

SECTION 260500

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Basic electrical methods.
 - 2. Grounding and bonding.
 - 3. Hangers and supports.
 - 4. Electrical identification.
 - 5. Electrical system testing and inspection.
- B. Related Documents: Requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
 - 1. Section 260519 - Low-Voltage Electrical Power Conductors and Cables
 - 2. Section 260533 - Raceway and Boxes for Electrical Systems
 - 3. Section 283100 - Fire Detection and Alarm

1.2 REFERENCES

- A. National Electrical Contractors Association (NECA):
 - 1. NECA SI - Standard of Installation.
- B. National Electrical Testing Association (NETA):
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- C. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data:
 - a. Grounding connections.
 - 2. Assurance/Control Submittals:
 - a. Certificates: Manufacturer's certificate that each Product specified meet or exceed specified requirements.
 - b. Qualification Documentation: Submit documentation of experience indication compliance with specified qualification requirements.
- B. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals.
 - 1. Project Record Documents: Accurately record the following.
 - a. Locations of components and grounding electrodes.

- A. Installer Qualifications: Company specializing in performing Work of this Section with minimum 5 years documented experience.
- B. Regulatory Requirements:
 - 1. Products: Listed and classified by Underwriters Laboratories, Incorporated as suitable for the purpose specified and indicated.
 - 2. Work herein shall conform to all applicable laws, ordinances and regulations in accordance with the latest applicable requirements of:
 - a. National Electrical Manufacturer's Associates.
 - b. Standards of National Fire Protection Association (NFPA 72, 90A and 101).
 - c. Underwriter's Laboratories.
 - d. Occupational Safety and Health Agency Standards.
 - e. The International Existing Building Code.
 - f. The International Electrical Code.

1.5 BASIC ELECTRICAL METHODS

- A. Drawings are schematic and diagrammatic. Use judgment and care to install electrical Work to function properly and fit within building construction and finishes. Electrical conductors, conduit, components, not shown or specified, which are required for any device or system to produce a complete and operative system are required to be furnished and installed.
- B. Exact location of outlets are determined from dimension on Drawings, manufacturer's shop drawings, or as may be determined at Project Site. Do not scale Drawings for exact location of any item. Verify item mounting heights as required by project conditions prior to rough-in.
- C. Route conduits and wiring associated with new equipment and systems above ceilings, in existing chases, and concealed within building structure.
- D. Surface mounted raceways or conduit permitted only at locations indicated on Drawings.
- E. Circuit grouping, conduit or cable runs and home runs are indicated with number of conductors shown in each raceway to clarify operation and function of various systems. Provide proper number of conductors and conduits or cables to provide operative system as indicated on Contract Documents. Do not regroup any feeder circuits, branch circuits, home runs, and zone alarms at any point, from that shown on Contract Documents. Each conduit run shall contain no more than (6) current carrying conductors.
- F. Branch and home run circuits are indicated as 2, 3, or 4 wire circuits unless otherwise noted. Do not connect two ungrounded conductors to same circuit breaker/fused switch in any panel. Circuit runs consist of a maximum of five conductors; 3 phase conductors, 1 neutral conductor, and 1 equipment ground conductor, unless otherwise noted. Do not splice branch circuit conductors in any panels, safety switches, or circuit breakers in separate enclosures.
- G. The sharing of neutral conductors for multiwire branch circuits is prohibited. All branch circuits shall contain individual neutrals.
- H. Proposed equipment, switches or devices, shown mounted on and/or adjacent to equipment, which if installed, would impair proper operation of existing or new equipment, shall be removed and relocated by Contractor as required so equipment will function properly. Notify USPS Project Manager immediately if any such condition exists.
- I. Seal and make permanently watertight penetrations by electrical raceways or equipment through ceilings, walls or floors.

1. Seal penetrations in non-fire rated ceilings, walls or floors material specified in Section 079200 – Joint Sealants.
 2. Seal penetrations in fire rated walls with material specified in Section 078400 - Firestopping.
- J. Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A, and NFPA 70.
- K. Install equipment and materials to provide required maintenance and code working clearance for servicing and maintenance. Coordinate final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow required space for removal of parts that require replacement or servicing.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING

- A. Grounding System Resistance: Five ohm.
- B. Mechanical Connectors: Bronze.
- C. Electrode Conductor:
1. Material: Bare stranded copper.

2.2 HANGERS AND SUPPORTS

- A. Product Requirements: Furnish and install approved materials, sizes, and types of anchors, fasteners, and supports to carry loads of equipment and conduit, including weight of wire in conduit plus 300 pounds.
- B. Materials and Finishes: Corrosion resistive.
- C. Anchors and Fasteners:
1. Steel Structural Elements: Beam clamps and welded fasteners.
 2. Concrete Surfaces: Self-drilling anchors and expansion anchors.
 3. Hollow Masonry, Plaster, and Gypsum Board Partitions: Toggle bolts and hollow wall fasteners.
 4. Solid Masonry Walls: Expansion anchors.
 5. Sheet Metal: Sheet metal screws.
 6. Wood: Wood screws.

2.3 ELECTRICAL IDENTIFICATION

- A. Nameplates:
1. Engraved three-layer laminated phenolic plastic, white letters on black background.
 2. Locations:
 - a. Each electrical distribution and control equipment enclosure.
 - b. Communication cabinets.
 - c. Terminal Cabinets.
 - d. Pull boxes.
 - e. Relays.

- f. Switches and disconnects.
 - 3. Letter Size:
 - a. Use 1/8 inch letters for identifying individual equipment and loads.
 - b. Use 1/4 inch letters for identifying grouped equipment and loads.
- B. Wire and Cable Markers:
 - 1. Description: Cloth tape or tubing type wire markers.
 - 2. Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.
 - 3. Identification:
 - a. Power and Lighting Circuits: Branch circuit or feeder number indicated on Drawings.
 - b. Control Circuits: Control wire number indicated on schematic and interconnection diagrams on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
- B. Report in writing to USPS Project Manager prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- C. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION - GROUNDING AND BONDING

- A. Provide bonding and grounding in conformance with NFPA 70.
- B. Equipment Grounding Conductor: Provide separate, insulated conductor within all lighting and power raceways. Terminate each end on suitable lug, bus, or bushing.
- C. Testing and Inspection:
 - 1. Inspect and test in accordance with NETA ATS, where applicable.
 - 2. Perform inspections and tests listed in NETA ATS, Section 7.13.

3.3 INSTALLATION - HANGERS AND SUPPORTS

- A. Install products in accordance with manufacturer's published instructions.
- B. Furnish and install anchors, fasteners, and supports in accordance with NECA SI.
- C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- D. Do not use spring steel clips and clamps.
- E. Do not use powder-actuated anchors.

- F. Obtain permission from structural engineer before drilling or cutting structural members.
- G. Fabricate supports from structural steel angle or structural steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- H. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- I. In wet and damp locations use structural steel channel supports to stand cabinets and panelboards one inch off wall.
- J. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

3.4 INSTALLATION - ELECTRICAL IDENTIFICATION

- A. Install nameplate parallel to equipment lines.
- B. Secure nameplate to equipment front using stainless steel screws. Use minimum two screws at each end of nameplate.
- C. Secure nameplate to outside surface of door on panelboards and switchboards.

3.5 FIELD QUALITY CONTROL - ELECTRICAL TESTING AND INSPECTION

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Conduct testing to Determine that Electrical Equipment and Systems:
 - 1. Are in conformance with Contract Documents and applicable reference standards.
 - 2. Is properly installed without damage due either to installation or shipment.
 - 3. Operate correctly, meet design intent, and are performing at optimum level, in safe manner.
- C. Provide a complete written record of operational values to be used as a baseline for future operational testing.
- D. Instrumentation:
 - 1. Provide calibration program that assures applicable test instrumentation is maintained within rated accuracy and directly traceable to National Bureau of Standards.
 - 2. Calibrate instruments in accordance with following frequency schedule:
 - a. Field Instruments:
 - 1) Analog - 6 months maximum.
 - 2) Digital - 12 months maximum.
 - b. Leased Specialty Equipment: 12 months. (Where accuracy is guaranteed by lessor.)
 - 3. Dated Calibration Labels: Visible on test equipment.
 - 4. Keep records current; show date and result of instruments calibrated or tested.
 - 5. Maintain current instrument calibration instruction and procedure for each test instrument.
 - 6. Calibrating Standard: Higher accuracy than that of instrument being calibrated.
- E. Regulatory Requirements:
 - 1. Safety Practices: Include, but not limited to, the following requirements:
 - a. Occupational Safety and Health Act of 1970 - OSHA.
 - b. Accident Prevention Manual for Industrial Operations, Seventh Edition, National Safety Council, Chapter 4.

Seattle NDC Fire Alarm Replacement

Federal Way, WA

USPS Project Number

- c. Applicable State and Local Safety Operating Procedures.
 - d. NETA Safety/Accident Prevention Program.
 - e. United States Postal Service Safety Practices.
 - f. NFPA 70E - Electrical Safety Requirements for Employee Workplace.
 - g. American National Standards for Personnel Protection, ANSI Z244.1.
 2. Perform tests with apparatus de-energized except where otherwise specifically required herein.
 3. Testing Laboratory: Provide a designated safety representative present at Project Site and supervise safety operations.
 4. Power Circuits: Conductors shorted to ground by a hot line grounded device approved for the purpose.
 5. Do not proceed until safety representative has determined that it is safe to do so.
 6. Testing Laboratory: Provide sufficient protective barriers and warning signs to conduct specified tests safely.
- F. Tests and inspections include, but are not limited to the following:
1. Proper operation of equipment.
 2. Continuity of raceway system.
 3. Sub-system tests indicated in other Sections.
 4. Proper operation of fire alarm system specified in Section 283100.
- G. Perform electrical system testing and inspection as specified in each related Section and as specified in this Section.

END OF SECTION

SECTION 260519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Building wire and cable.
 - 2. Branch-circuit cable.
 - 3. Wiring connectors and connections.
- B. Related Documents: Requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections
 - 1. As specified in Section 260500 - Common Work Results for Electrical.

1.2 REFERENCES

- A. As specified in Section 260500 - Common Work Results for Electrical.

1.3 SUBMITTALS

- A. As specified in Section 260500 - Common Work Results for Electrical.

1.4 QUALITY ASSURANCE

- A. As specified in Section 260500 - Common Work Results for Electrical.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver in accordance with NEMA WC 26.

PART 2 - PRODUCTS

2.1 BUILDING WIRE AND CABLE

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Alcan Cable, Atlanta, GA (770) 392-2376.
 - 2. Anixter, Inc., Skokie, IL (800) ANIXTER.
 - 3. General Cable, Highland Heights, KY (800) 526-4391.
 - 4. General Electric, Plainville, CT (860) 747-7111.
 - 5. Okonite, Ramsey, NJ (201) 825-0300.
 - 6. Southwire Company, Carrollton, GA (800) 444-1700.

7. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

- B. Description: Single conductor insulated wire.
- C. Conductor: Copper, except conductors #1/0 AWG and larger may be compact stranded aluminum if equipped with compression lugs and installed per manufacturer's recommendations and the National Electrical Code.
- D. Insulation Voltage Rating: 600 Volts.
- E. Insulation: NFPA 70, Type THHN/THWN or Type XHHW-2

2.2 WIRING CONNECTORS

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Buchanan Construction Products, Hackettstown, NJ (800) 610-5201.
 - 2. Thomas and Betts, Memphis, TN (800) 695-1901.
 - 3. 3M, St. Paul, MN (800) 364-3577.
- B. Compression Connectors; Conductor sizes #12 through #6 AWG:
 - 1. Buchanan: 2006S or 2011S.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. As specified in Section 260500 - Common Work Results for Electrical.

3.2 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

3.3 INSTALLATION

- A. Wiring methods
 - 1. Concealed Dry Interior Locations: Use building wire, Type THHN/THWN or Type XHHW-2 insulation in metallic raceway or MC multiconductor cable.
 - 2. Exposed Dry Interior Locations: Use building wire, Type THHN/THWN or Type XHHW-2 insulation in metallic raceway or MC multiconductor cable.
 - 3. Above Accessible Ceilings: Use building wire, Type THHN/THWN or Type XHHW-2 insulation in metallic raceway or MC multiconductor cable.
 - 4. Wet or Damp Interior/Exterior Locations: Use only building wire, Type THHN/THWN or Type XHHW-2 insulation in raceway.
- B. Install products in accordance with manufacturers published instructions and NECA SI.
- C. Use solid conductor for feeders and branch circuits 10 AWG and smaller.

- D. Use stranded conductors for control circuits and final connections to all vibration equipment.
- E. Use conductor not smaller than 12 AWG for power and lighting circuits.
- F. Use conductor not smaller than 14 AWG for control circuits.
- G. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.
- H. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet.
- I. Pull all conductors into raceway at same time.
- J. Use approved wire pulling lubricant for all building wire.
- K. Protect exposed cable from damage.
- L. Neatly train and lace wiring inside boxes, equipment, and panelboards in accordance with NECA Standards.
- M. Clean conductor surfaces before installing lugs and connectors.
- N. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- O. For splices and taps, use only compression connectors for copper conductors, 6 AWG and larger or aluminum conductors 1/0 and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- P. Use solderless pressure compression connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
- Q. Use conductors rated 90 degrees C, inside a ballast compartment or within 6 inches of any ballast.
- R. Conductor Sizes #8 and Larger: Class B stranding.
- S. The sharing of neutral conductors for multiwire branch circuits is prohibited. All branch circuits shall contain individual neutral conductors.

