

## **Bid Documents**



### **CITY OF RICHMOND FIRE ALARM SYSTEM REPLACEMENT JUVENILE DETENTION CENTER**

1700 Oliver Hill Way  
Richmond, Virginia

January 27, 2017

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**CITY OF RICHMOND  
JUVENILE DETENTION CENTER  
FIRE ALARM PANEL REPLACEMENT**

**BID DOCUMENTS  
January 27, 2017**

**TECHNICAL SPECIFICATIONS**

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Division 26

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## SECTION 260100 - BASIC ELECTRICAL REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 26.

#### 1.2 SUMMARY

- A. This Section includes general administrative and procedural requirements for electrical installations:
  - 1. Submittals.
  - 2. Coordination drawings.
  - 3. Record documents.
  - 4. Maintenance manuals.
  - 5. Rough-ins.
  - 6. Electrical installations.
  - 7. Cutting and patching.
- B. Related Sections: The following sections contain requirements that relate to this section:
  - 1. Division 26 Section "BASIC ELECTRICAL MATERIALS AND METHODS," for materials and methods common to the remainder of Division 26.

#### 1.3 SUBMITTALS

- A. Submit product data and shop drawings per Division 26 sections for review prior to start of construction. All submittals shall be submitted in PDF format. Paper submittals are not acceptable. Submittals containing sheets scanned from printed material will be automatically Rejected and returned to Contractor without review. Also submittals containing poor quality copies will be automatically Rejected and returned to Contractor without review.
- B. Cover Sheet: The electrical related shop drawings and product data submittals shall be provided with a cover sheet that includes at a minimum the following information: Project name, Contractor name, electrical sub-contractor name, supplier name, Specification section or sheet reference, variation from plans (yes/no), Contractor approval, and electrical sub-contractor approval. A 5x3" empty rectangle shall be provided at the bottom of the page reserved for Engineer review stamp

#### 1.4 RECORD DOCUMENTS

- A. Prepare record documents, also known as Contractor's Red-lines, in accordance with Owner's requirements. Red-lines shall include all changes to the design documents and the installed conditions for:
  - 1. Major raceway systems, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements.
  - 2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
  - 3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

## 1.5 MAINTENANCE MANUALS

- A. Prepare maintenance manuals in accordance with Owner's requirements. In addition to the requirements, include the following information for equipment items:
  - 1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
  - 2. Manufacturer's published installation and operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
  - 3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
  - 4. Servicing instructions and lubrication charts and schedules.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - PART 1 - EXECUTION

### 3.1 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected. Refer to equipment specifications through Division 26 for rough-in requirements.

### 3.2 ELECTRICAL INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate electrical systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
9. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
10. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified in Division 26 Section "BASIC ELECTRICAL MATERIALS AND METHODS."

### 3.3 CUTTING AND PATCHING

#### A. General: The following requirements apply:

1. Perform cutting, fitting, and patching of electrical equipment and materials required to:
  - a. Uncover Work to provide for installation of ill-timed Work.
  - b. Remove and replace defective Work.
  - c. Remove and replace Work not conforming to requirements of the Contract Documents
  - d. Install equipment and materials in existing structures.
2. Cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new Work.
3. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
4. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
5. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
6. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

END OF SECTION 260100

BASIC ELECTRICAL REQUIREMENTS  
JUVENILE DETENTION CENTER  
FIRE ALARM SYSTEM REPLACEMENT

260100-3





## SECTION 260500 - BASIC ELECTRICAL MATERIALS AND METHODS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Supporting devices for electrical components.
  - 2. Electrical identification.
  - 3. Grounding.
  - 4. Electrical demolition.
  - 5. Cutting and patching for electrical construction.
  - 6. Touchup painting.

#### 1.3 QUALITY ASSURANCE

- A. Source Limitations: Provide fuses from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

#### 1.4 COORDINATION

- A. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- B. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.
- C. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

## PART 2 - PRODUCTS

### 2.1 SUPPORTING DEVICES

- A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.
- B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
- C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch diameter slotted holes at a maximum of 2 inches o.c., in webs.
- D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
- E. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
- F. Expansion Anchors: Carbon-steel wedge or sleeve type.
- G. Toggle Bolts: All-steel springhead type.
- H. Powder-Driven Threaded Studs: Heat-treated steel.

### 2.2 ELECTRICAL IDENTIFICATION

- A. Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.
- B. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than 1 inch wide by 3 mils thick.
- C. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
- D. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch minimum thickness for signs up to 20 sq. in. and 1/8-inch minimum thickness for larger sizes. Engraved legend in black letters on white background.
- E. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment, including central or master unit of each system. This includes alarm systems. Unless otherwise indicated, provide three lines of text with 3/8-inch high lettering on 2-inch high label; where four lines of text are required, use labels 2-1/2 inches high. Use white lettering on red field. Provide additional information as listed below:
  - 1. Fire alarm control panel: ID and source branch circuit.

- F. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

## 2.3 GROUNDING

- A. Grounding Conductors:
  - 1. For insulated conductors, comply with Division 26 "Conductors and Cables".
  - 2. Equipment Grounding Conductors: Insulated with green-colored insulation.
- B. Connector Products:
  - 1. Bolted Connectors: Bolted-pressure-type connectors, or compression type.

## 2.4 TOUCHUP PAINT

- A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
- B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

## PART 3 - EXECUTION

### 3.1 ELECTRICAL EQUIPMENT INSTALLATION

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- D. Right of Way: Give to raceways and piping systems installed at a required slope.

### 3.2 ELECTRICAL SUPPORTING DEVICE APPLICATION

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
- B. Dry Locations: Steel materials.
- C. Selection of Supports: Comply with manufacturer's written instructions.
- D. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

### 3.3 SUPPORT INSTALLATION

- A. Install support devices to securely and permanently fasten and support electrical components.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- F. Install 1/4-inch diameter or larger threaded steel hanger rods, unless otherwise indicated.
- G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.
- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Simultaneously install vertical conductor supports with conductors.
- J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.
- K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- L. Install sleeves for cable and raceway penetrations of walls with core-drilled holes. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies.
- M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
  - 1. Wood: Fasten with wood screws or screw-type nails.
  - 2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
  - 3. Existing Concrete: Expansion bolts. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
  - 4. Steel: Welded threaded studs or spring-tension clamps on steel.

- a. Field Welding: No Allowed.
5. Light Steel: Sheet-metal screws.
6. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

### 3.4 IDENTIFICATION MATERIALS AND DEVICES

- A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.
- C. Self-Adhesive Identification Products: Clean surfaces before applying.
- D. Identify raceways and cables with color banding as follows:
  1. Bands: Pretensioned, snap-around, colored plastic sleeves or colored adhesive marking tape. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
  2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
  3. Junction Box Covers: Paint covers of concealed junction boxes. Apply paint prior to installation on boxes.
  4. Colors: As follows:
    - a. Fire Alarm System: Red.
- E. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.
- F. Circuit Identification Labels on Outlet Boxes, Junction Boxes and Pull Boxes: Install labels externally.
  1. Concealed junction and pull boxes: Neat handwritten label using permanent black marker.
  2. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.
- G. Color-code 208/120-V 3-phase system feeder, and branch-circuit conductors throughout the electrical system as follows:
  1. Phase A: Black.
  2. Phase B: Red.
  3. Phase C: Blue.
  4. Neutral: White.
  5. Ground: Green.

### 3.5 GROUNDING APPLICATION

- A. In raceways, use insulated equipment grounding conductors.

### 3.6 FIRESTOPPING

- A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Comply with applicable UL assembly details.

### 3.7 DEMOLITION

- A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
- B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.
- C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.
- D. Remove demolished material from Project site.
- E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.
- F. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

### 3.8 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

### 3.9 FIELD QUALITY CONTROL

- A. Inspect installed components for damage and faulty work, including the following:
  - 1. Supporting devices for electrical components.
  - 2. Electrical identification.
  - 3. Fire Alarm Demolition.
  - 4. Cutting and patching for electrical construction.

- 5. Touchup painting.

### 3.10 REFINISHING AND TOUCHUP PAINTING

- A. Refinish and touch up paint.
  - 1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
  - 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.

