



2020
CONSTRUCTION
STANDARDS
VOLUME III

Divisions 27, and 28

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For use in all new projects as of the issue date

Projects in progress prior to the issue date should refer to the appropriate prior issue

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DIVISION 27 COMMUNICATION

27 00 00 General Requirements for Communication

Division 27 Communication is part of the third volume of a three-volume series, LPS Construction Standards and should be coordinated with Division 28 and the other two volumes. This division provides definitive goals, design & installation mandates, and detailed specifications for District facilities infrastructure and systems supporting Information Technology, Domestic and Emergency Communications, Smoke/Fire Detection and Alarm, and Building Access, and Security.

The standards identify professional certifications for design engineers, manufacturer certifications for installers, and relevant experience required for both. Proprietary platforms are identified for each major system, along with pre-approved providers of mutually compatible component devices.

Deviation from any provision in these Standards is prohibited except for unique circumstances and only following exhaustive review and sign-off by the LPS Operations, Maintenance and Construction Department (OMC), Information and Technology Services (ITS) and/or Security and Emergency Planning, as appropriate, via specific project programming and design.

Construction drawings and specifications based on these standards, in conjunction with the other two volumes, must provide for complete, properly operating systems fully integrated into existing District central operations, monitoring and control.

Consultants are required to coordinate with LPS resources including:

- Division 27 Technology Design Typicals
- Division 28 FA & MN Schematics
- Safety and Security Guidelines for Facility Design
- Construction Standards Volume 1 for Divisions 00-14 and 31-33
- Construction Standards Volume 2 for Divisions 21-23, and 26

Resources can be found on LPS Manuals and Regulations web page:

<https://littletonpublicschools.net/manuals-regulations>

27 05 20 Pathways and Spaces Standards

1.0 INTRODUCTION

1.1 PURPOSE

The intent of this document is to provide a standard specification that will be used for all Littleton Public Schools facilities requiring new pathways and spaces for structured cabling installation. This document provides the minimum requirements and criteria for the distribution pathways and telecom spaces that should accommodate the Owner's requirements through 2018.

Pathway in any facility shall be contingent upon prevailing architectural conditions within the facility. The primary factor influencing the design of pathways within any facility shall be ceiling type. Size of a facility and the functional use of spaces and facilities may be considered when developing pathway design.

Telecommunication Spaces in LPS facilities shall consist of (1) main equipment room (MDF) in each facility and additional telecom rooms (IDFs) as needed to support the facility based on size and configuration.

1.2 SCOPE

This document defines the pathways, spaces, and subsystem components that are necessary for a comprehensive structured cabling system supporting voice, data, notification, and security systems. The intent of this document is to provide all pertinent information to allow a design team to successfully design and specify a complete system. However, it is the responsibility of the technology consultant and design team, in consultation with Littleton Public Schools technical staff, to propose any and all items required for a complete system installation if not specifically identified within the scope of the project.

1.3 APPLICABLE DOCUMENTS

The cabling system described in this standard is derived in part from the recommendations made in industry standard documents. The lists of documents below are incorporated by reference:

- 1) These Construction Standards and Associated Drawings
- 2) ANSI/TIA-568-C Commercial Building Telecommunications Cabling Standard - 2012
- 3) ANSI/TIA-569-C Commercial Building Standard for Telecommunications Pathways and Spaces - 2012
- 4) ANSI/TIA-606-B Administration Standard for the Telecommunications Infrastructure of Commercial Buildings - 2012
- 5) ANSI/TIA-607-B Commercial Building Grounding and Bonding Requirements for Telecommunications - 2012
- 6) TIA-526-14-B Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant - 2012
- 7) Building Industries Consulting Services, International (BICSI) Telecommunications Distribution Methods Manual (TDMM) – 13th edition
- 8) National Fire Protection Agency (NFPA) - 70, National Electrical Code (NEC) - 2011
- 9) National Fire Protection Agency (NFPA) - 72, National Fire Alarm and Signaling Code- 2011
- 10) Littleton Public Schools Division 26 Construction Standards
- 11) Littleton Public Schools Division 27 Construction Standards

If a conflict exists between applicable documents, then the order in the list above shall dictate the order of precedence in resolving conflicts. This order of precedence shall be maintained unless a lesser-order document has been adopted as code by a local, state, or federal entity and is therefore enforceable as law by a local, state, or federal inspection agency.

If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents; the design team is responsible to determine and adhere to the most recent release when developing the proposal for installation.

1.4 DESIGN TEAM QUALIFICATIONS

For LPS project design, all architectural firms shall employ or contract with a technology design consultant or engineer. The consultant or engineer shall possess a current Registered Communications Distribution Designer credential from BICSI (Building Industries Consulting Services, International) in order to demonstrate proficiency in the design and implementation of a comprehensive structured cabling system.

1.5 CONSTRUCTION DOCUMENTS

Construction documents shall provide separate drawings specifically for structured cabling system locations and details. Structured Cabling System drawings shall indicate all new pathways and spaces required in the facility. Existing raceway, conduit, and other pathways shall be indicated on drawings and noted as to disposition. All existing pathways that are to remain in place are to be properly reworked as necessary to bring them into current standards and codes. Mounting height of all equipment shall be indicated by way of floor plan keynotes, or equipment installation detail sheets. CSI-formatted specification sheets shall be provided as a supplement to the design documentation. Specifications must call out the manufacturers of the cabling products as indicated in this document. No alternates are to be accepted on products specified within this document.

All vendors for any cabling project will submit contractor qualifications and project data sheets. It will be the responsibility of the Technology Consultant and design team to review all submitted documentation for accuracy before forwarding the submittal package to Littleton Public Schools for final approval.

1.6 SUBMITTALS

- Submittals shall include product data literature. Submittals shall include adequate descriptive literature, catalog cut sheets, and other data necessary for LPS ITS to ascertain that the proposed equipment and materials comply with specification requirements.
- Product data submittals shall consist of technical data sheets, manufacturer specifications, illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and test data furnished to illustrate a product, material, or system for some portion of the work. Product data literature is required on all items of material and equipment and should be clearly marked, identifying specific items proposed.
- Prior to assembling or installing the work, prepare and submit shop drawings as necessary for review and approval.
- Shop Drawings shall include schematic layout of raceway, conduit, and pathways.

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- The contractor shall not purchase any materials or equipment for incorporation into the project prior to receipt of reviewed submittals from LPS ITS.
- Review of product data shall not relieve the Contractor from responsibility for deviations from the drawings or specifications, unless the Contractor has, in writing, called attention to such deviations at the time of submission and secured written approval.
- Samples may be requested, which shall be physical examples, which represent materials, equipment, or workmanship and establish standards by which the work will be judged.
- Product data submittals shall be reviewed by the Technology Consultant and design team prior to being forwarded to LPS ITS for review and final approval. LPS ITS will have authority for final approval of all product data submittals.
- Submittals shall include a labeling system and plan for the structured cable installation.

1.7 CONTRACTOR QUALIFICATIONS

Contractors bidding on this project must meet the following minimum requirements:

- Bidding contractors shall be companies specializing in the installation, fabrications, and design of raceway and architectural support for telecommunications systems.
- Typically, conduit, tray, and raceways will be installed by an Electrical Contractor, and architectural support will be installed or fabricated by a General Contractor. The Design Team shall coordinate with the construction team to insure efficient and clean pathway and space installations.
- Build-out of rack and raceway within Telecom Spaces shall be performed by a structured cabling contractor who meets the requirements laid out in Section 27 10 00 Structured Cabling Standards.

2.0 STRUCTURED CABLING PATHWAY REQUIREMENTS

2.1 HORIZONTAL DISTRIBUTION PATHWAY

Distribution pathway design and components shall be determined based on architectural design and conditions of existing building. In facilities with suspended ceilings installed, structured cabling pathways shall be above the suspended ceilings in broad base support devices attached to the deck above the suspended ceiling.

Facilities that do not have suspended ceilings or have areas without suspended ceilings shall have pathways designed and coordinated with LPS Operations, Maintenance and Construction (OMC) and LPS ITS departments.

Typically, main pathways shall route through hallways and common areas to mitigate interruption of educational spaces during construction and future troubleshooting. Facilities that have suspended ceilings in classrooms but not in hallways are the exception to this rule. Where routing cable pathways through hallways is not practical, pathways may be established through educational spaces. Acceptable pathways within educational spaces must be coordinated and approved by LPS OMC and LPS ITS departments.

Acceptable pathway solutions in facilities without suspended ceilings include architectural soffit fully enclosing cable pathway and establishment of new suspended ceiling in hallways or common areas. Conduit pathway through hallways and common areas shall be considered on a case by case basis and must be coordinated with and approved by LPS OMC and LPS ITS departments. Open-top cable tray or other pathways that are not fully enclosed shall not be considered.

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Where conduit or other enclosed pathway is approved, Construction Drawings shall detail layout of pathway including pull boxes, consolidation boxes, and vertical elevation changes. Additionally, shop drawings of pathways shall be generated as submittals to confirm and coordinate pathway installation.

2.2 IN-CLASSROOM DISTRIBUTION PATHWAY

Distribution pathway design and components shall be determined based on architectural design and conditions of existing building. In classrooms with suspended ceilings installed, structured cabling pathways shall be above the suspended ceilings in broad base support devices attached to the deck above the suspended ceiling.

Classrooms that do not have suspended ceilings shall have pathways designed and coordinated with LPS OMC and LPS ITS departments.

All classrooms shall include a Wireless Access Point enclosure that shall serve as a consolidation point and pull point in classrooms without suspended ceilings.

In-Classroom pathways where suspended ceilings do not exist shall consist of conduit mounted to the ceiling or walls. Construction Documents shall include a typical classroom conduit layout based on ceiling type, light fixtures, access to trunk pathways, and architectural considerations. Larger facilities may require additional typical classroom drawings to accommodate different areas and room functions. Typical classroom conduit layout shall be designed and coordinated with LPS OMC and LPS ITS departments. Shop drawings of In-Classroom pathway shall be generated as submittals to confirm and coordinate pathway installation.

2.2.1 Product Specifications

Wireless Access Point Enclosure – Hard Lid

- Wireless access point enclosure designed to be surface mounted on “hard-lid” ceilings or walls.
- Back box per Oberon 1015-C specification.
- Fully hinged locking cover is impact resistant and transparent to wireless signals.
- Knockouts for 3/4” trade conduit connectors, and snap-in keystone jacks and connectors.

Oberon

- 1015-C
- No Exceptions

Wireless Access Point Enclosure – Suspended Ceiling

- 15” x 15” Ceiling tile insert telecommunications enclosure.
- UL Listed, designed to meet NEC300-22 and 300-23 for plenum installations.
- 16-gauge clear coat aluminum back-box; 14 gauge textured white, powder coated steel door; textured white, powder coated steel flange; UL Classified domes.

Oberon

- 1075-CP
- No Exceptions

3.0 TELECOM SPACE REQUIREMENTS

3.1 EQUIPMENT AND TELECOM ROOMS

Equipment Room (MDF) and Telecom Room (IDF) locations shall be coordinated with and approved by LPS OMC and LPS ITS departments, in collaboration with the specific facility staff. When possible, the MDF shall be located to support the facility without IDFs, based upon field verification to assure that maximum effective cable runs will not be exceeded. Where IDFs are required to support facility size and configuration, they shall be located to minimize the need for additional rooms.

MDF rooms shall be at least 12' x 10', and IDF rooms shall be at least 10' x 10'. Rooms shall be square or rectangular in shape. Equipment not related to support of the MDF/IDF, including piping and ductwork, shall not be installed in, pass through, or enter the MDF/IDF rooms. Ceilings must be free and clear of any obstructions, including architectural /structural members not directly related to the MDF/IDF. Access to MDF/IDF rooms shall be through common areas, corridors or utility spaces and shall not route through instructional spaces. All MDF/IDF doors shall be secured with electronic card reader and keyed lock (with access restricted to LPS ITS and OMC Department personnel).

MDF rooms shall have a minimum of four (4) two-post equipment racks ganged together with vertical wire management. Telecom Rooms shall have a minimum of three (3) two-post equipment racks ganged together with vertical wire management. Racks shall be placed in a manner that will allow a minimum of three (3) feet of clearance from the front and rear mounting surfaces. Ladder rack raceway shall be installed over racks and around the perimeter of the room to provide adequate pathway for inter- and intra-room cabling. Ladder rack shall be installed with extension brackets 6" above the top of two-post racks. Crossbar and stringer radius drops shall be used to maintain cable bend radius where cable enters vertical wire management. All walls shall be completely covered with $\frac{3}{4}$ " x 4' x 8' sheets of AC grade plywood. Plywood shall be painted with two (2) coats of fire-retardant white paint. Plywood shall be mounted above electrical outlets (19" AFF typical) and extend above ladder rack.

Configuration and layout of equipment and termination panels shall be coordinated with LPS ITS. Typically, one (1) two-post rack shall be dedicated to horizontal and backbone cable termination; one (1) two-post rack shall be dedicated to Owner-provided network equipment; one (1) two-post shall be dedicated to secondary systems including security and paging notification equipment and termination panels.

3.1.1 Product Specifications

Equipment Racks

- Racks shall be constructed of aluminum and include two (2) top angles, two (2) base angles and two (2) 3" deep channels.
- Available as 84" high.
- Channels shall be tapped to accept #12/24 mounting screws.
- Channels shall have RMU markings.
- Shall be black in color.

Chatsworth Products (CPI)

- 55053-703
- Approved Equal

Wall Mount Equipment Cabinets

- Wall-mounted design with hinged sections to permit rear access to mounted equipment.
- Vertical mounting rails shall be adjustable front to rear.
- Welded construction with power coat finish.

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- Available with 12 to 26 rack mount spaces.
- Available as 24" by 24" by 36" or 48" high.
- UL listed.
- Shall be black in color.

Chatsworth Products:

- 11900-736
- Approved Equal

Vertical Cable Manager

- Double-sided design for cable management front and rear.
- 1 RMU cable guides on the front for managing patch cords.
- Shall include a front cover that can be opened right or left or removed entirely.
- Use 6" width, only. (3.65" width is too small.)

Chatsworth Products (CPI)

- 30162-703
- Approved Equal

Horizontal Cable Manager

- Available in 1U and 2U high wire managers.
- Rings may be made of metal or flexible material.
- Rings on front only.
- Shall be black in color.

Chatsworth Products (CPI)

- 30139-719
- Approved Equal

Ladder Rack (Cable runway)

- Ladder rack shall be manufactured from 3/8" wide by 1-1/2" tubular steel with .065" wall thickness.
- Ladder rack (side stringers) will be 9'-11 1/2" long. Cross members will be welded in between stringers on 12" centers beginning 5-3/4" from one end so that there are 10 cross members per ladder rack. There will be 10-1/2" of open space in between each cross member.
- Ladder rack will be delivered individually boxed, and available in 12" width.
- Finish shall be epoxy-polyester hybrid powder coat (paint) in black.

Chatsworth Products (CPI)

- 10250-712
- Approved Equal

Ladder Rack Mounting Hardware

- Wall angle support kits:
 - Shall be available in widths and colors to match ladder rack.
 - Shall include hardware for mounting ladder rack.
- Triangle support bracket kits:
 - Shall be available in widths and colors to match ladder rack.
 - Shall be constructed as a triangular welded bracket.
 - Shall carry a load rating of 100 lbs.
 - Shall include hardware for mounting ladder rack.

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- Cable Runway Elevation kits:
 - Used to support ladder rack above racks or cabinets.
 - Elevate ladder rack between 2" and 6" above racks or cabinets.
 - Rack-to-Runway Mounting Plate
 - Used to secure ladder rack to top of equipment rack.
 - Material is ¼" thick cold-rolled steel.
 - Can mount either parallel or perpendicular.
 - Finish shall be epoxy-polyester hybrid powder coat (paint) in the color(s) specified.
 - Match ladder rack color.
- Chatsworth Products (CPI)
- Approved Equal

Ladder Rack Splice Kits

- Splice kits will provide a method of mechanically connecting ladder rack sections and turns together end-to-end or side-to-end to form a continuous pathway for cables.
 - Splices (splice plates) will be manufactured from steel. Splice, grounding, and insulator bar kits will include installation hardware.
 - Finish (of splice plates and hardware) shall be zinc plate.
 - Splice kits shall consist of butt splices and junction splices as required.
- Chatsworth Products (CPI)
- Approved Equal

Cable Runway Radius Drop

- Can mount to side stringer or cross member.
 - Controls cable exit from ladder rack to racks or cabinets below.
 - Cross member drops available in varying widths to match cross member widths.
 - Available in colors to match ladder rack.
- Chatsworth Products (CPI)
- 12100-712
 - 12101-711
 - No Exceptions

Rack Mount UPS

APC Smart UPS Series Rack Mount Uninterruptible Power Supply

- All UPS devices use for LPS systems shall include a Smart Slot interface port and pre-installed network card.

1500V:

- SMX 1500RM2UNC

2000V:

- SMX2000RMLV2UNC

3000V:

- SMX3000RMLV2UNC

External Battery:

- SMX48RMBP2U
- SMX120RMBP2U

3.2 GROUNDING AND BONDING

The MDF room in each building shall be equipped with a telecommunications main grounding bus bar (TMGB). Each IDF room shall be provided with a telecommunications ground bus bar (TGB). The TMGB and TGB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.

Ladder rack raceway, two post equipment racks, and wall mount cabinets shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Use 2-hole, long-barrel lugs where ground bonds are fastened to equipment racks, ladder racks and busbars. Lugs shall have compression type fittings and be designed for the purpose of bonding equipment to ground. Use factory made bonding conductors where possible. Use proper crimping tools and dies when field installing lugs. Mechanical lugs with screw connections are not permitted. Scrape paint or power coat from equipment racks and ladder racks to bare metal before attaching lugs.

Refer to LPS Design Guidelines and Specifications Division 26 for additional details regarding grounding system.

3.3 ENVIRONMENTAL PROVISIONING

MDF and IDF rooms shall be provided with independent or split-system HVAC systems. Separation from building HVAC is required to maintain cooling when main building systems are not in operation.

Temperature shall be controlled to provide a continuous operating range of 64°F (minimum) to 78°F (maximum).

Humidity shall be controlled to provide a continuous operating range of 10% to 85% relative humidity.

Lighting shall be a minimum of 50-foot candles, measured three (3) feet above finished floor on both sides of equipment racks.

3.4 POWER REQUIREMENTS

Each active equipment rack shall be provided with two (2) separate dedicated 20amp 110VAC circuits with isolated ground, mounted on the ladder rack raceway above the rack. Each circuit shall terminate in a dual outlet receptacle. Receptacle back boxes and conduit shall be mounted with appropriate isolation from the ladder rack itself.

Racks dedicated to cabling termination and cross connect do not require power. Typical MDFs will have three (3) racks with power, and typical IDFs will have two (2) racks with power, but this will vary based on building layout and engineered evaluation and design.

3.5 UPS BACK-UP POWER PROVISIONING

Active equipment shall be supported by rack mounted uninterruptible power supplies (UPS). UPS sizing

shall be determined by the design team based on run-time requirements as laid out below. UPS systems shall be equipped with a Smart Slot interface for network interface cards. Paging and notification systems equipment shall be supported by a dedicated UPS device. Other building and auxiliary systems (excluding fire alarm) may share UPS support only if approved in advance by the LPS ITS Department and Director of Security.

Design teams shall consult with the LPS ITS department on a case-by-case basis to determine UPS procurement responsibilities for a given project. Requirements for UPS support shall be coordinated between the design team and LPS ITS during the development of construction documents.

Telephone, data, and video network equipment shall have UPS backup for two (2) hours of continuous run time.

Security network equipment shall have UPS or battery backup providing minimum two (2) hours of continuous run time. Bosch panel connecting fixed duress buttons to building lock-down function and alert messaging shall have battery backup providing eight (8) hours of continuous run time.

Paging/Notification equipment shall have UPS backup providing a minimum eight (8) hours continuous standby and run time.

Provide and install APC AP9810 relay modules for MDF/IDF networked APC UPS systems as required. All UPS devices provided with AP9810 relays per Divisions 27 and 28 Specifications shall be programmed to provide contact closures for Fire Alarm supervision. Coordinate event initiation with LPS Representative and paging system contractor.

4.0 FIRESTOPPING

All penetrations through fire rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating items—i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc.—shall be properly fire-stopped. Fire-stop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed. See also LPS Guideline Spec Section 07 80 00.

5.0 TERMINATION HARDWARE

Refer to Section 27 10 00 Structured Cabling Standards in this document for design, specification, and installation details of termination hardware.

6.0 AS BUILT DOCUMENTATION

Trunk pathways and ER/TR layout information shall be included in as-built documentation. Design and Construction Documents may be used as a template or base for as-built documentation. All deviations from construction drawings shall be represented on as-built drawings.

Refer to Section 27 10 00 Structured Cabling Standards for as-built documentation details.

7.0 INSTALLATION WARRANTY

The contractor shall warrant the cable pathway system against defects in workmanship for a period of one (1) year from the date of system acceptance. The warranty shall cover all labor and materials

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necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after repairs are accomplished. This warranty shall be provided at no additional cost to the Owner.

MDF/IDF room build-out shall be included in Structured Cabling Contractor's Installation and Workmanship warranty.

END OF SECTION 27 05 20

27 10 00 Structured Cabling

1.0 INTRODUCTION

1.1 PURPOSE

The intent of this document is to provide a standard specification that will be used for all Littleton Public School (LPS) facilities requiring copper and fiber optic structured cabling installation. This document provides the minimum performance criteria for the components and sub-systems comprising a complete cabling system that shall accommodate the Owner's requirements in excess of ten years.

Product specifications, general design considerations, and installation guidelines are provided in this written document. Quantities of telecommunications outlets, typical installation details, cable routing and outlet types for a specific Littleton Public School facility will be provided as an attachment to this document. If the bid documents are in conflict, the written specification shall take precedence. The successful vendor shall meet or exceed all requirements for the cabling system described in this document.

The Littleton Public School's infrastructure requires a CommScope Uniprise structured cabling system installed by a CommScope Certified Installer install team local to the State of Colorado. Contractor must be within a two- hour travel distance from the Littleton Public Schools. All copper cabling shall comply with the link and channel performance requirements of the latest revision of ANSI/TIA/EIA 568-C.2 "Balanced Twisted-Pair Telecommunications Cabling Components Standard". A copper cabling system shall be backed by a Uniprise Solutions Product and Applications 20-Year System Warranty. All fiber optic cabling shall comply with the transmission performance requirements of the latest revision of ANSI/TIA/EIA 568-C.3 "Optical Fiber Cabling Components Standard". A fiber optic cabling system shall be backed by a Corning, 25-Year System Warranty.