3.4 CONSTRUCTION

- A. Interface with Other Work:
 - 1. Identify wire and cable using Thomas and Betts type WM vinyl markers.
 - 2. Identify each conductor with its circuit number or other designation indicated on Drawings in all junction, pull, terminal boxes and cabinets. Identify neutrals with common circuit numbers in all junction, pull and terminal boxes, panels and cabinets.

3.5 WIRING COLOR CODE

- A. Comply with the following color code for each voltage system.
- B. 208Y/120 Volt System:
 - 1. Phase A - Black
 - 2. Phase A Switch Leg - Black with "S" tag.

Seattle NDC Fire Alarm Replacement

Federal Way, WA

USPS Project Number

3. Phase B - Red
 4. Phase B Switch Leg - Red with "S" tag.
 5. Phase C - Blue.
 6. Phase C - Switch Leg - Blue with "S" tag.
 7. Travelers - Yellow.
 8. Neutral - White.
 9. Equipment Ground - Green.
- C. Use same color for same phase throughout. Use same colors for switch legs. Travelers shall be yellow. Phase rotation shall be same in all panels. Identify large cables with colored tape.
- D. Provide identification tags on each conductor entering panel, switch, junction box and pull box to identify conductor.

3.6 FIELD QUALITY CONTROL

- A. As specified in Section 260500 – Common Work Results for Electrical.
- B. Cables, 600 Volt or less and size no. 3 or larger, shall be meggered using an industry-approved "megger with a minimum of 500 Volt internal generating voltage. All inspection, cleaning and testing procedures shall be in compliance with the recommendations and standards outlined in the "maintenance testing specifications for electrical power distribution equipment and systems", latest edition, published by International Electrical Testing Association (NETA). Insulation resistance test values shall be no less than 250 megaohms. A typewritten report of all readings shall be prepared and submitted.

END OF SECTION

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduit.
2. Flexible metal conduit.
3. Liquidtight metal conduit.
4. Electrical metallic tubing.
5. Fittings and conduit bodies.
6. Wall and ceiling outlet boxes.
7. Pull and junction boxes.
8. Cable trays.

B. Related Documents: Requirements and information necessary to complete the Work of this Section may be found in other documents.

C. Related Sections:

1. Section 283100 – Fire Detection and Alarm.
2. Section 260500 – Common Work Results for Electrical.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A 123 - Specification for Zinc (Hot-Galvanized) Coatings on Iron and Steel Products.

B. American National Standards Institute (ANSI):

1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
2. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
3. ANSI C80.5 - Rigid Aluminum Conduit.

C. National Electrical Contractors Association (NECA):

1. NECA "Standard of Installation."

D. National Electrical Manufacturers Association (NEMA):

1. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
2. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
3. NEMA VE 1 - Metallic Cable Tray Systems.

E. National Fire Protection Association (NFPA):

1. NFPA 70 - National Electrical Code.

1.3 SYSTEM DESCRIPTION

A. Design Requirements

1. Conduit Size: NFPA 70, unless indicated otherwise on Drawings.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 1. Conform to requirements of NFPA 70.
 2. Provide products listed and classified by Underwriters Laboratories, Incorporated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect products.
- B. Accept conduit on site. Contractor inspect for damage prior to acceptance.
- C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

PART 2 - PRODUCTS

2.1 CONDUIT REQUIREMENTS

- A. Where conduit is required by standards, codes, or required elsewhere, minimum size shall be as follows:
 1. 1/2 inch for power and branch circuit wiring, unless indicated otherwise. All homerun conduits shall be 3/4 inch, minimum.
 2. 3/4 inch for communications cable, unless indicated otherwise.
 3. 3/4 inch for low voltage, control, intercom, security and communications unless indicated otherwise.

2.2 METAL CONDUIT

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 1. Allied Tube & Conduit, Harvey, IL (800) 882-5543.
 2. Wheatland Tube Co., Collinswood, NJ (800) 257-8182.
 3. Republic Wire & Cable, Rocky Mount, NC (800) 533-8198.
 4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Rigid Galvanized Steel Conduit (GRC): ANSI C80.1, UL6.
- C. Intermediate Metal Conduit (IMC): UL1242.
- D. Fittings and Conduit Bodies: NEMA FB1 Material to match conduit.

2.3 FLEXIBLE METAL CONDUIT (FMC)

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 1. Hubbell, Millford, CT (203) 882-4800.

Seattle NDC Fire Alarm Replacement

Federal Way, WA

USPS Project Number

2. Electriflex, Roselle, IL (800) 323-6174.
3. O-Z/Gedney, Farmington, CT (860) 677-5541.
4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

B. Description: Interlocked steel and aluminum construction.

C. Fittings: NEMA FB 1.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:

1. Hubbell, Millford, CT (203) 882-4800.
2. Electriflex, Roselle, IL (800) 323-6174.
3. Anixter, Inc., Skokie, IL (800) ANIXTER.
4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

B. Description: Interlocked steel and aluminum construction with PVC jacket.

C. Fittings: NEMA FB 1.

2.5 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:

1. Allied Tube & Conduit, Harvey, IL (800) 882-5543.
2. Wheatland Tube Co., Collinswood, NJ (800) 257-8182.
3. Republic Wire & Cable, Rocky Mount, NC (800) 533-8198.
4. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

B. Description: ANSI C80.3; galvanized tubing.

C. Fittings and Conduit Bodies: NEMA FB 1; steel set-screw type. Die-cut Zinc not permitted.

2.6 FITTINGS

A. Manufacturer: Raco, Inc., South Bend, IN (219) 234-7151.

1. Subject to compliance with project requirements, one of the following manufacturers may also be provided:
 - a. Steel City.
 - b. O-Z/Gedney.
2. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

B. Conduits 1/2 inch thru 1 inch enter junction boxes, pull boxes, panels, cabinets, and gutters, provide the following:

1. Rigid Conduit: Raco 1222, 1223, 1224.
2. Flexible Metal Conduit: Raco 3302, 3303, 3304, 3305, 3306, 3308.
3. Liquidtight Flexible Metal Conduit: Raco 3511, 3512, 3513, 3541, 3542, 3543.

- C. Conduits 1-1/4 inch and larger entering junction boxes, pull boxes, panels, cabinets, and gutters, provide Insulated throat type bushings; Raco 1225, 1226, 1228, 1230, 1232, 1234, 1236.
- D. Provide threaded joint connectors and malleable iron no thread compression box connectors on rigid conduit. Do not provide fittings requiring set screws or indenter type applications including BM connectors.
- E. Provide only steel set-screw couplings and connectors on EMT conduit.

2.7 CONDUIT STRAPS AND HANGERS

- A. Strap Manufacturer: Raco, Inc., South Bend, IN (219) 234-7151
 - 1. Subject to compliance with project requirements, one of the following manufacturers may also be provided:
 - a. Steel City.
 - b. Unistrut.
 - 2. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Hanger Manufacturer: Steel City/Thomas & Betts, Memphis, TN (800) 888-0211.
 - 1. Subject to compliance with project requirements, one of the following manufacturers may also be provided:
 - a. Unistrut.
 - b. Raco.
 - 2. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- C. Straps: Two hole push on stamped steel straps on surface areas such as concrete, masonry, wide flange beams, columns, and wood.
 - 1. Rigid Conduit: Raco 2232, 2233, 2234, 2235, 2336, 2238.
 - 2. Electrical Metallic Tubing: Raco 2092, 2093, 2094.
- D. Hangers: Lay-in pipe hanger.
 - 1. Conduits 1-1/4 Inch and Larger: Steel-City C-149.
- E. Trapeze Hangers for Conduits Grouped Together: Hangers consisting of all thread rods sized as required and Kingdorff channel.
 - 1. Steel City B-909, 1/2 inch x 1-7/8 inch (12 gauge) with single bolt channel pipe straps.
 - 2. Steel City C-105, C-105-AL, or C-106, (no wire permitted for anchoring conduit).

2.8 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
 - 1. Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.
 - 2. Receptacle and Device Boxes - 4 inch square x 2-1/8 inch deep with raised, single gang, plaster ring unless indicated otherwise.
 - 3. Switch Boxes: 2 inch x 4 inch x 2-1/8 inch deep, unless indicated otherwise.
 - 4. Communication Boxes: 4 inch square x 3 inch deep with raised gang plaster ring unless indicated otherwise.

- B. Cast Boxes: NEMA FB 1, Type FD, aluminum. Provide gasketed cover by box manufacturer. Provide threaded hubs.

2.9 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

2.10 CABLE TRAY

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
 - 1. Chalfant Cable Trays, Cleveland, OH (216) 521-7922.
 - 2. Cable Management Solutions, Incorporated, Deer Park, NY (800) 308-6788.
 - 3. GS Metals Corporation, Pinckneyville, IL (800) 851-9341.
 - 4. Southwire Co., Carrollton, GA (800) 444-1700.
 - 5. Mono-Systems, Inc., Rye Brook, N.Y. (914) 934-2075.
 - 6. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Provide factory shop drawing submittals for each type of cable tray.
 - 1. Show fabrication and installation details of cable tray, including plans, elevations and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths and fittings.
 - 2. Seismic-Restraint Details: Signed and sealed by a qualified Professional Engineer, licensed in the state where Project is located, who is responsible for their preparation.
 - a. Design Calculations: Calculate requirements for selecting seismic restraints.
 - b. Detail fabrication, including anchorages and attachments to structure and to supported cable trays.
- C. Description: NEMA VE 1, ladder tray, wire mesh tray or solid bottom tray as indicated on drawings.
- D. Material: Steel or aluminum.
- E. NEMA Load/Span Class: 20C
- F. Finish: ASTM A 525, pre-galvanized or clear aluminum.
- G. Inside Width and Depth: Indicated on Drawings. Inside Radius of Fittings: 24 inches (minimum).
- H. Provide with compartment dividers as indicated on drawings. Same materials and finish as tray.
- I. Straight Section Rung Spacing: 9 inches on center (ladder tray only).
- J. Provide approved manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps. Obtain cable tray components from a single manufacturer.
- K. Engraved Nameplates: 1/2 inch high black letters on yellow laminated plastic nameplate, engraved with the following wording:

WARNING! DO NOT USE CABLE TRAY AS WALKWAY, LADDER, OR SUPPORT. USE ONLY AS MECHANICAL SUPPORT FOR CABLES AND TUBING!

3.1 EXAMINATION

- A. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Verify routing and termination locations of conduit prior to rough-in.
- B. Report in writing to the USPS Project Manager prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- C. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION - RACEWAYS

- A. Install in accordance with the following schedule, unless indicated otherwise on Drawings: Plastic flexible PVC conduit shall not be permitted. Flexible metal conduit shall be permitted for electrical power and security wiring only and not permitted for fire alarm cables. Intermediate grade rigid conduit permitted where indicated below.
 - 1. Above suspended ceilings: Galvanized or sheradized thick wall rigid steel (GRC), or intermediate grade rigid steel (IMC), or electrical metallic tubing (EMT).
 - 2. Metal stud walls: Galvanized or sheradized thick wall rigid steel (GRC), intermediate grade rigid steel (IMC), or electrical metallic tubing (EMT).
 - 3. Exposed interior areas: Galvanized or sheradized thick wall rigid steel (GRC), intermediate grade rigid steel (IMC), electrical metallic tubing (EMT).
 - 4. Exposed exterior areas: Galvanized or sheradized thick wall rigid steel (GRC).
- B. Install conduit in accordance with NECA "Standard of Installation."
- C. Conduit routing indicated on Drawings are approximate locations unless dimensioned. Route parallel and perpendicular to building construction for complete wiring system regardless whether exposed or concealed.
- D. Arrange supports to prevent misalignment during wiring installation.
- E. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- F. Group related conduits; support using conduit rack. Construct rack using approved steel channel and provide space on each rack for 25 percent additional conduits.
- G. Fasten conduit supports to building structure and surfaces under provisions of this section.
- H. Do not support conduit with wire or perforated pipe straps in any type structure. Remove wire used for temporary supports. Steel tie wire may be used to anchor conduit down to reinforcing rods in concrete encasement only.
- I. Do not attach conduit or boxes to ceiling support wires. Boxes shall be independently supported.
- J. Arrange conduit to maintain headroom and present neat appearance. Maintain required clearance between conduit and piping.