### 3.11 CLEANING AND PROTECTION

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 260500





## SECTION 260600 – CONDUCTORS, RACEWAYS, AND WIRING DEVICES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600V and less.
  - 2. Raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
  - 1. Division 26 Section "Basic Materials And Methods" for raceways and box supports.
- C. Definitions:
  - 1. EMT: Electrical metallic tubing.
  - 2. FMC: Flexible metal conduit.
  - 3. GFCI: Ground-fault circuit interrupter. Also referred to as GFI.
  - 4. LFMC: Liquidtight flexible metal conduit.
  - 5. RMC: Rigid metal conduit.

#### 1.3 SUBMITTALS

- A. Product Data:
  - 1. For wires and cables.
  - 2. For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: Include layout drawings showing components and wiring for nonstandard boxes, enclosures, and cabinets.

#### 1.4 QUALITY ASSURANCE

- A. Listing and Labeling: Provide all products specified in this Section that are listed and labeled. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.

- B. Comply with NFPA 70.

## 1.5 COORDINATION

- A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access. Revise locations and elevations from those indicated, as required to suit field conditions, and as approved by Engineer or Architect.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store all materials in dry location.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- 1. Wires and Cables:

- a. American Insulated Wire Corp.; Leviton Manufacturing Co.
- b. BICC Brand-Rex Company.
- c. Southwire Company.

- 2. Connectors for Wires and Cables:

- a. AMP Incorporated.
- b. General Signal; O-Z/Gedney Unit.
- c. 3M Company; Electrical Products Division.

- 3. Metal Conduit and Tubing:

- a. Grinnell Co.; Allied Tube and Conduit Div.
- b. Spiraduct, Inc.
- c. Wheatland Tube Co.

- 4. Boxes, Enclosures, and Cabinets:

- a. Erickson Electrical Equipment Co.
- b. Hoffman Engineering Co.; Federal-Hoffman, Inc.
- c. Hubbell Inc.; Raco, Inc.
- d. Thomas & Betts Corp.

### 2.2 CONDUCTORS AND CABLES

- A. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3 "Wire and Insulation Applications" Article.
- B. Conductor Material: Copper.
- C. Stranding: Solid conductor for No. 10 AWG and smaller; stranded conductor for larger than No. 10 AWG.
- D. Minimum size: #12AWG for power and lighting circuits.
- E. Connectors and Splices:
  - 1. UL-listed, factory-fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated. Comply with Project's installation requirements and as specified in Part 3 "Wire and Insulation Applications" Article.
  - 2. Push-in type splice connectors are prohibited.

### 2.3 RACEWAY AND BOXES

- A. Metal Conduit and Tubing:
  - 1. Rigid Steel Conduit: ANSI C80.1.
  - 2. EMT and Fittings: ANSI C80.3.
    - a. Fittings: Steel compression type. Cast, pot metal, set-crew, or crimp type fittings are not acceptable. Box connectors shall be insulated throat type.
  - 3. FMC: Zinc-coated steel.
  - 4. LFMC: Flexible steel conduit with PVC jacket.
  - 5. Fittings: NEMA FB 1; compatible with conduit/tubing materials.
- B. Metal Wireways:
  - 1. Material: Sheet metal sized and shaped as indicated.
  - 2. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
  - 3. Wireway Covers: Hinged type.
  - 4. Finish: Manufacturer's standard enamel finish.
- C. Outlet and Device Boxes:
  - 1. Sheet Metal Boxes: NEMA OS 1.
  - 2. Cast-Metal Boxes: NEMA FB 1, Type FD, cast box with gasketed cover.
- D. Pull and Junction Boxes:
  - 1. Small Sheet Metal Boxes: NEMA OS 1.
  - 2. Cast-Metal Boxes: NEMA FB 1, cast box with gasketed cover.
- E. Enclosures and Cabinets:

1. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
  - a. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment.

## PART 3 - EXECUTION

### 3.1 CONDUCTORS AND CABLES

- A. Examination: Examine raceways and building finishes to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Wire and Insulation Applications:
  1. Branch Circuits: Type THHN/THWN, in raceway.
  2. Fire Alarm Circuits: Type THHN/THWN, in raceway.
  3. Class 2 Control Circuits: Type THHN/THWN, in raceway.
- C. Installation: Install wires and cables as indicated, according to manufacturer's written instructions and NECA's "Standard of Installation."
  1. Pull Conductors: Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
  2. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
  3. Install exposed cables, parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
  4. Support cables according to Division 26 Section "Basic Electrical Materials and Methods."
  5. Seal around cables penetrating fire-rated elements according to U.L. assembly details.
  6. Identify wires and cables according to Division 26 Section "Basic Electrical Materials and Methods."
- D. Connections:
  1. Conductor Splices: Keep to minimum.
  2. Install splices and tapes that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced. Push-in type splice connectors are prohibited. Use splice and tap connectors compatible with conductor material.
  3. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

4. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.
5. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.2 RACEWAY AND BOXES

- A. Examination: Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Wiring Methods:
  1. Indoors: Use the following wiring methods:
    - a. All Raceway and wiring shall be concealed except in control room and electrical rooms.
    - b. Exposed in control room and electrical room only:
      - 1) EMT: All branch circuits and fire alarm SLC and Audio Visual Circuits
    - c. Concealed above lay-in ceiling: EMT.
    - d. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
      - 1) Damp or Wet Locations: NEMA 250, Type 4, nonmetallic.
      - 2) Where exposed to severe corrosive influence (Type 4X) and/or severe physical damage.
- C. Installation: Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions
  1. Minimum Raceway Size: 3/4-inch trade size.
  2. Conceal conduit, unless otherwise indicated, within finished walls, ceilings, and floors.
  3. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
  4. Install raceways level and square and at proper elevations. Provide adequate headroom.
  5. Complete raceway installation before starting conductor installation.
  6. Support raceways as specified in Division 26 Section "Basic Electrical Materials and Methods."
  7. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.
  8. Use raceway fittings compatible with raceways and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.
  9. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.
  10. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.
    - a. Run parallel or banked raceways together, on common supports where practical.
    - b. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

11. Join raceways with fittings designed and approved for the purpose and make joints tight.
    - a. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
    - b. Use insulating bushings to protect conductors.
  12. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box.
  13. Install hinged-cover enclosures and cabinets plumb. Support at each corner.
- D. Protection: Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.
1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

### 3.3 FIELD QUALITY CONTROL

- A. Conductors and Cables:
1. Testing: Refer to Section 26811 Fire Alarm

### 3.4 CLEANING

- A. Raceway and Boxes: On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION 260600

## SECTION 268311 - FIRE ALARM

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. This section of the specifications includes the furnishing, installation, and connection of the microprocessor controlled, addressable/intelligent reporting voice notification fire alarm equipment required to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panels, auxiliary control devices, annunciators, power supplies, and wiring as shown on the Drawings and specified herein.
- B. New fire alarm system shall be an EST3 system. During first phase of construction the existing IRC3 fire alarm control panel is to be removed and replaced with an EST3 fire alarm control panel. The new EST3 fire alarm panel shall have addressable analog device controllers to operate the existing System Sensor M series and 155, 255 detectors that are current installed in the facility. The fire alarm system must remain operational during construction with minimal outages.
- C. The existing fire alarm program for the IRC3 panel is not available. The contractor shall monitor all 'Troubles' during construction to insure that no active devices are in 'Trouble'.
- D. The contractor is responsible for submitting plans to the City of Richmond Department of Planning & Development Review, Bureau of Permits and Inspections, 900 East Board Street Room 110, Richmond for permitting. Contractor to obtain a copy of the Fire Alarm Plan Review Requirements from their web-site and insure the requirements are followed when submitting plans for permitting.

#### 1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of fire alarm systems of types, sizes, and electrical characteristics required, and whose products are Listed and Labeled. All products, including initiating devices and notification appliances, shall be as produced or supplied by the same manufacturer as the fire alarm control panel. Products of firms that do not maintain factory authorized service organization and spare parts stock are not acceptable for use on this project.
- B. Company Qualifications: The company must be a Edwards EST Strategic Partner, still in good standing with Edwards, must have experience converting the Edwards IRC3 fire alarm system

to a Edwards EST3 fire alarm system. Project must include similar scope and phased construction.