The system warranty shall be facilitated by the Contractor and be established between the Littleton Public Schools and the cabling system manufacturer.

The successful contractor is required to furnish all labor, supervision, tooling, miscellaneous mounting hardware, and consumables for each cabling system installed. The contractor shall maintain current status with the warranting manufacturer, including all training requirements, for the duration of the Cable Infrastructure Project. The Contractor shall staff each installation crew with the appropriate number of trained personnel, in accordance with their manufacturer/warranty contract agreement, to support the 20-Year System Warranty requirements. After installation, the Contractor shall submit all documentation to support the warranty in accordance with the manufacturer's warranty requirements, and to apply for said warranty on behalf of the Littleton Public Schools. The warranty will cover the components and labor associated with the repair/replacement of any failed link, within the warranty period, which is a valid warranty claim.

1.2 SCOPE

This document defines the cable system and subsystem components specific to cable, termination hardware, supporting hardware, and miscellany that are necessary for a complete structured cabling system supporting voice, data, notification, and security systems. The intent of this document is to provide all pertinent information to allow a design team to successfully design and specify a complete system. However, it is the responsibility of the technology consultant and design team to propose any and all items required for a complete system installation if not specifically identified within the scope of the project.

1.3 APPLICABLE DOCUMENTS

The cabling system described in this standard is derived in part from the recommendations made in industry standard documents. The lists of documents below are incorporated by reference:

- 1) This Technical Specification and Associated Drawings
- 2) ANSI/TIA-568-C Commercial Building Telecommunications Cabling Standard – 2012
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- 5) ANSI/TIA-607-B Commercial Building Grounding and Bonding Requirements for Telecommunications - 2012
- 6) TIA-526-14-B Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant - 2012
- 7) Building Industries Consulting Services, International (BICSI) Telecommunications Distribution Methods Manual (TDMM) – 13th edition
- 8) National Fire Protection Agency (NFPA) - 70, National Electrical Code (NEC) - 2011
- 9) National Fire Protection Agency (NFPA) - 72, National Fire Alarm and Signaling Code- 2011
- 10) Littleton Public Schools Division 26 Design Guidelines and Specifications

If a conflict exists between applicable documents, then the order in the list above shall dictate the order of precedence in resolving conflicts. This order of precedence shall be maintained unless a lesser order document has been adopted as code by a local, state, or federal entity, and is therefore enforceable as law by a local, state, or federal inspection agency.

If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents; the design team is responsible to determine and adhere to the most recent release when developing the proposal for installation.

1.4 DESIGN TEAM QUALIFICATIONS

For LPS project design, all architectural firms shall employ or contract with a technology design consultant or engineer. The consultant or engineer shall possess a current Registered Communications Distribution Designer credential from BICSI (Building Industries Consulting Services, International) in order to demonstrate proficiency in the design and implementation of a comprehensive structured cabling system.

1.5 CONSTRUCTION DOCUMENTS

Construction documents shall provide separate sheets specifically for structured cabling system locations and details. At the design team's discretion, the structured cabling sheets may be combined with paging and notification drawings and details. The structured cabling layout shall not be overlaid onto electrical, security, or any sheets other than public address as noted. Structured Cabling System sheets shall indicate all new cabling and devices present in the facility. Existing equipment, devices, and cabling shall be indicated on drawings and noted as to disposition. All existing equipment, devices, and cabling that are to remain in place are to be properly reworked as necessary to bring them into current standards and codes. Mounting height of all equipment shall be indicated by way of floor plan keynotes, or equipment installation detail sheets.

CSI formatted specification sheets shall be provided as a supplement to the design documentation. Specifications must call out the manufacturers of the cabling products as indicated in this document. No alternates are to be accepted on products specified within this document.

All vendors for this cabling project will submit contractor qualifications and project data sheets. It will be the responsibility of the Technology Consultant and design team to review all submitted documentation for accuracy before forwarding the submittal package to LPS IT for final approval.

1.6 SUBMITTALS

- Submittals shall include product data literature. Submittals shall include adequate descriptive literature, catalog cut sheets, and other data necessary for LPS IT to ascertain that the proposed equipment and materials comply with specification requirements.
- Product data submittals shall consist of technical data sheets, manufacturer specifications, illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and test data furnished to illustrate a product, material, or system for some portion of the work. Product data literature is required on all items of material and equipment and should be clearly marked, identifying specific items proposed.
- Prior to assembling or installing the work, prepare and submit shop drawings as necessary for review and approval.
- The contractor shall not purchase any materials or equipment for incorporation into the project prior to receipt of reviewed submittals from LPS IT staff.
- Review of product data shall not relieve the Contractor from responsibility for deviations from the drawings or specifications, unless the Contractor has, in writing, called attention to such deviations at the time of submission and secured written approval.
- Samples may be requested, which shall be physical examples, which represent materials, equipment, or workmanship and establish standards by which the work will be judged.
- Product data submittals shall be reviewed by the Technology Consultant and design team prior to being forwarded to LPS IT staff for review and final approval. LPS IT staff will have authority of final approval for all product data submittals.
- Submittals shall include a labeling system and plan for the structured cable installation.

1.7 CONTRACTOR QUALIFICATIONS

Contractors bidding on this project must meet the following minimum requirements:

- Bidding contractors shall be companies specializing in the installation, fabrications, and design of telecommunications systems.
- Contractors must be a CommScope Uniprise Certified Installer headquartered in the state of Colorado.
- The Contractor shall have a minimum of five (5) years of experience in this specialized field and shall have completed a minimum of three projects similar in the scope to this project.

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- The telecommunications Contractor must be certified for installing the proposed manufacturer's solution throughout the entire completion of project.
- Contractors must submit proof of above stated required qualifications.
- The design team shall acquire a list of currently certified contractors from the local CommScope Uniprise representative to include in specification documentation. The list of certified contractors shall be provided to LPS IT staff for approval prior to inclusion in specification documents.
- At the discretion of LPS IT staff and Building and Operations staff, past performance may be used to disqualify a contractor from providing services for LPS technology projects.

1.8 PROJECT MANAGEMENT / GENERAL

The contractor shall establish a single point of contact with the Littleton Public Schools who will be responsible for reporting progress and updating the LPS IT representative with issues that the Owner must address to facilitate the cabling system installation. The contractor's POC shall provide weekly written reports to the LPS IT representative detailing progress. Requests for access to limited access or restricted areas shall be made two days prior to the required access. Information critical to the completion of the task or project shall be communicated to the Technical Representative as the requirement becomes known. Casual information shall be passed during the scheduled progress report.

The contractor shall maintain the Littleton Public Schools facility in a neat and orderly manner during the installation of the communications cabling system. The Littleton Public Schools facilities shall be maintained in broom clean condition at the completion of work each day. At the completion of work in each area, the contractor will perform a final cleaning of debris prior to moving the installation crew to the next work area.

2.0 STRUCTURED CABLING SYSTEM REQUIREMENTS

2.1 STRUCTURED CABLING SYSTEM DESCRIPTION

The Littleton Public School District structured cabling system consists of cabling that supports multiple systems and functions. Structured cabling shall support voice, data, wireless, security, and paging/notification systems. Projects that include one or more of these systems shall employ a Structured Cabling Installer that meets the requirements laid out in section 1.7 Contractor Requirements to install Category and fiber optic cable required for the project. The design team shall include in the Construction Documents clarification of contractor responsibility for these system's cable installation and testing. Cabling and connectivity to support systems shall be color coded and rated for the specific system.

- Paging, Clock, and Notification cabling shall be BLUE Cat 5e with GREEN Cat5e RJ-45 jacks at station end and GREEN Cat5e RJ-45 modular patch panel jacks.
- Voice and Data (wall mount workstation outlets) cabling shall be WHITE Cat 5e. Data systems shall terminate with WHITE Cat5e RJ-45 jacks at station end and WHITE Cat5e RJ-45 modular patch panel jacks. Voice systems shall terminate with BLUE Cat5e RJ-45 jacks at station end and BLUE Cat5e RJ-45 modular patch panel jacks.
- Video (projector) cabling shall be WHITE Cat 6 with ORANGE Cat6 RJ-45 jacks at station end and ORANGE Cat6 RJ-45 modular patch panel jacks.

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- Security cabling shall be YELLOW Cat 6. Camera systems shall terminate with YELLOW Cat6 RJ-45 jacks at station end and YELLOW Cat6 RJ-45 modular patch panel jacks. Non-Camera security systems shall terminate with IVORY Cat6 RJ-45 jacks at station end and IVORY Cat6 RJ-45 modular patch panel jacks.
- Building Automation cabling shall be GRAY Cat 5e with GRAY Cat5e RJ-45 jacks at station end and GRAY Cat5e RJ-45 modular patch panel jacks.
- Fire Alarm connectivity to District Network shall be RED Cat 5e with RED Cat5e RJ-45 jacks at station end and RED Cat5e RJ-45 modular patch panel jacks.
- Wireless Access cabling shall be WHITE Cat6A with VIOLET Cat6A RJ-45 jacks at station end and VIOLET Cat6A modular patch panel jacks.

Typical LPS standard classroom configuration includes (2) classroom voice outlets (2) locations in each classroom), (1) Wireless Access Point outlet, (1) Video outlet, and (1) Clock/Speaker notification outlet. The classroom workstation outlets shall consist of a single gang box with a single gang modular faceplate populated with (1) voice systems cable. Typical classroom workstation outlets shall employ a 1" conduit stubbed to accessible ceiling or routed to Wireless Enclosure in classrooms without dropped ceiling. Typical Wireless Access Point outlet includes a wireless access point enclosure which shall serve as a distribution pull box for classroom conduit and cable within classrooms without suspended ceiling. Cable for wireless outlet shall be terminated within enclosure in a (1) port surface mount box. Typical video outlets shall be located in-wall at the front of the classroom at 84 inches FF. Typical Speaker/Clock locations shall be wall mounted near the entrance of the classroom. Speaker/Clock outlets shall terminate within speaker backbox in a (1) port surface mount box.

Typical LPS office configuration includes (2) voice outlets. Typical office outlet shall consist of a single gang modular faceplate populated with (1) voice systems cable.

Typical GYM, Cafeteria and Auditorium space configuration includes (2) Wireless Access Point outlets, and (1) Speaker/Clock outlet. Typical Wireless Access Point outlet include a wireless access point enclosure. Cable for wireless outlet shall be terminated within enclosure in a (1) port surface mount box. At LPS IT staff discretion, Wireless locations in spaces with elevated ceilings may be mounted without Wireless Enclosure. Typical Speaker/Clock locations shall be wall mounted near the entrance of the space. Speaker/Clock outlets shall terminate within speaker backbox in a (1) port surface mount box.

Typical LPS conference room configuration includes (2) voice outlets and (1) video outlet located at front of conference room at 84 inches FF. Typical conference room outlet shall consist of a single gang modular faceplate populated with (1) voice systems cable.

Media Center and Library configurations shall be determined through coordination only with LPS IT staff on a case by case basis during Schematic Design and Design Development.

Where applicable a 12-strand single-mode fiber (SMF) OS1 fiber-optic backbone is employed between the MDF and IDF for data connectivity, and a 25-pair Category 3 backbone copper cable is employed between the MDF and each IDF for analog voice connectivity (fax, modem, voice failover, etc). Within the MDF/IDFs, backbone fiber strands are terminated and housed in rack-mount fiber-optic enclosures. Within the MDF/IDFs, backbone copper pairs are terminated on rack-mount Cat 5e patch panels.

3.0 HORIZONTAL DISTRIBUTION SYSTEM

3.1 TELECOMMUNICATIONS OUTLETS

Each voice outlet location, unless otherwise noted in the scope of the project, shall be with (1) Category 5e cables. Each Category 5e cable shall be terminated on an 8-position, 8-conductor Category 5e jack to the T568B color code.

The outlet plates, unless otherwise noted in the scope of the project, shall be mounted to single gang boxes, box eliminators, surface mount boxes and/or floor monuments (3rd party) as required. To facilitate user interface and IT maintenance, Voice cabling and connectivity will utilize color coded jacks at outlets and patch panels. Throughout this document, the term "voice" shall reference Voice systems and outlet designations.

3.1.1 PRODUCT SPECIFICATIONS

Horizontal Cabling

- The cable shall meet or exceed all requirements of ANSI/TIA/EIA-568-C.2, ISO/IEC 11801 and CENELEC EN 50173 for performance level specified.
- The horizontal data cabling shall be, 4-pair UTP cabling with 23-24 AWG solid copper conductors.
- Category 5e shall be performance tested to a minimum of 200 MHz Category 6 shall be performance tested to a minimum of 250 MHz Category 6A shall be performance tested to a minimum of 500 MHz
- Cable shall be UL listed. Cable shall be third party verified to meet manufacturer performance claims.
- Horizontal cable shall be plenum rated and shall comply with NFPA 262.

Category 5e:

CommScope Uniprise Datapipe 5E55

- Paging and Clock systems shall utilize BLUE cable – 4759014/10
- Voice and Data systems utilize WHITE cable – 4759114/10
- Building systems shall utilize GRAY cable – 4759214/10

Category 6:

CommScope Uniprise Media 6 6504

- Video systems shall utilize WHITE cable – 8773714/10
- Security systems shall utilize YELLOW cable – 8773914/10

Category 6A:

CommScope Uniprise Ultra 10 10G4

- Wireless Access Point systems shall utilize WHITE cable – 8765504/10

Modular Jacks

- Outlets shall meet or exceed all requirements of ANSI/TIA/EIA-568-C.2, ISO/IEC 11801 and CENELEC EN 50173 for performance level specified.

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- The outlets shall terminate 4-pair 24 to 22 AWG 100-ohm solid unshielded twisted pair cable.
- The outlets shall consist of 8-position, 8 wire modular RJ-45 jacks.
- All outlets shall be produced by the same manufacturer and shall be designed to flush mount in the faceplate, adapter plate, or mounting strap.
- The outlets shall support TIA/EIA 568A and 568B wiring schemes for terminating the horizontal cables.
- Include strain relief device to control bend radius and help secure cable terminations.

Category 5e:

CommScope Uniprise M Series

- UNJ500-xx
- Paging and clock systems shall utilize GREEN Category 5e jacks.
- Data systems shall utilize WHITE Category 5e jacks.
- Voice systems shall utilize BLUE Category 5e jacks.
- Building Automation systems shall utilize GRAY Category 5e jacks.

Category 6:

CommScope Uniprise M Series

- UNJ600-xx
- Security camera systems shall utilize YELLOW Category 6 jacks.
- Non-Camera Security systems shall utilize IVORY Category 6 jacks.
- Video systems shall utilize ORANGE Category 6 jacks.

Category 6A:

CommScope Uniprise M Series

- UNJ10G-xx
- Wireless Access Point systems shall utilize VIOLET Category 6A jacks.

Telecommunications Faceplates

- Wall mount Faceplates shall be front loading, modular frames that accept snap-in adapter housings and are available to fit single-gang or double-gang outlet boxes.
- Faceplate frame shall be completely populated. Fill empty spaces with blank adapter housings. Adapter housings, blank inserts, and media inserts shall match color of housing frame.
- Provide label with clear label cover.
- Available in standard colors to match electrical plates. Coordinate faceplate color with architect prior to procurement or installation.

Housing Frame:

CommScope Uniprise Flexible Faceplate

- Typical wall outlet (single gang) M13FP-xxx

Adapter Housing:

CommScope Uniprise Flexible Faceplate

- Dual port inserts M30FP-2RJ45-xxx
- Blank Insert M30FP-BLANK-xxx

Surface Mount Boxes

- Surface mount boxes shall accept between 1 and 4 telecommunications outlets and inserts depending on location/function.
- Designed to accept flush mounted telecommunications outlets and inserts.
- Provide label with clear label cover.
- Available in standard colors.
- Category cable terminated in suspended ceilings, wireless access enclosures, in building systems or third-party panels, or any termination outside of wall mount or furniture mount faceplates shall include appropriately sized surface box.
- Wireless access point and projector outlets shall include single port surface boxes.

Surface Box:

CommScope Uniprise

- M10xSMB-B-xxx

3.1.2 TELECOMMUNICATIONS OUTLET INSTALLATION

All outlets shall be installed in the following manner:

- Cables shall be coiled in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturer's bend radius. In hollow wall installations where box-eliminators are used, excess wire will be stored in the wall with a minimum of 12" of slack. No more than 12" of slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. 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 or the wall.
- Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B document, manufacturer's recommendations and/or best industry practices.
- Bend radius of the cable in the termination area shall not be less than 4 times the outside diameter of the cable.
- The cable jacket shall be maintained as close as possible to the termination point.
- Voice jacks shall be located in the top left position of each faceplate. Voice jacks in horizontally oriented faceplates shall occupy the left-most position.
- Data jacks shall occupy the top right position on the faceplate. Data jacks in horizontally oriented faceplates shall occupy the right-most position.

3.1.3 HORIZONTAL DISTRIBUTION CABLE INSTALLATION

- Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.
- Cable raceways shall not be filled greater than the NEC maximum fill for the particular raceway type.
- Cables shall be installed in continuous lengths from origin to destination (no splices).
- The cable's minimum bend radius and maximum pulling tension shall not be exceeded.
- If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of four-foot intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.
- Horizontal distribution cables shall be bundled in groups of not greater than 48 cables. Cable bundle quantities in excess of 48 cables may cause deformation of the bottom cables within the bundle.
- Cable shall be installed above fire-sprinkler and systems and shall not be attached to the system or any ancillary equipment or hardware. 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.
- Cables shall not be attached to ceiling grid or lighting support wires. Where light support for drop cable legs are required, the contractor shall install clips to support the cabling.
- Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.
- Cables shall be identified by a self-adhesive label in accordance with the System Documentation Section of this specification. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.
- Unshielded twisted pair cable shall be installed so that there are no bends less than four times the cables outside diameter (4 X cable O.D.) at any point in the run.
- Pulling tension on 4-pair UTP cables shall not exceed 25-pounds for a single cable or cable bundle.
- Cables shall be grouped by color at the entrance to MDF/IDF rooms and shall be bundled separately within Telecom Spaces. Within pathways and ceilings, cable grouping or bundling by color is not required.

3.2 HORIZONTAL EQUIPMENT ROOM TERMINATION PANELS

Horizontal cabling shall terminate on rack mounted patch panels within Telecommunications Rooms. The patch panels shall be unloaded modular panels designed for individual modular outlets. Modular outlets shall include Category 5e, 6, and 6A. Specific color and category rating of individual jacks to be determined by network and system. Cabling for each system shall terminate on independent patch panels supporting that system. At the discretion of LPS IT staff, modular patch panels may share systems terminations in satellite Telecom Rooms where individual patch panels for each system is impractical.

Patch panels shall be populated with jacks required to complete system installation. Unused modular ports shall be left empty. 24-port and 48-port patch shall be utilized appropriately to accommodate horizontal cabling density.

3.2.1 PRODUCT SPECIFICATIONS

Horizontal Patch Panels

- Write-on designation labels with protective clear plastic covers, or equivalent, shall be provided on both the front and rear of the patch panels for circuit identification.
- Patch panels shall be supplied with cable management hardware facilitating proper installation and cable management techniques. Accessories supplied shall be designed to provide strain relief on cables, maintain the wire pair twists as close as possible to the termination points and support the proper bend radius of the cables.
- Patch panels shall be modular in nature and individual jack modules shall be field installed. Patch panels shall be rack mountable and comply with EIA 19" rack mounting standards.
- Be available in 24- and 48-port configurations.

Patch Panel:

CommScope Uniprise

- M2000-48-2U
- M2000-24-1U

Modular Jacks

- Outlets shall meet or exceed all requirements of ANSI/TIA/EIA-568-C.2, ISO/IEC 11801 and CENELEC EN 50173 for performance level specified.
- The outlets shall terminate 4-pair 24 to 22 AWG 100-ohm solid unshielded twisted pair cable.
- The outlets shall consist of 8-position, 8 wire modular RJ-45 jacks.
- All outlets shall be produced by the same manufacturer and shall be designed to flush mount in the faceplate, adapter plate, or mounting strap.
- The outlets shall support TIA/EIA 568A and 568B wiring schemes for terminating the horizontal cables.
- Include strain relief device to control bend radius and help secure cable terminations.

Category 5e:

CommScope Uniprise M Series

- UNJ500-xx
- Paging and clock systems shall utilize GREEN Category 5e jacks.
- Data systems shall utilize WHITE Category 5e jacks.
- Voice systems shall utilize BLUE Category 5e jacks.
- Building Automation systems shall utilize GRAY Category 5e jacks.
- Fire Alarm Interface to District Network shall utilize RED Category 5e Jacks.

Category 6:

CommScope Uniprise M Series

- UNJ600-xx
- Security camera systems shall utilize YELLOW Category 6 jacks.
- Non-Camera Security systems shall utilize IVORY Category 6 jacks.
- Video systems shall utilize ORANGE Category 6 jacks.

Category 6A:

CommScope Uniprise M Series

- UNJ10G-xx
- Wireless Access Point systems shall utilize VIOLET Category 6A jacks.

3.2.2 HORIZONTAL TERMINATION PANEL INSTALLATION

Copper termination and management hardware shall be installed in the following manner:

- Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B document, manufacturer's recommendations and/or best industry practices.
- All cabling shall use Velcro style hook and loop fastener strips for bundling, support, and dressing. Use of zip ties, tie wraps, or other narrow, locking loop fasteners for cable bundling, support, or dressing shall not be accepted.
- Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.
- Cables shall be neatly bundled and dressed to their respective panels or blocks.
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.
- The cable jacket shall be maintained as close as possible to the termination point.
- Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

4.0 BACKBONE CABLE SYSTEMS

4.1 COPPER AND FIBER BACKBONE CABLE

Intra-Building fiber backbone between closets shall consist of 12-strand armored OS1 single-mode fiber-optic cable. Intra-Building copper backbone between closets shall consist of 25-pair Category 3 copper cable. At the discretion of LPS IT staff additional strands and/or pairs may be required. Intra-Building fiber and copper shall be installed to provide connectivity to MDF/IDF rooms. Backbone shall be designed and installed in a star configuration with each IDF having a dedicated backbone fiber and copper run from the MDF. All fiber backbone between closets shall be terminated in rack mounted fiber enclosures. All copper backbone between closets shall be terminated on rack mounted 24-port Cat 5e patch panels. Provide 2" conduit between MDF and WAN service provider demarcation point (fiber hand-hole vault at property easement). LPS IT staff will provide specific location of WAN service provider vault.