- K. Route all conduit, whether exposed or concealed, parallel and perpendicular to walls, ceilings, building structures, etc.
- L. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.
- M. Cut EMT conduit square using saw or pipe cutter; de-burr cut ends and ream. Bring conduit to shoulder of fittings; fasten securely.
- N. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes. Use Myers hub connectors on all conduit entering top or sides of all junction boxes, pull boxes, wiring gutters, exposed to weather.
- O. The number of conduit bends per box shall comply with NFPA 70, Article 360. Conduit bends for "SCS" installation shall not exceed two 90 degree bends or exceed a total of 180 degrees of bend between pull boxes or conduit ends. Pull boxes shall be sized per NEC codes per conduit installed. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate or use factory elbows for bends in metal conduit larger than 2 inch size.
- P. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- Q. Provide suitable fittings to accommodate expansion and deflection where conduit crosses control and expansion joints.
- R. Provide suitable nylon pull string or #14 AWG steel wire in each conduit excluding sleeves and nipples.
- S. Ground and bond conduit per NFPA 70.
- T. Coat all metallic conduit with "General Electric" RTV silicone sealer where conduit is installed in exterior areas or in contact with concrete or earth.
- U. Conduits shall be sized as indicated on Drawings. Where sizes are not indicated, conduit shall be sized per NFPA 70.
- V. Cap all upturned conduits during construction rough-in to prevent moisture or debris from entering. Pull through each and every conduit a dry swab of sufficient size to remove any and all moisture.
- W. Maximum length of flexible metal conduit (Greenfield), or flexible liquidtight shall be 5 feet.
- X. Assure ground continuity on all branch circuitry conduits with two locknuts, one inside and one outside of all boxes, cabinets and gutters for rigid conduit. One locknut inside of all boxes, cabinets, and gutters for EMT.
- Y. Provide conduit supports as follows:
 - 1. Galvanized rigid thick wall conduit (GRC), intermediate grade rigid conduit (IMC) and electrical metallic conduit (EMT) within three feet of all outlet boxes, junction boxes, cabinets, gutters, or fittings. Horizontally anchored at 10 foot maximum intervals. Other spacings indicated on Drawings.
 - 2. Flexible metal conduit (Greenfield) and liquid-tight flexible metal conduit (sealtite), within 12 inches of all outlet boxes, junction boxes, cabinets, gutters, or fittings and bends or turns. Horizontally anchored at 4-1/2 foot intervals. 1/2 inch minimum size permitted.

3.3 INSTALLATION - BOXES

- A. Install boxes in accordance with NECA "Standard of Installation."

- B. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with NFPA 70.
- C. Set wall mounted boxes at elevations to accommodate mounting heights indicated or as required for specific project requirements. Orient boxes to accommodate wiring devices as specified in Section 262726.
- D. Electrical boxes are indicated on Drawings in approximate locations unless dimensioned. Adjust box location up to 10 feet if required to accommodate intended purpose with no additional cost to contract. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- E. Maintain headroom and present neat mechanical appearance.
- F. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only. Install pull boxes in freezer and dock area above bottom chord of structural joist. Pullboxes sized in excess of 12 inches shall be equipped with hinged and hasped covers.
- G. Install outlet and junction boxes within inaccessible ceiling areas, no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- H. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- I. Flush mounted boxes shall not be mounted back-to-back in walls; provide minimum 6 inches separation. Provide minimum 24 inches separation in acoustic rated walls.
- J. Secure flush mounted box to interior wall and partition studs. Accurately position to allow for surface finish thickness. Use approved stamped steel bridges to fasten box between studs.
- K. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- L. Use approved adjustable steel channel fasteners spanning joist for hung ceiling outlet box.
- M. Provide factory sectioned multi-gang boxes where more than one adjacent device is to be mounted. Sectional boxes shall not be permitted.

3.4 INSTALLATION - CABLE TRAYS

- A. Install trays level and plumb in accordance with manufacturer's published instructions.
- B. Install metallic cable tray in accordance with NEMA VE 2.
- C. Support cable trays as follows:
 - 1. Use anchors and fasteners as specified in Section 260500.
 - 2. Provide supports at each connection point and at the end of each run.
 - 3. Design supports including attachment to structure to carry the greater of calculated load multiplied by a factor of four or the calculated load plus 200 lb.
- D. Locate cable tray with sufficient space to permit access for installing cables.
- E. Make changes in directions and elevations using standard fittings. Use expansion connectors where required.

- F. Ground and bond cable tray under provisions of Section 260500.
- G. Provide continuity between tray components.
- H. Use anti-oxidant compound to prepare aluminum contact surfaces before assembly.
- I. Provide #2 AWG bare copper equipment grounding conductor through entire length of tray; bond to each section.
- J. Connections to tray may be made using mechanical connectors.
- K. Install warning signs at 50 feet on center along cable tray, located to be visible.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspection.
- B. Inspect conduit installation, types, sizes, fittings and attachment to structure.
- C. Inspect box installation, locations, connection to conduit, and attachment to structure.
- D. Inspect cable tray installation, locations, connection to conduit, and attachment to structure.

3.6 ADJUSTING

- A. Adjust flush-mounting outlets to make front flush with finished wall material.
- B. Install knockout closures in unused box openings.

3.7 CLEANING

- A. Clean interior of boxes to remove dust, debris, and other material.
- B. Clean exposed surfaces and restore finish like new.

END OF SECTION

SECTION 283100

FIRE EMERGENCY VOICE/ALARM COMMUNICATION SYSTEM (EVACS)

PART 1 - GENERAL

1.1 SUMMARY

- A. This specification provides the minimum requirements for the Fire Emergency Voice/Alarm Communication System. The system shall include, but not limited to all equipment, materials, labor, documentation and services necessary to furnish and install a complete, operational system to include but not limited to the following functions:
 - 1. Protected premises fire alarm systems.
 - 2. Initiating devices.
 - 3. Notification appliances.
 - 4. Inspection and testing.
 - 5. Auxiliary fire alarm equipment.
- B. Related Sections:
 - 1. Section 260500 - Common Work Results for Electrical.
 - 2. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.
 - 3. Section 260533 – Raceway & Boxes for Electrical Systems.

1.2 REFERENCES

- A. All work and materials shall conform to all applicable federal, state and local codes and regulations governing the installation. If there is a conflict between the referenced standards, federal, state or local codes, and this specification, it is the bidder's responsibility to immediately bring the conflict to the attention of the engineer for resolution. National standards shall prevail unless local codes are more stringent. The equipment and installation shall comply with the current provisions of the following codes and standards.
- B. American National Standards Institute (ANSI):
 - 1. ANSI S3.411, Audible Emergency Evacuation Signals.
 - 2. ANSI/UL 1971, Standard for Safety Signaling devices for Hearing Impaired.
- C. National Fire Protection Association (NFPA):
 - 1. NFPA 13, Installation of Sprinkler Systems.
 - 2. NFPA 70, National Electrical Code.
 - 3. NFPA 72, National Fire Alarm Code.
 - 4. NFPA 101, Life Safety Code.
- D. Underwriters Laboratories, Inc.(UL):
 - 1. UL 864 - Control Units for Fire Protective Signaling Systems.
 - 2. UL 268 - Smoke Detectors for Fire Protective Signaling Systems.
 - 3. UL 268A - Smoke Detectors for Duct Applications.
 - 4. UL 521 - Heat Detectors for Fire Protective Signaling Systems.
 - 5. UL 228 - Door Closers-Holders, With or Without Integral Smoke Detectors.
 - 6. UL 464 - Audible Signaling Appliances.
 - 7. UL 38 - Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems.
 - 8. UL 346 - Waterflow Indicators for Fire Protective Signaling Systems.

Seattle NDC Fire Alarm Replacement

Federal Way, WA

USPS Project Number

9. UL 1711 - Amplifiers for Fire Protective Signaling Systems.
10. UL 1638 - Visual Signaling Appliances.
11. UL 1971 - Signaling Devices for the Hearing-Impaired.
12. UL 1481 - Power Supplies for Fire Protective Signaling Systems.

NOTE: Control equipment shall be listed to comply with both UL864 and UL2572 standards.

- E. Federal Codes and Regulations
 1. Americans with Disabilities Act (ADA)
- F. International Standards Organization (ISO)
 1. ISO-9000
 2. ISO-9001
- G. Factory Mutual (FM)
 1. Provide factory mutual approval.
- H. ASME 17.1 – Elevator Code
- I. International Code Council
 1. International Building Code
 2. International Fire Code
 3. International Mechanical Code

1.3 DEFINITIONS

- A. Authority Having Jurisdiction (AHJ): See Public Authorities.
- B. Engineer of Record: A Professional Engineer Registered in the State where the project is located who undertakes design of the fire protection system.
- C. Owner: Building/facility owner, landlord/lessor, tenant/lessee, Insurance Carrier or any designated representative of these entities.
- D. Public Authorities: Local, State or Federal government body having jurisdiction over any portion of the project. This includes, but is not limited to: Fire Departments, Fire Marshal Offices, Aviation Authorities, Insurance Regulatory Boards, etc.
- E. Approved: Unless otherwise stated, materials, equipment or submittals approved by the Authority or AHJ.
- F. Circuit: Wire path from a group of devices or appliances to a control panel or transponder.
- G. Central Station: A remote supervising station (facility) that is listed for central station remote monitoring in accordance with NFPA 72. The central station serves as the constantly attended location that receives alarm, supervisory or trouble signals from the protected premises fire alarm system.
- H. CPU: The central computer of a multiplex fire alarm or voice command control system.
- I. EVACS: Dedicated in building “Emergency Voice/Alarm Communication System” utilized for originating and distributing voice instructions and evacuation signals pertaining to a fire emergency to the occupants of a building.
- J. FAAP: Fire Alarm Annunciator Panel.

- K. FACP: Fire Alarm Control Panel.
- L. FM: FM Global (Factory Mutual).
- M. MPSA: Medium Power Speaker Array.
- N. IDC: Initiating Device Circuit.
- O. LCD: Liquid Crystal Display.
- P. NAC: Notification Appliance Circuit.
- Q. NICET: National Institute for Certification in Engineering Technologies.
- R. NRTL: Nationally Recognized Testing Laboratory.
- S. SLC: Signaling Line Circuit.
- T. Style 1: As defined by NFPA 72, Class B.
- U. Style 4: As defined by NFPA 72, Class B.
- V. Style 6: As defined by NFPA 72, Class A.
- W. Style 7: As defined by NFPA 72, Class A.
- X. Style B: As defined in NFPA 72, Class B.
- Y. Style D: As defined in NFPA 72, Class A.
- Z. Style Y: As defined in NFPA 72, Class B.
- AA. UL Listed: Materials or equipment listed and included in the most recent edition of the UL Fire Protection Equipment Directory.
- BB. Zone: Combination of one or more circuits or devices in a defined building area.

1.4 SYSTEM DESCRIPTION

- A. Summary:
 - 1. Provide all permits, labor, equipment, materials and services to furnish and install a fully tested functional, UL Listed, code compliant, intelligent addressable networked, fire emergency voice/alarm communication system (EVACS) including but not limited to all initiation and notification appliances, all raceways and wiring, and connection to a central station monitoring company.
 - 2. The fire alarm system supplied under this specification shall utilize modular low voltage design with direct wired, node to node, peer-to-peer network communications. The system shall utilize independently addressed, fire detection devices, input/output control modules, audio amplifiers, and notification appliances as described in this specification. Network panels shall contain the required user interfaces for all functions.
 - 3. The system shall be designed for interior building audibility of 15 dBA-fast over ambient condition and intelligibility. Intelligibility shall be designed to ensure
 - 4. All equipment shall be new and the current products of a single manufacturer, actively engaged in the manufacturing and sale of digital fire detection devices for over ten years.
 - 5. Also included are system wiring, fiber optic cable, raceways, pull boxes, terminal cabinets, mounting boxes, and any accessories and miscellaneous items required for a code compliant system.

6. The system drawings show the intended coverage and suggested device locations. Final device quantity, location, and AHJ approval are the responsibility of the contractor.
7. The final system shall be complete, tested, and ready for operation as described elsewhere in this specification, before owner acceptance.
8. Strict conformance to this specification is required to ensure that the installed and programmed system will function as designed, is compatible with other systems, and will accommodate the future requirements and operations of the building owner. All specified operational features must be met without exception.
9. The Contractor shall furnish all labor, services and materials necessary to furnish and install a complete, functional protected premises fire alarm system (System). The System shall comply in all respects with the requirements of the specifications, manufacturer's recommendations and Underwriters Laboratories Inc. (ULI) listings.
10. Certification that the entire system(s) has/have been inspected and tested, is/are installed entirely in accordance with the applicable codes, standards, manufacturer's recommendations and ULI listings, and is/are in proper working order. Contractor shall use "Fire Alarm System Certification and Description" as required by NFPA 72.

B. Related Work:

1. Work and/or equipment provided in other sections and related to the fire alarm system shall include, but not be limited to:
 - a. Sprinkler water flow, high and low pressure switches and supervisory switches shall be wired and connected by the fire alarm system contractor.
 - b. Duct smoke detectors shall be furnished, wired and connected by the electrical contractor.
 - c. Elevator recall control circuits are to be provided in compliance with ANSI A17.1.