- C. **Installer Qualifications:** An experienced Installer who is an authorized representative of the FACP manufacturer for both installations and maintenance of all equipment required for this Project. The Installer technicians shall be individually certified NICET Level 2 and by the manufacturer of the equipment and trained and certified on the specific model being installed. Installer shall have at least one technician on staff certified NICET Level 3. Certification shall be current to latest release and must have occurred in the most recent 24 months. All connections to the FACP and the systems programming shall be completed only by Installer technicians compliant with qualifications. Copies of certifications shall be submitted with shop drawings.
- D. **Codes and Standards:**
  - 1. **NFPA Compliance:** Comply with applicable requirements of NFPA-72, National Fire Alarm Code.
  - 2. **NEC Compliance:** Comply with applicable requirements of NFPA-70, National Electrical Code (NEC) standards pertaining to fire alarm systems.
  - 3. **Testing Laboratory Compliance:** Comply with provisions of UL safety standards pertaining to fire alarm systems. Provide products and components which are Listed and Labeled.
  - 4. **FM Compliance:** Provide fire alarm systems and accessories which are FM approved.
  - 5. **Fire Marshall Compliance:** Provide fire alarm systems and accessories which are Fire Marshall approved.
  - 6. **Comply with Authority Having Jurisdiction.**

#### 1.4 SUBMITTALS - GENERAL

- A. **Authority Having Jurisdiction Submittal:** Submit plans to the City of Richmond Department of Planning & Development Review, Bureau of Permits and Inspections, 900 East Board Street Room 110, Richmond for permitting. Contractor to obtain a copy of the Fire Alarm Plan Review Requirements from their web-site and insure the requirements are followed when submitting plans for permitting.
- B. **Submittals to Engineer:** Shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not comply fully with each and every requirement of the specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific.
  - 1. **Installer Certifications:** Copies of manufacturer signed certifications and NICET certifications as required above.
  - 2. **Product Data:** Submit Manufacturer's technical product data, including specifications and installation instructions, for each type of fire alarm system equipment.
  - 3. **Battery Sizing Calculations.** Also submit voltage drop and current draw calculations for control panel and NAC panels.
  - 4. **Shop Drawings:** Submit (2) bound full size sets of shop drawings showing equipment, device locations, and connecting wiring of entire fire alarm system depicted on scaled architectural floor plans with Installer's border sheet. Include wiring and riser diagrams



and battery calculations. Provide distance and proposed route for each notification appliance circuit. Devices shall include proposed address label. Electronic copy of architectural floor plans will be provided by Engineer in format compatible with most recent release of AutoCAD upon request. Copies of Project Construction Documents or details there from may NOT be a part of the shop drawing submittal.

5. Maintenance Data: Submit maintenance data and parts lists for each type of fire alarm equipment installed, including furnished specialties and accessories. Include this data, product data, and shop drawings in maintenance manual.
6. As-Builts: Submit (3) three bound full size sets of scaled architectural floor plans depicting final device and equipment locations, all circuiting, and pathway and terminal cabinet locations. Include wiring and riser diagrams with battery calculations based off of installation. Also submit (3) copies of Product Data, Installation Instructions, Device Address List, System Matrix, System Status and Programming Report and all other pertinent information specified elsewhere within document.
7. Test Reports: Submit a letter and a copy of the test report indicating proper functioning of the system, and conformance to the requirements of the Contact Documents.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, the manufacturers offering products that may be incorporated into the Work include the following:
  1. Edwards Systems Technology (EST).

### 2.2 FIRE ALARM CONTROL PANEL (FACP)

- A. General: The FACP shall meet the following general requirements:
  1. Signal Line Circuits: Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded onto an NFPA Style 6 (Class B) Signaling Line Circuit (SLC).
  2. Initiation Device Circuits: Initiation Device Circuits (IDC) shall be wired Class B (NFPA Style Y).
  3. Notification Appliance Circuits: Notification appliance circuits shall be wired Class B (NFPA Style Y).
  4. Digitized electronic signals shall employ check digits or multiple polling. In general a single ground or open on any system signaling line circuit, initiating device circuit, or notification appliance circuit shall not cause system malfunction, or loss of operating power.
  5. Loss of Power: Alarm signals arriving at the main FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.
  6. System Response to an Alarm Condition: When a fire alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
    - a. The system alarm LED shall flash. A local piezo-electric signal in the control panel shall sound.

- b. The 80-character LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
  - c. On systems equipped with a printer, printing and history storage equipment shall log the information associated each new fire alarm control panel condition, along with time and date of occurrence.
  - d. All system output programs assigned via control-by-event equations to be activated by the particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated. Exact programming shall be provided by the Contractor to meet the Owners requirements.
  - e. Activate all alarm notification appliances in the building, sounding and flashing in synchronization continuously until manually silenced, or until the initiating device and control unit have been reset to normal condition.
  - f. Activate digital alarm communicator.
  - g. Deactivate door hold control relay such that all smoke doors are allowed to close.
  - h. Activate smoke removal sequence if smoke is detected in any of the holding cell PODs or Blocks.
7. System Response to a Trouble Condition:
- a. System AC power trouble signal shall not be sent unless maintained for 6 hours (or more).
  - b. Provide adjustable time delay for all trouble signals prior to transmission.
  - c. Default setting shall be immediate transmission for all supervising signals.
- B. FACP - Minimum Requirements: The FACP shall contain a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent detectors, addressable modules, local and remote operator terminals, annunciators, and other system controlled devices. The main FACP shall perform the following functions:
- 1. Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
  - 2. Supervise all initiating, signaling, and notification circuits throughout the facility by way of connection to monitor and control modules.
  - 3. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed.
  - 4. Visually and audibly annunciate any trouble, supervisory or alarm condition on operator's terminals, panel display, and annunciators.
- C. System Capacity and General Operation: The system shall have the following capacities and general operation modes:
- 1. The FACP shall be capable of connecting to the number of devices shown on drawings or capable of expansion to 198 intelligent/addressable devices per SLC and 2048 annunciation points per system, whichever is greater. The number of SLCs provided shall be as indicated on the Drawings. Each SLC shall not carry more than 75% of its load capacity.
  - 2. The FACP shall include a full featured operator interface control and annunciation panel that shall include a backlit, 80 character liquid crystal display, individual, color coded

system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.

3. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel.
4. The FACP shall be able to provide the following features:

Upload/Download to PC Computer	Charger Rate Control
Alarm Verification with Tally	Drift Compensation
Automatic Day/Night Sensitivity Adjust	Device Blink Control
Pre-alarm Control Panel Indication	Trouble Reminder
NFPA Smoke Detector Sensitivity Test	Walk Test
System Status Reports	Periodic Detector Test
Alarm Verification, by device, with tally	Multiple Printer Interface
Multiple CRT Display Interface	Security Monitor Points
Non-Alarm Module Reporting	Block Acknowledge
Smoke Detector Maintenance Alert	Control-By-Time

- D. Central Processing Unit: The Central Processing Unit (CPU) shall communicate with, monitor, and control all other modules within the control panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the system display by the CPU.

1. The CPU shall contain and execute all control-by-event (including ANDing, ORing, NOTing, CROSSZONEing) programs for specific action to be taken if an alarm condition is detected by the system. Such control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost with system primary and secondary power failure. The CPU shall also provide a real-time clock for time annotation of all system displays. The Time-of-Day and date shall not be lost if system primary and secondary power supplies fail.
2. The CPU shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems that require the use of external programmers or change of EPROMs are not acceptable.
3. The CPU and associated equipment are to be protected so that they will not be affected by voltage surges or line transients consistent with UL standard 864. □ □

- E. Display: The system display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters. The display assembly shall contain, and display as required, custom alphanumeric labels for all intelligent detectors, addressable modules, and software zones.

1. The system display shall provide an 80-character back-lit alphanumeric Liquid Crystal Display (LCD). It shall also provide five Light-Emitting-Diodes (LEDs), that will indicate the status of the following system parameters: AC POWER, SYSTEM ALARM, SYSTEM TROUBLE, DISPLAY TROUBLE, and SIGNAL SILENCE.
2. The system display shall provide a 25-key touch key-pad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be accessible through the display interface assembly to prevent unauthorized system control or programming.
3. The system display shall include the following operator control switches: SIGNAL SILENCE, LAMP TEST, RESET, and ACKNOWLEDGE.