4.1.1 PRODUCT SPECIFICATIONS

Single-mode Fiber

- Shall be single-mode fiber with nominal 9/125µm-core/cladding diameter.
- Shall support serial 10 Gigabit Ethernet to distances of 10000m @ 1310 nm.
- Each cabled fiber shall meet the more stringent of the manufacturer's specifications or the performance specifications below.
- Maximum attenuation dB/Km @ 1310/1383/1550 nm: 1.0/1.0/.75
- Shall have individual fiber tube colors per TIA/EIA-606A and overall yellow colored jacket.
- Install 6 strand fiber configurations.
- Utilize plenum rating for indoor installation.
- Cable shall have dielectric armor.

Single Mode:

CommScope

- P-006-DZ-8W-FSUYL

Category 3 Copper

- Voice backbone cables shall consist of multi-pair 24 AWG UTP insulated copper conductors following the ANSI/ICEA S-80-576 color code. The pair groups shall be bound together and covered by a protective sheath.
- Available in riser (CMR) or plenum (CMP) ratings.
- Backbone (Riser) UTP cables shall be used for telephone systems only and shall be third party verified Category 3.
- Available in 25, 50, and 100 pair sizes.

Category 3 Copper:

- General Cable
- CommScope Uniprise
- Superior Essex
- Approved equal

4.1.2 BACKBONE CABLE INSTALLATION

- Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.
- Backbone cables shall be installed separately from horizontal distribution cables.
- Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits or in separate innerduct within conduits. Cable raceways shall not be filled greater than the NEC maximum fill for the particular raceway type.

- Where horizontal backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.
- Cables shall be installed in continuous lengths from origin to destination (no splices).
- The cable's minimum bend radius and maximum pulling tension shall not be exceeded.
- If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of four-foot intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.
- Cable shall be installed above fire-sprinkler and systems and shall not be attached to the system or any ancillary equipment or hardware. 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.
- Cables shall not be attached to ceiling grid or lighting support wires. Where light support for drop cable legs are required, the contractor shall install clips to support the cabling.
- Cables shall be identified by a self-adhesive label in accordance with the System Documentation Section of this specification. Label both ends of each copper backbone cable with origin and destination. Apply labels in visible area using machine made labels.

4.2 BACKBONE EQUIPMENT ROOM TERMINATION PANELS

Copper backbone termination equipment shall consist of rack mounted Category 5e patch panels. Fiber backbone termination shall consist of LC fiber connectors mounted in adapter panels housed in rack mounted fiber enclosures. Copper 25-pair shall be terminated (1) pair per port. Single-mode fiber shall be field terminated with epoxy polish LC type connectors. Single mode fiber shall be field terminated with epoxy polish LC type connectors or fusion spliced to pre terminated pigtails. Crimp-on and no-polish fiber connector kits shall not be used. LC fiber connectors shall be housed in 12 strand adaptor panels color coded and rated for the appropriate fiber type.

4.2.1 PRODUCT SPECIFICATIONS

Copper Backbone Patch Panel

- Patch panel design shall consist of Modular-to-IDC Type construction. The patch panel shall provide insulation displacement contacts (IDC) on printed circuit boards (PCB) for mechanical termination of horizontal and backbone cabling. The printed circuit board shall be utilized as the interconnection method between the IDC Type connectors and 8-position, modular RJ-45 jacks.
- Write-on designation labels with protective clear plastic covers, or equivalent, shall be provided on both the front and rear of the patch panels for circuit identification.
- Patch panels shall be supplied with cable management hardware facilitating proper installation and cable management techniques. Accessories supplied shall be designed to provide strain relief on cables, maintain the wire pair twists as close as possible to the termination points and support the proper bend radius of the cables.
- Patch panels shall be rack mountable and comply with EIA 19" rack mounting standards.

- Be available in 24- and 48-port configurations.

Category 5e Patch Panel:

CommScope Uniprise

- UNP510-24P
- UNP510-48P

Rack Mount Fiber Enclosure

- Rack mount fiber enclosures shall be designed to manage and organize fiber optic cable to and from equipment or cross-connects.
- Designed to accept snap-in fiber adapter panels.
- Enclosures shall have internal cable means such as spools to properly manage individual fibers to termination.
- Enclosures shall be constructed of metal in a sliding shelf format.
- 1U or 2U size.
- Provide area for cable identification.

Rack Mount Fiber Enclosure:

CommScope Uniprise

- RFE-SLC-IS-EMT-BK/1U-PNL
- RFE-SLC-IS-EMT-BK/2U-PNL

Wall Mount Fiber Enclosure

- Wall mount fiber enclosures shall be designed to manage and organize fiber optic cable to and from equipment or cross-connects.
- Designed to accept snap-in fiber adapter panels.
- Enclosures shall have internal cable means such as spools to properly manage individual fibers to termination.
- Enclosures shall have latching door to protect fiber terminations.
- Available in black.
- Provide area for cable identification.

Wall Mount Fiber Enclosure:

CommScope Uniprise

- WBE-EMT-BK-2P-PNL

Fiber Adaptor Panels

- Designed to snap into enclosure.
- Multi-mode provides (6) duplex (12 fibers) AQUA colored LC adapters with ceramic alignment sleeves.
- Single mode provides (6) duplex (12 fibers) BLUE colored LC adapters with ceramic alignment sleeves.
- Available blank panel for installation in unused enclosure ports.

Fiber Adaptor Panels:

CommScope

- PNL-BK-012-MFA-LC02-AQ-NS
- PNL-BK-012-SFA-LC02-BL-NS

Fiber Optic Connectors – Single-mode

- Connectors shall comply with TIA/EIA-604-10A FOCIS-10 and meet or exceed TIA/EIA-568-C.3 standards and shall support single mode fiber.
- Connectors shall be field installable and accept 900µm tight-buffer cable.
- Connectors shall be type LC with a zirconia ceramic ferrule.
- Connectors shall have .2 to .3 dB average insertion loss, 0.75 dB maximum insertion loss.
- Connectors shall include BLUE colored boots.

Single Mode LC Connector:

- Corning Anaerobic connector
- CommScope Anaerobic connector
- Approved equal anaerobic connector

4.2.2 BACKBONE TERMINATION HARDWARE INSTALLATION

- All material and equipment shall be installed in a neat and workmanlike manner.
- All material and equipment shall be installed per manufacturer's specifications, using methods and tools approved by the manufacturer.
- Install backbone cable in strict accordance with the manufacturer's recommendations and in compliance with TIA/EIA standards.
 - All cabling shall use Velcro style hook and loop fastener strips for bundling, support, and dressing. Use of zip ties, tie wraps, or other narrow, locking loop fasteners for cable bundling, support, or dressing shall not be accepted.
- All backbone cable and fiber optic cable will be terminated on rack mounted equipment unless otherwise stated.
- Provide 10-foot slack for copper backbone cable at the telecommunications room.
 - Neatly coil cable slack on wall.
- Provide 20-foot slack for fiber backbone cable at the telecommunications room.
 - Neatly coil cable slack on wall.
- Terminate all fiber optic cable in fiber enclosures using LC connectors. Provide strain relief for fiber cables at enclosure. Manage fiber strands inside enclosures per manufacturer's instructions.

5.0 TELECOMMUNICATIONS SPACES

The telecommunications closets shall house racks, and required cable routing hardware for voice, data, paging/notification, security, and building systems. Refer to Division 27 Pathways and Spaces in this document for design, specification, and installation details.

6.0 COPPER AND FIBER PATCH CORD CABLE ASSEMBLIES

Patch cord and fiber jumper requirements for LPS technology projects are system specific. Responsibility for procurement and installation of patch cords shall be dependent on system requirements and commissioning. Typically, any system installed that requires patch cords, fiber jumpers, or cross-connect in order to be tested and commissioned shall have the cords, jumpers and cross-connect provided and installed by the contractor responsible for commissioning. Typically patch cords for voice and data links shall utilize patch cords that are provided by and installed by Littleton Public Schools IT staff. At the discretion of LPS IT staff a given project may be used to procure patch cords or fiber jumpers for general District use. Requirements for patch cords shall be coordinated between the design team and LPS IT staff during the creation of construction documents. All lengths, colors, and quantities of copper patch cord and fiber jumpers shall be confirmed by design team and LPS IT staff prior to procurement in any given project.

6.1 COPPER PATCH CORDS

- Paging, Clock, and Notification patch cords shall be GREEN Cat 5e in appropriate lengths. Paging and Notification patch cords shall be supplied by paging equipment contractor and installed by paging equipment contractor during installation and commissioning of paging and notification systems.
- Voice, Data and Video patch cords shall be WHITE Cat 5e in appropriate lengths. Voice, Data, and Video patch cords shall be supplied and installed by LPS IT staff during activation and cut over of LPS provided equipment and systems. For selected, atypical projects, LPS ITS staff may direct that Voice, Data, and Video patch cords may be provided by and/or installed by the structured cabling contractor on a given project.
- Security patch cords shall be YELLOW Cat 6 in appropriate lengths. Security patch cords shall be supplied by security equipment contractor and installed by security equipment contractor during installation and commissioning of security systems.
- Building Automation patch cords shall be GRAY Cat 5e in appropriate lengths. Building Automation patch cords shall be supplied by LPS IT staff and installed by specific systems integrators during activation and cut over of equipment and systems.
- Wireless Access cabling patch cords shall be WHITE Cat 6 in appropriate lengths. Wireless Access patch cords shall be supplied and installed by LPS IT staff during activation and cut over of LPS provided equipment and systems.

6.2 PRODUCT SPECIFICATIONS

Copper Patch Cords

- Equipment and station patch cords shall be factory made and constructed from Category, 6 24 AWG UTP (F/UTP) stranded cable and matching Category Modular (RJ-45) plugs.
- Equipment and station patch cords will meet or exceed TIA/EIA-568-C.2 Category 5e, 6, or 6A standard and be third party verified.

Copper Patch Cords:

- CommScope Uniprise
- Approved Equal

7.0 CABLING SYSTEM TESTING

All cables and termination hardware shall be 100% tested for defects in installation and to verify cable performance under installed conditions. All conductors of each installed cable shall be verified useable by the contractor prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feedthrough couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed. The test equipment by name, manufacturer, model number and last calibration date will also be provided in test result documentation.

The design team shall employ a BICSI certified Registered Communications Distribution Designer to review test results and reports. The design team RCDD shall review test results and guide contractor in rectifying

discrepancies prior to providing test results to LPS IT staff for review and record keeping. It shall be the responsibility of the RCDD certified design team technology consultant or engineer to verify testing criteria and equipment and to ensure that cables meet or exceed the current ANSI/TIA/EIA-568 specifications for the category and type of cable installed.

Fiber-optic link loss budgets and calculated loss shall be reviewed and confirmed by design team RCDD for comparison to tested attenuation results.

Test results shall be provided to LPS IT staff electronically in both PDF format and in the cable test equipment's file format. Software necessary for viewing proprietary test equipment file formats shall be provided to LPS IT with electronic documentation of test results. At LPS IT staff discretion hard copy test results may be required for individual projects.

7.1 COPPER TESTING

- Category 3 twisted-pair voice cables shall be tested for continuity, pair reversals, shorts, and opens using a "green light" type test set.
- Category 5e, 6, and 6A cables shall be tested for Permanent Link cable performance per ANSI/TIA/EI-568.C Section 6. Category 5e, 6, and 6A cables shall be tested using a Level III cable tester in accordance with ANSI/TIA-1152.

7.2 FIBER OPTIC TESTING

- Intra-Building fiber shall be tested according to TIA/EIA TSB-140 standards for Tier 1 tests. Single mode links are to be tested at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.1, One Reference Jumper.
- Fiber test results shall show calculated or expected link loss budget as well as actual tested attenuation results.

8.0 AS BUILT DOCUMENTATION

All elements of the structured cabling system shall be represented in as-built documentation. Design and Construction Documents may be used as a template or base for As-built documentation. All deviations from construction drawings shall be represented on as-built drawings.

In addition, as-built drawings shall include label and cable identification information for 100% of cables installed. The design team RCDD shall review as- built drawings and guide contractor in rectifying discrepancies prior to providing as-built drawings to LPS IT staff for review and record keeping.

One full sized drawing set will be designated as the central location to document all as-built information as it occurs throughout the project. This central set will be maintained by the Contractor's Foreman on a daily basis and will be available to the design team technology consultant and LPS IT representative upon request during the course of the project.

At the conclusion of the project as-built drawings shall be provided to LPS IT staff electronically in both CAD and PDF formats. CAD files shall be bundled with ETRANSMIT format. (1) full-size hard copy as built drawings shall be required for individual projects.

9.0 CABLING SYSTEM LABELING

The contractor shall develop and submit for approval a labeling system for the cable installation. Littleton Public Schools will negotiate an appropriate labeling scheme with the successful contractor. The design team technology consultant shall review labeling plan prior to submittal to LPS IT staff for approval. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels, and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cabling system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

All label printing will be machine generated using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet labels will be the manufacturer's labels provided with the outlet assembly.

10.0 WARRANTY AND SERVICES

The contractor shall provide a system warranty covering the installed cabling system against defects in workmanship, components, and performance, and follow-on support after project completion.

10.1 INSTALLATION WARRANTY

The contractor shall warrant the cabling system against defects in workmanship for a period of (2) years from the date of system acceptance. The warranty shall cover all labor and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after repairs are accomplished. This warranty shall be provided at no additional cost to the Owner.

10.2 CABLING SYSTEM WARRANTY

The contractor shall facilitate a 20-year system performance warranty between the manufacturer and the Owner. An extended component warranty shall be provided which warrants functionality of all components used in the system for 20 years from the date of acceptance. The performance warranty shall warrant the installed horizontal copper, and both the horizontal and the backbone optical fiber portions of the cabling system.

Copper links shall be warranted against the link performance minimum expected results defined in ANSI/TIA/EIA-568-C.2. Fiber optic links shall be warranted against the link and segment performance minimum expected results defined in ANSI/TIA/EIA-568-C.3.

11.0 CABLING SYSTEM ACCEPTANCE

The design team technology consultant shall coordinate periodic inspections with LPS IT staff representative of the project in progress. One inspection will be performed at the conclusion of cable pulling, prior to closing of the drop ceiling, to inspect the method of cable routing and support. A second inspection will 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 and orderly.

11.1 FINAL INSPECTION

Upon completion of the project, the design team technology consultant shall perform an inspection of the completed structured cabling installation. After approval from design team consultant, the LPS IT representative will perform a final inspection of the installed cabling system with the Contractor's Project

Foreman. The final inspection will 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 Littleton Public Schools.

11.2 TEST VERIFICATION

Upon receipt of the test documentation, The Littleton Public Schools reserves the right to perform spot testing of the cabling system to validate test results provided in the test document. Littleton Public Schools testing will use the same method employed by the contractor, and minor variations will be allowed to account for differences in test equipment. If significant discrepancies are found the Contractor will be notified for resolution.

11.3 FINAL ACCEPTANCE

Completion of the installation; in-progress and final inspections; receipt of the test and as-built electronic documentation; and successful performance of the system for a two-week period will constitute acceptance of the system.

END OF SECTION 27 10 00

27 30 00 Paging and Notification

1.0 INTRODUCTION

1.1 PURPOSE

This document defines the paging system and notification components specific to speakers, amplifiers, servers, supporting hardware, and miscellany that are necessary for a complete paging system supporting local paging, Emergency Communication, and Fire Alarm audio notification. The intent of this document is to provide all pertinent information to allow a design team to successfully design and specify a complete system. However, it is the responsibility of the technology consultant and design team to propose any and all items required for a complete system installation if not specifically identified within the scope of the project.

1.2 APPLICABLE DOCUMENTS

The notification system described in this standard is derived in part from the recommendations made in industry standard documents. The lists of documents below are incorporated by reference:

- 1) National Fire Protection Agency (NFPA) - 70, National Electrical Code (NEC) - 2011
- 2) National Fire Protection Agency (NFPA) - 72, National Fire Alarm and Signaling Code- 2011
- 3) This Technical Specification and Associated Drawings
- 4) ANSI/TIA-568-C Commercial Building Telecommunications Cabling Standard – 2012
- 5) ANSI/TIA-569-C Commercial Building Standard for Telecommunications Pathways and Spaces - 2012
- 6) ANSI/TIA-606-B Administration Standard for the Telecommunications Infrastructure of Commercial Buildings - 2012
- 7) ANSI/TIA-607-B Commercial Building Grounding and Bonding Requirements for Telecommunications - 2012
- 8) TIA-526-14-B Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant - 2012
- 9) Building Industries Consulting Services, International (BICSI) Telecommunications Distribution Methods Manual (TDMM) – 13th edition
- 10) Littleton Public Schools Division 26 Construction Standards
- 11) Littleton Public Schools Division 27 Construction Standards
- 12) Littleton Public Schools Division 28 Construction Standards

If a conflict exists between applicable documents, then the order in the list above shall dictate the order of precedence in resolving conflicts. This order of precedence shall be maintained unless a lesser order document has been adopted as code by a local, state, or federal entity, and is therefore enforceable as law by a local, state, or federal inspection agency.

If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents; the design team is responsible to determine and adhere to the most recent release when developing the proposal for installation.

1.3 DESIGN TEAM REQUIREMENTS

For LPS project design, all architectural firms shall employ or contract with an audio/visual design consultant and a Fire Protection Engineer. The consultant and engineer team shall demonstrate proficiency in the design and implementation of paging and notification systems. The paging and notification design shall be coordinated with fire alarm signaling and notification design. The design team shall meet with and coordinate with the Authority Having Jurisdiction (Littleton Fire Rescue and others) prior to and during notification system design. As necessary, the design team shall include an acoustical engineer to assist in determining acoustically distinguishable spaces.

1.4 CONSTRUCTION DOCUMENTS

Construction documents shall provide separate drawings specifically for paging/notification system locations and details. At the design team's discretion, the structured cabling drawings may be combined with paging and notification drawings and details. The paging/notification layout shall not be over-laid onto electrical, security or any drawings other than structured cabling as noted. Paging/notification drawings shall indicate all new cabling and devices required in the facility. Existing equipment, devices, and cabling shall be indicated on drawings and noted as to disposition. All existing equipment, devices, and cabling that are to remain in place are to be properly reworked as necessary to bring them into current standards and codes. Mounting height of all equipment shall be indicated by way of floor plan keynotes, or equipment installation detail sheets. CSI-formatted specification sheets shall be provided as a supplement to the design documentation. Specifications must call out the manufacturers of the cabling products as indicated in this document. No alternates are to be accepted on products specified within this document.

Construction documentation for paging and notification shall include audibility and intelligibility expectations for all areas of the facility. Documentation shall include at a minimum a matrix detailing expected CIS Intelligibility for typical spaces.

All vendors for this cabling project will submit contractor qualifications and project data sheets. It will be the responsibility of the Technology Consultant and design team to review all submitted documentation for accuracy before forwarding the submittal package to LPS ITS for final approval.

1.5 SUBMITTALS

- Submittals shall include product data literature and shop drawings. Submittals shall include adequate descriptive literature, catalog cut sheets, and other data necessary for LPS ITS to ascertain that the proposed equipment and materials comply with specification requirements.
- Product data submittals shall consist of technical data sheets, manufacturer specifications, illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and test data furnished to illustrate a product, material, or system for some portion of the work. Product data literature is required on all items of material and equipment and should be clearly marked, identifying specific items proposed.
- Prior to assembling or installing the work, prepare and submit shop drawings as necessary for review and approval. Shop drawings shall at minimum consist of riser diagrams, one-lines, order of operations and fire alarm connection diagrams.

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- The contractor shall not purchase any materials or equipment for incorporation into the project prior to receipt of reviewed submittals from LPS ITS.
- Review of product data shall not relieve the Contractor from responsibility for deviations from the drawings or specifications, unless the Contractor has, in writing, called attention to such deviations at the time of submission and secured written approval.
- Samples may be requested, which shall be physical examples, which represent materials, equipment, or workmanship and establish standards by which the work will be judged.
- Product data and shop drawing submittals shall be reviewed by the Fire Protection Engineer, Technology Consultant, and design team prior to being forwarded to LPS ITS for review and final approval. LPS ITS will have authority for final approval of all product data submittals.
- Submittals shall include a labeling system and plan for the paging/notification system installation.

1.6 CONTRACTOR QUALIFICATIONS

Contractors bidding on any project must meet the following minimum requirements:

- Bidding contractors shall be companies specializing in the installation, fabrications, and design of telecommunications systems.
- Contractors must be a Valcom Engineered Solutions (Class Connections) Authorized Distributor headquartered in the State of Colorado.
- The Contractor shall have a minimum of five (5) years' experience in this specialized field and shall have completed a minimum of three (3) projects similar in scope to this project.
- The paging/notification contractor must be certified for installing the proposed manufacturer's solution throughout the entire completion of project.
- Contractors must submit proof of above stated required qualifications.
- The design team shall acquire from the local Valcom Class Connection (Engineered Solutions) representative a list of currently certified contractors to include in specification documentation. The list of certified contractors shall be provided to LPS ITS for approval prior to inclusion in specification documents.
- At the discretion of Littleton Public Schools, past performance may be used to disqualify a contractor from providing services for LPS technology projects.
- Pre-qualified Valcom qualified integrators as of June 2016 include: Alerio Technologies, Sterling Communication Technologies, Interface Communications, NetStructures and CComm.

1.7 PROJECT MANAGEMENT / GENERAL

The contractor shall establish with Littleton Public Schools a single point of contact who will be responsible for reporting progress and updating the LPS ITS representative with issues that the Owner must address to facilitate the cabling system installation. The contractor's POC shall provide weekly written reports to the LPS ITS representative detailing progress. Requests for access to limited access or restricted areas shall be made two (2) days prior to the required access. Information critical to the completion of the task or project shall be communicated to the Technical Representative as the requirement becomes known. Casual information shall

be passed during the scheduled progress report.

The contractor shall maintain the Littleton Public Schools facility in a neat and orderly manner during the installation of the communications cabling system. The Littleton Public Schools facilities shall be maintained in broom clean condition at the completion of work each day. At the completion of work in each area, the contractor will perform a final cleaning of debris prior to moving the installation crew to the next work area.

2.0 PAGING/NOTIFICATION SYSTEM REQUIREMENTS

2.1 STRUCTURED CABLING SYSTEM DESCRIPTION

The Littleton Public Schools structured cabling system consists of cabling that supports multiple systems and functions. Structured cabling shall support voice, data, wireless, security and paging/notification systems. Projects that include one or more of these systems shall employ a Structured Cabling Installer that meets the requirements laid out in Section 27 10 00 Structured Cabling Standards subsection 1.7 Contractor Qualifications to install Category and fiber optic cable required for the project. The design team shall include in the Construction Documents clarification of contractor responsibility for these systems' cable installation and testing. Cabling and connectivity to support systems shall be color coded and rated for the specific system.