C. General:

1. Furnish and install a complete UL list/certified, modular, non-coded, independently point addressable, intelligent Fire Alarm System as described herein and as shown on the plans.
2. System shall be dedicated to fire service.
3. The system shall be fully field programmable such that virtually any combination of system output functions may be correlated to any type of input event(s). Inputs may be combined using Boolean logic, be time dependent or under manual control, as defined by required system operation. Each FACP shall have an operator interface to allow for loading or editing special instructions and system operating sequences as required. The system shall be capable of on-site programming to accommodate and facilitate expansion, building parameter changes and changes as required by local codes. All software operations are to be stored in a non-volatile programmable memory within each of the FACP's. Loss of primary and secondary power shall not erase the system programs stored in memory. There shall be no limit, other than maximum system capacity, as to the number of addressable devices which may be in alarm simultaneously.
4. The FACP's shall allow the operator to set detector sensitivity ratings for each device, within code allowed parameters. To accommodate and facilitate job site changes, initiation circuits shall be individually configurable on site to provide either alarm/trouble operation, alarm only, trouble only, current limited alarm, no alarm, normally closed device monitoring, a non-latching circuit or an alarm verification circuit. All control equipment shall have transient protection devices to comply with UL864 requirements. Addressable smoke detector sensitivity settings for both pre-alarm and alarm activation shall be automatically individually configurable for both daytime and nighttime operation. Addressable smoke detectors shall be UL listed for automatic sensitivity testing.
5. Each FACP unit shall accept addressable analog detectors and addressable monitor modules for dry contact devices.
6. Bypass switches shall be included for system testing to prevent audible/visual signal operation, sprinkler system flow, high and low pressure switch operation, HVAC control activation and remote fire department notification. Bypass switches for fire alarm system testing shall be located in each of the FACP's. Activation of bypass switches shall cause system trouble alarm.
7. Ease of maintenance shall be facilitated by the use of panel based and PC based system diagnostics.

- a. The system shall automatically test smoke detector sensitivity, eliminating the need for manual sensitivity testing.
 - b. Ground fault detection and annunciation shall be by individual module address for supervised input and output devices.
 - c. System test operation shall be configurable by individual addressable devices, and not disable entire circuits.
 - d. The system shall be capable of generating a graphical map of connected all addressable devices to aide in circuit troubleshooting.
 - e. Placement supervision of addressable devices shall couple a device's location (not its address) to the programmed system response.
8. The system shall provide a one-way multi-channel emergency communication sub-system for the distribution of emergency messages to facility occupants.

D. System Components:

1. Provide and install a new fire detection and alarm system that shall consist of:
 - a. Fire Alarm Control Panel.
 - b. LCD remote annunciator(s).
 - c. A system printer.
 - d. Manual pull stations.
 - e. Area smoke detectors.
 - f. Area heat detectors.
 - g. Duct smoke detectors.
 - h. Sprinkler system waterflow(s) and valve supervisory switch(s).
 - i. Interface with suppression, smoke control and ancillary shutdown system(s).
 - j. Audible notification appliances.
 - k. Synchronized visual notification appliances.
 - l. Magnetic door holders.
 - m. Communications.
 - n. Addressable interface devices.
 - o. Control system integration.
 - p. Provide elevator recall functions for primary and alternate floors and elevator power shunt trip activation.

1.5 SEQUENCE OF OPERATIONS

A. General

1. The alarm activation of any area smoke detector, heat detector, manual pull station, sprinkler waterflow, the following functions shall automatically occur:
 - a. The internal audible device shall sound at the control panel and remote annunciator.
 - b. The LCD display shall indicate all applicable information associated with the alarm condition including; device type, device location and time/date.
 - c. All system activity/events shall be documented in system history and on the system printer.
 - d. Any remote or local annunciator LCD/LED's associated with the alarm shall be illuminated.
 - e. Activate notification audible appliances throughout the building.
 - f. Activate visual strobes notification appliances throughout the building. The visual strobe shall continue to flash until the system has been reset. The visual strobe shall not stop operating when the "Alarm Silence" is pressed.
 - g. All automatic events programmed to the alarm point shall be executed and the associated outputs activated.
 - h. All exit doors shall unlock throughout the building.
 - i. All self-closing fire/smoke doors held open shall be released.
 - j. Recall elevators to primary or alternate recall floors.
 - k. Upon water flow, the designated mail processing equipment shall immediately shutdown as indicated on the drawings.

B. Duct Smoke Operation

1. The Alarm activation of any duct smoke detector, the following functions shall automatically occur:
 - a. The internal audible device shall sound at the control panel and remote annunciator.
 - b. The LCD display shall indicate all applicable information associated with the alarm condition including; device type, device location and time/date.
 - c. All system activity/events shall be recorded on the system printer and system history file.
 - d. Any remote or local annunciator LED's associated with the alarm shall be illuminated.
 - e. Shutdown the local air handling unit.
 - f. All automatic events programmed to the alarm point shall be executed and the associated outputs activated.

C. Elevator Control

1. Upon activation of elevator lobby, hoist-way or machine room smoke detector, phase 1 & 2 elevator recall shall be initiated.
2. Upon activation of designated heat detector(s) in elevator hoist-way or machine room, power to the elevator(s) shall be disconnected prior to the application of water. Phase I recall shall meet all requirements of ASME A17.1, 211 3b (5).

D. Supervisory Operation

1. Upon supervisory activation of any sprinkler valve supervisory switch, the following functions shall automatically occur:
 - a. The internal audible device shall sound at the control panel and remote annunciator.
 - b. The LCD display shall indicate all applicable information associated with the supervisory condition including; device type, device location and time/date.
 - c. All system activity/events shall be documented on the system printer and system history file.
 - d. Any remote or local annunciator LCD/LED's associated with the supervisory activation shall be illuminated.

E. Trouble Operation

1. Upon activation of a trouble condition or signal from any device on the system, the following functions shall automatically occur:
 - a. The internal audible device shall sound at the control panel and remote annunciator.
 - b. The LCD display shall indicate all applicable information associated with the trouble condition including; device type, device location and time/date.
 - c. All system activity/events shall be documented on the system printer and system history file.
 - d. Any remote or local annunciator LCD/LED's associated with the trouble zone shall be illuminated.

1.6 SYSTEM CONFIGURATION

A. General

1. All Life Safety System equipment shall be arranged and programmed to provide a system for the early detection of fire, the notification of building occupants, the automatic summoning of the local fire department (when required), the override of the HVAC system operation, and the activation of other auxiliary systems to inhibit the spread of smoke and fire, and to facilitate the safe evacuation of building occupants.
2. The System shall utilize independently addressed, smoke detectors, heat detectors and input/output modules as described elsewhere in this specification.

B. Power Supply

1. The power supply shall be a high efficiency switch mode type with line monitoring to automatically switch to batteries for power failure or brown out conditions. The automatic battery charger shall have low battery discharge protection. The power supply shall provide internal power and 24 Vdc

- at 4.5A continuous for notification appliance circuits. All outputs shall be power limited. The battery shall be sized to support the system for 60 hours of supervisory and trouble signal current plus general alarm for 5 minutes.
2. Auxiliary power supplies shall be a high efficiency switch mode type with line monitoring to automatically switch to batteries for power failure or brown out conditions. The automatic battery charger shall have low battery discharge protection. The power supply shall provide internal power and 24 Vdc at 6.4 continuous for notification appliance circuits. The power supply shall be capable of providing 8A to output circuits for a maximum period of 100 ms. All outputs shall be power limited. The battery shall be sized to support the system for 60 hours of supervisory and trouble signal current plus general alarm for 5 minutes. All supervision of the auxiliary supply shall be transmitted via addressable analog loop without additional equipment.
- C. Display
1. The display module shall be of membrane style construction with a 16 line by 40 character Liquid Crystal Display. The LCD shall use super-twist technology and backlighting for high contrast visual clarity. In the normal mode display the time, the total number of active events and the total number of disable points. In the alarm mode display the total number of events and the type of event on display. Reserve 40 characters of display space for user custom messages. The module shall have visual indicators for the following common control functions; AC Power, alarm, supervisory, monitor, trouble, disable, ground fault, CPU fail, and test. There shall be common control keys and visual indicators for; reset, alarm silence, trouble silence, drill, and one custom programmable key/indicator. Provide four pairs of display control keys for selection of event display by type (alarm, supervisory, monitor and trouble) and forward / backward scrolling through event listings. The operation of these keys shall be integrated with the related common control indicator that lights when an event of its type is active. Allow the first event of the highest priority to capture the LCD for display so that arriving fire fighters can view the first alarm event "hands free". Provide system function keys; status, reports, enable, disable, activate, restore, program, and test. The module shall have a numeric keypad, zero through nine with delete and enter keys.
 - a. Basis of Design: Edwards model 3-LCDXL
- D. Initiating Device Circuits
1. The Initiating device circuits (IDC) used to monitor manual fire alarm stations, smoke and heat detectors, waterflow switches, valve supervisory switches, fire pump functions, and air pressure supervisory switches shall be Class B.
- E. 24 VDC Notification Appliance Circuits
1. 24 VDC Notification appliance circuits (NAC) shall be Class B. All notification appliance circuits shall have a minimum circuit output rating of 2 amp @ 24 vdc. The notification circuits shall be power limited. Non-power limited circuits are not acceptable.
- F. Audio Notification Appliance Circuits
1. One-way audio notification appliance circuits (NAC) shall be Class B. All notification appliance circuits shall have a minimum circuit output rating of 35W @70Vrms. The notification circuits shall be power limited. Non-power limited circuits are not acceptable.
- G. Signaling Line Circuits (SLC-Data Circuits)
1. The signaling line circuit shall communicate from a panel/node to analog/addressable detectors, input modules, output modules, isolation modules and notification appliance circuits.
 2. Each signaling circuit connected to addressable/analog devices shall provide a minimum of 20 spare addresses.
 3. When a signaling line circuit covers more than one fire/smoke compartments, a wire-to-wire short shall not affect the operation of the circuit from the other fire/smoke compartments.
 4. The signaling line circuit (SLC) connecting all components Class B (style 4).

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
1. Product Data: For each type of Product required.
 2. It shall be the contractor's responsibility to inspect the job site and become familiar with the conditions under which the work will be performed. These conditions should be used to adjust the submittals.
 3. Shop Drawings: Include plans, elevations, sections, details, and attachments necessary:
 - a. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
 - b. Include voltage drop calculations for notification appliance circuits.
 - c. Include 25 percent spare capacity on each signal circuit so that additional devices can be added.
 - d. Include substantiating emergency (battery) and normal power supply calculations for supervisory and alarm power requirements and calculations of notification device circuit loading (end of circuit voltage drop) to ensure proper operation of all devices.
 - e. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 - f. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits. Drawing scale shall match engineers design drawings.
 - g. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
 - h. Include complete schematic circuit diagrams for system, including all equipment. Wiring diagram shall show point to point connections between all system components
 - i. Include descriptions of system operation, annunciator schedule showing titles for each zone, and manufacturer's literature marked to show model and catalog number for all equipment.
 - j. Include complete riser diagrams for system indicating wiring sequence of all alarm devices and control equipment shall be included with submittal data.
 - k. Include requirements of the Integrated Automation, Security, and Clean-Agent System and data sharing details.
- B. General Submittal Requirements:
1. Submit for approval four (4) sets of shop drawings and submittal documentation to the consulting engineer for review and comment. Drawing and submittal documentation sets shall be bound. Additional copies may be required at no additional cost to the project.
 2. Contained in the title block of each drawing shall be symbol legends with device counts, wire tag legends, circuit schedules for all addressable and notification appliance circuits, the project name/address, and a drawing description which corresponds to that indicated in the drawing index on the coversheet drawing. A section of each drawing title block shall be reserved for revision numbers and notes.
 3. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified fire-alarm technician, Level III minimum.
- C. Construction Drawings:
1. The System's Contractor shall prepare fire alarm system installation drawings for permitting in accordance with Florida Administrative Code Rule 61G15. Drawings shall incorporate all required information per Rule 61G15 and be signed and sealed by a registered professional engineer meeting the requirements of Rule 61G15. The System's Contractor furnishing and installing the fire alarm system is responsible for preparation of these drawings and getting drawings approved by the Authority Having Jurisdiction (AHJ).
- D. Systems Contractor Qualifications:

1. The contractor directly responsible for this work shall be a systems contractor, who is and who has been regularly engaged in the furnishing and installation of commercial and industrial fire alarm systems of this type and size for at least the immediate past 5 years. All equipment shall be installed by a technician with experience installing the manufactured system or a recognized training school or course for the installations of this type system. The contractor shall, if requested by the engineer; show proof of a specific individual's training. The system's contractor shall directly employ a suitable number of skilled systems installers whose normal work is systems installation and who shall install and make the wire and cable connections thereto.
 2. As part of the project submittal, it shall be demonstrated to the satisfaction of the engineer that the systems contractor has adequate plant and equipment to do the work properly and expeditiously, adequate staff and technical experience.
- E. Test Reports: Submit the following reports directly to USPS Project Manager from Manufacturer's Quality Control Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
1. Pre-test.
 2. Acceptance test.
- F. Certificates: Manufacturer's certificate certifying that components and Products meet or exceed specified requirements.
- G. Qualification Documentation:
1. Submit documentation of manufacturer and installer experience indicating compliance with specified qualification requirements. Include lists of completed projects with project names and addresses, and names of Engineers and Owners.
 2. Fire alarm contractor license issued by State or local authority having jurisdiction.
- H. Manufacturer's Field Reports: Submit the following reports directly to USPS Project Manager from Manufacturer's Quality Control Inspector, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements.
1. Preparatory inspection.
 2. Initial inspection.
 3. Follow-up inspection.
 4. Final inspection.
- I. A copy of the installing technician's NICET certification shall be provided.
- J. Section 017704 - Closeout Procedures and Training: Procedures for closeout submittals:
1. Operation and Maintenance Data: Project specific operating manuals covering the installed Life Safety System. A generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement. Include user's software data and recommendations for spare parts to be stocked at the site. Provide names, addresses, and telephone numbers of service organizations that stock repair parts for the system.
 2. Operations and maintenance data for fire-alarm system and components shall include the following:
 - a. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - b. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 - c. Record copy of site-specific software.
 - d. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - 1) Frequency of testing of installed components.
 - 2) Frequency of inspection of installed components.
 - 3) Requirements and recommendations related to results of maintenance.
 - 4) Manufacturer's user training manuals.