- F. Signaling Line Circuit (SLC) Interface Board: The FACP shall contain SLC interface boards as required to communicate with the SLC loops as shown on the Drawings. Each SLC board shall monitor and control a minimum of 250 intelligent addressable devices. This includes 125 analog detectors (Ionization, Photoelectric, or Thermal) and 125 monitor or control modules.
1. Each SLC interface board shall contain its own microprocessor, and shall be capable of operating in a local mode (any SLC input activates all or specific SLC outputs) in the event of a failure in the main CPU of the control panel. The SLC interface board shall not require any jumper cuts or address switch settings to initialize SLC Loop operations. SLC interface boards shall provide power and communicate with all intelligent addressable detectors and modules connected to its SLC Loop on a single pair of wires. This SLC Loop shall be capable of operation as NFPA Style 4, Style 6, or Style 7.
  2. Each SLC interface board shall receive analog information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular detector. The SLC interface board software shall include software to automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.
- G. Voice Evacuation: Audible alarm notification shall be by voice evacuation and tone signals on loudspeakers.
1. Provide an emergency communication system, integral with the FACP, including voice alarm system components, microphones, amplifiers, and tone generators. Features include:
    - a. Amplifiers comply with UL 1711, "Amplifiers for Fire Protective Signaling Systems." Amplifiers shall provide an onboard local mode temporal coded horn tone as a default backup tone. Test switches on the amplifier shall be provided to test and observe amplifier backup switchover. Each amplifier shall communicate to the host panel amplifier and NAC circuit voltage and current levels for display on the user interface.
    - b. Amplifiers and audio circuits shall not exceed 60% of capacity as calculated with speaker maximum wattage.
  2. The system shall provide dual audio output which shall allow the evacuation signal and prerecorded message to be transmitted over selected circuits while simultaneously permitting paging to be transmitted over other selected circuits.
  3. Each signal circuit shall have three manually selected modes.
    - a. Automatic mode; the circuit shall operate in its preprogrammed, selective evacuation signal and prerecorded message sequence.
    - b. Manual evacuation mode; the circuit shall transmit the evacuation signal and prerecorded message upon manual selection at the fireman's control and status panel.
    - c. Paging mode; when the paging mode is selected during either automatic or manual evacuation mode, the evacuation signal shall continue to sound until the microphone button is pressed for a paged signal. Once the microphone button is

released, the evacuation tone shall again sound when in the manual or automatic evacuation mode. When not in automatic or manual evacuation, the paging mode shall operate as described without the prerecorded evacuation signal.

4. Each circuit shall be provided with a visual indicator to indicate that the evacuation/prerecorded message sequence is being transmitted and a second indicator to indicate that paging or the alerting signal is being transmitted.
  5. A function selector switch shall permit emergency voice and alarm transmission to be made to selected areas by the use of zone selection switches. The alarm tone shall continue to sound in those zones not selected for voice transmission.
    - a. The function selector switch shall allow all alarm tones to be silenced and selective voice transmission only shall be permitted via zone selection switches.
    - b. If the function selector switch is not returned to the normal position, prior to closing the access panel, an audible and visual trouble signal shall be initiated.
    - c. Facility for total building evacuation or paging shall be accomplished by means of a dual function "all circuit" switch.
    - d. Each alarm zone shall be provided with an individual selection switch for the purpose of selective voice and/or tone transmission. Zone selection switches shall be maintained contact type with visual indication operation. The voice communication system shall have provision for at least a separate zone for each floor of each building.
- H. Serial Interface Board: The FACP shall contain a serial interface board to provide an EIA-232 interface between the fire alarm control panel and the UL Listed Electronic Data Processing (EDP) peripherals. The serial interface board shall allow the use of multiple printers, CRT monitors, and other peripherals connected to the EIA-232 ports. In addition, the serial interface board shall provide one EIA-485 port for the serial connection to annunciation and control subsystem components; LEDs shall be provided to show operational status. All serial interface input/outputs shall be optically isolated to provide protection from surges and/or earth grounds.
- I. Operators Terminal: Provide an operators terminal which allows the following minimum functions. In addition, the operators terminal shall support any other functions required for system control and/or operation:
1. Acknowledge (ACK/STEP) Switch
  2. Signal Silence Switch
  3. System Reset Switch
  4. System Test Switch
  5. Lamp Test Switch
- J. Remote Transmissions: Re-use the existing Silent Knight Model 5104 Digital Alarm Communications Transmitter (DACT). The FACP shall be interfaced to this DACT for transmission of its fire alarm, supervisory, and other trouble signals to the Owner's designated receiving station. The existing facility is monitored by Richmond Alarm Company. The DACT performs a daily self-test and upon failure of the test a local trouble will be initiated. The loss of any telephone line shall initiate a local trouble. The trouble signal for the AC power loss

notification must not be sent to the supervising station unless maintained for 6 hours or more. The following signals, in order of precedence shall be reported (as applicable):

1. Fire
  2. Waterflow
  3. Supervisory.
  4. Trouble.
- K. Power Supply: The FACP power supply(ies) shall operate on 120 VAC, 60 Hz circuit with dedicated ground and shall have a continuous rating adequate to power all equipment and functions in full alarm continuously. All modules and drivers must be able to withstand prolonged short circuits in the field wiring, either line-to-line or line-to-ground, without damage. Further, the power supply shall be expandable for additional notification appliance power in 3.0 Ampere increments.
1. The power supply shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge.
- L. Emergency Power Supply: Components include batteries, charger, and an automatic transfer switch.
1. Batteries. Sealed maintenance-free lead calcium construction with fully gelled electrolyte.
    - a. Battery Nominal Life Expectancy: 15 years, minimum.
    - b. Battery Capacity: Comply with NFPA 72. Under maximum quiescent load (system functioning in a non-alarm condition), the secondary supply shall have sufficient capacity to operate the entire system for 24 hours; and at the end of that period, shall be capable of operating all alarm notification appliances used for evacuation or to direct aid to the location of the emergency for 5 minutes.
    - c. Magnetic door holders are not served by emergency power. Magnetic door holders are released when normal power fails.
    - d. Battery Calculations: Calculations must be based on the most distant notification appliance on each circuit such that the voltage level at the end of 60 hours of monitor and 5 minutes of alarm is greater than the listed minimum operating voltage for that appliance.
  2. Battery Charger: Solid-state, fully automatic, variable-charging-rate type. Provide capacity for 150 percent of the connected system load while maintaining batteries at full charge. If batteries are fully discharged, the charger recharges them completely within four hours. Charger output is supervised as part of system power supply supervision.
  3. Integral Automatic Transfer Switch: Transfers the load to the battery without loss of signals or status indications when normal power fails.
- M. Enclosures: The FACP shall be housed in a UL listed cabinet suitable for surface or semi-flush mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators. For convenience, the door may be hinged on either the right or left side (field selectable).

## 2.3 EMERGENCY VOICE/ALARM COMMUNICATIONS SYSTEM

- A. Provide emergency voice communication systems with the following characteristics and features:
1. Systems with voice capability shall comply with NFPA 72 concerning one-way Public Address (PA) emergency communications, especially with regards to survivability requirements.
  2. One-way voice/alarm systems shall be dual channel, permitting the application of an evacuation signal to one or more zones simultaneously with manual voice paging to the other zones. Communication zones shall be capable of being selected in any combination.
  3. Each phase of construction shall be a separate communication zone. (Total of 5 zones)
  4. Control module shall be provided, which contains a central oscillator motherboard, microphone inputs and dual channel mixer/pre-amplifier circuits necessary for proper system operation. Provide two (2) in-phase alarm oscillators and two (2) independent auxiliary oscillators. Provide Slow Whoop alarm oscillators which make a slowly ascending tone from 200 to 830Hz in 2.5 seconds.
  5. Dual pre-amplifier module shall provide continuous supervision of the dual pre-amplifier, dual alarm oscillators and microphone output levels. This module shall provide individual channel "trouble" LED's, automatic monitoring and switching for all system amplifiers.
  6. A hand-held, push-to-talk microphone with self-winding five-foot coiled extension cable shall be recessed within a protective panel-mounted enclosure at the Main Control Panel. The microphone shall be a noise-canceling communication type with a frequency range of 200 to 4,000Hz.
  7. A control switch module shall be furnished to provide manual access for authorized fire-fighting personnel of the audio control module functions. Include "all circuits", "manual alarm", "auxiliary 1 tone", "auxiliary 2 tone", "oscillator stop", and "audio trouble reset" pushbuttons.
  8. Provide switches for manual speaker circuit selection.
  9. Dual channel message player shall provide a prerecorded evacuation message and shall contain switching circuits, volume control, trouble indication, selection switches, test switch, and speaker.
  10. Provide duplicate tone oscillators, pre-amplifiers, and power amplifiers. In the event of an amplifier, a pre-amplifier or a tone oscillator failure, the system shall automatically switch all functions performed by that failed unit to an assigned standby unit.
  11. Normal amplifier power shall be sized such that full load does not exceed 60% of amplifier capacity with all speakers sized at full wattage (highest tap setting).
  12. At least one back up amplifier shall be provided for each transponder location. The minimum backup power shall be equal to the largest amplifier served from the transponder. Failure of any amplifier shall automatically result in the defective unit being switched offline and replaced with the backup.
  13. The system panel shall include a local speaker and switch for testing the prerecorded message.

