawings showing wiring and components, including one-line diagram of major system components. Include notes from on-site investigations for existing systems.

3. Manufacturer's Instructions: Submit written instructions for a complete installation, set-up, and operations & maintenance data.

- Master Clock – System Controller:

1. System Controller shall be equipped with a wired clock system run and correction output circuits and correction protocols for select wired clock systems. System controller can simultaneously operate a wired clock system and provide wireless clock signal to maintain synchronization of the wired and wireless clock systems throughout a facility.
2. Approved Manufacturers:
   a. American Time (ATS)
   b. Sapling, Inc.
3. System Controller shall synchronize to Ethernet via SNTP.
4. Master Clock shall be able to transmit clock correction wirelessly to secondary clocks

5. Wireless transmitters may be internal or external.

   a. Transmitter:

      (1) Frequency Range: multiple frequencies acceptable but are specific to manufacturer.

(2) Transmission Range: To include all clocks associated with a building and campus.

(3) Transmission format: POCSAG, digital one-way communication

(4) Digital Data rate: 512 - 2400BPS

(5) Operating range: 0 to 45 degrees C (32 to 114 degrees F)

6. Interface with existing wired clock systems
   a. 3-Wire Synchronous clocks (code 01)
   b. National Movement (code 18)
   c. Frequency generated systems
7. Ethernet connection
   a. System Controller shall be capable of remote web interface which allows for event and circuit programming as well as manual circuit activation via a web browser without the need for special software.
      (1) Include triggering wired and wireless events
      (2) Assigning custom durations to signals
      (3) Managing programming of up to six (6) circuits, backing up and restoring schedules to and from PC's
      (4) Activating circuits manually
      (5) Ability to monitor and adjust Daylight Savings Time remotely
   b. Shall have the ability to remotely control schedules for relays (bells) via network
   c. Shall have the ability to manually ring the bells remotely
   d. Shall have the ability to remotely control master clock setup and master clock functions.
8. System controller shall incorporate a display and a keypad to provide the following features:
   a. Password protected Administrator menu to set the date, local time zone, clock addresses, and other system parameters
   b. Time zone selection via the keypad and display for all USA time zones.
   c. Automatic Daylight Saving Time Adjustment can be enabled or disabled from keypad.
   d. Database programming and administration using its keypad and LCD display
   e. The system controller shall contain an internal clock such that failure of reception from the SNTP will not disable the operation of the clocks.
9. Antenna:
   a. For indoor or outdoor applications. Antenna polarization per manufacturer's recommendation.

b. Install clock antenna as far away from Paging System head end as possible to avoid interference.

10. Power supply: (included with master):
    a. Manufacturer's Recommendation

- Devices:
  1. Direct wired electrical devices with on/off capability or momentary signaling.
  2. Analog Clocks:
     a. 15" diameter (at Assembly locations), 12" diameter all other locations
     b. Black Case
     c. Wall Mounted
     d. Polystyrene frame and polycarbonate lens.
     e. Face shall be white.
     f. Hour and minute hands shall be black, second hand is red.
     g. Misc. clock features:
        (1) Analog clocks with no user mechanical adjustments.
        (2) Run time of a half hour after power loss without losing time for AC versions.
        (3) Time shall be automatically updated from the transmitter with a minimum of 1 time per day.
        (4) Use manufacturers recommended batteries or AC power adapter without battery.
     h. The clock shall have an ultra-sensitive receiver and integrated internal antenna.
     i. The clock will keep operating using its internal quartz clock in case of signal reception loss due to malfunction of the wireless system controller or transmitter.
  3. Digital Clocks:
     a. 4 or 6 digit (with approval of District Project Manager), 4" high red LED character display with built-in wireless receiver.
     b. Operate off of 110VAC.
     c. Manufacturer shall have digital clocks that operate as a countdown/message clock along with displaying normal time.

4. Wireless Relay Module:
   a. For use where wireless signals are utilized.
   b. Manufacturer shall be able to provide both low voltage and high voltage remote relays that receives a wireless signal and supplies a contact closure based on the schedule in the system controller that is assigned to that circuit.

- Acceptable Components
  1. ATS
     a. Master Clocks
        (1) SSQMSTR-05N8E – Site Sync 5-watt master clock with Ethernet, 2 wired clock circuits and 6 bell circuits
        (2) SSQMSTR-10N8E – Site Sync 10-watt master clock with Ethernet, 2 wired clock circuits and 6 bell circuits
        (3) SSQMSTR-10C8E – Site Sync 10-watt master clock with Ethernet, 2 wired clock circuits and 6 bell circuits, campus antenna
     b. Wall Clocks
        (1) SQ55BADD504BP – 12" Molded Battery Wireless Clock
        (2) SQ55BAAD504 – 12" Molded 120vac Wireless Clock
        (3) SQ55BABD504 – 12" Molded 24vac Wireless Clock
        (4) SQ65BADD504BP – 15" Molded Battery Wireless Clock
        (5) SQ65BAAD504 – 15" Molded 120vac Wireless Clock
        (6) SQ65BABD504 – 15" Molded 24vac Wireless Clock
  2. Sapling
     a. Master Clock
        (1) SMA-3S0-1004-1 – Master Clock with 4 Bell Relays
        (2) SMA-3S0-1008-1 – Master Clock with 8 Bell Relays
     b. Wall Clocks
        (1) SAL-4BS-12R-0 – 12" Battery Wireless Clock
        (2) SAL-4BS-12R-14 – 12" 120vac or 24vac Wireless Clock (specify 120vac or 24vac)
        (3) SAL-4BS-15R-0 – 15" Battery Wireless Clock
        (4) SAL-4BS-15R-0 – 15" 120vac or 24vac Wireless Clock (specify 120vac or 24vac)

END SECTION 27 53 13

27 53 19 Bi-directional Antennas – August 2022

- Bi-directional Antenna systems utilized to support local first responders and provide uninterrupted on-site emergency communications

- Coordinate requirements with local authorities having jurisdiction
- Coordinate with the District's Information Technology and Communications department through the District's Project Manager
- Components:
  1. Bi-directional amplifier (BDA)
     a. Radio Frequency amplifiers
        i. Some jurisdictions may require multiple BDA's
     b. Antenna system located in the interior of the building
        i. Multiple antennas or "leaky COAX" cabling as approved by the local jurisdiction
        ii. Donor antenna mounted on the building's roof to receive signals from a carrier radio tower
     c. Mounting sled for roof antenna with weather-resistant weights
     d. COAX cable for antenna connections (interior and exterior)
     e. Connectors
     f. Uninterrupted power supply (UPS)
        i. NEMA fire-rated UPS enclosure
     g. Splitters and Combiners
        i. Signal splitters and combiners

END SECTION 27 53 19