- e. Manufacturer's required maintenance related to system warranty requirements.
 - f. Abbreviated operating instructions for mounting at fire-alarm control unit.
 - g. Copy of NFPA 25.
 - 3. Software and Firmware Operational Documentation:
 - a. Software operating and upgrade manuals.
 - b. Program Software Backup: On magnetic media or compact disk, complete with data files. Provide all required passwords and access to allow independent, factory trained technician working for an authorized partner/dealer to utilize the backup database files.
 - c. Device address list.
 - d. Printout of software application and graphic screens.
 - 4. Project Record Documents: As-Built drawings consisting of: a scaled plan of each building showing the placement of each individual item of the Life Safety System equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway. All drawings must reflect point to point wiring, device address and programmed characteristics. All drawings shall be provided in AutoCAD format. A hard copy plot of each sheet shall also be provided. Provide the application program listing for the system (to the facility) as installed at the time of acceptance (disk, hard copy printout, and all required passwords).
 - a. The Contractor shall provide three bound copies of the following, to be forwarded to the Owner at completion of project:
 - 1) As-built wiring and conduit layout diagrams showing all fire alarm devices on floor plans, including wire color code and terminal numbers, and showing all interconnections in the system.
 - 2) Electronic circuit diagrams of all FACP modules, power supplies, annunciator, data gathering panels, addressable interface modules, etc.
 - 3) Technical literature on all major parts of the system, including control panels, smoke detectors, batteries, manual stations, alarm notification appliances, power supplies, and remote alarm transmission means.
 - 5. Record of Completion: Figure 4.5.2.1 NFPA 72.
- K. Maintenance Material Submittals:
- 1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - a. Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no less than 3 units of each type.
 - b. Detector Bases: Quantity equal to 10 percent of amount of each type installed, but no less than 5 units of each type.
 - c. Keys and Tools: Four extra sets for access to lock and tamper proofed components.
 - d. Audible and Visual Notification Appliances: Five of each type installed.
 - e. Manual Pull Stations: Five of each type installed.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firm experienced in manufacturing equipment of the types and capacities indicated that have record of successful in-service performance with minimum 10 years documented experience. Prime system manufacturer and manufacturers of major system components required to qualify separately.
- 1. Service Center: The System Supplier shall maintain a service organization with adequate spare parts stock within 75 miles of the installation. Any defects that render the system inoperative shall be repaired within 24 hours of the owner notifying the contractor.
 - 2. System equipment shall be from a single manufacturer and shall be supported by a manufacturer authorized, established service organization that shall stock parts for the equipment supplied.
 - 3. Equipment shall be manufactured by a firm that has been actively manufacturing fire alarm systems for a minimum of 7 years and that offers a 3 year warranty on all control equipment.
 - 4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

5. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

- B. Installer Qualifications: Experience with systems of the type and scope indicated and certified as authorized service representative of the prime system manufacturer with minimum 5 years documented experience.
 1. System shall be installed by a single contractor that assumes responsibility for system components and their compatibility.
 2. Only manufacturer's certified installers with NICET Level III or higher shall be utilized.
 3. The addressable fire alarm system shall be connected, programmed, and tested only by the manufacturer or by an authorized distributor who stocks a full complement of spare parts for the system. Technicians performing this service shall be trained and individually certified by the manufacturer for the model of system being installed and NICET Level II or greater. Copies of their certifications must be included with the contractor's submittal to the engineer, prior to installation. The submittal cannot be approved without this information.
- C. Regulatory Requirements:
 1. Calculations, Product Data, Shop Drawings: Provide stamp of approval from Public Authorities.
 2. Comply with requirements of Public Authorities for submittals, approvals, materials, installation, inspections, and testing.
 3. Comply with requirements of USPS Project Manager and Owner's insurance underwriter for submittals, approvals, materials, installation, inspections, and testing.
 4. Provide certificate of compliance from Public Authorities indicating approval of field acceptance tests.
 5. Conform to applicable code for submission of design and calculations, reviewed shop and erection drawings and as required for acquiring permits.
 6. Cooperate with regulatory agency or authority and provide data as requested.
- D. Pre-Installation Meetings:
 1. Convene a pre-installation meeting one week prior to commencing Work of this Section. Final device and equipment locations shall be coordinated with the Plant and Engineer during this meeting.
 2. Require attendance of parties directly affecting Work of this Section.
 3. Review conditions of operations, procedures and coordination with related Work.
 4. Agenda:
 - a. Tour, inspect, and discuss conditions of building and building structure.
 - b. Review system design and requirements.
 - c. Review required submittals, both completed and yet to be completed.
 - d. Review system Drawings and data.
 - e. Review and finalize construction schedule related to system and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
 - f. Review required inspections, testing, certifying, and material usage accounting procedures.

1.9 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall be responsible for all receiving, handling, and storage of his materials at the job site.
- B. Overnight storage of materials is limited to the assigned storage area. Materials brought to the work area shall be installed the same day, or returned to the assigned storage area unless previously approved by the Owner. Store equipment in a clean, dry space and protect from dirt, fumes, water, construction debris, and physical damage.
- C. The Contractor shall remove rubbish and debris resulting from his work on a daily basis. Rubbish not removed by the Contractor will be removed by the Owner and back-charged to the Contractor.

- D. Handle equipment to prevent internal components damage, breakage, denting, and scoring enclosure and finish.
- E. Do not install damaged equipment.
- F. Do not install or connect any smoke detectors (spot or duct) before areas where detectors are installed are cleaned and ready for occupants as indicated in NFPA-72. If detectors are installed before areas are cleaned, and found to be contaminated at time of final commission or soon after. The installing contractor shall replace detectors with new at no cost to the owner.
- G. After installation, protect from damage by work of other trades.

1.10 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning with Substantial Completion, provide software support for three years.
- C. Upgrade Service:
 - 1. Update software to latest version at Project completion. Install and program software upgrades that become available within three years from date of Substantial Completion. Upgrading software shall include operating system of the FACP's.
 - 2. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.11 COORDINATION

- A. Coordinate locations of panels, annunciators and equipment with existing field conditions and Plant Staff.
- B. Coordinate conduit and cable runs with other contractors. Include fire proofing and fire stopping at penetrations.
- C. Coordinate locations of devices with reflected ceiling plans and wall elevations.
- D. Pre-installation Conference: Conduct conference at Project site. Conference should discuss all necessary coordination and outline specific interface details to be coordinated with the existing mail processing equipment and access control systems.

1.12 POSITIVE ALARM SEQUENCE

- A. Positive Alarm Sequence: If permitted by the public authority, the fire alarm system shall be equipped with positive alarm sequence feature (per NFPA 72, 9.6.3.4) that allows initial fire alarm signals to be received at the constantly attended control panel location and for which human action is subsequently required to delay the general alarm by 180 seconds after the start of the alarm processing. The transmission of the alarm signal to the central station shall activate upon the initial alarm signal.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. All equipment and components shall be the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approval agency for use as part of a protected premises protective signaling (fire alarm) system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.
- B. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
 - 1. Edwards, (800) 655-4497
 - 2. Siemens, (800) 262-7976.
 - 3. Honeywell/Notifier, (800) 289-3473.
 - 4. Simplex/Grinnell, (978) 731-2500
- C. Section 016000 - Product Requirements: Product options and substitutions. Substitutions: Permitted subject to approval of USPS Project Manager.
 - 1. Conflicts, deviations, or change requests shall be submitted in writing to USPS Project Manager with supporting documentation. Include written justification, designs, manufacturer's specifications, cost benefits, and any special circumstances dictated by local conditions. Documentation package shall be submitted in sufficient time to minimize any adverse effects of the proposed changes to the project construction schedule. USPS Project Manager reserves the right to reject substitute and other systems.

2.2 PANEL COMPONENTS AND FUNCTIONS

- A. General
 - 1. The control panel(s) shall be a multi-processor-based system designed specifically for fire and releasing system applications. The control panel shall be listed and approved for the application standard(s) as listed under the General section.
 - 2. The control panel(s) shall include all required hardware, software and system programming to provide a complete and operational system. The control panel(s) shall assure that life safety takes precedence among all panel activities.
 - 3. The control panel(s) shall include the following capacities:
 - a. Support up to 2500 analog/addressable points per panel with capacity of networking up to 64 nodes.
 - b. Support up to 5 fully supervised network remote annunciators.
 - c. Support a DACT (dialer) for off premise cellular notification.
 - d. Support up to 576 chronological events in history.
 - 4. The control panel(s) shall include the following features:
 - a. Provide auto-programming and electronic addressing and mapping of analog/addressable devices.
 - b. Provide an operator interface display that shall include functions required for annunciation, command and control system functions.
 - c. Provide a discreet system control switch provided for reset, alarm silence, local silence, drill switch, up/down switches, status switch, program switch, enable and disable switches, activate and restore switches, reports switch and test switch.
 - d. Provide system reports that provide sensitivity and history details.
 - e. Provide an authorized operator with the ability to operate or modify system functions like system time, date, passwords; and auto-program, enable mapping, restart the system and clear control panel event history file.
 - f. Provide an authorized operator to perform test functions within the installed system.
 - 5. Supervision of system components, wiring, initiating devices and software shall be provided by the control panel(s). Failure or fault of system component or wiring shall be indicated by type and location on the LCD display. Software and processor operation shall be independently monitored for failure.
 - 6. Basis of Design: Control Panel - Edwards, EST3 Series.

B. Annunciation

1. The system shall be designed and equipped to receive, monitor, and annunciate signals from devices and circuits installed throughout the building. Manufacturer's standard control switches shall be acceptable if they provide the required operation, including performance, supervision and position indication. If the manufacturers' standard switches do not comply with these requirements, fabrication of custom manual controls acceptable to the USPS Project Manager is required.
2. Receipt of alarm, trouble, and supervisory signals shall activate integral audible devices at the control panel(s) and at each remote annunciator panel.
3. The control panel(s) and remote annunciator(s) shall contain the following system status indicators:
 - a. 80 character Backlit Liquid Crystal Display.
 - b. System Power Indicator - green LED.
 - c. System Common Alarm - red LED.
 - d. System Common Trouble - yellow LED.
 - e. System Common Supervisory - yellow LED.
 - f. System Common Monitor - yellow LED.
 - g. System Ground Fault - yellow LED.
 - h. System CPU Fault - yellow LED.
 - i. System Disabled - yellow LED.
 - j. System Test Point(s) - yellow LED.
 - k. System Reset Switch with Integral yellow LED.
 - l. System Alarm Silence Switch with Integral yellow LED.
 - m. System Local Silence Switch with Integral yellow LED.
 - n. System Drill Switch with Integral yellow LED
 - o. System Message Queue Scroll Switches.
 - p. Additional buttons as required to provide system control and operator functions.
4. Basis of Design: Edwards EST3 series.

C. Power Supply

1. Each system power supply shall be a minimum of 6 amps @ 24 vdc.
2. Upon failure of normal (AC) power, the affected portion(s) of the system shall automatically switch over to secondary power without losing any alarm, trouble or operator acknowledgment signals.
3. Each system power supply shall be individually annunciated and shall identify the inoperable power supply in the event of a trouble condition.
4. All standby batteries shall be continuously monitored by the system. Low battery and disconnection of battery power supply conditions shall immediately annunciate as a trouble signal, identifying the deficient batteries.
5. All system power supplies shall be capable of recharging their associated batteries, from a fully discharged condition to a capacity sufficient to allow the system to perform consistent with the requirements of this section, in 48 hours maximum.
6. All AC power connections shall be to the building's designated emergency electrical power circuit and shall meet the requirements of Section 4.4.1.4 of NFPA 72. The AC power circuit shall be installed in conduit raceway. The power circuit disconnect means shall be clearly labeled FIRE ALARM CIRCUIT CONTROL and shall have a red marking. The location of the circuit disconnect shall be labeled permanently inside each control panel.
7. Basis of Design: Edwards model 3-PPS/M2.

D. Display

1. System Message Processing and Display Operations:
 - a. The system shall allow message routing to be configured to any or all annunciators.
 - b. All system printer port(s) shall be configurable to output any combination of alarm, supervisory, trouble, or monitor, event messages.
 - c. Each LCD display on each annunciator shall be configurable to display the status of any combination of alarm, supervisory, trouble, or monitor, event messages.