## 2.4 ALARM APPLIANCES

- A. Speakers shall be located as shown on the Drawings; speakers located outdoors shall be listed for use in wet locations. Speakers shall have the following specifications:

1. Voltage: Speakers shall operate on 25V or 70.7V RMS nominal.
  2. Programming: Speakers shall be field programmable without the use of special tools to provide multiple sound levels at 0.25W, 0.50W, 1.0W and 2.0W.
    - a. Where noted on the plans with high levels of ambient sound levels provide high output 15W multi-tap speakers.
  3. Sound Level: Speakers shall have a sound level of at least 84 dBA measured at 10 feet from the device when tapped at 1W. Speakers shall have a frequency range of 400 to 4kHz for fire alarm and 125 to 12kHz for General Signaling.
  4. Mounting: Provide flush mounting devices suitable for mounting in a standard single gang device box unless otherwise indicated on the Drawings. Mount devices at heights indicated on plans or 6" Below Finished Ceiling (BFC), whichever is lower.
  5. Speakers shall be vandal resistant when located in all areas outside of the admin area.
- B. Strobe Lights shall be located as shown on the Drawings. Strobe lights indicated for use at exterior of the building shall be mounted at the indicated elevation and listed for use in wet locations. Strobe lights shall have the following specifications:
1. Voltage: Strobe lights shall operate on 24 VDC nominal.
  2. Programming: Strobes shall field programmable without the use of special tools to provide 15/75, 30, 75, and 110 Candela output.
  3. Maximum pulse duration: 2/10ths of one second.
  4. Mounting: Provide flush mounting devices suitable for mounting in a standard single gang device box unless otherwise indicated on the Drawings. Mount devices at heights indicated on plans or 6" Below Finished Ceiling (BFC), whichever is lower.
  5. Strobe intensity and flash rate: Must meet minimum requirements of UL 1971. Provide strobe lights with specific intensity Candela (Cd) rating if such is indicated adjacent to the device symbol on the Drawings.
  6. Strobes shall be synchronized
- C. Audible/Visual Combination Devices shall be located as shown on the Drawings and shall comply with all applicable requirements for both Speakers and Strobe Lights. Mount devices at heights indicated on plans or 6" Below Finished Ceiling (BFC), whichever is lower.

## 2.5 INITIATING DEVICES

- A. Addressable Devices - General: Unless otherwise indicated on the Drawings all initiating devices shall be individually addressable. Addressable devices shall comply with the following requirements:
1. Address Setting: Addressable devices shall provide an address-setting means that use rotary decimal switches configured to provide decade (numbered 1 to 10) type addresses.
  2. Connections: Addressable devices shall be connected to a Signaling Line Circuit (SLC) with two (2) wires. Signaling Line Circuits shall originate as indicated on the Riser Diagram shown in the Drawings.
  3. Operational Indications: Addressable initiation devices shall provide dual alarm and power LEDs. Both LEDs shall flash under normal conditions, indicating that the device is operational and in regular communication with the control panel. Both LEDs shall be placed into steady illumination by the FACP to indicate that an alarm condition has been



detected. The flashing mode operation of the detector LEDs shall be optional through the system field program. An output connection shall also be provided in the device base to connect an external remote alarm LED.

4. Intelligent Initiation Devices: All smoke detectors shall be the "intelligent" in that smoke detector sensitivity shall be set through the FACP and shall be adjustable in the field through the field programming of the system. Sensitivity shall be capable of being automatically adjusted by the FACP on a time-of-day basis. Using software in the FACP, detectors shall be capable of automatically compensating for dust accumulation and other slow environmental changes that may affect performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter.
5. Device mounting Base: Unless otherwise specified all detectors shall be ceiling- mount and shall include a separate twist-lock base with tamper proof feature.
6. Test Means: The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel when in the "test" condition.
7. Device Identification: Detectors shall store an internal identifying type code that the control panel shall use to identify the type of device. Device identifications shall be either PHOTO or THERMAL.

B. Pull Stations: Re-use existing Keyed Pull Stations, but replace the addressable monitor module at each pull station. Addressable type pull stations, on command from the Control Panel, send data to the panel representing the state of the manual switch. The existing pull stations use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key. There are no existing pull stations that employ a glass break rod as these types are not acceptable.

1. Pull stations shall have a dual-action mechanism requiring two actions to initiate alarm.
2. All pull stations shall have a positive, visual indication of operation and utilize a double pole, double throw key type reset.
3. Construction: Pull stations shall be constructed of Lexan or other material suitable to the installation environment with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches or larger. Stations shall be suitable for surface mounting or semiflush mounting as shown on the plans. Mount devices at heights indicated on plans.

C. Photoelectric Smoke Detectors: Photoelectric smoke detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density. Unless otherwise indicated on the Drawings all smoke detectors shall be photoelectric type.

1. Plug-in Arrangement: Detector and associated electronic components are mounted in a module that connects in a tamper-resistant manner to a fixed base with a twist-locking plug connection. Terminals in the fixed base accept building wiring.
2. Smoke detector guards: All smoke detectors shall have a guard that is Listed for use with the specific model of smoke detector being protected. All smoke detector guards are to have a separate base which must be very securely anchored to wall or ceiling. The cover must be readily removable by the Owner for periodic detector cleaning and servicing but, to prevent unauthorized entry, must be secured to the base by a lock or tamper resistant screws approved by the Engineer. Metal guards must be 16 gauge or heavier steel.

- D. Thermal Detectors: Thermal Detectors shall be intelligent addressable devices rated at 200°F. (93° C.) and unless otherwise indicated on the Drawings shall have a rate-of-rise element rated at 15° F. (9.4° C.) per minute. Thermal detectors shall use an electronic sensor to measure thermal conditions caused by a fire and shall, on command from the control panel, send data to the panel representing the analog level of such thermal measurements.
  - 1. Plug-in Arrangement: Detector and associated electronic components are mounted in a module that connects in a tamper-resistant manner to a fixed base with a twist-locking plug connection. Terminals in the fixed base accept building wiring.
- E. Non-Rate of Rise Detectors: Where indicated on the Drawings provide thermal detectors with non-rate of rise thermal elements. Non-rate of rise detectors are indicated by NRR adjacent to the thermal detector symbol.
- F. Duct Smoke Detector: In-Duct Smoke Detector Housings shall accommodate either an intelligent ionization sensor or an intelligent photoelectric sensor as described elsewhere. The device, independent of the type used, shall provide continuous analog monitoring and alarm verification from the panel. When sufficient smoke is sensed, an alarm signal shall be initiated at the FACP. Unless otherwise indicated on the Drawings all duct smoke detectors shall be photoelectric type.
  - 1. Installation: Duct detectors and related items shall be furnished and installed by the Division 26 (Electrical) Contractor.
  - 2. Verify that each existing duct detector installation has a hinged or latched access panel, 12"x12" minimum, for sampling tube inspection and cleaning. Notify engineer immediately upon detection of any missing access panels required for sampling tube inspection and cleaning.

2.6 Smoke Removal from PODS: Provide an output signal using an addressable relay to start the POD smoke removal fans and stop the make-up air fans as indicated in the Matrix on the plans. Signal shall remain on until alarm conditions are cleared and fire-alarm system is reset. Signal shall not stop in response to alarm acknowledge or signal silence commands.