Cabling for paging and notification systems shall comply with Division 27 requirements laid out in this document. Installation of Category 5e cabling supporting paging and notification systems shall be by a contractor meeting the requirements of Section 27 10 00 Structured Cabling Standards.

- Paging, Clock, and Notification cabling shall be BLUE Cat 5e with GREEN Cat5e RJ-45 jacks at station end and GREEN Cat5e RJ-45 modular patch panel jacks.

2.2 TYPICAL PAGING/NOTIFICATION SYSTEM DESCRIPTION

Source input for paging and notification system shall include:

- Contact relay input from fire panel. Fire panel input shall trigger tone and voice evacuation message generation and distribution from Valcom system.
- Addressable page input from LPS phone system.
- Emergency responder handset located adjacent to fire panel.
- Additional sources may be identified by LPS stakeholders during Schematic Design, following District-wide guidelines as adjusted for site-specific conditions.

Sound levels for fire alarm tone must be 15dB above average ambient sound levels.

Normally occupied spaces must maintain a CIS intelligibility score of not less than 0.8.

Spaces not normally occupied may have a CIS score lower than 0.8 if they are within 50 feet of an area with a 0.8 CIS score.

Initiation of audible emergency notification messages shall provide contact closure to Fire Alarm system for visual notification. Program Valcom head-end to provide contact closure to Notifier Fire Alarm system for strobe activation. Coordinate emergency notification messages with LPS Security Director. Coordinate emergency notification initiation with LPS Security

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representative and Fire Alarm contractor.

Audible and visual notification for Lock-Down events may be initiated from local fixed duress buttons and on-site screen icons through the security panel, as well as from the main Security Command Center at the ESC. Program Valcom head-end to receive contact closure from Security panel for message initiation. Program audible message for lock-down event to silence after ten (10) minutes. Coordinate lock-down event notification with LPS security representative, Security contractor and Fire Alarm contractor.

Typical LPS standard classroom configuration includes one (1) wall mount clock/speaker combo. Clock/speaker combo units in all classrooms shall be two-way talkback IP devices. Elementary Schools shall utilize analog clocks in classrooms. High Schools and Middle Schools shall utilize six-digit digital clocks in classrooms. Classroom spaces that require additional speakers due to size, noise levels or configuration shall use additional passive or IP speakers as required to achieve required coverage and sound pressure levels. The additional speakers shall follow the requirement that one (1) IP speaker may connect to a maximum of two (2) passive speakers. Self-powered speakers are not permitted (no exception). In addition, spaces with high noise levels (music rooms, gyms, cafeteria, shop areas, etc.) will require speakers with visual indicators (e.g., flashers) to alert occupants to announcements.

Typical hallway, commons and office area paging and notification configuration shall consist of IP speakers distributed to ensure audibility and intelligibility requirements are met. Audibility and intelligibility shall meet the requirements laid out in NFPA 72 Chapter 24. Hallway, commons, and office speakers in areas with suspended ceilings shall be cut-in or lay-in speakers designed for installation in suspended ceiling tiles. Hallway, commons, and office speakers in areas without suspended ceilings shall be wall mount or ceiling mount speakers with appropriate back box designed for wall or ceiling mounting. Architectural design teams shall consider materials and construction of area ceilings, height of ceilings above finished floor, materials and construction of area walls, and architectural obstructions as well as other systems that cause obstructions when determining hallway and common areas speaker layout and types. Hallway, commons, and office speaker distribution may include Valcom passive (45 Ohm unpowered) speakers augmenting the IP speaker distribution. The passive speakers augmenting the IP speakers shall be integrated with and receive signal solely from the amplified output of the adjacent IP speakers. The utilization of the passive speakers in hallways and commons shall be such that a "set" is created, where a passive speaker on each side of an IP speaker, with the two (2) passive speakers connected to that one (1) IP speaker. No more additional passive speakers shall connect to this or any other set. These sets shall be grouped logically to support addressability in distinct architectural spaces. No self-powered passive speakers shall be used with the IP speakers in this system.

Note: Valcom passive speaker part numbers are listed in the "Analog Speakers" subsection of Section 3.2.1 on page 27 30 00 – 7 of this document. No substitutions are permitted (no exception).

Typical restroom and locker room paging, and notification speaker layout shall include a minimum of one (1) ceiling mounted IP speaker. If such spaces are determined to require additional speakers, a set of one (1) IP speaker with up to two (2) passive speakers connected to that IP speaker shall be provided as required.

The paging system for a typical gymnasium, cafeteria and auditorium shall meet all the requirements of this document and NFPA 72 Chapter 24 for audibility and intelligibility. Acoustical characteristics of these types of space must be considered in the design of speaker

locations, and the system layout shall be coordinated with the LPS ITS Department and with Littleton Fire Rescue or other Authority Having Jurisdiction (AHJ). At least one (1) two-way talk-back clock/speaker combination shall be included in each space of this type. Additional speakers shall comply with the above description such that a “set” is created where one (1) passive speaker is located on each side of an IP speaker, with the passive speakers connected to that primary IP speaker. Auxiliary sound systems, audio enhancement systems, and audio-visual display systems provided separately in such spaces shall include an input override. Auxiliary audio systems input override shall be connected to line-level input from the primary clock/speaker combo. It shall be the responsibility of the design team to determine and specify input override for existing audio systems. It shall be the responsibility of the LPS ITS and Operations, Maintenance and Construction (OMC) departments to ensure that new audio systems are provided with input override.

Media Centers, conference rooms, non-instructional and other spaces shall be treated as Hallway and common areas for purposes of determining typical paging and notification layout.

Requirements for notification supporting the exterior of the building shall be determined in coordination with LPS ITS and OMC Departments, Littleton Fire Rescue (or other AHJ) and the facility administrator. At minimum, Elementary School playgrounds shall be supported by wall-mount Valcom IP Flexhorns mounted on exterior walls of the building.

3.0 PAGING AND NOTIFICATION EQUIPMENT

3.1 PAGING CONTROL HEAD END EQUIPMENT

New build projects and remodel projects for facilities still operating legacy analog paging systems shall include the installation and programming of a Valcom Class Connections IP-6000 paging control server. Remodel projects at facilities with an existing IP paging and notification system shall include integration of new equipment and programming of existing server, as necessary. Paging servers shall be located in the facility’s primary Equipment Room. Paging servers shall be provided with dedicated rack mounted UPS battery backup. UPS shall be sized to provide a minimum eight (8) hours of emergency power for paging server, modules, and associated POE switches, or as acceptable to the AHJ. UPS switches shall be equipped with dry contact relay accessory to provide trouble indication alert to fire panel. Dedicated paging and notification UPS shall not be used to support any other systems or equipment and shall be used solely to provide emergency power for notification equipment.

To maximize system flexibility and migration to Mass Notification, all systems shall be installed with the following input/output modules and extensions:

- The IP Input / Output Module shall provide contact closure relay interface to the fire alarm system. Dry contact relay interface with the fire alarm system shall include at minimum: fire alarm initiation of tone and voice evacuation message and paging system trouble indication to fire alarm panel. The IP Input / Output Module may also provide contact closure relay interface with security systems or other third-party notification modules.
- The Network Page Extender shall provide interface to the Emergency Responder handset located adjacent to the Fire Alarm Control Panel. The Network Page Extender may also be used to provide output to analog speakers and third-party systems such as two-way radios.

- The Network Station Port shall provide interface to the LPS phone system. The Network Station Port shall be used to interface with a dedicated emergency panel handset. The Network Station Port shall also be used to interface with a Main Office backup hand-set and future alternate page control inputs, allowing the building direct access to the paging system as well as one-touch access.

3.1.1 PRODUCT SPECIFICATIONS

Paging Server

IP 6000:

Valcom Engineered Solutions (Class Connection):

- VE6025
- No Exceptions

Input / Output Relay Module

Valcom Eight in / Eight out:

- VE8048R
- No Exceptions

Network Station Port FXS

Valcom Quad Station Port:

- VE8014AR
- No Exceptions

Network Station Port FXO

Valcom Quad Intercom Remote:

- VE8022AR
- No Exceptions

Network Page Extender

Valcom Quad Page Zone Extender:

- VE8004AR
- No Exceptions

Rack Mount UPS

APC Smart UPS Series Rack Mount Uninterruptible Power Supply

- All UPS devices used for LPS systems shall include a Smart Slot interface port and pre-installed network card.

1500V:

- SMX1500RM2UNC

2000V:

- SMX2000RMLV2UNC

3000V:

- SMX3000RMLV2UNC

External Battery:

- SMX48RMBP2U
- SMX120RMBP2U

Dry Contact Relay Interface:

- AP9810

POE Switches

- Procurement of Power Over Ethernet switches for paging and notification shall be coordinated with LPS ITS on a project-by-project basis.
- Projects that include Owner-Furnished / Contractor-Installed POE switches for paging and notification shall include in the Construction Document specifications details of equipment installation and transfer from LPS to contractor.

3.2 DISTRIBUTION SPEAKERS

Speaker layout shall be guided by subsection 2.1. Audibility and intelligibility shall meet the requirements laid out in NFPA 72 Chapter 24.

3.2.1 PRODUCT SPECIFICATIONS

Classroom IP Talk-Back Speaker/Digital Clock Combo

- Digital clock speaker combo with 6-digit display
- Valcom VIP-426A-D
- Back Box: Valcom VB-S23 (Surface), VB-R22 (Recessed), VB-A24 (Angled)
- No Exceptions
- For areas with high noise levels, specify visual notification option with Valcom digital device.

Classroom IP Talk-Back Speaker/Analog Clock Combo

- Valcom VE4031A-A
- Back Box: Valcom VB-S20 (Surface) or VB-R19 (Recessed)
- No Exceptions
- For areas with high noise levels, provide separate visual notification connected to Valcom analog device.

IP Speakers

- IP One-Way only 2'x2' Lay-In Speaker: Valcom VE4002A (no backbox required)
- IP Surface Mount Speaker: Valcom VE4028A
- Backbox for VE4028A: VB-S11 (Surface), VB-R12 (Recessed)
- No exceptions

Analog Speakers

- Analog Lay-In Speaker: Valcom VECTLA-2 (attaches to VE4002A)
- Analog Surface Mount Speaker: Valcom V-CTSQPK (attaches to VE4028A)
- Backbox for V-CTSQPK: VB-S11 (Surface), VB-R12 (Recessed)
- No exceptions

T-Bar for Lay-In Speakers

- Valcom V-TBAR

IP Wall Mount One-Way Flex Horn

- Valcom VE4080AL-GY
- No Exceptions

Flex Horn Enclosure

- Valcom V-9809
- No exceptions

Push Button Call Switch

- Valcom V-2972PK
- No Exceptions

Admin. Console Phone

- Valcom VEADP2

IP Digital Clocks

- 2.5" Clock: Valcom VIP-D625A
- 4" Clock: Valcom VIP-D640A
- 4" Double-Sided Clock: Valcom VIP-D640-ADS
- No exceptions

4.0 PAGING & NOTIFICATION SYSTEM DEVICE LABELING

The design team shall coordinate with LPS ITS to determine labeling scheme for security devices. Paging device labeling shall be included in submittal documentation for approval by LPS ITS prior to system programming. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

Notification device labeling shall be cross-indexed to structured cabling labeling. As-built documentation shall include a matrix identifying structured cabling patch panel port and paging device label information for each device installed. Matrix shall be provided as an editable Excel spreadsheet.

5.0 AS-BUILT DOCUMENTATION

All elements of the paging system shall be represented in as-built documentation. Design and Construction Documents may be used as a template or base for as-built documentation. All deviations from construction drawings shall be represented on as-built drawings. In addition, as-built drawings shall include label and device identification information for 100% of devices installed.

One (1) full-sized drawing set will be designated as the central location to document all as-built information as it occurs throughout the project. This central set will be maintained by the Contractor's Foreman on a daily basis and will be available to the design team technology consultant and LPS ITS representative upon request during the course of the project.

At the conclusion of the project as-built drawings shall be provided to LPS ITS electronically in both CAD and PDF formats. CAD files shall be bundled with eTransmit format. One (1) full-size hard-copy as-built documents shall be required for individual projects.

6.0 TEST DOCUMENTATION

Structured cabling supporting notification systems shall be tested and recorded according to the requirements of the LPS Section 27 10 00 Structured Cabling Standards. Structured

Cabling shall be tested prior to installation of notification devices.

Audibility and intelligibility shall be measured in every zone. Common Intelligibility Scale (CIS) shall be measured with an analyzer utilizing the STI-CIS method of measurement. Audibility and intelligibility shall meet the requirements laid out in NFPA 72 Chapter 24.

Testing shall be conducted in conjunction with fire alarm testing, and interface of fire alarm audio input to paging system shall be subject to approval by the design team FPE, LPS ITS and LPS OMC Departments, local AHJ and fire alarm installation team.

Test documentation shall be provided in accordance with Division 28 Electronic Safety and Security. Refer to Section 28 05 00 Common Work Results for Electronic Life Safety and Section 28 31 00 Fire Alarm Standards.

7.0 WARRANTY AND SERVICES

The contractor shall provide a system warranty covering the installed paging and notification system against defects in workmanship, components, and performance, and follow-on support after project completion.

7.1 INSTALLATION WARRANTY

The contractor shall warrant the paging and notification system against defects in workmanship for period of two (2) years from the date of system acceptance. The warranty shall cover all labor and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after repairs are accomplished. This warranty shall be provided at no additional cost to the Owner.

7.2 MANUFACTURER WARRANTY

The contractor shall facilitate a 1-year system performance warranty between the manufacturer and the Owner. An extended component warranty shall be provided which warrants functionality of all components used in the system for two (2) years from the date of acceptance.

8.0 PAGING & NOTIFICATION SYSTEM ACCEPTANCE

The design team technology consultant shall coordinate periodic inspections of the project in progress with the LPS ITS representative and the design team Fire Protection Engineer. Inspections shall be performed during device installation and system start-up, testing and training of Owner personnel.

8.1 FINAL INSPECTION

Upon completion of the project, the design team Technology Consultant and Fire Protection Engineer shall perform an inspection of the completed paging installation. After approval from design team consultants, the LPS ITS representative will perform a final inspection of the installed systems with the Contractor's Project Foreman. The final inspection will be performed to validate that all devices were installed as defined in the drawing package and that the installation meets the aesthetic expectations of Littleton Public Schools.

8.2 FINAL ACCEPTANCE

Upon completion of the project, the LPS ITS Representative will perform a final inspection of the installed notification system with the Contractor's Project Foreman. The final inspection will

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be performed to validate that all systems and devices were installed as defined in the drawing package, and that the installation meets the aesthetic expectations of Littleton Public Schools. A functional test of all software configurations shall be performed by the District ITS Representative to validate that all programming required for the system has been completed satisfactorily.

END OF SECTION 27 30 00

END OF DIVISION 27

DIVISION 28 ELECTRONIC SAFETY and SECURITY

28 00 00 General Requirements for Electronic Safety and Security

Division 28 Electronic Safety and Security is part of the third volume of a three-volume series, LPS Construction Standards and should be coordinated with Division 27 and the other two volumes. This division provides definitive goals, design & installation mandates, and detailed specifications for District facilities infrastructure and systems supporting Information Technology, Domestic and Emergency Communications, Smoke/Fire Detection and Alarm, and Building Access, and Security.

The standards identify professional certifications for design engineers, manufacturer certifications for installers, and relevant experience required for both. Proprietary platforms are identified for each major system, along with pre-approved providers of mutually compatible component devices.

Deviation from any provision in these Standards is prohibited except for unique circumstances and only following exhaustive review and sign-off by the LPS Operations, Maintenance and Construction Department (OMC), Information and Technology Services (ITS) and/or Security and Emergency Planning, as appropriate, via specific project programming and design.

Construction drawings and specifications based on these standards, in conjunction with the other two volumes, must provide for complete, properly operating systems fully integrated into existing District central operations, monitoring and control.

Consultants are required to coordinate with LPS resources including:

- Division 27 Technology Design Typicals
- Division 28 FA & MN Schematics
- Safety and Security Guidelines for Facility Design
- Construction Standards Volume 1 for Divisions 00-14 and 31-33
- Construction Standards Volume 2 for Divisions 21-23, and 26

Resources can be found on LPS Manuals and Regulations web page:

<https://littletonpublicschools.net/manuals-regulations>

28 05 00 Common Work Results for Electronic Life Safety

1.0 INTRODUCTION

1.1 PURPOSE

The intent of this document is to provide a standard specification, identifying common work results that will be used for all Littleton Public School facilities requiring fire alarm and detection system installation. This document provides the minimum performance criteria for the components and sub-systems comprising a complete fire alarm and detection system that shall accommodate the Owner's requirements.

The successful vendor shall meet or exceed all requirements described in this document.

At the time of bid, all exceptions taken to these Specifications, any variances to the contract drawing design, and any nonconformance to the operating capabilities called for in this specification, shall be listed in writing and forwarded with the submission of the bid. Any such exception, variance, or nonconformance, which was not listed at the time of bid, and is identified in the submittal, shall be grounds for immediate disapproval without comment.

1.2 SCOPE

The work covered by this Section of the Specification shall consist of, but not be limited to, the following:

- A. Cable Material Requirements
- B. Cable Installation Requirements

1.3 APPLICABLE DOCUMENTS

The common work results described in this standard are derived in part from the recommendations made in industry standard documents. Materials and workmanship shall conform to the latest issue of all industry standards, publications, or Regulations referenced in this standard, and with the following Codes and Standards, as applicable. All equipment shall be listed and classified by Underwriters Laboratories, under the following Littleton Public School District Technical Specifications & Design Guidelines:

- A. Division 07: Firestopping.
- B. Division 08: Door Hardware
- C. Division 26: Electrical
- D. Division 27: Communications
- E. Technology Design Typicals
- F. Division 28: Electronic Safety and Security
- G. Fire Alarm and Mass Notification Schematics

If a conflict exists between applicable documents, then the order in the list above shall dictate the order of precedence in resolving conflicts. This order of precedence shall be maintained unless a lesser order document has been adopted as code by a local, state or federal entity, and is therefore enforceable as law by local, state or federal inspection agency.

If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents; the design team is responsible to determine and adhere to the most recent release when developing the proposal for installation.

1.4 PART 2 SUBMITTALS

- A. Reference the LPS General Conditions of the Contract and other sections in Divisions 26, 27 and 28.
- B. Product Data: Provide manufacturer's data sheets showing product appearance, electrical characteristics, and connection requirements.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use, as stipulated by the product-testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and start-up or products.
- D. Exceptions: Provide a details listing of any and all exceptions, variances, and non-conformances to the specifications and contract design drawings. Failure to disclose any such items shall be grounds for immediate disapproval of submittals without comment.
- E. Samples: Provide samples of the following items.
 - 1. Provide a minimum of two (2) samples of all cable to be installed on the projects. Cable samples shall be of sufficient length to identify cable marking (striping) and cable listing identification.
 - 2. Provide a minimum of two (2) samples of all cable supporting devices, metal bridle rings, metal mounting brackets, plastic plenum rated wire bushings, and other applicable cable installation equipment to be utilized on the project.

1.5 QUALIFICATIONS

- A. Installer/Vendor: School District approved installers/vendors only.
- B. Manufacturer: Company specializing in manufacturing the products specified in this section with a minimum three (3) years experience, and with service facilities within fifty (50) miles of the project.
- C. Fire Alarm Installer: Installing Company shall use only Premier Level Notifier distributors. Programming and final testing shall be completed by the selected Notifier equipment distributor with oversight by a fire protection engineer. The Bidding Company must specialize in installing the products specified in this section with a minimum three (3) years documented experience. Work shall be performed by licensed electricians supervised by a licensed electrician with NICET Level 2 certification and three years of experience.
- D. Contractors must submit proof of above required qualifications.
- E. At the discretion of Littleton Public Schools and the LPS Operations and Maintenance Department, past performance may be used to disqualify a contractor from providing services for LPS.

1.6 PROJECT MANAGEMENT/GENERAL

The contractor shall establish a single point of contact with Littleton Public Schools who will be responsible for reporting progress and updating the LPS representative with issues that the Owner must address to facilitate the fire alarm and detection system installation. The contractor's POC shall provide weekly written reports to the LPS representative detailing progress. Requests for access to limited access or restricted areas shall be made two days prior to the required access. Information critical to the completion of the task or project shall be communicated to the LPS representative as the requirement becomes known. Casual information shall be passed during the scheduled progress report.

The contractor shall maintain Littleton Public Schools facilities in a neat and orderly manner during the installation of the fire alarm and detection system.

PART 2 PRODUCTS

2.01 FIRE ALARM SYSTEM WIRE AND CABLE

- A. Cable for Class 1 Remote Control and Signal Circuits: Copper conductor, 600 volts insulation rated 75 degrees C, individual conductors twisted together, shielded, and covered with a non-metallic jacket, UL listed for use in air handling ducts, hollow spaces used as ducts, and plenums.
- B. Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300 volts insulation rated 75 degrees C, individual conductors twisted together, shielded, and covered with a non-metallic jacket, UL listed for use in air handling ducts, hollow spaces used as ducts, and plenums.
- C. Miscellaneous Access Control/System Circuits: Power limited fire protective signaling cable for fire and smoke characteristics, copper conductor, 300 volts insulation rated 105 degrees C, UL listed for use in air handling ducts, hollow spaces used as ducts, and plenums.
- D. Provide wet environment exterior rated cable for underground raceway or exterior cable applications.
- E. Install all cable in conduit or 700 series Wiremold© (as approved by LPS) in concealed, unprotected, inaccessible, exposed locations and locations as required by the NEC.
- F. Install all remote control and signal cables in raceways, or supported every 4 to 6 feet on metal bridle rings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Plenum rated cable.
 - 1. All cable shall be new and red with striping.
 - 2. Cable routing shall be perpendicular to or parallel to structural building members, and shall utilize a metal bridle ring type support system attached to structural building members only.
 - 3. Mounting cable to other building systems (fire protection, electrical conduit, mechanical ductwork, etc.), or running cable in any fashion other than described, is strictly forbidden.
 - 4. FPLP (fire rated plenum cable) shall be utilized for all fire alarm circuits.
 - 5. Wire shall be installed in a neat and workmanship like manner. Wire installed in flutes of decking is not permitted. Reference the NEC for proper installation methods.
- C. Do not exceed 40% fill rate in raceways and back boxes.
 - 1. For retrofit applications, conduit and box fill shall be assessed and approved by the Engineer and the LPS Operations, Maintenance and Construction (OMC) Department
- D. Minimum size for back boxes shall be 4" x 4" x 2-1/8" with 512HD mounting bracket or approved equivalent.
- E. Adjustable Caddys are not permitted.
- F. The use of extension rings on new or retrofit construction shall be approved on a "case-by-case basis" by the Engineer and the District.
- G. STI backplate shall be utilized for joist mounted devices requiring a wire guard.
- H. Junction boxes for any new or retrofit construction shall be appropriately sized in accordance with NEC requirements.