- d. Clear distinction shall be provided between alarm, supervisory, trouble, and monitor status messages.
 2. The system shall provide the ability to retrieve data from the analog/addressable detectors to a PC while the system is on-line and operational in the protected premises. The uploaded data may then be analyzed in a diagnostic program supplied by the system manufacturer.
 3. A standby power supply shall automatically supply electrical energy to the system upon primary power supply failure.
- E. One-Way Emergency Audio Communications
1. A supervised one-way (8)-channel emergency communications system shall be provided in the main control panel located within the maintenance operation's office. The main one-way audio controller shall provide a push-to-talk microphone with coiled cord, and switches that allow the emergency user to page to the evacuation channel, page to the alert channel or quickly place evacuation or alert tones on the selected channels. Switches shall also be provided to permit paging on the evacuation or alert channel using the firefighters telephone system as the paging source.
 2. Each channel shall have the capability to output a different tone or prerecorded message independent of each other. Each supervised branch audio circuit shall provide a connect/disconnect switch and indicators for active circuit selection and circuit trouble.
 3. Basis of Design: One-way emergency audio communications module. Edwards model 3-ASU.
- F. One-Way Emergency Audio Amplifiers
1. The One-Way amplifiers shall be high-efficiency switch-mode audio amplifiers. Each amplifier must support dual channel audio. The audio output shall be configurable as 25VRMS or 70VRMS in Class B wiring, rated at 20,40 or 95 watts. The amplifiers shall support speakers connected directly to the output of the amplifier or the amplifier output shall be capable of being run as an audio riser to switching modules where speaker zone selection is made.
 2. Each amplifier shall have a built in back up 1kHz tone generator that automatically activates with loss of input signal. Each amplifier cabinet shall include a backup redundant amplifier. It shall be possible to default to back up tone or standby amplifier in the event of the loss of input signals. System remote amplifiers must communicate their status directly to the main control panel. External monitoring is not acceptable. Onboard status LEDs shall be provided for quick visual indication of amplifier status
 3. Basis of Design: Edwards model 3-ZA20, 3-ZA40, 3-ZA95.
- G. System Printer
1. The event and status printer shall be a 9-pin, impact, dot matrix printer with a minimum print speed of 232 characters per second. The printer shall be capable of serial communications protocol. The printer shall list the time, date, type and user defined message for each event printed.
 2. Basis of Design: Edwards model PT-1S.
- H. Reports
1. The system shall provide the operator with system reports that give detailed chronological description of the last 576 system events. The system shall provide a report that gives a listing of the sensitivity and environmental compensation usage of all of the detectors on the system, or specified analog/addressable circuit.
 2. The system report shall also include facility name, compiled date, compiler revision, project revision and report date. The system shall output these reports via the main LCD, and reports shall be capable of being printed on the system printer.

2.3 GRAPHIC FIRE COMMAND SERVERS AND WORKSTATIONS

- A. General: The graphic fire command workstation shall Edwards EST FireWorks and be an integral part of the fire command station, and shall function as the common point for operational and administration functions required for the fire alarm system/emergency communication system(s) provided in this specification.
- B. The graphic fire command workstation shall provide multiple points of view of a system event to deliver the user the maximum amount of information with minimum intervention. Complete control of connected FACP's shall be provided.
- C. The graphic fire command workstation shall consist of a primary server (FW-ULS). The graphic command network shall have the capability of supporting a minimum of 15 remote WebClients, and 125 individual EST3 networks with each EST3 network supporting 64 EST3 nodes (ACU/FACP's). The graphic fire command workstation shall support a digital alarm communications receiver (DACR) unit to monitor third-party fire systems using Contact ID format via cellular communications. The workstation shall be UL listed to command and control all FACP networks and equipment supplied under this contract.
- D. The workstation shall be an industrial grade computer listed for UL Standards 864 (Control Units for Fire-Protective Signaling Systems) under categories UOJZ, APOU, and UUKL; UL 1076, (Proprietary Burglar Alarm Units and Systems) under category APOU as applicable. The workstation shall be capable of annunciation and control of all fire detection control points.
- E. The computer shall be a minimum of an Industrial Grade i7 4770S processor 3.9 GHZ, 32 GB RAM, 8 MB Chace, QPI speed of 5 GT/S, 4 core, multi-threaded to 8, RAID solid State Drives, and 2 NICs. .
- F. The computer operating system shall be Windows® 10 Pro 64, Service Pack 1.
- G. There shall be a 22" LCD touch screen main monitor installed as shown on drawing.
- H. Graphic fire command workstation shall be provided with an uninterruptable power source system sized for 4 hours of operation. At a minimum, the system shall provide annunciation and controls for:
 1. Activate prerecorded audio messages to any combination of local or remote FACP's.
 2. Initiating live page messages to any combination of local or remote FACP's.
 3. Controlling/Monitoring local and/or remote building functions as detailed on the functional matrix.
 - a. Fire detection.
 - b. Fire pump status
 - c. Standby generator.
 4. Workstation functions shall include but not be limited to:
 - a. Display events in response to an alarm or off normal point. The workstation shall simultaneously display
 - An "Event List Viewport" to display the alarm or off normal point with type and description and time of the event in a prioritized color-coded event list.
 - An "Event Action Viewport" to provide common control capability for Alarm Silence, Panel Silence, Drill and Reset as well as the Event Acknowledge button, the Computer Silence button, and the Event Log.
 - A "Map Viewport" to display a graphical representation of the area/location in which the alarm or off-normal device is located. Device Icons shall be surrounded by a color coded boarder that indicates the status of each device.
 - A "Browser Viewport" to automatically access web based emergency information sites,
 - An "Image Viewport" to display a stored image of items relevant to the event highlighted in the event list area. Examples include Hardware identification, Equipment diagrams, etc.
 - b. Highlighting any event in the event list viewport shall automatically cause the viewports to display information relating to the highlighted event. Systems requiring multiple screens to display this information shall not be considered as equal.
 - c. Receipt of incoming events shall transmit event details to web clients.

- d. Receipt of incoming events shall email event details to responsible parties.
- 5. Workstation shall be capable of:
 - a. Acknowledging, silencing, and resetting all fire alarm functions.
 - b. Manually activating, deactivating, enabling, and disabling individual fire alarm points.
 - c. Generating status, maintenance and sensitivity reports for all fire alarm components.
 - d. Operating the smoke control system.
- 6. Workstation shall log all events and operator actions to history for future review.
- 7. Workstation shall be capable of logging the operator's comments for each event to history with time and date.
- 8. Workstation shall transmit system status to all connected web clients.

2.4 FIELD-MOUNTED SYSTEM COMPONENTS

A. Smoke Detectors and Accessories

- 1. Analog Addressable Smoke General
 - a. Each analog addressable smoke detector's sensitivity shall be capable of being programmed individually as: most sensitive, more sensitive, normal, less sensitive or least sensitive.
 - b. An alternate alarm sensitivity level shall be provided for each detector, which can be set to any of the five (5) sensitivity settings manually or automatically using a time of day event.
 - c. The detector's sensing element reference point shall automatically adjust, compensating for background environmental conditions such as dust, temperature, and pressure. Periodically, the sensing element real-time analog value shall be compared against its reference value. The detector shall provide a maintenance alert signal that 80% to 99% compensation has been used. The detector shall provide a dirty fault signal that 100% compensation has been used.
 - d. The system shall allow for changing of detector types for service replacement purposes without the need to reprogram the system. The replacement detector type shall automatically continue to operate with the same programmed sensitivity levels and functions as the detector it replaced. System shall display an off-normal condition until the proper detector type has been installed or change in the application program profile has been made.
- 2. Smoke Detector - Multi-Sensor Photo Thermal (Ceiling Mounted)
 - a. Provide analog/addressable multisensor combination photoelectric, thermal smoke detectors for all ceiling mounted locations. Alarm condition shall be based upon the combined input from the photoelectric and thermal detection elements. Separately mounted photoelectric detectors and heat detectors in the same location, clustered at the manufacturer's listed spacing is not an acceptable alternative. The system shall have the ability to set the sensitivity and alarm verification of each individual detector on the circuit. It shall be possible to automatically set the sensitivity of individual analog/addressable detectors for the day and night periods.
 - b. Each smoke detector shall be capable of transmitting alarm signals as well as normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings. Each detector microprocessor shall contain an environmental compensation algorithm that identifies and sets ambient environmental thresholds approximately six times an hour. The microprocessor 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. Basis of Design: Edwards model SIGA-PHD.
- 3. Smoke Detector - Photoelectric (Duct Mounted)
 - a. Provide analog/addressable photoelectric smoke detectors at all duct applications. The system shall have the ability to set the sensitivity and alarm verification of each of the individual detectors on the circuit. It shall be possible to automatically change the sensitivity of individual analog/addressable detectors for the day and night periods. Each smoke

detector shall be capable of transmitting alarm signals as well as normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings. Each detector microprocessor shall contain an environmental compensation algorithm that identifies and sets ambient environmental thresholds approximately six times an hour. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 80% and 100% of the allowable environmental compensation value.

- b. Provide key operated "normal-reset-test" switch at each duct smoke detector.
- c. Basis of Design: Edwards model SIGA-PD.
- 4. Duct Detector Housing
 - a. Provide smoke detector duct housing assemblies to mount an analog/addressable detector along with a standard, relay or isolator detector mounting base. The housing shall also protect the measuring chamber from damage and insects. The housing shall utilize an air exhaust tube and an air sampling inlet tube that extends into the duct air stream up to ten feet. Drilling templates and gaskets to facilitate locating and mounting the housing shall also be provided. The housing shall be finished in baked red enamel. Remote alarm LED indicators and remote test stations shall be provided.
 - b. Basis of Design: Edwards model SIGA-DH.

B. Heat Detectors

- 1. Fixed Temperature Heat Detector (Equipment Rooms)
 - a. Provide analog/addressable fixed temperature heat detectors within all equipment rooms. The heat detector shall have a nominal fixed temperature alarm point rating of 135°F (57°C). The heat detector shall be rated for ceiling installation at a minimum of 70 ft (21.3m) centers and be suitable for wall mount applications.
 - b. Basis of Design: Edwards model SIGA-HFD.
- 2. Fixed Temperature-ROR Heat Detector (Ceiling Mounted)
 - a. Provide analog/addressable combination fixed temperature / rate-of-rise detectors for all ceiling mounted locations. The heat detector shall have a nominal fixed temperature alarm point rating of 135°F (57°C) and a rate of rise alarm point of 15°F (9°C) per minute. The heat detector shall be rated for ceiling installation at a minimum of 70 ft (21.3m) centers and be suitable for wall mount applications.
 - b. Basis of Design: Edwards model SIGA-HRD.
 - c. Equipment rooms containing permanently installed fuel burning appliances and equipment shall be equipped with analog/addressable, combination, fixed temperature heat and carbon monoxide sensors. Sensors shall be equipped with a sounder base and temporal pattern generator for early detection.
 - 1) Basis of Design: Edwards model SIGA-PHCD with SIGA-AB4GT and SIGA-TCDR.

C. Detector Bases

- 1. Detector Base - Standard
 - a. Provide detector mounting base suitable for mounting on single gang, 3½ or 4 inch octagon box or 4 inch square box. The base shall, contain no electronics and support all series detector types.
 - b. Basis of Design: Edwards model SIGA-SB4.
- 2. Detector Base - Relay
 - a. Provide relay detector mounting base suitable for mounting on single gang, 3½ or 4 inch octagon box and 4 inch square box. The relay base shall support all detector types and have the following minimal requirements.
 - b. The relay shall be a bi-stable type and selectable for normally open or normally closed operation.
 - 1) The position of the contact shall be supervised.
 - 2) The relay shall automatically de-energize when a detector is removed.
 - 3) The operation of the relay base shall be controlled by its respective detector processor. Detectors operating standalone mode shall operate the relay upon

changing to alarm state. Relay bases not controlled by the detector microprocessor shall not be acceptable.

- 4) Form "C" Relay contacts shall have a minimum rating of 1 amp @ 30 Vdc and be listed for pilot duty.
- 5) Removal of the respective detector shall not affect communications with other detectors.

c. Basis of Design: Edwards model SIGA-RB.

D. Manual Stations

1. Manual Station - Double Action Single Stage

- a. Provide analog/addressable double action, single stage fire alarm stations at the locations shown on the drawings. The fire alarm station shall be of polycarbonate construction and incorporate an internal toggle switch. A locked test feature shall be provided. The station shall be finished in red with silver "PULL IN CASE OF FIRE" lettering. The manual station shall be suitable for mounting on 2 ½ (64mm) deep single gang boxes and 1 ½ (38mm) deep 4 square boxes with single gang covers.
- b. Provide factory manufactured boxes for all surface mounted applications.
- c. Basis of Design: Edwards model SIGA-278.