- 1. Smoke Removal starts when POD smoke detector go into alarm.

## 2.7 MISCELLANEOUS SYSTEM ITEMS

- A. Addressable Dry Contact Monitor Module: Addressable Monitor Modules shall be provided to connect one supervised IDC zone (either Style D or Style B) of conventional Alarm Initiating Devices (any Normally Open [N.O.] dry contact device) to one of the Fire Alarm Control Panel Signaling Line Circuit Loops. Monitor modules shall be installed as required by the system configuration. All required monitor modules may not be shown on the Drawings.
  - 1. Indication of Operation: Unless otherwise indicated on the Drawings an LED shall be provided that shall flash under normal conditions, indicating that the Monitor Module is operational and in regular communication with the control panel.
  - 2. Mounting Requirements: Monitor Modules shall mount in a standard 4-inch square, 2-1/8" deep electrical boxes.

3. Location Requirements: Monitor Modules shall be located within conditioned space.
- B. Two Wire Detector Monitor Module: Addressable Monitor Modules shall be provided to connect one supervised IDC zone, either Class A or B (Style D or Style B operation) of conventional 2- wire smoke detectors or alarm initiating devices (any N.O. dry contact device) to one of the Fire Alarm Control Panel Signaling Line Circuit Loops. Monitor modules shall be installed as required by the system configuration. All required monitor modules may not be shown on the Drawings.
1. Indication of Operation: Unless otherwise indicated on the Drawings an LED shall be provided that shall flash under normal conditions, indicating that the Monitor Module is operational and in regular communication with the control panel.
  2. Mounting Requirements: Monitor Modules shall mount in a standard 4-inch square, 2-1/8" deep electrical boxes.
  3. Location Requirements: Monitor Modules shall be located within conditioned space.
- C. Addressable Control Module: Addressable Control Modules shall be provided to supervise and control the operation of one conventional Notification Appliance Circuit (NAC) of compatible, 24 VDC powered, polarized Audio/Visual (A/V) Notification Appliances, for audio circuit page zoning. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contract relay. The control module shall provide address-setting means using decimal switches and shall also store an internal identifying code that the control panel shall use to identify the type of device. An LED shall be provided that shall flash under normal conditions, indicating that the control module is operational and is in regular communication with the control panel.
1. Mounting Requirements: Control Modules shall mount in a standard 4-inch square, 2-1/8" deep electrical boxes.
  2. Configuration: The control module NAC circuit may be wired for Style Z or Style Y (Class A/B) with up to 1 Amp of inductive A/V signal, or 2 Amps of resistive A/V signal operation, or as a dry contact (Form C) relay. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.
  3. Location Requirements: Monitor Modules shall be located within conditioned space.
  4. Power Source: Audio/visual power shall be provided by a separate supervised power loop from the main fire alarm control panel or from a supervised, UL listed remote power supply. A/V power sources and connections are not shown on the Drawings.
  5. Test Switch: A magnetic test switch shall be provided to test the module without opening or shorting its NAC wiring.
- D. Isolator Module: Isolator Modules shall be provided to automatically isolate wire-to- wire short circuits on an SLC loop. The Isolator Module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC Loop.
1. Operation: Isolator Modules shall operate such that if a wire-to-wire short occurs, the Isolator module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the Isolator Module shall automatically reconnect the isolated section. The Isolator Module shall not require any address-setting, and its

- operations shall be totally automatic. It shall not be necessary to replace or reset an Isolator Module after its normal operation.
2. Mounting: The Isolator Module shall mount in standard 4-inch square, 2-1/8" deep electrical boxes. It shall provide a single LED that shall flash to indicate that the Isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.
  3. Isolation Modules shall be mounted at the same height as required for A/V devices.
- E. Remote Display Annunciator: The Alphanumeric display annunciator shall be a supervised, remotely located back-lit LCD display containing a minimum of eighty (80) characters for alarm annunciation in clear English text. The LCD annunciator shall display all alarm and trouble conditions in the system and duplicate manual switching functions of the FACP, including acknowledging, silencing, reset, and test. The remote annunciator shall also have a LED graphic display panel mounted adjacent to the LCD display.
1. System Capacity: The system shall allow a minimum of four LCD annunciators. In addition to annunciation functions, each LCD annunciator shall be capable of the following software programmed system functions: Acknowledge, Signal Silence and Reset.
  2. Connections: The annunciator shall connect to a two-wire EIA-485 interface. The two-wire connection shall be capable operation at distances of 6,000 feet. Provide interface to fiber optic cable systems and/or repeater units where such are indicated on the Drawings.
  3. Protection: The annunciator shall be outfitted with a full Lexan cover on hinged door with locking key access.
- F. Zone Map: Zone maps shall show entire building layout with initiating devices, remote annunciators, and FACP. Room numbers shall reflect actual building signage, not architectural room numbers. Zone maps shall be large enough scale to read device labels easily and clearly. Do not display notification appliances on zone maps.
- G. Remote Annunciator Indicator Lights (RAIL): Remote annunciator indicator lights shall be provided in locations where indicated on the Drawings. RAILS shall be provided with a key type switch for testing of the annunciated device. In addition, RAILS shall have the following features:
1. Voltage: RAILS shall operate on 24 VDC nominal.
  2. Mounting: Provide flush mounting devices suitable for mounting in a standard single gang device box unless otherwise indicated on the Drawings. Unless otherwise indicated on the Drawings, RAILS shall be mounted as described for electronic sounders above.
- H. Surge Suppressors (TVSS): The system shall be equipped with the following protective devices to prevent damage or nuisance alarms by nearby lightning strikes, stray currents, or voltage transients. The devices are to be provided by the fire alarm equipment supplier:
1. On AC Input: A feed-through (not a shunt-type) branch circuit transient arrester such as the EFI HWM-120, Leviton OEM-120EFI, Northern Technologies DMK-B, Transtector ACP100BWN3, or equivalent UL Listed device by Square-D or EIT. Install in a listed enclosure near the electrical panelboard and trim excess lead lengths. Wind small coil in the branch circuit conductor, within panelboard, downstream of the suppressor connection. Coil is to be about 1" diameter, 5 to 10 turns, and tie-wrapped.

2. On DC Circuits Extending Outside Building: Adjacent to the FACU, and also near point of entry to outlying building, provide "pi"-type filter on each leg, consisting of a primary arrester, series impedance, and a fast acting secondary arrester which calmps between 30 and 40 Volts. Acceptable models include Innovative Technology D2S33-2ML, Simplex 2081-9027 and 2081-9028, Transtector TSP8601, Ditek DTKxLVL series, Citel America B280-24V, and Northern Technologies DLP-42, or equivalent by Square-D or EIT.

I. Wire

1. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, THHN/THWN, color-coded insulation.
  - a. Low-Voltage Circuits: No. 18 AWG, minimum.
  - b. Line-Voltage Circuits: No. 12 AWG, minimum.
2. Power-Limited Circuits: NFPA 70, Types FPL, FPLR, or FPLP, as recommended by manufacturer. Data Loop wire shall be shielded pair #18 AWG, 30 pf/ft capacitance or less, unless specifically prohibited by the equipment manufacturer and stated on the wiring submittal

## PART 3 - EXECUTION

### 3.1 FIRE ALARM SYSTEM INSTALLATION AND CONFIGURATION

- A. Installation of the FACP and connection of all circuits shall be performed by person meeting requirements listed in Quality Assurance paragraph.
  1. All connections at the FACP must be made by the Manufacturer's authorized, factory trained representative (rather than by the electrical contractor).
- B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.
  1. All system components shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (*e.g.*, detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load. Adhesives are not permitted to mount fire alarm system components to building surfaces or structure.
- C. Circuit Breaker serving FACP shall be lockable and locked in the "ON" position.
- D. All addressable loop controller circuits must have a minimum of 20% spare addresses for future use. New "T-taps" from the loop are not permitted, but existing "T-tap" locations to remain.
- E. Manual Pull Stations shall be mounted semi-flush within recessed back boxes
- F. Visible signals must be the strobe (flash discharge) type, with white or clear lens, and shall comply with current ADA requirements for intensity, placement, and synchronization.