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1. Wire runs shall be continuous and shall not contain splices or t-taps unless otherwise approved by engineer or District.
 2. Wire nuts are acceptable unless more than four (4) splices are required in which case terminal strips shall be utilized and backbox shall be appropriately sized in accordance with NEC. Label
- I. Route cables such that a minimum separation of ½" is maintained between Class 1 wire and power-limited fire alarm circuits. Provide separate relay (MR101C or approved equivalent) where 120VAC is required to release fire/smoke dampers, magnetic door holders, or similar. For Notifier devices, barrier CB500 may be installed in place of an additional relay.
- J. Conduit or Wiremold©
1. Conduit shall be provided in exposed joist construction, above hard lid ceilings, in all areas where wire would be exposed or unprotected, and concealed spaces. Contractor shall utilize Wiremold© for surface mount in locations accessible to the public. Contractor shall obtain approval from LPS or engineer representative for exceptions to Wiremold© and conduit locations.
 2. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.
 3. Conduit is not permitted to be secured to the roof deck. All existing conduit utilized for fire alarm shall be removed if improperly secured to the roof deck and new conduit shall be installed. Conduit shall be installed in accordance with NEC spacing requirements from the roof deck.
 4. All conduit shall be installed by a licensed electrician.
 5. All exposed raceways, including fire alarm, shall be painted to match their mounting surfaces, or as requested by Owner. Fire alarm boxes/covers shall be painted red.
 6. All Wiremold raceway shall be cut only by a Wiremold cutter; any Wiremold raceway cut by a hacksaw or other unapproved means shall be removed and replaced at the contractor's expense.
 7. Exposed knockouts are not acceptable in public areas.
 8. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC.
 9. Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or back boxes, except where conduit entry is specified by the FACP manufacturer.
 10. Conduit shall be trade size 3/4-inch (19.1 mm) minimum. ½-inch conduit may be allowed if the contractor submits a specific request in writing.
 11. Conduit edge protection shall be provided for all transitions from conduit to bridge rings. Reference Open (Plenum) Cable Installation Requirements.
 12. Conduit sleeves shall be used for all penetrations through fire rated or non-fire rated walls and partitions. Sleeves through fire rated walls shall be fire caulked on both sides of the wall and filled after cable installation.
 13. Knockouts are not permitted in exposed back boxes installed in public areas. Provide and install device specific surface skirts for all surface mounted devices in public areas.
- K. Support all boxes by All-thread or other approved box support device; or bolt directly to building structural members. Do not support boxes to ceiling tie-wires.
- L. All box knock outs and exposed conduit edges shall have plastic edge protection.

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- M. Provide red marking paint on fire alarm support hardware. Do not allow paint to contaminate any wire. Fire alarm wire contaminated with paint shall be removed and repulled. Fire alarm support hardware contaminated with paint [does not apply to approved marking paint (red)] shall be removed and replaced. The General Contractor shall reimburse the electrical contractor on a case-by-case basis.
- N. Mount end-of-line device in box with last device.
- O. Mount outlet box for electric door holder to withstand 80 pounds pulling force. Where wall construction is wood or steel frame, utilize Caddy telescopic bracket TSGB16/TSGB24 or approved equivalent.
- P. Division 28 contractor shall make conduit and wiring connections to door release devices, sprinkler flow switches, sprinkler valve tamper switches, duct smoke detectors, smoke/fire dampers, HVAC units, and other fire alarm interconnections, furnished under other Sections.
- Q. Automatic Detector Installation: Conform to NFPA 72.
- R. Automatic Duct Detector Installation: Conform to IMC and NFPA 72.
- S. When patching ducts, utilize steel plates secured by #8 x ½" indented slotted hex washer head type A sheet metal screws and apply mastic which is listed and labeled "181A-M" in accordance with UL 181A. Do not use tape.

3.02 OPEN (PLENUM) CABLE INSTALLATION REQUIREMENTS

- A. Open cabling shall be installed in a neat and workmanlike manner, and shall be run perpendicular or parallel to building structural members. Diagonal routing of cable shall not be considered acceptable and shall cause to be removed and reinstalled.
- B. Open cabling shall be routed away from other building cabling and equipment. Separation from other building wire shall be at least 12 inches.
- C. Open cabling shall be routed to and from the device in a vertical or horizontal manner. Maintain cabling at the same level where possible, Cabling that is not dropped vertically to the device or routed horizontally straight to the device shall not be considered acceptable. Cabling that is routed through, over, under or around other equipment, when a straight horizontal or vertical path is available shall not be considered acceptable and shall cause the cable to be removed and be reinstalled.
- D. Open cabling shall be supported at a minimum of every 4 to 6 feet to building structural members utilizing metal bridle rings. Cabling that is secured to or contacting sprinkler piping, HVAC ductwork, electrical conduit or other non-structural building member shall not be acceptable and shall require the contractor to re-install and re-support cable in a proper manner.
- E. Open cabling shall be installed in a neat and workmanship-like manner. Contractor shall not use zip ties. Red plenum rated Velcro shall be utilized only to avoid obstructions and to secure the service loop in the bridle ring.
- F. Conduits and device back boxes shall have appropriate plastic plenum rated wire bushings where open cable routing occurs. Do not use Romex type connectors.
- G. Pull through bushings may be utilized only for pull boxes.
- H. Conduits shall be utilized for all separation (wall, ceiling, fire separation barrier, etc.) penetrations.
- I. EMT conduit shall be utilized in all wall cavities. Provide appropriate plastic plenum rated wire bushing where open cable routing occurs. Do not use Romex connectors.
- J. A four (4) foot service loop located directly above each device shall be provided

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and installed inside the bridal ring above the device. The contractor shall utilize plenum rated Velcro to secure the bottom of the service loop in a neat and workmanship like manner.

1. On structural steel use Caddy (or approved equivalent) beam clamps # BC, BC200 or spring steel clips Caddy (or approved equivalent) # 2FMP28, M24, M58 or M912.
 2. Do not use power fasteners. Only screws and anchors are acceptable.
 3. Any substitutions shall be submitted to the engineer and LPS for approval prior to installation. Substitutions shall be industry equivalent or greater than in nature.
- K. Appropriate fire caulking or sealant shall be utilized where open cabling penetrations through fire separation barriers or building separation walls occur. Fire caulk all conduit ends where conduit sleeves penetrate fire barrier separations, after cable has been installed. Reference 07 84 00 – Firestopping.
- L. Wire jacket shall be visible at each termination location.
- M. Provide transient surge suppression for all circuits that exit building structures.
- N. Provide 120VAC surge suppression for all 120VAC circuits feeding panels.
- O. Wiring shall be provided and installed in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 16 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 mm) for Strobe Circuits.
- P. All fire alarm wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
- Q. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g. FPLP).
- R. Provide wet environment exterior rated cable for underground raceway exterior applications. THHN Cable is not acceptable for fire alarm wet locations.
- S. Wire and cable not installed in conduit shall be securely fastened to a structural member at intervals not exceeding NFPA 70 requirements.
- T. All wire shall be supported with Caddy (or approved equivalent) Beam clamps & Threaded Bridle Rings. Bridle Ring size is dependent upon the number of conductors requiring support. Any substitutions shall be of equal or greater than in nature.
1. Caddy (or approved equivalent) Threaded Bridle Ring: 1 1/4" inside diameter
 2. Caddy (or approved equivalent) Threaded Bridle Ring: 2" inside diameter
 3. Caddy (or approved equivalent) Threaded Bridle Ring: 4" inside diameter
- U. Plenum rated Velcro shall be utilized at the end of wire runs, at 90° turns, service loops and around obstructions. Quantity of Velcro shall be limited for neatness and workmanship like manner. Excessive use of Velcro may be subject to removal at the discretion of the LPS Operations, Maintenance and Construction (OMC) Department.
- V. Wiring used for the multiplex communication circuit (SLC) shall be twisted and unshielded and support a minimum wiring distance of 12,500 feet. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit.
- W. All field wiring shall be electrically supervised for open circuit and ground fault.

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3.03 LABELING

- A. All fire alarm devices shall have the room number/location description provided in the software programming. Example (Device Address) AHU-1 Return Classroom 201. RPS monitor modules shall have the room number included in the software description. When necessary to distinguish the locations of two or more detectors, compass directions shall be incorporated in the device location description in programming.
- B. Label each initiating device with device ID address (L01-D001 format), and control module or monitor module with device ID address and circuit function (L01-M001, Strobes format). Use Kroy lettering machine with ¼-inch minimum black lettering on clear background, unless alternate labeling approved by the District. Place label on initiating device base. **DO NOT PLACE ON SENSOR.**
- C. Label each notification appliance with notification appliance (NAC) circuit number and device number in circuit (NAC 1:1-1, NAC 1:1-2, etc.). Label notification appliance (NAC) circuit and or line (EOL) device location on the notification appliance where the EOL is located (NAC 1:1 EOL). Use Kroy lettering machine with ¼-inch minimum black lettering on clear background, unless alternate labeling approved by the District.
- D. Label each remote duct detector or beam detector test station with device ID address and associated HVAC unit or beam detector designated (L01-M001 RTU-1 format). Label location of the device associated with the test station (L01-M001 RTU-1 Classroom 201 format). Use Kroy lettering machine with ¼-inch minimum black lettering on clear background, unless alternate labeling approved by the District.
- E. Label each concealed device location with device ID address and circuit function (L01-M001 Door Holder format) at the adjacent ceiling tile grid T-bar. Use plastic laminate with engraved ¼-inch minimum white lettering. Laminate shall be of red on white core construction (white lettering on red background), unless alternate labeling approved by the District.
- F. Label each power supply with power supply designation and function. Use plastic laminate with engraved ¼-inch lettering. Laminate shall be of red on white core construction (white lettering on red background), unless alternate labeling approved by the District.
- G. Label circuit terminations in panels and junction boxes with shrink wrap type written labels.
- H. Label each security device with device ID address (ID # format), and motion detector, keypad, card reader, etc. with device ID address and circuit function with ¼-inch minimum black lettering on white background, unless alternate labeling approved by the District. All motion detectors shall also have the Contact ID Zone number on the label.
- I. Contractor shall provide and install door frame placards as noted on contract documents. The door frame placards shall reflect the LPS approved room designation and number and shall be engraved phenolic labels matching the color of existing door frame labels, approximately 2" tall by 5" wide and attached to the top right corner of the door frame (sticky back) as directed on contract documents.

3.04 FIRE ALARM WIRE AND CABLE COLOR CODE

- A. Provide solid, twisted Fire Alarm system conductors with size and insulation color codes as follows:
 - 1. SLC Circuit: 16AWG, Red Jacket with preprinted SLC (every foot)

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2. IDC Circuit: 16 AWG, Red Jacket with Brown Stripe
3. 24 VDC Power Circuit: 14AWG, Red Jacket with Black Stripe
4. Notification Appliance Circuit (NAC):
 - a. NAC Strobe only Circuit: 14AWG, Red Jacket with Green Stripe
 - b. NAC horn/strobe circuit: 14 AWG, Red Jacket with Blue Stripe
5. Network Circuit: 16AWG, Red tagged RS-485 on both ends.
6. Relay Circuit: 16AWG, Red with Yellow Stripe
7. Remote Test Station Circuit: 16AWG, Red with Yellow Stripe
8. Miscellaneous Fire Circuit: 16AWG, Red with Yellow Stripe
9. Fire alarm wire shall be one pair [Red (+)/Black (-)].
10. Remote test station wire can be two pair [Red (+)/Black (-) and Yellow (+)/Green (-)]
11. Left hand lay shall be a minimum of 4.
12. Conductor sizing and numbers subject to equipment manufacturer recommendations.
13. Fire alarm wire shall be unshielded unless required by manufacture.
14. All 120VAC shall meet NEC standards.

3.05 DEDICATED CIRCUIT

- A. The fire alarm control panel shall be connected to a separate dedicated emergency branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold-water pipe or grounding rod.
- B. Provide dedicated circuits for fire alarm equipment.

PART 4 FIELD QUALITY CONTROL

4.01 FIRE ALARM SYSTEM

- A. Test in accordance with NFPA 72, District, State, and Authority Having Jurisdiction (AHJ) fire department requirements. Use NFPA 72 forms provided by fire protection engineer of record (or third-party oversight FPE) and customized to specific LPS facility.
- B. Provide forty-eight (48) hours prior notice to the fire protection engineer of record (or third party oversight FPE) and District personnel for rough inspection, prior to installing ceiling tiles, devices or drywall.
- C. Provide seven (7) days prior notice to the fire protection engineer of record (or third party oversight FPE) and District personnel for scheduled contractor pre-testing of the system.
- D. Provide three (3) days prior notice to the fire protection engineer of record (or third party oversight FPE) and District personnel for the scheduled Authority Having Jurisdiction (AHJ) testing of the system.
- E. Provide three (3) original copies of the NFPA 72 - Certificate of Completion Form.
 1. One for the District, one for the Authority Having Jurisdiction (AHJ), and one for the facility's Fire Alarm System Logbook.
 2. Voltage and current values must be true measured values (not estimates) as observed fire protection engineer of record (or third-party oversight FPE).

3. Provide a table list of each speaker location (room/area) with actual measured dB and intelligibility per NFPA. All readings shall be observed by fire protection engineer of record (or third-party oversight FPE) and recorded on the record drawings.
- F. Provide two (2) detailed records of the pre-testing of the system.
1. One for the District and one for the facility's Fire Alarm System logbook.
 2. Pre-testing record must contain a minimum of the device ID, proper annunciator description, proper functionality of the device (audible/visual signaling, shutdown, etc.), and date of the testing.

4.02 MANUFACTURER'S FIELD SERVICES

- A. Prepare and start systems.
- B. Include services of NICET II certified technician to supervise installation, adjustments, final connections, and system testing.
- C. Provide one (1) hard copy and two (2) electronic copies in CD ROM or flash drive format of the final system programming. One set to be delivered to the District Project Manager for the District Central Reporting System programming, and one set to be left at the facility.

4.03 DEMONSTRATION

- A. Demonstrate normal and abnormal modes of operation and required responses to each.

4.04 TRAINING

- A. Provide the services of a factory-certified service representative to demonstrate the system and train Owner's maintenance personnel as specified below.
- B. On-Site Training: Provide a minimum of two (2) hours of on-site training of the facility's staff in the basic operations and functionality of the system panel, and field devices. Review field panel locations, typically device locations, and 120VAC power locations (panels, breakers, and circuits). Demonstrate the various system responses to the field off-normal conditions. Simulate supervisory conditions, trouble conditions, and ground fault conditions of the various field devices. Demonstrate how to reset various building systems (HVAC units, fire doors, etc.). Provide written instructions of basic system operating instructions in Fire Alarm Log Book, located adjacent to the fire alarm control panel.
 1. On-Site System Training shall be completed within six (6) days of completion of the system and Owner Acceptance of the system.
 2. Schedule on-site training with the District at least three (3) days in advance.
- C. Maintenance Staff Training: Provide a minimum of eight (8) hours of training of the District's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, programming, and preventative maintenance of a system. The training shall be conducted in a classroom type setting, at a location designated by LPS, with the content approved by the District in advance. Provide maintenance, service, and programming manuals of the various components of the system. Provide a working (panel and field devices) system demonstration unit; whereby the various system troubleshooting, and servicing procedures can be adequately performed in a "hands-on" scenario.

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1. Training shall be completed within thirty (30) days of completion of the system and Authority Having Jurisdiction (AHJ) test and/or final Owner Acceptance of the System, unless the District specifically directs an alternate training schedule.
2. Schedule Training with the District at least fourteen (14) days in advance.

END OF SECTION

SECTION 28 4600
FIRE ALARM AND DETECTION SYSTEMS

PART 1 GENERAL

1.02 PURPOSE

The intent of this document is to provide a standard specification that will be used for all Littleton Public School facilities requiring fire alarm and detection system installation. This document provides the minimum performance criteria for the components and sub-systems comprising a complete fire alarm and detection system that shall accommodate the owner's requirements.

The successful vendor shall meet or exceed all requirements for the fire alarm and detection system described in this document.

At the time of bid, all exceptions taken to these Specifications, any variances to the contract drawing design, and any nonconformance to the operating capabilities called for in this specification, shall be listed in writing and forwarded with the submission of the bid. Any such exception, variance, or nonconformance, which was not listed at the time of bid, and is identified in the submittal, shall be grounds for immediate disapproval without comment.

Fire Alarm manufacturer shall be required to provide Littleton Public Schools a licensed copy of any software required to download, modify and maintain the system. Programming access codes shall not be given to the District until after certification training of District technician(s) and the end of the warranty period.

1.03 SCOPE

The work covered by this Section of the Specification shall include all labor, equipment, materials, and services to furnish and install a complete fire alarm and detection system of the zoned, non-coded general alarm type. It shall be complete with all necessary hardware, software, and memory specifically tailored for this installation. The system shall consist of, but not be limited to, the following:

- 1) Fire Alarm control panels.
- 2) Annunciator panels.
- 3) Addressable manual fire alarm stations.
- 4) Analog/Addressable automatic initiating devices.
- 5) Fire/Emergency alarm signaling devices.
- 6) Auxiliary fire alarm equipment and connections.

1.04 APPLICABLE DOCUMENTS

The fire alarm system described in this standard is derived in part from the recommendations made in industry standard documents. Materials and workmanship shall conform to the latest issue of all industry standards, publications, or Regulations referenced in this standard, and with the following Codes and Standards, as applicable. All equipment shall be listed and classified by Underwriters Laboratories (latest editions), under the following Littleton Public School District Technical Specifications & Design Guidelines:

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- 1) Signaling Systems.
- 2) UL 228 – Door Closers-Holders, With or Without Integral Smoke Detectors.
- 3) UL 268 – Smoke Detectors of Fire Protective Signaling Systems.
- 4) UL 268A – Smoke Detectors for Duct Applications.
- 5) UL 464 – Audible Signal Devices for Fire Alarm and Signaling Systems, Including Accessories.
- 6) UL1638 – Visible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories.
- 7) UL 1480 – Speakers for Fire Alarm and Signaling Systems, Including Accessories.
- 8) UL 38 – Standard for Manual Signaling Boxes for Fire Alarm Systems.
- 9) UL 346 – Standard for Waterflow Indicators for Fire Protective Signaling Systems.
- 10) UL 521 – Standard for Heat Detectors for Fire Protective Signaling Systems.
- 11) UL 1481 – Standard for Power Supplies for Fire-Protective Signaling Systems.
- 12) UL 1711 – Standard for Amplifiers for Fire Protective Signaling Systems.
- 13) UL 864 – Control Units for Fire Protective Signaling Systems.
- 14) UL 1076 – Proprietary Burglar Alarm Units and Systems.**
- 15) UL 1971 – Signaling Devices for the Hearing Impaired.
- 16) FM P7825a – Approval Guide Fire Protection.
- 17) NFPA 70 - National Electrical Code. Current Version adopted by the AHJ.
- 18) NFPA 72 - National Fire Alarm Code. Current Version adopted by the AHJ.
- 19) IFC - International Fire Code. Current Version adopted by the AHJ.
- 20) IBC International Building Code. Current Version adopted by the AHJ.
- 21) IMC – International Mechanical Code. Current Version adopted by the AHJ.
- 22) ANSI S3.41 – Audible Emergency Evacuation Signals.
- 23) EIA ANSI/EIA/TIA2323 – Interface between Data Terminal Equipment and Data Circuit Terminating Equipment employing Serial Binary Data Interchange.
- 24) IEEE C6.41 – Surge Voltages in Low Voltage AC Power Circuits.
- 25) LPS General Conditions of the Agreement.
- 26) LPS Electrical Specifications.
- 27) Local AHJ shall enforce State of Colorado Requirements.
- 28) Americans with Disabilities Act (ADA).
- 29) Section 07 8413: Firestopping.
- 30) Section 08 7100: Door Hardware.
- 31) Section 21 1000: Water Based Fire Suppression Systems.

- 32) Section 23 3300: Air Duct Accessories.
- 33) Division 26: Electrical.
- 34) Division 27: Communications.
- 35) Littleton Public Schools Fire Alarm and Mass Notification Standards Plans (FA & MNS Plans).
- 36) Division 28 0500 Common Work Results for Electronic Life Safety.
- 37) Compatibility with Notifier ONYXWorks.
- 38) Compatibility with LPS selected cellular service provider.

If a conflict exists between applicable documents, then the order in the list above shall dictate the order of precedence in resolving conflicts. This order of precedence shall be maintained unless a lesser order document has been adopted as code by a local, state or federal entity, and is therefore enforceable as law by local, state or federal inspection agency.

If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents; the design team is responsible to determine and adhere to the most recent release when developing the proposal for installation.

1.05 DESIGN TEAM REQUIREMENTS

COMPLETE and COMPLIANT: For all Littleton Public Schools fire alarm and detection projects, all architectural firms shall employ or contract with a fire protection engineer. The fire protection engineer shall be a registered P.E. in fire protection engineering, with a minimum of four (4) years' experience in fire protection and alarm engineering, and a minimum NICET Level 3 in fire alarm systems.

1.06 CONSTRUCTION DOCUMENTS

Construction documents shall provide separate sheets specifically for fire alarm and detection system locations and details. At the design teams discretion the fire alarm and detection sheets may be combined with public address and security drawings and details. Fire alarm and detection sheets shall indicate all new fire alarm and devices present in the facility. Existing equipment, devices and cabling shall be indicated on drawings and noted as to demolish. All existing equipment, devices and cabling that are to remain in place are to be properly reworked as necessary to bring them into current standards and codes. Mounting heights of all equipment shall be indicated by way of floor plan keynotes, or equipment installation detail sheets. Construction documents shall include the following:

Specifications must call out the manufacturers of the fire alarm and detection system products as indicated in this document. No alternates are to be accepted on products specified within this document.

All vendors for this fire alarm and detection system project shall submit contractor qualifications and project data sheets. It shall be the responsibility of the fire protection engineer and design team to review all submitted documentation for accuracy before forwarding the submittal package to LPS for final approval.