E. Notification Appliances

1. General

- a. All appliances which are supplied for the requirements of this specification shall be UL Listed for Fire Protective Service, and shall be capable of providing the "equivalent facilitation" which is allowed under the Americans with Disabilities Act Accessibilities Guidelines (ADA(AG)), and shall be UL 1971 Listed.
- b. All appliances shall be of the same manufacturer as the fire alarm control panel specified to insure absolute compatibility between the appliances and the control panels, and to insure that the application of the appliances are done in accordance with the single manufacturer's instructions.
- c. All notification appliances shall be white in administrative areas, and red in all other areas, unless noted otherwise on the drawings.

2. Heavy Duty Horns (Exterior Locations)

- a. Provide heavy duty electronic horns for exterior locations. Horns shall be selectable for high or low dBA output and steady or temporal output. At the high output setting, the horn shall provide a 85 dBA continuous sound output or a 82 dBA temporal sound output, when measured in reverberation room per UL-464. In and out screw terminals shall be provided for wiring. Weatherproof wall boxes shall be provided for outdoor applications.
- b. Basis of Design: Edwards Integrity series.

3. Low Profile Speaker (Interior Locations)

- a. Provide low profile wall mount speakers within interior locations. The low profile speaker shall not extend more than 1" (2.5cm) past the finished wall surface, and provide a switch selectable audible output of 2W (90dBA), 1W (87dBA), 1/2W (84dBA), or 1/4W (81dBA) at 10 ft. when measured in reverberation room per UL-464.
- b. Wattage setting shall be visible with the cover installed. When the cover is installed, no mounting hardware shall be visible. In and out screw terminals shall be provided for all wiring. The low profile speaker shall mount in a 4" x 2 1/8" square electrical box, without trims or extension rings.
- c. Provide factory manufactured boxes for all surface mounted applications.
- d. Basis of Design: Edwards Genesis G4 series.

4. Speaker-Ceiling Mount-8in

- a. Provide 8" ceiling mounted speakers at the locations shown on the drawings. In and out screw terminals shall be provided for wiring. Speaker baffles shall be round <square> steel with white finish as required. Provide square surface mount boxes with matching finish where required. Speakers shall provide 1/2W, 1W, 2W, and 4W power taps for use with 25V or 70V systems. At the 4 watt setting, the speaker shall provide a 94 dBA sound output a frequency of 1000 Hz. when measured in an anechoic chamber at 10 ft.

- b. Basis of Design: Edwards Integrity series.
- 5. Low Profile Speaker-Strobe
 - a. Provide low profile wall mount speaker/strobes at the locations shown on the drawings. The low profile speaker/strobe shall not extend more than 1" (2.5cm) past the finished wall surface, and provide a switch selectable audible output of 2W (90dBA), 1W (87dBA), 1/2W (84dBA), or 1/4W (81dBA) at 10 ft. when measured in reverberation room per UL-464.
 - b. Strobes shall provide synchronized flash output that shall be switch selectable for output values of 15cd, 30cd, 75cd & 110cd. Wattage and candela settings shall be visible with the cover installed. When the cover is installed, no mounting hardware shall be visible. In and out screw terminals shall be provided for all wiring. The low profile speaker/strobes shall mount in a 4" x 2 1/8" square electrical box, without trims or extension rings.
 - c. Provide factory manufactured boxes for all surface mounted applications.
 - d. Basis of Design: Edwards Genesis G4 series.
- 6. Speaker-Strobe Ceiling Mount-8in
 - a. Provide 8" ceiling mounted speaker/strobes at the locations shown on the drawings. In and out screw terminals shall be provided for wiring. Speaker baffles shall be round or square, steel with white finish as required. Provide square surface mount boxes with matching white finish as required. Speakers shall provide 1/2w, 1w, 2w, and 4W power taps for use with 25V or 70V systems. At the 4 watt setting, the speaker shall provide a 94 dBA sound output a frequency of 1000 Hz. when measured in an anechoic chamber at 10 ft. Strobes shall provide synchronized flash outputs. Strobe output shall be determined as required by its specific location and application from a family of 15cd, 30cd, 75cd, and 110cd devices.
 - b. Basis of Design: Edwards Integrity series.
- 7. Low Profile Strobes
 - a. Provide low profile wall mounted strobes at the locations shown on the drawings. In and out screw terminals shall be provided for wiring. Strobes shall provide synchronized flash outputs. Strobe output shall be determined as required by its specific location and application from a family of 15cd, 30cd, 60cd, 75cd, or 110cd devices. Low profile strobes shall mount in a single gang box.
 - b. Provide factory manufactured boxes for all surface mounted applications.
 - c. Basis of Design: Edwards Genesis series.
- 8. Strobe Ceiling Mount
 - a. Provide low profile, 7 inch diameter ceiling mounted strobes at the locations shown on the drawings. Devices shall be round and shall not extend more than 1.6 inches past the finished ceiling surface.
 - b. Strobes shall provide synchronized flash outputs. Strobe output shall be from a family of 15cd, 30cd, 75cd, and 110cd devices.
 - c. Low profile ceiling strobes shall mount to a 4 inch square x 2-1/8 inch deep box.
 - d. Basis of Design: Edwards Genesis "GC" series.
- 9. Speaker-Strobe and Speakers Weatherproof
 - a. Provide low profile, weatherproof, wall mounted speaker-strobes or speakers at the exterior locations shown on the drawings.
 - b. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections for speaker with clear fire strobe.
 - c. Rated for outdoor use and wall mounted.
 - d. The weatherproof speaker-strobe or speaker shall mount in a factory supplied back box.
 - e. Strobe lights rated light output shall be 15/30/75/110 CD, field selectable and synchronized.
- F. Interior Medium Power Speaker Arrays:
 - 1. Provide UL864 interior medium power speaker arrays MPSA at the locations shown on the drawings.
 - 2. Each MPSA site shall include a local control unit, amplifier, standby batteries, charger, power supply, mounting bracket.
 - a. Sound levels at any location where personnel may be located shall be at least 15dBA above ambient but not exceed 120 dBA when measured on the A-scale of a standard sound level meter at slow response.

3. Speakers and control unit
 - a. 650 Watt Omni-directional MPSA Assembly (5 of 5 Active Panels) with lockable cabinet, 250 Watt amplifiers, amplifier terminal panel(s), universal riser supervisory module(s) and 110V/60 Hz. battery backup.
 - b. Provide MPSA amplifier cabinets and components as indicated on the drawings.
4. The MPSA shall be an Edwards MN-HSMP650G70 series.

2.5 INITIATION AND CONTROL MODULES

A. General

1. It shall be possible to address each intelligent module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable. The personality of multifunction modules shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Modules requiring EPROM, PROM, ROM changes or DIP switch and/or jumper changes shall not be acceptable. The modules shall have a minimum of 2 diagnostic LEDs mounted behind a finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes which can be retrieved for troubleshooting assistance. Input and output circuit wiring shall be supervised for open and ground faults. The module shall be suitable for operation in the following environment:
 - a. Temperature: 32oF to 120oF (0oC to 49oC)
 - b. Humidity: 0-93% RH, non-condensing

B. Control Relay Module

1. Provide intelligent control relay modules at the locations shown on the drawings. The Control Relay Module shall provide one form "C" dry relay contact rated at 2 amps @ 24 Vdc to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems. The position of the relay contact shall be confirmed by the system firmware. The control relay module shall be suitable for mounting on 2 ½" (64mm) deep single gang boxes or 1 ½" (38mm) deep 4" square boxes with single gang covers.
2. Basis of Design: Edwards model SIGA-CR.

C. Dual Input Module

1. Provide intelligent dual input modules at the locations shown on the drawings. The Dual Input Module shall provide two (2) supervised Class B input circuits each capable of a minimum of 4 personalities, each with a distinct operation. The module shall be suitable for mounting on 2 ½" (64mm) deep single gang boxes or 1 ½" (38mm) deep 4" square boxes with single gang covers. The dual input module shall support the following circuit types:
 - a. Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
 - b. Normally-Open Alarm Delayed Latching (Waterflow Switches)
 - c. Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)
 - d. Normally-Open Active Latching (Supervisory, Tamper Switches)
2. Basis of Design: Edwards model SIGA-CT2.

D. Dual Input Signal Module

1. Provide intelligent dual input signal modules at the locations shown on the drawings. The Dual Input (Dual Riser Select) Signal Module shall provide a means to selectively connect one of two (2) signaling circuit power risers to one (1) supervised output circuit. The module shall be suitable for mounting on 2 ½" (64mm) deep 2-gang boxes or 1 ½" (38mm) deep 4" square boxes with 2-gang covers. The dual input signal module shall support the following operation:
2. Audible/Visible Signal Power Selector (Polarized 24 Vdc @ 2A, 25 Vrms @ 50w or 70 Vrms @ 35w of Audio).
3. Basis of Design: Edwards model SIGA-CC2.

E. Isolator Module

1. Provide intelligent fault isolators modules at the locations shown on the drawings. The Isolator Module shall be capable of isolating and removing a fault from a class A data circuit while allowing the remaining data loop to continue operating. The module shall be suitable for mounting on 2 ½" (64mm) deep 2-gang boxes or 1 ½" (38mm) deep 4" square boxes with 2-gang covers.
2. Basis of Design: Edwards model SIGA-IM.

F. Single Input Module

1. Provide intelligent single input modules at the locations shown on the drawings. The Single Input Module shall provide one (1) supervised Class B input circuit capable of a minimum of 4 personalities, each with a distinct operation. The module shall be suitable for mounting on 2 ½" (64mm) deep 1-gang boxes or 1 ½" (38mm) deep 4" square boxes with 1-gang covers. The single input module shall support the following circuit types:
 - a. Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
 - b. Normally-Open Alarm Delayed Latching (Waterflow Switches)
 - c. Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)
 - d. Normally-Open Active Latching (Supervisory, Tamper Switches)
2. Basis of Design: Edwards model SIGA-CT1.

G. Single Input Signal Module

1. Provide intelligent single input signal modules at the locations shown on the drawings. The Single Input (Single Riser Select) Signal Module shall provide one (1) supervised Class B output circuit capable of a minimum of 2 personalities, each with a distinct operation. When selected as a telephone power selector, the module shall be capable of generating its own "ring tone". The module shall be suitable for mounting on 2 ½" (64mm) deep 2-gang boxes or 1 ½" (38mm) deep 4" square boxes with 2-gang covers. The single input signal module shall support the following operations:
 - a. Audible/Visible Signal Power Selector (Polarized 24 Vdc @ 2A, 25Vrms @50w or 70 Vrms @ 35 Watts of Audio)
2. Basis of Design: Edwards model SIGA-CC1.

H. Suppression System Releasing Module

1. Provide addressable suppression system releasing interface modules at the locations shown on the drawings. The interface shall be suitable for preaction and deluge sprinkler systems and clean extinguishing agent release. The interface shall provide supervised Class B circuits required for solenoid activation, manual release, system abort, and audible and visible notification of pending release. The interface shall provide all required release and abort timing functions. The interface shall be listed for use with solenoid releasing valves that has both ULI listing and FM approval. The solenoid release circuit shall be provided with a manual disconnect switch for system maintenance.
2. Basis of Design: Edwards model SIGA-REL.

I. Universal Class AB Module

1. Provide intelligent class A/B modules at the locations shown on the drawings. The Universal Class A/B Module shall be capable of a minimum of fifteen (15) distinct operations. The module shall be suitable for mounting on 2 ½" (64mm) deep 2-gang boxes or 1 ½" (38mm) deep 4" square boxes with 2-gang covers. The universal class A/B module shall support the following circuit types:
 - a. Two (2) supervised Class B Normally-Open Alarm Latching.
 - b. Two (2) supervised Class B Normally-Open Alarm Delayed Latching.
 - c. Two (2) supervised Class B Normally-Open Active Non-Latching.
 - d. Two (2) supervised Class B Normally-Open Active Latching.
 - e. One (1) form "C" dry relay contact rated at 2 amps @ 24 Vdc.
 - f. One (1) supervised Class A Normally-Open Alarm Latching.
 - g. One (1) supervised Class A Normally-Open Alarm Delayed Latching.
 - h. One (1) supervised Class A Normally-Open Active Non-Latching.
 - i. One (1) supervised Class A Normally-Open Active Latching.

- j. One (1) supervised Class A 2-wire Smoke Alarm Non-Verified.
 - k. One (1) supervised Class B 2-wire Smoke Alarm Non-Verified.
 - l. One (1) supervised Class A 2-wire Smoke Alarm Verified
 - m. One (1) supervised Class B 2-wire Smoke Alarm Verified
 - n. One (1) supervised Class A Signal Circuit, 24Vdc @ 2A.
 - o. One (1) supervised Class B Signal Circuit, 24Vdc @ 2A.
2. Basis of Design: Edwards model SIGA-UM.