- G. The FACP must have an Alarm Silence switch, and be equipped with the Subsequent Alarm (alarm resound) feature. Any remote annunciators or graphic displays located away from the alarm area must also include an audible signal with alarm resound feature.
  - 1. Alarm Silence shall not reverse AHU shutdown or disable smoke evacuation system.
- H. All supervisory trouble signals shall be different and distinct from a normal system trouble and shall be non-silenceable.
- I. Provide a supervised "AHU Shutdown Defeat" toggle switch in the FACP. Provide an informative engraved label at switch indicating "Normal" position. The switch must cause a system "trouble" indication when it is placed in the off ("Shutdown Defeated") position.
- J. Provide a supervised "Audio/Visual & Door Holder Bypass" membrane switch with LED indicator in the FACP. Provide an informative engraved label at switch indicating "Normal" position. The switch must cause a system "trouble" indication when it is placed in the off ("Bypass") position.
- K. Provide a supervised "Sprinkler Point Bypass" membrane switch with LED indicator in the FACP to bypass float switches, tamper switches, and other sprinkler system monitoring points. Provide an informative engraved label at switch indicating "Normal" position. The switch must cause a system "trouble" indication when it is placed in the off ("Bypass") position.
- L. Provide a supervised "Speaker Defeat" membrane switch with LED indicator in the FACP. Provide an informative engraved label at switch indicating "Normal" position. The switch must cause a system "trouble" indication when it is placed in the off ("Speakers Defeated") position.
- M. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceways and Boxes." Conceal raceway except in unfinished spaces and as indicated.
  - a. For wiring concealed above inaccessible ceilings (Hard Gypsum Board), wiring shall be allowed to run in free air and supported with 'J' hooks.
  - b. For wiring in concealed above accessible ceilings (Lay-in Tile), wiring shall be installed in metal conduit and supported according to Division 26 Section Conduit, Raceway and Wiring Devices
  - c. The only exposed raceway allowed is in Control Room for connection to FACP, Electrical Rooms and support spaces with no ceiling. For wiring in exposed areas install wiring in metal conduit according to Division 26 Section Conduit, Raceway and Wiring Devices
    - 1) The exterior of all junction boxes containing fire alarm conductors shall be painted red, and conduit shall be RED; box interiors shall not be painted. Box covers for junction boxes containing fire alarm conductors shall be painted red on both sides. All painting of junction boxes and junction box covers shall be accomplished prior to installation of the boxes to avoid possible problems with overspray.
    - 2) Box covers shall be labeled to indicate the circuit(s) or function of the conductors contained therein. Labels shall be neatly applied black lettering on a clear background. Handwritten labels or labels made from embossed tape are not acceptable.

- 3) Provide metal back boxes or plastic skirts as manufactured by fire alarm manufacture for devices installed in a surface mounted application. Boxes shall match device in size and color.

N. All wiring shall be color coded in accordance with the following scheme, which shall be maintained throughout the system, without color change in any wire run:

Signaling Circuits	Overall Red Sheath, Red	(+) and Black (-)
Alarm Notification Circuits		Blue (+) and Black (-)
24V System Circuits (HVAC)		Yellow (+) and Brown (-)
Door Control Circuits		Orange

- O. Cable Splices: Any and all cable splices shall be in junction boxes. There shall be NO splices in the system other than at terminal blocks. "Wire nuts," crimp splices, or insulation piercing type connectors are not acceptable. All terminal block screws shall have pressure wire connectors of the self-lifting or box lug type. Permanent wire markers shall be used to identify all splices and terminations for each circuit. For splices, use markers or other means to indicate which conductors leads to the FACP.
- P. Detection or alarm circuits shall not be installed in raceways containing AC power or AC control wiring. Within the FACP, any 120 VAC control wiring or other circuits with an externally supplied AC/DC voltage above the nominal 24 VDC system power must be properly separated from other circuits and the enclosure must have an appropriate warning label to alert service personnel to the potential hazard.
- Q. Provide an engraved label on FACP and all notification appliance circuit expansion panels identifying its 120 VAC power source. This label shall include panelboard identification and circuit number and panelboard location.
- R. All wiring shall be checked for grounds, opens, and shorts, prior to termination at panels and installation of detector heads. The minimum resistance to ground or between any two conductors shall be ten megohms (10 M $\Omega$ ), as verified with a megger. Provide advance notice to the Engineer of these tests.
- S. The system shall be electrically supervised for open or (+/-) ground fault conditions in SLC, alarm circuits, and control circuits. Removal of any detection device, alarm appliance, plug-in relay, system module, or standby battery connection shall also result in a trouble signal. Fire alarm signal shall override trouble signals, but any pre-alarm trouble signal shall reappear when the panel is reset.
- T. Supervision required: The connection between individual addressable modules and their contract type initiating device(s) must be supervised.
- U. Wall-mounted magnetic door holders and separate heavy-duty closers shall be used, instead of combination door control units.
  - 1. The electromagnets shall be controlled by the FACP. Individual smoke detector auxiliary contacts shall not be used to release door holders.

### 3.2 SMOKE DETECTORS

- A. Provide dust covers for bases throughout construction. Unless suitably protected against dust, paint, etc., detectors shall not be installed until the final construction clean-up has been completed. Contaminated detectors must be REPLACED by the Contractor at no additional cost to the Owner.
- B. A spot type smoke detector shall be provided within 15' from FACP, auxiliary panels, power extenders, NAC expansion panels and other control equipment. As NAC expansion panels and power extenders are not shown on drawings, additional detectors not shown shall be added required to meet this provision.
- C. When installed in a room, detectors shall be oriented so their alarm light is visible from the nearest door to the corridor, unless Remote Alarm Indicator Light (RAIL) equipped.
- D. Spot type smoke detectors mounted within 12 feet of a walking surface shall have their built-in locking device activated. Unless suitably protected against dust, paint, etc., detectors shall not be installed until the final construction clean-up has been completed. Contaminated detectors must be REPLACED by the Contractor at no additional cost to the Owner.
- E. Ceiling-Mounted Smoke Detectors: Not less than 4 inches (100 mm) from a side wall to the near edge. For exposed solid-joint construction, mount detectors on the bottom of joists. On smooth ceilings, install not more than 30 feet (9 m) apart in any direction.
- F. Wall-Mounted Smoke Detectors: Installed not more than 12 inches (300 mm), below the ceiling.
- G. Smoke Detectors near Air Registers: Install no closer than 36 inches (1520 mm).
- H. All air duct/plenum detectors must have a RAIL located in the nearest corridor or public area and identified by an engraved label affixed to the wall or ceiling. These detectors shall be installed in a manner that provides suitable access for required periodic cleaning and calibration.
- I. Duct detector sampling tubes shall extend the full width of the duct. Those over 36 inches long must be provided with rear support. The preferred method for doing this is to have the tube go through the far side of the duct, with the point of penetration tightly sealed to prevent air leakage around the tube. This facilitates smoke testing and tube cleaning. Duct smoke detector mounting position and air sampling tube orientation, are critical for proper operation. The Manufacturer's detailed installation instructions must be followed. The Contractor shall mark the direction of air flow on the duct at each duct detector location. Each duct detector installation shall have a hinged or latched access panel, 12"x12" minimum, for sampling tube inspection and cleaning.
- J. Smoke detector guards: All smoke detectors shall have a guard that is Listed for use with the specific model of smoke detector being protected. All smoke detector guards are to have a separate base which must be very securely anchored to wall or ceiling. The cover must be readily removable by the Owner for periodic detector cleaning and servicing but, to prevent unauthorized entry, must be secured to the base by a lock or tamper resistant screws approved by the Engineer. Metal guards must be 16 gauge or heavier steel.



### 3.3 AUTOMATIC SMOKE DOOR HOLD OPEN REQUIREMENTS

- A. The existing doors have a 'Smoke Check' device built into the door. Provide addressable relay module to release doors upon any General Alarm from FACP

### 3.4 EMERGENCY VOICE/ALARM COMMUNICATIONS

- A. All One-way Voice Alarm shall be wired with twisted pair copper conductors AWG 18 minimum in shielded cable, Belden 8790, West Penn 293, or equivalent. Cable jacket color shall be gray, with red (+) and black (-) conductor insulation. The shields shall be continuously connected from the amplifiers to the end of line. Tape the shield splice at each speaker and handset, to insulate from ground. All shields shall be single point grounded at the amplifier, unless prohibited by system manufacturer.
- B. Each speaker circuit shall be supervised so that an opening in any circuit will result in audible and visual trouble indication.
- C. Should the system be unable to transmit the pre-recorded message because of failure, the system shall automatically revert to the fire alarm signal transmission mode.
- D. Trouble indicators shall be automatically de-energized during a system alarm condition and reappear when the alarm condition has been reset.
- E. Evacuation signal shall be a "three-pulse" temporal pattern complying with ANSI S3.41-1990.