1.07 SUBMITTALS

- 1) Submittals shall include product data literature. Submittals shall include manufacturer's data sheets showing product appearance, electrical characteristics, and connection requirements and other data required for LPS to ascertain that the proposed equipment and materials comply with specification requirements.
 - a) Load Calculations: Provide load calculations for all visual appliance circuits, audible notification appliance circuits, audible/visual notification appliance circuits, system power supplies, and battery standby systems.
 - b) Manufacturer's Installation Instructions: Indicate application conditions and limitations of use, as stipulated by the product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and start-up of products.
- 2) Provide all documentation required by NFPA 72 chapter 7.4 Shop Drawings (Installation Documentation). Shop drawings shall be prepared, submitted, reviewed by design team and fire protection engineer and approved prior to starting work on the fire alarm and detection system.
 - a) Contractor shall provide shops drawings in compliance with NFPA 72 and this section.
 - a. Wiring diagrams showing all equipment, device placement, and wiring connection required.
 - b. One-line riser diagrams.
 - c. Device ID numbers (manufacturer's format), room numbers, room descriptors, and compass direction (if applicable).
 - d. Zone schedules, operational matrix, and location of all end-of-line (EOL) devices.
 - e. Each initiating device and notification appliance device shall include signaling loop circuit or notification appliance circuit number and device ID numbers (manufacturer's format) with preceding zeros.
 - f. All system wiring shown on the floor plans.
 - g. Include fire alarm control panel elevation view
 - h. Control Panels and Power Supply: Show fire alarm control panel layout, configurations, and terminations.
 - b) Shop drawings shall include custom address list which includes device number, device location and references to major building areas. Extended label shall include compass direction and floor (i.e. 1st West, 2nd Center, 3rd North). Waterflow descriptor shall indicate area served. Examples include:
 - i. L01-D001 Smoke(Photo) PHOTO Classroom 1
 - j. L01-D002 Smoke(Photo) PHOTO Corridor near RECPT 117
 - k. L01-D003 Heat HEAT IDF 100

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- l. L01-D004 Sup L(Duct P) PHOTO AHU-1 Return
 - m. L01-M001 Pull Station MANUAL STATION North Entry 136
 - n. L01-M010 Track Superv MONITOR Tamper Switch Zone 1 - 1st Floor Area A Mech 150
 - o. L01-M011 Monitor MONITOR Waterflow Switch Zone 1 - 1st Floor Area A Mech 150
 - p. L01-M012 Non Fire MONITOR Waterflow Track Zone 1 - 1st Floor Area A
 - q. L01-M013 Monitor MONITOR Waterflow Switch Zone 1 - 1st Floor Area B Mech 150
 - r. L01-M014 Non Fire MONITOR Waterflow Track Zone 1 - 1st Floor Area B Mech 150
 - s. L01-M015 Monitor MONITOR Waterflow Switch Zone 1 - 1st Floor Area B
 - t. L01-M016 Non Fire MONITOR Waterflow Track Zone 1 - 1st Floor Area B
 - u. L01-M030 Monitor MONITOR Ansul System Kitchen 143
 - v. L01-M040 Trouble Mon MONITOR APS # 4 Trouble Custodian 214
 - w. L01-M050 Trouble Mon MONITOR APS #5 Trouble IDF RM 205
 - x. L01-M060 Relay RELAY RTU-2 Shutdown
- 3) The contractor shall not purchase any materials or equipment for incorporation into the project prior to receipt of reviewed submittals from design team's fire protection engineer and LPS.
- 4) Review of product data shall not relieve the contractor from responsibility for deviations from the drawings or specifications. Contractor shall provide a detailed listing of any and all exceptions, variances, and non-conformances to the specifications and contract design drawings and obtain written approval. Failure to disclose any such items shall be grounds for immediate disapproval of submittals without comment.
- 5) Provide physical samples which represent materials, equipment, and workmanship.
- a) Provide a minimum of two (2) samples of all fire alarm cable to be installed on the projects. Cable samples shall be of sufficient length to identify cable marking (striping) and cable listing identification.
 - b) Provide a minimum of two (2) samples of all cable supporting devices, metal bridle rings, metal mounting brackets, plastic plenum rated wire bushings, and other applicable cable installation equipment to be utilized on the project.
- 6) Product data submittals shall be reviewed and approved by the fire protection engineer and design team prior to being forwarded to LPS for review and final approval. LPS will have authority of final approval for all product data submittals.

1.08 CONTRACTOR QUALIFICATIONS

- A. Contractors bidding on this project must meet the following minimum requirements:

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1. Manufacturer: Company specializing in manufacturing the products specified in this section shall have a minimum of three (3) years documented experience and have service facilities within fifty (50) miles of the project.
 2. Shop Drawing Preparer: Company shall employ a NICET level 3 or 4 shop drawing preparer. Preparer shall sign shop drawing submittal.
 3. Project Supervisor: The installing company shall provide a full time project supervisor dedicated to the supervision of the fire alarm installation. The project supervisor shall have at least 5 years of experience installing addressable fire alarm systems. The project supervisor shall be on site at all times that the fire alarm system installation is in progress, including system testing.
 4. Installer: Installing Company shall use only Premier Level Notifier distributors. Programming and final testing shall be completed by the selected Notifier equipment distributor with oversight by fire protection engineer.
 5. The bidding electrical contractor must specialize in installing the products specified in this section with a minimum five (5) years documented experience with Denver Metro Area schools. The installer shall employ NICET Level 2 trained technicians to install the products specified in this Section. The bidding contractor shall submit a resume for fire protection engineer review at time of bid submission.
- B. Contractors must submit proof of above required qualifications.
- C. The design team and fire protection engineer shall acquire a list of currently certified/qualified contractors to include in specification documentation. The list of certified contractors shall be provided to LPS for approval prior to inclusion in specification documents.
- D. At the discretion of Littleton Public Schools and the LPS Operations, Maintenance and Construction (OMC) Department, past performance may be used to disqualify a contractor from providing services for LPS fire alarm and detection system projects.

1.09 PROJECT MANAGEMENT/GENERAL

The contractor shall establish with Littleton Public Schools a single point of contact who will be responsible for reporting progress and updating the LPS representative with issues that the Owner must address to facilitate the fire alarm and detection system installation. The contractor's POC shall provide weekly written reports to the LPS representative detailing progress. Requests for access to limited access or restricted areas shall be made two days prior to the required access. Information critical to the completion of the task or project shall be communicated to the LPS representative as the requirement becomes known. Casual information shall be passed during the scheduled progress report.

The contractor shall maintain Littleton Public Schools facilities in a neat and orderly manner during the installation of the fire alarm and detection system.

PART 2 FIRE ALARM SYSTEM REQUIREMENTS

2.01 LITTLETON PUBLIC SCHOOLS FIRE ALARM SYSTEM DESIGN CRITERIA

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The fire alarm system design shall be based upon the following codes:

1. 2021 - International Building Code (IBC)
2. 2021 - International Mechanical Code (IMC)
3. 2021 - International Fire Code (IFC)
4. 2020 - National Electrical Code (NEC)
5. 2019 - National Fire Alarm Code (NFPA 72)
6. 2016 - Elevator Safety Code (ANSI A17.1)
7. State Of Colorado Requirements
8. Littleton Public Schools Technical Guidelines

In addition to the state and code requirements, the fire alarm system design shall incorporate the following additional design criteria:

Smoke Detection:

1. Smoke detectors shall be located in all electrical rooms.
2. Smoke detectors shall be located in all MDF, IDF and other communication type rooms.
3. A smoke detector shall be located at fire alarm control panel.
4. Smoke detectors shall be located at all fire alarm remote power supply panels.
5. Smoke detectors shall be located in elevator lobbies, elevator machine room, and the elevator shaft for elevator control purposes as required by code.
6. Only a single smoke detector is required in each modular classrooms.
7. Contractor shall utilize intelligent (or approved equivalent) beam detectors in place of spot smoke detectors where cost efficient.
8. In a sprinklered building, smoke detectors for door release service on smoke rated walls/partitions shall be installed in accordance with NFPA 72.
9. Smoke detectors for fire/smoke damper and firefly release shall be located in accordance with IBC. Contractor shall pretest fire/smoke damper and firefly function prior to start of construction and report deficiencies to LPS.
10. Smoke detectors shall be located in all air handling equipment rooms and other similar areas.
11. Smoke detectors shall be located throughout all common corridors. [non-sprinklered facilities]
12. Smoke detectors shall be located in auditoriums, cafeterias, gymnasiums and similar areas. [non-sprinklered facilities]

Heat Detection:

1. Heat detectors shall be located in all code required areas not suitable for smoke detection, and shall be intelligent, analog heat detectors.
2. Heat detectors set at the highest programmable fixed temperature setting (190°F) shall be located in the kiln room.

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3. Heat detectors shall be located in the kitchen (8 feet from heat source) and have an integral Carbon Monoxide detector.
4. Heat detectors shall be located in the elevator machine room and elevator shaft for elevator shunt trip purposes as required by state code. Heat detectors shall be located within 2 feet of every elevator shaft and elevator machine room sprinkler head.
5. Heat detectors set at the highest programmable fixed temperature setting (190°F) shall be located in all boiler rooms, chiller rooms and other similar rooms located below corridor grade level. [non-sprinklered facilities]
6. Heat detectors set to 135°F rate of rise temperature setting shall be located on stages. [non-sprinklered facilities]
7. Heat detectors set to 135°F rate of rise temperature setting shall be located in all shops and laboratories. [non-sprinklered facilities]

Duct Smoke Detection:

1. Duct smoke detectors shall be intelligent analog/addressable type, which shall report to the fire alarm system as a "supervisory" type device.
2. Duct smoke detectors shall be located in the return air ductwork of all HVAC units greater than 2,000 cfm. Duct smoke detectors shall be located in the return air ductwork of all HVAC systems with a combined capacity greater than 2,000 cfm.
3. Duct smoke detectors shall be located in the return ductwork of all HVAC units greater than 15,000 cfm where return air risers serve two or more stories such smoke detectors shall be installed at each story per the IMC.
4. Duct smoke detectors shall be located within five feet of each smoke damper or fire/smoke damper used for control purposes unless an alternate method from IMC can be applied.
5. Duct smoke detectors shall shutdown the respective HVAC unit.

Manual Pull Stations:

1. Manual pull stations shall be dual action type.
2. The fire alarm control panel shall be programmed such that activation of a pull station initiates a 2 minute delay at middle and high schools only. Activation of a second alarm device will immediately activate notification appliances.
3. A manual pull station shall be located by the FACP in the main office. After hours staff has regular access to the main office.
4. Manual stations shall be mounted with the operating mechanism at 48" above finished floor.
5. All existing sounder covers shall be reinstalled with the sounder disabled.

Magnetic Door Holders:

1. Existing magnetic door holders shall remain in place.
2. Magnetic door holders shall be provided and installed at rated 2hr walls.
3. All magnetic door holders shall be 120VAC.

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Carbon Monoxide (CO) Sensors:

1. Carbon monoxide (CO) sensors shall be conventional and shall report to the fire alarm system as a "supervisory" type device.
2. Carbon monoxide (CO) sensors shall have three CO exposure level settings for short, medium, and long duration periods of exposure to CO gas.
3. Carbon monoxide (CO) sensors shall have an integral sounder, which shall provide a local temporal 4 alarm signal upon activation of any of the three CO exposure level settings.
4. Carbon monoxide detectors shall be located in kitchen (integral to heat detector), boiler room, rooms with gas fired equipment including science rooms, laboratories, gas water heaters, gas furnaces, and gas fired AHUs, or first room served by a gas fired AHU.
5. Carbon monoxide detectors associated with a gas fire AHU shall shutdown only the associated unit.

Visual Notification Appliances:

1. Strobes shall be located in all common "public area" spaces, including corridors, classrooms, restrooms, open office areas, and other areas where more than two person occupancy is currently established.
2. Strobes shall be located in all restrooms except single water closets (toilet only) without a sink specifically in kindergarten and pre-school classrooms.
3. Strobes shall be located in copy rooms, work rooms, storage rooms greater than 400 square feet, and storage rooms where high occupant usage levels are anticipated under normal conditions.
4. Strobes shall be located in health service rooms and conference rooms.
5. Strobes shall not be installed in single occupant offices.
6. Ceiling mounted strobes are preferred over wall mounted in all areas with acoustical grid. Ceiling mounted strobes shall be centered in the space as much as possible, but shall not exceed 5 feet in any direction from the center, unless approved by the engineer, LPS or AHJ.
7. When ceiling mounting is not practical strobes shall be wall mounted with the bottom of the visual signal (strobe) lens at 80" above finished floor, or with the top of the visual signal (strobe) lens at 6" below the ceiling (for low ceiling areas), whichever is lower.
8. Strobes shall be white and labeled "ALERT".
9. An exterior weatherproof strobe shall be provided at main entrance and shall be on dedicated circuit.
10. Exterior weatherproof horn/strobes shall be provided at the fire department connection. The horn/strobe shall track waterflow and the notification appliance shall be mounted 10 feet above grade. The horn/strobe shall be red and labeled "FIRE".
11. Initiation of non-fire emergency notification messages shall also activate alert strobes. Provide addressable input module for contact closure from Valcom paging system, and program system to activate visual notification in conjunction with audible notification. Coordinate event initiation with LPS Representative and paging system contractor.

Audible Notification Appliances:

1. Interface with IP for speakers.
2. IP speakers shall be located to provide a minimum of 60dba sound levels throughout acoustically distinguishable spaces.
3. IP speakers shall be located in all mechanical rooms, and other high-noise areas.
4. IP speakers shall be located in all classroom areas.
5. IP speakers shall be located in order to meet mass notification audibility and intelligibility requirements.
6. IP speakers and server trouble shall be supervised by the fire alarm system.
7. Each ups power supply for IP speakers shall be supervised by the fire alarm system.

Wire Guards:

1. Wire guards shall be provided and installed on notification and initiating devices located in all gyms, locker rooms, cafeterias, and pace rooms.
2. Protective pull station covers equipped with alarms shall be installed without batteries unless otherwise noted on plans or in writing by the engineer or District Project Manager.

END FIRE ALARM SYSTEM DESIGN CRITERIA

PART 3 PRODUCTS

3.01 MANUFACTURERS

Subject to compliance with specified requirements, products of the following manufacturers shall be acceptable:

- A. Base Bid Shall be based upon Notifier NFS2-3030.
- B. Substitutions: Notifier Inspire.

3.02 MATERIALS

- A. Fire Alarm Control Panel
 1. The fire alarm control panel shall incorporate all control electronics, relays, necessary modules, and components in a semi-flush mounted cabinet. The operating controls and zone/supervisory indicators shall be located for the Fire Department and other authorized operating personnel. The fire alarm control panel shall consist of a base panel, system power supply, and battery charger, with optional modules suitable to meet the requirements of these specifications.
 2. The fire alarm control panel shall be supervised, site programmable, and of modular design with expansion modules to provide analog addressable loop modules as required, Allow for 20% spare on both detector and modules. Configurable to either Class A or Class B wiring.
 3. The fire alarm control panel shall store all basic system functionality and job specific data in nonvolatile memory and shall survive a complete power failure intact. The fire alarm control panel shall store all basic system functionality and job specific data in

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nonvolatile memory and shall survive a complete power failure intact. The fire alarm control panel shall be capable of automatic system operation with support of alarm silence, trouble silence, drill, lamp test and reset common controls. The fire alarm control panel shall allow downloading of job specific custom programming, and shall support programming of any input point to any output point, or using initiating events to start actions and sequences.

4. The fire alarm control panel shall utilize full digital communications to supervise all addressable loop detectors and modules for proper operation. The fire alarm control panel shall have a UL Listed Detector Sensitivity test feature, and shall support 100% of all remote detectors, remote alarm indicators and modules in alarm at any time.
5. The fire alarm control panel shall be placed on 120VAC dedicated circuit with surge protection.
6. The fire alarm control panel shall supervise all system modules for placement and shall have a digital display for reporting system status and abnormal conditions. The fire alarm control panel shall provide common control indicators (normal, alarm, monitor, ground fault, supervisory, trouble), common control switches (reset, alarm silence, trouble silence, and drill), and zone alarm and trouble LEDs, as per system zoning requirements. The fire alarm control panel shall provide system function keys for status, reports, enable, disable, activate, restore, program and test.
7. Provide a District approved Fire Alarm Document Enclosure adjacent to the FACP.
8. Provide a wall mounted 3 ring binder holder for District provided Fire Alarm Log Book adjacent to the FACP.
9. The fire alarm control panel shall send a signal to the Valcom IP-6000 Server located in the MDF room to activate temporal 3 and fire alarm evacuation message upon activation of a fire alarm system initiating device. See structured cabling drawings for equipment room location.
10. The fire alarm control panel shall monitor contact closure from Valcom IP-6000 Server located in the main equipment room for speaker or server trouble. See structured cabling drawings for equipment room location.
11. The fire alarm control panel shall monitor contact closure for APC uninterruptable power supply devices located in Telecom Rooms. See structured cabling drawings for telecom room locations and quantities.

B. Power Supplies

1. The fire alarm power supply shall be switch mode type with line monitoring to automatically switch to batteries upon power failure or brown out conditions, and shall be adequate to service all fire alarm control panel modules, all fire alarm system powered smoke sensors and modules, remote annunciators, control relays, and all fire alarm signaling appliances. The fire alarm power supply shall contain an integral battery charger capable of recharging the standby batteries per NFPA 72 requirements, and shall provide battery supervision for placement and low voltage.

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2. Provide booster power supply panels as required, to meet project requirements. The booster power supply shall activate via dry contact from the fire alarm control panel. The booster power supply shall generate a fault condition at the main fire alarm control panel, when any fault condition occurs on circuits connected to the booster power supply, or a trouble condition occurs at the booster power supply panel. The booster power supply shall contain an integral battery charger capable of recharging the standby batteries per NFPA 72 requirements, and shall provide battery supervision for placement and low voltage.
 3. Multiple power supplies may share monitor and control modules ONLY if they are mounted in the same room, not to exceed 3 power supplies per monitor point. Activation of a power supply from another power supply is not permitted.
 4. Provide a dedicated booster power supply for NAC modular classroom NAC circuits.
 5. Power supplies shall be placed on 120VAC dedicated circuit with surge protection.
- C. Standby Batteries: The secondary power source shall be standby batteries. Batteries shall be sealed lead acid type, with a minimum life expectancy of five years, and shall provide twenty four (24) hours of normal standby operation and five (5) minutes of normal alarm condition at the end of the standby period. System can use a four (4) hour battery system if the site has an Automatic-starting, engine-driven generator serving the dedicated branch circuit of the fire alarm system arranged in accordance with NFPA 72.
1. Batteries shall be dated with month and year of installation in the system.
 2. Batteries shall be dated with month and year of manufacture.
 3. Dedicated battery cabinets (when required) shall be located below the fire alarm control panel. Do not locate these panels above finished ceilings.
- D. System Design Parameters:
1. The facility shall have an emergency voice alarm communication system integrated with the paging system. Digitally stored message sequences shall notify the building occupants that a fire or life safety condition has been reported. Message generator(s) shall be capable of automatically distributing up to eight (8) simultaneous, unique messages to appropriate audio zones within the facility based on the type and location of the initiating event.
 2. Design the fire alarm system such that each power supply, initiating device (IDC) circuit, device initiating signaling loop (SLC) circuit, audible/visual notification appliance (NAC) circuit, power supply, and standby battery system shall have a minimum 20% spare capacity included.
 3. Design the fire alarm system such that each analog/addressable device initiating loop (SLC) circuit shall have a minimum 20% spare capacity included. Reference Division 28 0500.
 4. Fire Alarm Loop Fault Isolation: Design the fire alarm system such that each analog/addressable device initiating loop (SLC) circuit shall incorporate isolation

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detector bases and/or loop fault isolation modules, placed in accordance with NFPA 72.

5. Fire Alarm Class B Device Initiating Loop (SLC) Circuits: The analog/addressable device loop (SLC) circuit shall be power limited, electronically supervised and shall be monitored for active (short), trouble (open), and ground fault conditions. The analog/ addressable loop (SLC) circuit shall provide all power, signaling and polling communications to the analog detectors and addressable modules connected to it, and shall monitor all sensors for their analog values, environmental compensation levels, and maintenance conditions. The analog/ addressable device loop (SLC) circuit shall monitor all devices for trouble and alarm conditions, and shall place the circuit in trouble mode; but shall not disable any device from initiating an alarm of trouble signal to the fire alarm control panel. The analog/ addressable device loop circuit shall be Class B (Style 4) type.
6. Class B Notification Appliance (NAC) Circuits: The notification appliance (NAC) circuits shall be power limited, electronically supervised, and shall be monitored for trouble (open and/or short) and ground fault conditions. Occurrence of a single ground condition shall place the circuit in trouble mode, but shall not disable that circuit from signaling the alarm condition (audible or visual) to the field notification appliances. The alarm notification appliance circuits shall provide all power for the audible, visual, and audible/visual notification appliances, and shall be Style Y (Class B).
7. Audible and Visual (NAC) Appliance Circuits: Provide audible and visual notification appliance (NAC) circuits, such that the visual and audible notification appliances deactivate upon system silence. Strobes shall synchronize where two or more visual notification appliances or groups of synchronized appliances in the same room or adjacent space are within the field of view.
8. Audible and Visual (NAC) Appliance Circuits: Provide audible and visual notification appliance (NAC) circuits, such that the visual notification appliances continue to flash until the fire alarm control panel has been reset, even though the audible notification appliances have been silenced.
9. Design the fire alarm system such that the Beam and Duct smoke detectors are intelligent/analog devices. If conventional devices are used written permission must be given by the District Project Manager and must have a separate 24VDC power source that is resettable from the fire alarm control panel, as applicable.
10. LPS Fire Alarm System Design Criteria, including current FA & MNS Plans, may reflect supplemental coverage beyond strict Code requirements. This section shall be printed on the front page of all Fire Alarm Plans submitted to Local AHJ's. It is intended to help local AHJ's understand how the District applies additional selective coverage.

E. Offsite Signaling

1. Dialer: Provide digital alarm communicator transmitter (DACT) that shall transmit all control panel off normal condition, including Alarm, Water flow, Supervisory, or

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Trouble. The DACT shall utilize two (2) Cat6 voice lines to comply with NFPA 72 requirements, shall utilize Contact ID type point-by-point communication format. The DACT shall be Notifier Model UDACT or District approved equivalent transmitter (DACT). The Contractor shall provide all point-by-point programming to support transmission of all control panel off normal conditions, including Alarm, Supervisory, Water Flow and Trouble.