2.6 CONDUCTORS

- A. The requirement of this section apply to all system conductors, including all signaling line, initiating device, notification appliance, auxiliary function, remote signaling, AC and DC power and grounding/shield drain circuits, and any other wiring installed by the Contractor pursuant to the requirements of these Specifications.
- B. All circuits shall be rated power limited in accordance with NEC Article 760.
- C. Installed in conduit or enclosed raceway.
- D. All new system conductors shall be of the type(s) specified herein.
- 1. All initiating circuit, signaling line circuit, AC power conductors, shield drain conductors and grounding conductors, shall be solid copper, stranded or bunch tinned (bonded) stranded copper.
 - 2. All signaling line circuits, including all addressable initiating device circuits shall be 18 AWG minimum multi-conductor jacketed twisted cable or twisted shielded or as per manufacturer's requirements.
 - 3. All non-addressable initiating device circuits, 24 VDC auxiliary function circuits shall be 18 AWG minimum or per manufacturer's requirements.
 - 4. All notification appliance circuit conductors shall be solid copper or bunch tinned (bonded) stranded copper. Where stranded conductors are utilized, a maximum of 19 strands shall be permitted for #12/AWG and larger conductors. Minimum size conductor shall be #12 AWG.
 - 5. All audible notification appliance circuits shall be 14 AWG minimum twisted pairs or twisted pairs shielded or per manufacturer's requirements.
 - 6. All visual notification appliance circuits shall be #12 AWG minimum THHN or twisted pairs or twisted shielded pairs or per manufacturer's requirements.
 - 7. Color code fire alarm conductors as follows:

<u>ITEM</u>	<u>COLOR</u>
Initiating Device	Orange/Brown
Speakers	Red
Horn (Exterior)	Blue and Yellow
Flashing Lights	Blue and Yellow
Control Panel Power	Black, White and Green
Air Handler Shutdown	Purple
Door Holders	White

- 8. All conductors shall be terminated with crimp type, open end, space lugs using tool approved by lug manufacturer. Terminal cabinets shall be provided with screw type terminal strips and plywood backboards.

2.7 CONDUCTORS AND RACEWAY

- A. Except as otherwise required by Code and/or these Specifications, the installation of all system circuits shall conform to the requirements of Article 760 and raceway installation to the applicable sections of

NFPA 70, National Electrical Code. Fire alarm circuit wiring shall include all circuits described in Section 760.1 including Fine Print Note No. 1 (FPN No. 1), and as defined by the manufacturer's UL listing.

- B. The entire system shall be installed in a skillful manner in accordance with approved manufacturer's installation manuals, shop drawings and wiring diagrams. The contractor shall furnish all conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for the complete installation. All wiring shall be of the type required by the NEC and approved by local authorities having jurisdiction for the purpose.
- C. Any shorts, opens, or grounds found on new or existing wiring shall be corrected prior to the connection of these wires to any panel component or field device.
- D. The contractor shall neatly tie-wrap all field-wiring conductors in the gutter spaces of the control panels and secure the wiring away from all circuit boards and control equipment components. All field-wiring circuits shall be neatly and legibly labeled in the control panel. No wiring except home runs from life safety system circuits and system power supply circuits shall be permitted in the control panel enclosures. No wiring splices shall be permitted in a control panel enclosure.
- E. All penetration of floor slabs and firewalls shall be fire stopped in accordance with all local fire codes.

2.8 CONDUIT RACEWAY

- A. All systems and system components listed to UL864 Control Units for Fire Protective Signaling Systems maybe installed within a common conduit raceway system, in accordance with the manufacture's recommendations. System(s) or system components not listed to the UL864 standard shall utilize a separate conduit raceway system for each of the sub-systems.
- B. The requirements of this section apply to all system conduits, raceways, electrical enclosures, junction boxes, pull boxes and device back boxes.
- C. All system conduits shall be of the sizes and types specified.
- D. All system conduits shall be EMT, 3/4 -inch minimum, except for flexible metallic conduit used for whips to devices only, maximum length 6 feet, 3/4-inch diameter, minimum.
- E. All system conduits, which are installed in areas, which may be subject to physical damage or weather, shall be IMC or rigid steel, 3/4 -inch minimum.
- F. Conduits shall be sized according to the conductors contained therein. Cross sectional area percentage fill for system conduits shall not exceed 40%.
- G. All fire alarm conduit systems shall be routed and installed to minimize the potential for physical, mechanical or by fire damage, and so as not to interfere with existing building systems, facilities or equipment, and to facilitate service and minimize maintenance.
- H. All conduits, except flexible conduit whips to devices, shall be solidly attached to building structural members, ceiling slabs or permanent walls. Conduits shall not be attached to existing conduit, duct work, cable trays, other ceiling equipment, drop ceiling hangers/grids or partition walls, except where necessary to connect to initiating, notification, or auxiliary function devices.
- I. All system conduits, junction boxes, pull boxes, terminal cabinets, electrical enclosures and device back boxes shall be readily accessible for inspection, testing, service and maintenance.
- J. All electrical junction boxes shall be labeled "Fire Alarm System" with decal or other approved markings and shall be painted "red".

3.1 EXAMINATION

- A. Section 017300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
 - 1. Examine areas in which Work of this Section is to be performed.
 - 2. Verify that surfaces and site conditions are ready to receive Work.
- C. Report in writing to USPS Project Manager prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

3.2 INSTALLATION

- A. General
 - 1. All equipment shall be attached to walls and ceiling/floor assemblies and shall be mounted firmly in place. Detectors shall not be supported solely by suspended ceilings. Fasteners and supports shall be sized to support the required load.
- B. Installation Sequence
 - 1. Installation of the systems shall be conducted in stages and phased such that circuits and equipment are installed in the following order:
 - a. Riser conduits, AC power conduits and control cabinets.
 - b. Control panel(s), control component(s), remote annunciator(s), and printer(s).
 - c. Conduits and wiring for complete notification circuits and appliance installation throughout facility.
 - d. Pre-test the audible and visual notification appliance circuits.
 - e. Install all new detection devices.
 - f. Terminate between field devices and the associated control equipment.
 - g. Complete the interface to all suppression and ancillary shutdown systems.
 - h. Complete contractor pre-test of system.
 - i. Complete system testing
- C. Detectors:
 - 1. A unique identification number shall be assigned to each detector. (Identification shall be by zone number and device number within the zone.) This number shall be noted on the submittals and as built plans, and also be permanently mounted adjacent to the detector or affixed to its base.
 - 2. Smoke- or Heat-Detector Spacing:
 - a. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
 - b. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
 - c. Smooth ceiling spacing shall not exceed 30 feet (9 m).
 - d. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A or Appendix B in NFPA 72.
 - e. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.

- f. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.
 3. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.
 4. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.
 5. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
- D. Install products in accordance with NFPA standards and manufacturer's published instructions.
- E. Install manual station with operating handle 44 inches above floor. Install audible and visual signal devices in accordance with NFPA 72 and ANSI/UL 1971.
- F. End-of-line resistor device at the last easily accessible mount device or separate box adjacent to last device.
- G. Flush mount outlet box for electric door holder to withstand 80 pounds pulling force.
- H. Make wiring connections to door release devices, sprinkler flow switches, sprinkler valve tamper switches, fire suppression system control panels, and all other devices.
- I. Surge suppression shall be provided for all 120 Volt fire alarm equipment and all low voltage wiring exiting or exterior of the facility.

3.3 CONNECTIONS

- A. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
1. Alarm-initiating connection to elevator recall system and components.
 2. Supervisory connections at sprinkler valve supervisory switches.
 3. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
 4. Supervisory connections at elevator shunt trip breaker.
 5. Supervisory connections at fire-pump controllers.
 6. Supervisory connects at mail processing equipment shutdown relay.

3.4 PREPARATION

- A. Coordinate work of this Section with other affected work and construction schedule.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Manufacturer's Field Services: Provide services of NICET certified Level III technician to supervise installation, adjustments, final connections, and system testing. Submit written certification on manufacturers letterhead to USPS Project Manager that system has been installed in accordance with applicable codes and is functioning properly. Provide copy of "Certificate of Completion" and place inside plastic envelope at Fire Alarm Control Panel.

- C. Tests and Inspections: The contractor shall perform all testing in occupied facilities at times of day that present the lowest impact and disruption to business and activities. Coordinate all testing in occupied buildings with the building owner's representative to assure that fire alarm system testing does not interrupt operations. This may require extensive after hours work to perform such testing.
- D. Visual Inspection:
 - 1. Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - 2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - 3. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72. The systems operation matrix created by the equipment supplier shall be used to identify each alarm input and verify all associated output functions.
- E. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.
- G. Advise Plant, Engineer and authorities having jurisdiction in advance of dates and times that tests are to be performed on fire alarm systems.
- H. The system test plan shall include but not be limited to the following:
 - 1. Visually inspect all wiring.
 - 2. Verify the absence of unwanted voltages between circuit conductors and ground. The tests shall be accomplished at the preliminary test with results available at the final acceptance test.
 - 3. System wiring shall be tested to demonstrate correct system response for the following conditions:
 - a. Open, shorted and grounded signal line circuits.
 - b. Open, shorted and grounded notification appliance circuits.
 - 4. System indications shall be demonstrated as follows:
 - a. Correct message content for each alarm input at all system displays.
 - b. Correct annunciator light for each alarm input at each graphic display.
 - c. Correct history logging for all system activity.
 - d. Correct sensitivity for all smoke detection devices. The use of system generated sensitivity reports is acceptable in meeting this requirement.
 - e. Correct signals sent to the Central Monitoring Station.
 - 5. Notification appliances shall be demonstrated as follows:
 - a. All alarm notification appliances actuate as programmed
 - b. The system shall be tested for interior building audibility of 15 dBA-fast over ambient condition.
 - c. MPSA's shall be tested for an outside audibility level of 15 dBA-fast over ambient condition and intelligibility. Intelligibility shall be tested to ensure Common Intelligibility Standard (CIS) rating of 0.7 or Sound Transmission Index of 0.5 in outdoor areas during normal weather conditions. Intelligibility may be less than 0.7 CIS in areas of the zone if it can be determined that a voice signal is being broadcast and an individual could walk less than 164 feet to find a location in the zone with at least 0.7 CIS. Values of 0.65 through 0.74 shall be rounded to 0.7. The mean value of at least 3 readings shall be required to compute the intelligibility score at each test location.

- d. For 24VDC NACS, measure and record the voltage at the most remote appliance on each notification appliance circuit, while operating.
 6. System control functions shall be demonstrated as follows: In accordance with the system operation matrix.
 7. System off premises reporting functions shall be demonstrated as follows: Correct information received for each "Contact ID – Point Address" event.
 8. Secondary power supply (battery) capacity capabilities shall be demonstrated as follows, if all FACP's and associated booster power supplies are not connected to an emergency power circuit that is supported by an on-site generator:
 - a. System battery voltages and charging currents shall be measured and recorded at the fire alarm control panels.
 - b. System primary power shall be disconnected for 24 hours. At the end of that period, an alarm condition shall be created and the system shall perform as specified for a period of 5 minutes.
 - c. System primary power shall be restored for forty-eight (48) hours.
 - d. System battery voltages and charging currents shall again be measured and recorded at the fire alarm control panels.
 9. Verify the "As Built" record drawings are accurate.
- I. Preliminary Testing: Conduct preliminary tests to ensure that all devices and circuits are functioning properly. Tests shall meet the requirements of the written test plan. Correct any deficiencies, omissions or anomalies and retest the affected devices to assure proper function per the specification.
- J. Acceptance Testing:
 1. A final acceptance test shall not be scheduled until the system manuals are provided to and approved by the owner and the following are provided at the job site:
 - a. (1) "As Built" Record drawings of the system as actually installed
 - b. (2) A copy of the system operation matrix.
 2. The acceptance inspector shall use the system "As Built" record drawings in combination with the system operation matrix and the written acceptance test plan during the testing to verify system operation.
 3. Should the system not perform to the above criteria it shall not be accepted and the Contractor shall correct all deficiencies and shall re-test the system at Contractor's expense in the presence of the Architect using the same test criteria.
 4. The building owner's representative shall witness the final tests.
 5. The central station monitoring company and/or fire department shall be notified before final test in accordance with local requirements.
 6. Operate every installed device to verify proper operation and correct annunciation at control panel.
 7. Open signaling line circuits and notification appliance circuits in at least 2 locations to verify presence of supervision.
- K. Test Reports:
 1. A "Fire Alarm System Record of Completion" per the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in shall be prepared by the Contractor. Submit three (3) copies to the Architect. The report shall include, but not be limited to:
 - a. A list of all equipment installed and wired.
 - b. Certification that all equipment is properly installed and functions and conforms to these specifications.
 - c. Sensitivity settings for each ionization and photoelectric detector as measured in place with the HVAC system operating.
 - d. Technician's name, certificate number and date.

3.6 WARRANTY AND MAINTENANCE

- A. Warranty: The contractor shall warranty all materials, installation and workmanship for 36 months year from date of acceptance, unless otherwise specified. A copy of the manufacturer's warranty shall be provided with close-out documentation and included with the operation and installation manuals. The full cost of maintenance labor and materials required to correct any defect during the warranty period shall be included in the submitted bid.

3.7 TRAINING

- A. The System Supplier shall schedule and present a minimum of four (4) hours of documented formalized instruction for the building owner, detailing the proper operation of the installed System.
- B. The instruction shall be presented in an organized and professional manner by a person factory trained in the operation and maintenance of the equipment and who is also thoroughly familiar with the installation.
- C. The instruction shall cover the schedule of maintenance required by NFPA 72 and any additional maintenance recommended by the system manufacturer.
- D. Instruction shall be made available to the Local Municipal Fire Department if requested by the AHJ.

END OF SECTION