2. Ethernet Communications: Provide Ethernet topology data communications module (LAN) that shall transmit all control panel off normal condition, including Alarm, Water flow, Supervisory, or Trouble via Email. The LAN module shall utilize a Category 5E RJ45 data Ethernet connection port for interconnection to the District LAN/WAN network. The LAN module shall support remote web browsing and email alert functions.
3. Notifier NFN-GW-EM-3 Intelligent gateway interface for the ONYX Works™
4. Radio Transmitter: AES Subscribers transmit consolidated alarm, trouble, and supervisory signals triggered by a FACP output relay and an integrated AES-IntelliPro Fire full data module. Transmitter shall send full alarm zone and event codes captured off a panel's digital communicator. Transmitter shall meet UL and NFPA 72 requirements. AES Fire Subscribers with built in full data module are the drop-in full-function replacement for phone lines for communicating signals from both new and existing UL commercial fire alarm systems. Replacing phone lines with AES-IntelliNet maximizes RMR profit because, unlike with cellular technology, there are no service charges to a third-party network provider. Provide connection and power to AES radio communicator. Purchase AES Radio from Security Central. Coordinate with Security Central and LPS for AES Radio installation and fire alarm points list input for District monitoring.
 - a. AES radio shall be installed with and maintain a NetCon 5 value.
 - b. AES radio shall be the latest technology and include an integrated onboard local annunciator.
 - c. Rubber Duck antennas (PN 7214) are preferred by the owner. Exterior, high gain antennas shall only be installed where necessary to achieve a NetCon 5 value.
 - d. Furnish 7794A full data module for point contact ID.
 - e. Furnish 16.5VAC 40VA transformer with 1640-ENCL enclosure. Install in accordance with the manufacturers installation manual.
 - f. Cable between the AES radio and transformer shall be installed in conduit.
 - g. Furnish tamper proof screws.
 - h. COAX and CAT 6 cables shall be installed in conduit and utilize edge protection when entering/existing junction boxes and the AES radio enclosure.

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- i. Conduit sleeves shall be used for all penetrations through fire rated or non fire rated walls and partitions (interior and exterior). Sleeves through fire rated walls shall be fire caulked on both sides of the wall and filled after cable installation.
- j. Contractor shall submit radio coverage maps showing nearby antenna locations and types.
- k. External antenna mounting requirements.
 - l. Shall be at least 18 inches above the roof line.
- m. Shall be at least 10 inches away from any parapet, wall, or obstruction.
- n. Shall have 360-degree visibility.
- o. Antennas must be plumb when mounted.
- p. Furnish lightning protector as close to the antenna as possible (PN 7230).
- q. RG-58 cabling shall run no longer than twenty-five feet (25').
- r. RG-8 cabling shall run no longer seventy-five feet (75').
- s. LMR-400 (LMR-600 preferred) cabling shall run no longer than one-hundred twenty-five feet (125').
- t. Provide 12-inch service length.
- u. No tight bends smaller than a 6 inch radius.
- v. External antenna locations shall be approved by AHJ prior to installation.
- w. Roof penetration shall be coordinated with roofing contractor and be in liquid tight conduit and fittings with flashing suitable for wet locations.

F. Support For Installer and Owner Provisions:

- 1. The fire alarm control panel shall provide a coded "self-test" test feature, capable of audible or silent testing. The "self-test" test feature shall signal alarms and troubles during test, and shall allow receipt of alarms and programmed operations for alarms from other areas not under "self-test".
- 2. The fire alarm control panel shall provide internal system diagnostics and maintenance user interface controls to display and/or report the power, communications, and general status of specific panel components, detectors, and modules. The fire alarm control panel shall provide device loop controller diagnostics to identify common alarm, trouble, ground fault, and Class A fault conditions.
- 3. The fire alarm control panel shall allow the user to display/report the condition of the analog/addressable detectors, with analog sensitivity reading, and shall allow the user to report history for alarm, supervisory, monitor, trouble and restore activity on the system, with time date stamp.
- 4. The fire alarm control panel shall allow the user to disable/enable devices, zones, actions, and sequences. The fire alarm control panel shall allow the user to activate/restore outputs, actions, and sequences. The fire alarm control panel shall

allow the user to service the time and date of the system, and to change passwords for users. All these features shall be password protected.

5. The fire alarm system shall be programmed to shop drawing submittal standards for specific general alarm functions, and other common operating functions. Failure to follow standards shall be considered cause to reprogram the system to standards, at contractor's expense. All panels will include a separate general alarm, NAC, HVAC\damper, Door Holder, Sprinkler and Elevator disable function. Fire Drill\Dialer disable function shall not be allowed except by pre-arrangement between the AHJ and the OMC Department.

G. Fire Alarm System Sequence of Operation

1. Alarm Sequence of Operation: Operation of any alarm initiating devices shall automatically:
 - a. Sound local audible signal and display red common alarm LED.
 - b. Sound audible notification appliances throughout the building.
 - c. Flash visual notification appliances throughout the building.
 - d. Sound/flash the exterior Fire Department Response Point horn/strobes.
 - e. Indicate the device in alarm on the fire alarm control panel and remote annunciator.
 - f. Indicate the location of alarm zone (floor and area) on fire alarm control panel and remote annunciator.
 - g. Alarm signal transmitted to District central stating receiver.
 - h. Alarm signal transmitted to e-mail list
 - i. Manual acknowledgement function at the fire alarm control panel silences local audible alarm. Visual alarm condition is displayed until alarm condition is cleared and panel is reset.
2. Duct Smoke Detector Sequence of Operation: Operation of any duct smoke detector shall automatically:
 - a. Sound local audible signal and display yellow common supervisory LED.
 - b. Indicate the device in supervisory on the fire alarm control panel and remote annunciator.
 - c. Indicate the location of supervisory zone (floor and area) on the fire alarm control panel and remote annunciator.
 - d. Supervisory signal transmitted to District central station receiver.
 - e. Shutdown all HVAC unit(s) associated with the duct smoke detector zone, as required by the AHJ.
 - f. Delay for 60 seconds then close smoke/fire damper(s) associated with the specific HVAC system ductwork, as required by the AHJ. On reset allow 60 second delay of HVAC unit for dampers to open first.

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- g. A manual acknowledge function at the fire alarm control panel silences local audible alarm. Visual supervisory condition is displayed until supervisory condition is restored to normal.
- 3. Audible alarm notification: by voice evacuation and tone signals on IP speakers in areas as indicated on drawings.
- 4. Automatic emergency alert sequence:
 - a. The audio alarm signal shall consist of an alarm tone for a maximum of five seconds followed by an automatic digital voice message. At the end of the voice message, the alarm tone shall repeat. This sequence shall sound continuously until the "alarm silence" switch is activated or the FACP is reset on-site or remotely.
 - b. All audio operations shall be activated by the paging system software so that any required future changes can be facilitated by authorized personnel without any component rewiring or hardware additions.
- 5. The emergency alert system shall allow for up to 24 custom recorded messages, to be defined by LPS Security, in a format similar to the following:
 - a. Fire Alarm (temporal code alert tone followed by evacuation message).
Alert tone – Two cycles of the temporal code 3 pattern, then the two times evacuation message, then two more cycles of the temporal code 3 pattern.
Continuous cycle until silence.
 - b. Emergency Evacuation (general)
Alert tone – Fast whoop sound is played for 5 seconds. Follow same pattern as above (tone, tone, message, message, tone, tone, repeat).
Message – “Evacuation! Evacuation! Evacuation! Immediately exit the building and go to your outside fire evacuation staging area! Once there, take attendance and account for students, and await instructions.”
 - c. Lockdown
Label identification/color - "lockdown"/orange
Alert tone - Fast whoop sound is played for 5 seconds. Follow same pattern as above.
Message - “ Lockdown! Lockdown! Lockdown! Alert others! Shelter in place, and lock the classroom doors! Lights Out! Stay quiet and out of corridor line of sight! If you are unable to get to a secure location, flee immediately through the nearest exit to a safe location.”
 - d. Secured Perimeter:
Label identification/color – “secured perimeter”/orange
Alert tone - Fast whoop sound is played for 5 seconds. Follow same pattern as above. Message - “Secured Perimeter! Secured Perimeter! Secured Perimeter! If outside the school, move inside and shelter in the school! Staff close blinds

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on exterior windows! Staff take attendance, and account for students! Await instructions!”

e. Directed Response:

Label identification/color – “directed response”/orange

Alert tone - Fast whoop sound is played for 5 seconds. Follow same pattern as above.

Message - “Attention! Attention! Attention! This is a Directed Emergency Response Message from the school Incident Command Team! Please standby for an important announcement!”

f. Tornado Watch:

Label identification/color - "tornado watch"/blue

Alert tone - 100 kHz steady tone is played for 5 seconds. Same pattern as above.

Message - "Attention! Attention! Attention! A Tornado Watch has been issued for our area! Current weather conditions indicate that a tornado could develop in our area! Staff please review and implement tornado watch procedures! "

g. Tornado Warning:

Label identification/color - "tornado warning"/blue

Alert tone - 100 kHz steady tone is played for 5 seconds. Same pattern as above.

Message - "Attention! Attention! Attention! A tornado warning has been issued for our area! Students and staff take protective shelter in designated safe areas, and await instructions!”

h. Lightning Alert:

Label identification/color - "lightning alert"/blue

Alert tone - 100 kHz steady tone is played for 5 seconds. Same pattern as above.

Message - "Attention! Attention! Attention! Our area is currently under a Lightning Alert. At this time, all staff and students should return to the interior of the school and await further instructions!”

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- i. Natural Disaster Warning:
Label identification/color - "natural disaster"/orange
Alert tone - hi/lo alert tone (1000/800hz 0.25 seconds on/alternate) is played for 5 seconds. Same pattern as above.
Sample Message - "Attention, attention. A natural disaster has occurred in the area. Please take appropriate action and tune to local radio or television stations for the latest updates. Please remain calm, stay where you are, and await further instructions."
- j. Hazardous Material Emergency:
Label identification/color - "hazmat emergency"/yellow
Alert tone – march-time horn is played for 5 seconds. Same pattern as above.
Sample Message - "Attention, attention. A hazardous material incident or other emergency has been reported. Immediately take shelter inside a facility. Accomplish required shelter-in-place actions, and await further instructions."
- k. Routine Test of the mass notification system
Label identification/color – "audio test"/green
Alert tone – 1 kHz tone is played for 5 seconds. Same pattern as above.
Sample Message – "May I have your attention please. This is an audio test of the mass notification system, take no action, this is only a test."
- l. All Clear verbal
Label identification/color – "all clear"/green
Alert tone – 3 chimes. Same pattern as above.
Sample Message – "May I have your attention please. The emergency has now ended. An "all clear" has been given. Please resume normal duties. Thank you for your cooperation."
- m. Temporal code dba test tone –
Label identification/color – "test tone"/green
Alert tone – continuous temporal 3 code
- n. Security Tone –
Label identification/color – "lights-lock-out of sight"/blue
Alert tone – tbd
Message – to be coordinated with Security and recorded text-to-speech using "Paul" voice <https://www.vocalware.com/index/demo>.
- o. Security Two–
Label identification/color – "arm"/dark blue
Alert tone – TBD

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Message – to be coordinated with Security and recorded text-to-speech using “Paul” voice <https://www.vocalware.com/index/demo>.

- p. Security Three–
Label identification/color – “security alarm”/light blue
Alert tone – TBD

Message – to be coordinated with Security and recorded text-to-speech using “Paul” voice <https://www.vocalware.com/index/demo>.

- 6. Manual voice paging
 - a. The system shall be configured to allow two-way voice paging. Upon activating any talkbalk speaker call-switch or entering an access code at a paging system console phone, a pre-announce tone shall be sounded over all speakers in the selected dial-group.
 - b. Announcements may be made via either of two console phones over selected speakers or to zones as defined by the District.
 - c. Total building paging shall be accomplished by entering a dial-group code at a paging system console phone or authorization and dial-group codes at a building telephone.
 - d. Paging shall be interfaced with the building telephone system.
- 7. Trouble Sequence of Operation: The entire fire alarm system wiring shall be electrically supervised to automatically detect and report trouble conditions to the fire alarm panel. Any opens, grounds, disarrangement of system wiring on alarm initiating circuits, opens, shorts, grounds, or disarrangement of system wiring on alarm notification appliance circuits, or device trouble or maintenance conditions, shall automatically:
 - a. Sound local audible signal and display yellow common trouble LED.
 - b. Indicate the device in trouble on the fire alarm control panel and remote annunciator.
 - c. Indicate the location of trouble condition, as applicable, on the fire alarm annunciator.
 - d. Trouble signal transmitted to District central station receiver.
 - e. Manual acknowledgement function at the fire alarm control panel silences local audible signal. Visual trouble condition is displayed until the trouble condition is cleared.
- 8. Alarm Reset: System remains in alarm mode until alarm condition is cleared and fire alarm system is manually reset with key-accessible reset function. System resets only if initiating circuits are out of alarm. On reset allow 60 second delayed startup of HVAC unit for dampers to open first.
- 9. Alarm Silence: System audible and visual notification appliances remain sounding/flashing until the fire alarm system is manually silenced with a key-

accessible alarm silence function. Visual notification appliances remain flashing until the fire alarm system is manually reset as described above. System audible and visual notification appliances shall resound/flash upon reactivation of alarm silence function.

10. Drill Switch: Shall not be allowed.
11. Lamp Test: A manual lamp test function causes alarm indication of each alarm, trouble and/or system LED at the fire alarm control panel and remote annunciators upon activation of key-accessible lamp test function. Alarm indication of LEDs shall turn off upon reactivation of lamp test function, or upon automatic timeout.

H. Annunciators

1. Remote Annunciators
2. Alpha Numeric Annunciators: Remote alpha numeric Annunciators shall be located throughout the facility, as indicated on the plans. The annunciator shall operate from system 24VDC, be battery backed up, and shall contain a supervised, backlit, liquid crystal display (LCD) with a minimum of 4 lines with 20 characters per line. Each annunciator shall be capable of supporting custom messages similar to the main fire alarm control panel display. Provide key-accessible Lexan cover for Main Entry Annunciator location only.

I. Graphic Display Maps

1. Graphic display maps of the system shall be located at the fire alarm control panel and at all fire alarm annunciator panels, as shown on the plans. Graphic maps shall provide a graphical representation of the building layout with the fire alarm devices and system ID numbering indicated. Maps shall be framed in a snap open, front-loading frame behind clear anti-glare glass, and shall be readily modifiable to incorporate future changes in the buildings layout and/or functions.
2. Graphic Maps shall be printed on anti-glare, anti-fade, photo quality paper.
3. Graphic Maps shall be orientated for user reference based on the location in the building and have a "You Are Here" flag for each location.
4. Graphic Maps shall include:
 - a. Building Name and Address including zip code (Black, Bold, 1/2" text)
 - b. Accurate North Arrow based on orientation of each map.
 - c. Symbol legend identifying each device as shown on graphic map.
 - d. "You are here" arrow indicator (Red, Bold, 1/4" text)
 - e. Simplified Room designations (Black, 1/8" text).
 - f. Room designations are required for areas with devices (EX: Mech. 110)
 - g. Art rooms with Kiln Rooms shall be identified
 - h. Device Addresses with preceding zeros i.e. L01D001 (Blue, 1/8" Text)
 - i. Initiating Devices (Red)

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- j. Supervisory Devices (Orange)
 - k. Controlled HVAC unit (Black, 1/8" text in hexagon indicating AHU, RTU, etc.)
 - l. Domestic Water Shutoff Location (Blue)
 - m. Gas Shutoff Location (Green)
 - n. Electrical Shutoff Location (Red)
 - o. Fire Hydrant Locations (Red)
 - p. Fire Extinguisher Locations (Red)
 - q. Remote Power Supply Locations
 - r. Remote Test Switch Locations
 - s. Roof Access Locations
 - t. Legible key plan indicating building sprinkler zones
5. Onyxworks stations located in Education Service Center (ESC) and in the Life Safety Office.
- a. Provide latest software and hardware.
 - b. For existing remodels and additions: Update new building backgrounds, room names and numbers, and fire alarm modifications (graphic map standards listed above.)
 - c. Incorporate new buildings into district graphics.
- J. Intelligent Analog/Addressable Initiating Devices
- 1. All initiating devices shall be UL Listed for Fire Protective Use.
 - 2. Intelligent Detectors General:
 - a. The system detectors shall be capable of full digital communications using polling protocol, and shall be individually addressable. The detectors shall have a separate means of displaying communication and alarm status. As a minimum, each detector shall have a flashing LED to indicate communications status, and a red LED to indicate alarm status of the detector.
 - b. Each detector shall be capable of providing pre-alarm and alarm signals in addition to normal, trouble and need for cleaning information. Each detector shall be individually programmed to operate at any one (1) of five (5) sensitivity levels. And shall be capable of being programmed for different sensitivities during day/night periods: which allows the detector to be more sensitive during unoccupied periods, when lower ambient background conditions are expected. Each detector shall be provided with an environmental compensation feature, which will adjust the detector's compensation value to counteract the impacts of temperature, humidity, other contaminants, as well as detector aging. The individual detector's environmental compensation feature shall update itself, as a minimum, once every twenty-four (24) period. The detector shall monitor the environmental compensation value and alert the system operator when the

detector approaches 80% and 100% of the allowable environmental compensation value.

- c. Ionization smoke detectors shall not be used in District facilities.

K. Fire Detection Sensors

1. Heat Detector, Fixed Temperature/Rate-of-Rise: provide intelligent analog/addressable combination fixed temperature/rate of rise heat detector with a nominal alarm point rating of 135 degrees F, and a rate of rise alarm point of 15 degrees F. The heat detector shall incorporate a low mass thermistor heat sensor and shall operate at a fixed temperature and at a temperature of the air in its surroundings to minimize thermal lag or wall mount installation. The device location description in programming shall include "R135" for this type of heat detector. The heat detector shall mount to any of the mounting bases as specified below, and shall be suitable for operation in the following environment:
 - a. Temperature: 32 degrees F to 100 degrees F
 - b. Humidity: 93% RH, non-condensing
 - c. Elevation: No limit
2. Heat Detector, Fixed Temperature: Provide intelligent analog/addressable fixed temperature heat detector with a nominal alarm point rating 135 degrees F and 200 degrees F. The heat detector shall incorporate a low mass thermistor heat sensor and operate at a fixed temperature. The heat detector shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to report an alarm condition, and shall be rated for ceiling or wall mount installation. The device location description in programming shall include "F" followed by the nominal alarm point rating for each heat detector of this type (F135, F200, etc.) The heat detector shall mount to any of the mounting bases as specified below, and shall be suitable for operating in the following environment:
 - a. Temperature: 32 degrees F to 100 degrees F
 - b. Humidity 93% RH, non-condensing
 - c. Elevation: No limit

L. Smoke Detector Sensors

1. Photoelectric Smoke Detector: Provide intelligent analog-addressable photoelectric smoke detector. The photoelectric smoke detector shall utilize a light scattering type photoelectric smoke sensor to sense changes in air samples from its surroundings, and shall continually monitor any changes in sensitivity due to the environmental effects of dirt, smoke, temperature, aging and humidity. The photoelectric smoke detector shall be rated for ceiling or wall mount installation, and shall be rated for operation in constant air velocities from 4,000 ft/min. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five (5) sensitivity settings, ranging from 1.0% to 3.5% and shall be suitable for operation in the following environment:

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- a. Temperature: 32 degrees F to 100 degrees F
 - b. Humidity 93% RH, non-condensing
 - c. Elevation: No limit
2. Projected Beam Smoke Detectors: Provide intelligent addressable reflector type projected beam type smoke detector, as indicated on the plans. The unit shall be capable of covering distances up to 300 feet, and shall feature automatic gain control, which shall compensate for gradual deterioration from dirt accumulation on lenses. The beam detectors shall be either ceiling mount or wall mount. Provide a key activated remote test switch/annunciator station mounted at an accessible location from a 6' ladder above finished floor. Identify the remote test station with the associated device ID number it controls, and the associated beam detector unit identification.
 3. Standard Detector Mounting Base with Trim Ring: Provide standard detector mounting base with trim ring suitable for mounting to a standard electrical box or trim ring. The standard detector base shall have the following minimum requirements:
 - a. Removal of the respective smoke detector shall not affect communications with the remaining detectors.
 - b. Terminal connections shall be made on the room side of the base.
 - c. The base shall be capable of supporting one (1) remote alarm LED indicator, where shown on the drawings.
 4. Relay Detector Mounting Base with Trim Ring: Provide relay detector mounting base with trim ring suitable for mounting to a standard electrical box or trim ring. The relay detector base shall have the following minimum requirements:
 - a. Removal of the respective smoke detector shall not affect communications with the remaining detectors.
 - b. Terminal connections shall be made on the room side of the base.
 - c. The form "C" dry relay contacts shall have a minimum contact rating of 1 Amp at 30VDC, and be listed for "pilot duty."
 - d. The operation of the relay shall be controlled from its respective detector and shall automatically de-energize when the detector is removed.
 5. Isolator Detector Mounting Base with Trim Ring: Provide isolator detector mounting base with trim ring suitable for mounting to a standard electrical box or trim ring. Isolator devices shall only be used when the SLC leaves the building or enters a wet area. The isolator detector base shall have the following minimum requirements:
 - a. Terminal connections shall be made on the room side of the base.
 - b. The isolator base shall operate upon a short circuit condition on the device initiating loop circuit.
 - c. Following a short circuit condition, each isolator/detector shall be capable of performing an internal self-test procedure to reestablish normal operations.

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- d. Isolator device locations shall be shown on the graphic maps.
6. Duct Detector Housing: Provide smoke detector duct housing assemblies to facilitate mounting an intelligent analog/addressable photoelectric smoke detector, with a standard, relay, or isolator mounting base. Protect the measuring chamber from damage and insects, and provide an air exhaust tube and an air sampling inlet tube, which extends into the duct air stream, a minimum length of 75% of the duct width being covered. Provide air sampling inlet tube to cover duct widths up to ten (10) feet. The duct detector shall be suitable for use on ductwork with airflow velocities of 300ft³/min to 4,000 ft³/min.
- a. Provide key activated remote test station, as shown on the drawings.
 - b. Provide duct detector housing with auxiliary relay for all HVAC unit locations, for transmission of the alarm signal to the HVAC unit DDC control panel.
 - c. Provide duct detector housing with auxiliary relay for all smoke/fire damper locations.
 - d. Provide MAGNEHELIC DIFFERENTIAL PRESSURE delta and date of install written on the duct above the detector housing with a BLACK SHARPIE PEN. Also document this value on the permanent Record of Completion.
7. Remote Duct\Beam Detector Test Station: Provide a remote duct detector test station to facilitate testing of intelligent duct smoke detectors programmed actions and sequences. The test station shall be key-operated, shall feature a red alarm LED, and shall mount to a standard electrical box or trim ring. When the key is in the "TEST" position, it shall not be possible to remove the key; the alarm LED shall light to indicate that the duct detector is in alarm, and all programmed functions shall occur. Upon system reset, the "TEST" condition shall clear and the system returns to normal. Mount remote test station in the nearest corridor location in the ceiling tile, or wall mounted at a height accessible from 6' ladder from finished floor. Identify the remote test station with the associated device ID number it controls and the associated HVAC until identification.
- M. Carbon Monoxide Detectors
- 1. Carbon monoxide (CO) detector shall be an intelligent detector listed to Underwriters Laboratories UL 2075 for Gas and Vapor Detectors and Sensors. The detector shall be equipped with a trouble relay. The detector's base shall be able to mount to an approved electrical box or direct (surface) mount to the wall or ceiling. The detector shall provide dual-color LED indication that blinks to indicate normal standby, alarm, or end-of-life. The detector shall provide this with a test mode that accepts CO gas from a test agent and alarms immediately upon sensing CO entry.
- N. Intelligent Modules – General
- 1. The system modules shall be capable of full digital communications using polling protocol, and shall be individually addressable. The modules shall have a separate means of displaying communication and alarm status. As a minimum, each module shall have a flashing LED to indicate communications status, and a red LED to

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indicate alarm or active control status of the module. The modules input and output circuit wiring shall be supervised for opens and grounds faults, and shall be suitable for operation in the following environment:

- a. Temperature: 32 degrees F to 100 degrees F
- b. Humidity 93% RH, non-condensing
- c. Elevation: No limit
- d. Do not mount intelligent modules above finished ceilings. The intelligent monitor and control modules shall be mounted so that the LED is visible.
- e. Notifier Mini-modules are not allowed.
- f. Dual modules are not allowed.
- g. Multi-input modules shall not be acceptable unless each input has a distinguishable color or pulse.
- h. Bi-directional amplification (if provided) shall be monitored for loss of power, antenna failure, loss of radio signal, battery charger fail and low battery.

O. Fire Alarm Initiating Devices

1. Intelligent modules must be mounted at a height accessible from a 6' ladder from a finished floor.
2. Single Input Module: Provide intelligent addressable single input module, as applicable, The input module shall mount to a standard electrical box or trim ring, and shall provide one (1) supervised Class B circuit, capable of supporting the following circuit types:
 - a. Normally Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
 - b. Normally Open Active Non-Latching (Monitors, Fans, Dampers, Doors, Tamper Switches, etc.)
 - c. Normally Open Active Latching (Supervisory, Duct Detectors, etc.)
3. Single Input Signal Module: Provide intelligent addressable single input signal module. The signal module shall mount to a standard electrical box or trim ring, and shall provide one (1) supervised Class B output circuit, capable of supporting the following circuit types:
 - a. Audible Indicating Appliance Circuit, polarized, rated at 24VDC at 2 Amps.
 - b. Visual Indicating Appliance Circuit, polarized, rated at 24VDC at 2 Amps.
 - c. Supervised Control Circuit, polarized, rated at 24VDC at 2 Amps.
4. Control Relay Module: Provide intelligent addressable control relay module. The control module shall mount to a standard electrical box or trim ring, and shall provide one (1) Form "C" dry relay contact, rated at 2 Amps at 24VDC or 0.5 Amps at 120VDC; to control external appliances or equipment shutdown. The control relay module shall be rated for "pilot duty" and releasing systems.

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5. Fault Isolation Module: Provide intelligent fault isolation module whenever the SLC leaves the building or enters a wet area. The fault isolation module shall mount to a standard electrical box or trim ring, and shall be capable of isolating and removing a fault. Isolation devices shall not be installed above ceilings. Device locations shall be documented on the fire alarms graphic maps.
- P. Fire Alarm Integrated Audio/Visual Evacuation Systems
1. All notification appliances shall be UL Listed for Fire Protective Service.
 2. All visual notification appliances (strobes) or combination appliances with strobes shall be capable of providing the “Equivalent Facilitation” allowed under the Americans with Disabilities Act Accessibilities Guidelines (ADAAG), and shall be UL 1971 listed.
 3. Strobes: Provide standard synchronized UL 1971, 24VDC white strobe unit with 15cd, 30cd, 60cd, 75cd, 95cd, or 115cd flash outputs, as shown on the contract documents. The strobes shall have their lens markings oriented for wall mounting or ceiling mounting, shall be provided with screw terminals for wiring interconnect, and shall mount to a standard electrical box or trim ring. Provide weatherproof wall box for outdoor mounting. Locate strobes per NFPA 72 and ADA guidelines.
- Q. Horns & Combination Horn/Strobes
1. Horns/Horn Strobes: Provide 24VDC, red electronic horn, with a selectable low or high dBA output, capable of producing a sound rating of 97dBA, and shall have a selectable steady or temporal output. Both selectable features shall be capable of being reversed. Horns that cannot reverse these selectable settings shall not be acceptable. The horn and horn/strobes shall be provided with screw terminals for wiring interconnect, and shall mount to a standard electrical box or trim ring. Provide integral, 24VDC.
 2. Synchronized UL 1971 strobe unit with 15cd, 30cd, 60cd, 75cd, 95cd, 110cd, or 115cd flash outputs, as shown on the contract documents. The horn/strobes shall have their lens markings oriented for wall mounting or ceiling mounting. Provide weatherproof device and back box, where required. Locate horns and horn/strobes per NFPA 72 and ADA guidelines.
- R. Fire Alarm Pull Stations
1. Intelligent Manual Station: Provide intelligent addressable manual station. The manual station shall be semi-flush mounted, non-coded, dual action type, shall be red in color, and shall be individually addressable. The manual station shall require a key to reset the station and shall mount a standard electrical box or trim ring.
- S. Ancillary Devices
1. Remote Relays: provide remote control relays connected to supervised ancillary circuits for control of HVAC units, smoke/fire dampers, door releases, elevator controls, and other uses. Relay coils shall have a diode across its coil for polarity reversal purposes and SPDT contacts rated at 10 Amps at 120VAC. Provide load suppression devices, as required. Provide metal enclosure, as required.

2. Heavy Duty Remote Relays: Provide remote control relays connected to supervised ancillary circuits for control of HVAC units, smoke/fire dampers, door releases, elevator controls, and other uses. Relay coils shall have a diode across its coil for polarity reversal purposes and SPDT contacts rated for its interconnected load. Provide load suppression devices, as required. Provide metal enclosure, as required.
- T. Protective Device Wire Guards: Device wire guards shall be UL Listed with specific fire alarm device type and installation application. Reference LPS design criteria for wire guard locations.
- U. Fire Alarm Wire and Cable
 1. Fire Alarm Power Branch Circuits: Building wire as specified in Division 26.
 2. Fire Alarm Initiating Device Loop (SLC) Circuits and Notification Appliance (NAC) Circuits: as specified in Section 28 0500.
 3. Provide fire alarm circuit conductors with insulation color coded as specified in Division 28 0500.

PART 4 EXECUTION

4.01 INSTALLATION

- A. Install all products in accordance with manufacturer's instructions, NFPA 72, ADA guidelines and applicable documents.
- B. Install audible and audible/visual notification devices to achieve Code required sound levels as defined in NFPA and ADA Guidelines.
- C. Install ceiling mounted visual and audible/visual notification appliances in the center of the space as much as possible, but do not exceed 5 feet in any direction from the center, unless approved by the fire protection engineer, District, or AHJ, prior to rough or installation.
- D. Audible/visual notification appliances shall be wall mounted in areas where ceiling mounted devices are not practical.
- E. Ceiling mount visual notification appliances (in rooms/areas open to structure) shall located at or below lighting level.
- F. Install wall mounted visual and audible/visual notification appliances with the bottom of the visual (strobe) lens at 80" above finished floor, or with the top of the visual signal (strobe) lens at 6" below the ceiling (for low ceiling areas), whichever is lower.
- G. Install ceiling mounted devices located on structural beams and joists with STI-8170 back plate or approved equivalent. Protect accessible back boxes with bell box or back box skirt or approved equivalent.
- H. Ensure device locations do not impede entry to access panels, etc.
- I. Install wiring with plenum rated cable. Cable routing shall be perpendicular to or parallel to structural building members, and shall utilize a metal bridle ring type support system attached to structural building members only. Mounting cable to other building systems (fire protection, electrical conduit, mechanical ductwork, etc.) or running cable in any fashion other than described, is strictly forbidden.

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1. Dedicated cable tray and support shall be provided for fire alarm wire.
 2. For specific limited applications, the visual and audible/visual notification appliances may be installed with the top of the visual signal (strobe) lens at up to 96" above finished floor. Each location must be approved in writing by the Engineer, District, or AHJ, prior to rough-in or installation.
 3. For specific limited applications, the visual and audible/visual notification appliances may be wall mounted, when no suitable ceiling mount location is available. Each location must be approved in writing by the Engineer, District, or AHJ, prior to rough-in or installation.
- J. Provide panel breaker locks for all electrical circuits for fire alarm and detection control equipment panels. Fire alarm and detection circuit breaker locks shall be color coded red. Breaker Locks shall be Space Age Part Number: ELOCK-FA.
- K. Provide and install UL listed surge suppressor on 120VAC at the source. for fire alarm control units, remote power supplies, amplifiers and communicators.
- L. Mount end-of-line device in box with last device.
- M. Mount outlet box for electric door holder to withstand 80 pounds pulling force. Where wall construction is wood or steel frame, utilize Caddy telescopic bracket TSGB16/TSGB24 or approved equivalent.
- N. Make conduit and wiring connections to door release devices, duct smoke detectors, smoke/fire dampers, HVAC units, and other applicable devices, furnished under other Sections.
- O. Automatic Detector Installation: Conform to NFPA 72.
- P. Automatic Duct Detector Installation: Conform to IMC.
- Q. All fire alarm and detection system labeling shall be in accordance with Littleton Public Schools Standards for Division 28 0500.
- R. Fire alarm contractor shall provide up to five (5) fire alarm system programming downloads in his base bid price, to accommodate the required phasing for the project. Fire alarm contractor shall furnish a unit price for one (1) lot of system programming and download for additional system downloads as part of his bid.

PART 5 FIRE ALARM AND DETECTION SYSTEM TESTING

5.01 FIELD QUALITY CONTROL

- A. Test in accordance with NFPA 72, District, State, and Authority Having Jurisdiction (AHJ) fire department requirements. Use District forms for record of completion.
- B. Contractor shall complete observation checklists prepared and provided by the fire protection engineer of record (or third party oversight FPE). Forms shall be provided to the contractor prior to start of construction. Forms shall be customized for each LPS facility and shall include NFPA 72 requirements. Forms shall include but not be limited to the following:

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1. AES Radio Communicator
 2. Fire Alarm Control Panel
 3. DACT
 4. Fire Alarm System Annunciator
 5. Remote Power Supplies
 6. Smoke Detectors
 7. Beam Detectors
 8. Heat Detectors
 9. Pull Stations
 10. Waterflow
 11. Elevators
 12. Notification Appliances
 13. Mass Notification
 14. Intelligibility
 15. Magnetic Door Holders
 16. Smoke Dampers
 17. Bi-Directional Amplification
 18. Emergency Generator
- C. Contractor shall utilize Bluebeam Session (provided by Engineer) to respond to rough wire and testing observation punch list items. Contractor shall attach pictures confirming completion (picture settings shall be set to high quality).
- D. Provide forty-eight (48) hours prior notice to the Engineer and District personnel for rough Inspection, prior to installing ceiling tiles or drywall. Fire protection engineer shall observe and prepare field observation reports for each site visit.
- E. Provide seven (7) day prior notice to the fire protection engineer of record (or third party oversight FPE) and District personnel for scheduled contractor pre-testing of the system. Fire protection engineer shall observe and confirm compliance with applicable codes, standards, and specifications.
- F. Provide three (3) day prior notice to the Engineer and District personnel for the scheduled Authority Having Jurisdiction (AHJ) testing of the system.
- G. Provide three (3) original copies of the District Certificate of Completion Form. One for the District, one for the Authority Having Jurisdiction (AHJ), and one for the facility's Fire Alarm System Logbook. Utilize the standard District form available on the District website.
- H. Provide two (2) detailed records of the pre-testing of the system: One for the District and one for the facility's Fire Alarm System logbook. Pre-testing record must contain a minimum of the device ID, proper annunciator description, proper functionality of the device (audible/visual notification, HVAC shutdown, etc.), and date of the testing. Records must be

typed in numerical order by device address and include a report generated by the fire alarm control panel. Utilize the standard District form available on the District website. Pre-testing records shall be included as part of the Record of Completion.

- I. Decibel levels in every room shall be documented on record drawings. Any rooms exceeding 95dB as measured per NFPA 72 shall be adjusted by the contractor.
- J. Manometer readings shall be taken for each duct detector to ensure proper installation and orientation of sampling tube. Contractor shall write Δ inches of H₂O on the duct work. Readings shall be recorded and included on record drawings.
- K. Contractor shall provide NFPA 72 compliant inspection testing and maintenance documentation including following:
 - 1. ROC
 - 2. Notification ITM
 - 3. Initiating Device ITM
- L. Provide voltage drop readings for all notification circuits on battery backup.
- M. Contractor to provide ear protection for occupants during fire alarm testing.

5.02 MANUFACTURER'S FIELD SERVICES

- A. Prepare and start systems.
- B. Include services of factory trained and certified technician to supervise installation adjustments, final connections, and system testing.
- C. Provide one (1) hard copy and two (2) electronic copies in CD or flash drive format of the final system programming. One set to be delivered to the District Project Manager for the District Central Reporting System programming, and one set to be left inside the facility's Fire Alarm System logbook.

5.03 DEMONSTRATION

Demonstrate normal and abnormal modes of operation, and required responses to each.

PART 6 AS BUILT DOCUMENTATION

6.01 RECORD DRAWINGS

- A. Record "as-built" locations of all system components, initiating devices, signaling appliances, and end-of-line devices. Include "as-built" conduit routing and wire counts. The design engineer and LPS representative shall walk through the building and spot check 5-10% of device locations against the as-builts. If devices are not as shown, drawings will be rejected for a redraw. Upon resubmittal, another spot check will be performed. If deficiencies are found on the second check, an independent audit to the system by the system manufacturer shall be required. The contractor shall bear the cost of any such audit.
- B. As-Built drawings shall consist of one hard copy bond sets and one electronic AutoCAD file copy on CD or flash drive format.
- C. As-Built system load and battery calculations shall consist of two full size hard copy bond sets and one electronic copy on CD or flash drive format. Load calculations shall include all

audible, visual, and audible/visual notification appliance circuits with calculated voltage drop levels, calculated maximum circuit distance measurements, actual recorded circuit length distance measurements, and actual measured voltage drop levels.

- D. Provide electronic copy of all excel files (i.e. calculations, sequencing matrix, legend, etc.).
- E. Load calculations shall include all audible, visual, and audible/visual notification appliance circuits with calculated voltage drop levels, calculated maximum circuit distance measurements, actual recorded circuit length distance measurements, and actual measured voltage drop levels.
- F. Provide one (1) hard copy of all system programming (software).
- G. Provide two (2) electronic copies of all system programming (software); on CD ROM or flash drive format.
- H. Provide Contractor redline construction drawing set, with mark-ups.
- I. Provide one (1) full size hard copy bond set of AsBuilt record drawing set.
- J. Provide one (1) half size hard copy bond set of As Built record drawing set.
- K. Provide one (1) electronic copy of AsBuilt record drawing sets; on CD or flash drive format.
- L. Provide all special test equipment, filters, test leads, cords, etc. required to test the system.
- M. Record document box shall be manufactured by Space Age Technology and shall be located adjacent to FACP and shall contain contractor working set (actual field set – not cleaned up version) along with electronic copies as indicated above.

6.02 OPERATION AND MAINTENANCE (O&M) MANUALS

- A. Operational Data: Provide operating instructions, detailed for the specific project.
- B. Maintenance Data: Provide maintenance and repair procedures for each type of equipment provided, as applicable. Include any specific requirements particular to the project.
- C. Equipment Data: Provide manufacturer data sheets or catalog sheets for each type of equipment provided.
- D. Spare Parts Data: Provide manufacturer's recommended spare parts list, including quantity, and any equipment replaced schedules, as applicable.
- E. Supplier Data: Provide system manufacturer and local service organization information. Include contact, phone numbers, and addresses, as applicable.
- F. Warranty Data: Provide system warranty information, including all material and/or labor terms.

PART 7 WARRANTY AND SERVICES

7.01 INSTALLATION WARRANTY

- A. The manufacturer shall guarantee the system equipment for a minimum period of one (1) year from the date of final acceptance of the system. Any additional warranty periods shall be listed in the Operation and Maintenance Manuals. Any defective equipment, material, or software shall be replaced at no cost to the Owner during this warranty period.

- B. The installing contractor shall guarantee all wiring and raceways to be free from inherent mechanical or electrical defects for a minimum period of one (1) year from the date of final acceptance of the system. Any defective material and/or labor shall be replaced at no cost to the Owner.

7.02 MAINTENANCE SERVICE

- A. Furnish warranty service and maintenance of the fire alarm system for one (1) year from the date of final acceptance of the system, as follows:
 - 1. Basic Services: Systematic, routine maintenance visits, as required; at times coordinated with the Owner. In addition, respond to service calls within 24 hours of notification of system trouble. Adjust and replace defective parts, components, and supplies.
 - 2. Additional Services: Perform services within the above two (2) year period, not classified as routine maintenance or as warranty work, when authorized on writing by the Owner. Compensation for additional services shall be agreed upon in writing, prior to performing and additional services.

7.03 TRAINING

- A. Provide the services of a factory certified service representative to demonstrate the system and train Owner's maintenance personnel as specified below.
 - 1. On-Site Training: Provide a minimum of two (2) hours of onsite training of the facility's school staff and Maintenance personal in the basic operations and functionality of the fire alarm system panel, annunciator, and field devices. Review field panel locations, typical device locations, and 120VAC power locations (panels, breakers, and circuits). Demonstrate the various system responses to the field off-normal conditions. Simulate alarm conditions, supervisory conditions, trouble conditions, and ground fault conditions of the various field devices. Demonstrate how to reset various building systems (HVAC units, fire doors, etc.). Provide written instructions of basic system operating instructions behind clear Lexan framed glass, located adjacent to the fire alarm control panel. **DO NOT EVER TRAIN SCHOOL STAFF ON HOW TO DISABLE ANY POINTS.**
 - 2. Maintenance Staff Training: Provide a minimum of four (4) hours of Maintenance Staff training of the District's maintenance personnel in the procedures involved in operating, trouble shooting, servicing, programming, and preventive maintenance of the system. The Maintenance Staff training shall be conducted in a classroom type setting, and programming manuals of the various components of the system. Provide a working (panel and field devices) system demonstration unit; whereby the various system troubleshooting and servicing procedures can be adequately performed in a "hands-on" scenario. This is per project; training time can be accumulated from several projects to allow more detailed instruction.
- B. Onsite System training shall be completed within six (6) days of completion of the system and Authority Having Jurisdiction (AHJ) test. Offsite System training shall be completed

within thirty (30) days of completion of the system and Authority Having Jurisdiction (AHJ) test, unless the District specifically directs an alternate training schedule.

- C. Schedule the onsite training with the District at least three (3) days in advance. Schedule the offsite training with the District at least fourteen (14) days in advance.
- D. Provide Notifier certification for one (1) LPS employee. Certification training course shall be virtual and shall be provided per project.
 - 1. Provide a minimum of eight (8) hours of training of the District's maintenance personnel in the procedures involved in operating, trouble shooting, servicing, programming, and preventive maintenance of the system. The offsite training shall be conducted in a classroom type setting, and programming manuals of the various components of the system. Provide a working (panel and field devices) system demonstration unit; whereby the various system troubleshooting and servicing procedures can be adequately performed in a "hands-on" scenario. This is per project and can accumulate training time from several projects to allow more detailed instruction.
 - 2. Provide access key to LPS for verifier tools and any other items needed to perform panel programming modifications.

7.04 Field Modifications

- A. Include pricing for field changes in bid, as follows:
 - 1. Provide 5% analog/addressable manual stations minimum 1.
 - 2. Provide 5% of each type of automatic smoke or heat detector minimum 1.
 - 3. Provide 5% of each type of smoke or heat detector base minimum 1.
 - 4. Provide 5% of each type of audible, audible/visual, or visual notification appliance minimum 1 of each.
 - 5. Provide 5% of each type of addressable monitor module minimum 1.
 - 6. Provide 5% of each type of addressable control module minimum 1.

7.05 SPARE PARTS

- A. Provide extra materials, as follows:
 - 1. Provide 5% analog/addressable manual stations minimum 1.
 - 2. Provide 5% of each type of automatic smoke or heat detector minimum 1.
 - 3. Provide 5% of each type of smoke or heat detector base minimum 1.
 - 4. Provide 5% of each type of audible, audible/visual, or visual notification appliance minimum 1 of each.
 - 5. Provide 5% of each type of addressable monitor module minimum 1.
 - 6. Provide 5% of each type of addressable control module minimum 1.
 - 7. Provide six (6) of each type of key.

PART 8 FIRE ALARM AND DETECTION SYSTEM ACCEPTANCE

8.01 FINAL INSPECTION

Upon completion of the project, the design team fire protection engineer shall perform a complete visual and functional inspection of the completed fire alarm and detection system. After approval from design team fire protection engineer, the LPS representative will perform a final inspection of the installed cabling system with the contractor's project foreman. The final inspection will be performed to validate that all fire alarm and detection system devices and cabling were installed as defined in the drawing package, and that the installation meets the aesthetic expectations of Littleton Public Schools.

8.02 TEST VERIFICATION

Upon receipt of the test documentation, Littleton Public Schools reserves the right to perform spot testing of the fire alarm and detection system to validate test results provided in the test documentation. Littleton Public Schools testing will use the same method employed by the contractor. If significant discrepancies are found, the contractor will be notified for resolution.

8.03 FINAL ACCEPTANCE

Completion of the following will constitute acceptance of the fire alarm and detection system:

- 1) Installation in accordance with contract documents
- 2) Rough Wire and Final Inspections
- 3) Receipt of test and as-built electronic and hard-copy documentation
- 4) Successful performance of the system for a two week period

END OF SECTION