### 3.5 SPRINKLER SYSTEM MONITORING

- A. The following sprinkler system alarm and supervisory functions shall be provided as a part of the fire alarm system:
  - 1. Waterflow alarm, by sprinkler zone (not to exceed one floor).
  - 2. Supervision of each control valve.
  - 3. Supervision of air pressure, if used (both high and low).
- B. Sprinkler supervisory monitoring of flow switches, tamper switches, and similar functions shall be accomplished with a separate system address for each activity monitored.

### 3.6 FIRE ALARM CONTROL PANEL PROGRAMMING

- A. Due to phase construction, the FACP program shall be modified between each phase to ensure proper operation and function.
- B. Contractor shall include TWO additional paging options in programming the system. The owner will provide the messages for these option during the programming phase of the project.
- C. Programming of the FACP and connection of all circuits shall be performed by person meeting requirements listed in Quality Assurance paragraph.

- D. The complete configuration data (site-specific programming) for the system must be permanently stored on a computer disk and archived by the manufacturer or authorized distributor. A disk copy of this data must be submitted to the Engineer for transmission to the Owner when the system is commissioned.
- E. The Manufacturer or authorized distributor must maintain software version (VER) records on the system installed. The system software shall be upgraded free of charge if a new VER is released for any reason during the warranty period. For any new VER to correct problems, free upgrade shall apply during the entire life of the system.
- F. The Fire Alarm System shall have multiple access levels which permit the Owner's authorized personnel to make temporary changes in the system alarm response matrix without actually changing the system programming. This must include the ability to override selected alarm inputs or system responses to alarms without affecting the remaining portions of the system.
  - 1. The fire alarm system shall have a self-contained modem with a minimum speed of 9,600 baud for external communications purposes. All system functions and programming features must be available through the modem port. The modem port shall be password protected with multiple access levels as described above.
- G. In addition to the system tests and certification described elsewhere, the Manufacturer or authorized distributor must 100% test all site-specific software functions for the system and provide a written test report or detailed check list. This documentation must include a system operation matrix showing the actual FACP response for each initiating device input.

### 3.7 CONNECTIONS

- A. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches (910 mm) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

### 3.8 SYSTEM LABELING

- A. Detectors and initiating devices: Identification of individual detectors is required by a unique alphanumeric label. These device labels, which must also be shown on the shop drawings, shall be permanently affixed to the detector base. Device labels may not be affixed to the device head. Identification labels must be printed labels with black lettering on a clear background. Handwritten labels or labels made from embossed tape are not acceptable.
- B. Notification Appliances: Notification appliances shall be clearly labeled with NAC panel and circuit number. Add "EOL" designation to label where an end-of-line resistor is located in the junction box behind the notification appliance.
- C. FACP and System Equipment: Provide an engraved label in FACP identifying its 120 VAC power source. This label shall include panelboard location, identification, and circuit number. Labels shall also be provided for auxiliary panels, NAC panels, and power extenders.

- D. Zone Map: Provide framed zone map at FACP and at all remote annunciators.
- E. Provide framed basic operating instructions at FACP.
- F. Floor Plans with Device Numbers: A copy of the floor plans shall be provided in the control panel. A separate sheet shall be provided for each floor. Plans shall be reduced in size from engineering plans in order to fit on 11x17 sheets. All device addresses shall be clearly labeled on plans. Minimum printed text size shall be 0.75/10". Indicate location of all cabinets, modules, and end of line resistors. Plans shall be laminated and bound in book form. Provide legend for symbols. Provide holder for plan book in panel or in a locked box adjacent to panel keyed to match panel. Provide label for box and book.

### 3.9 PHYSICAL PROTECTION

- A. Visual alarm appliances: Provide protective wire guards, manufactured specifically for strobes, for all stobes/visual alarm appliances located in all areas, except general office area.
- B. Smoke Deetctors: Provide protective wire guards, manufactured specifically for smoke detector, for all smoke detectors located in all areas, except general office area.

### 3.10 CLEANING AND ADJUSTING

- A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and marred finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer. Replace damaged units.

## PART 4 - SYSTEM TESTING & CERTIFICATION

### 4.1 TESTING

- A. Pretesting: After installation, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the compliance of the system with requirements of Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones, and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.
  - 1. Minimum System Tests: Minimum test shall be a 100% operation test including, but not limited to the following-
    - a. Verify the absence of unwanted voltages between circuit conductors and ground.
    - b. Test all conductors for short circuits using an insulation-testing device.
    - c. With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on record drawings.
    - d. Verify that the control unit is in the normal condition as detailed in the manufacturer's operation and maintenance manual.

- e. Test initiating and indicating circuits for proper signal transmission under open circuit conditions. One connection each should be opened at not less than 10 percent of initiating and indicating devices. Observe proper signal transmission according to class of wiring used.
  - f. Test all initiating and indicating device for alarm operation and proper response at the control unit. Test smoke detectors with actual products of combustion.
  - g. All circuits shall be tested for supervision.
  - h. All sprinkler devices shall be tested for alarm, supervisory and trouble situations.
  - i. All control circuits (AHU shutdown, door holders, dampers) shall be tested for proper operation on an alarm condition and for wire supervision.
  - j. Check zone map for proper location of all devices. Verify that devices and wire are properly labeled.
  - k. Test the system for all specified functions according to the approved operation and maintenance manual. Systematically initiate specified functional performance items at each station, including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications. Observe all audible notification signals for routing, clarity, quality, freedom from noise and distortion, and proper volume level.
  - l. Test Both Primary and Secondary Power: Verify by test that the secondary power system is capable of operating the system for the period and in the manner specified.
- B. Report of Pretesting: After pretesting is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of witnesses to preliminary tests.
  - C. Authority Having Jurisdiction (AHJ) Inspection/Test: Only after Contractor has approved and tested the system installation the AHJ professional will schedule the inspection. The Contractor and the Manufacturer's authorized representative must be present for test. Provide a notice in writing to the Engineer for the Authority Having Jurisdiction Inspection/Test.
  - D. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets Specifications and complies with applicable standards.
  - E. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log on the satisfactory completion of tests.
  - F. Closeout: After successful completion of inspections and tests, the warranty period begins. In the event of malfunctions or excessive nuisance alarms, the Contractor must take prompt corrective action. The Owner may require a repeat of the Contractor's 100% system test, or other inspections. Continued improper performance during the warranty period shall be cause to require the Contractor to remove and replace the system.

#### 4.2 TEST EQUIPMENT

- A. Contractor shall provide two-way radios, ladders, smoke candles or test magnet, and any other materials needed to test the system.

#### 4.3 OWNER'S TRAINING/DEMONSTRATION

- A. The Manufacturer's authorized representative shall provide training for the Owner's designated employees in proper operation of the system and in all required periodic maintenance. Scheduling of training must be arranged to meet the Owner's schedule. The instruction shall include a minimum of three (3) copies of a written, bound training summary, for future reference. Basic operating instructions shall be framed and mounted at the FACP.
- B. Training shall cover the following topics as a minimum:
  - 1. Preventative maintenance service techniques and schedules, including historical data trending of alarm and trouble records.
  - 2. Overall system concepts, capabilities, and functions. The Owner shall be able to add or delete devices to the system and to take any device out of service and return any device to service without need for Manufacturer's approval.
  - 3. Explanation of all control functions, including training to program and operate the system software.
  - 4. Methods and means of troubleshooting and replacement of all field wiring and devices.
  - 5. Methods and procedures for troubleshooting the main fire alarm control panel, including field peripheral devices as to programming, bussing systems, internal panel and unit wiring, circuitry and interconnections.
  - 6. Manuals, drawings, and technical documentation. Actual system software used for training shall be provided on CD and shall be left with the Owner at the completion of training for the Owner's use in the future.

#### 4.4 DOCUMENTATION

- A. The Contractor shall provide the Engineer with three (3) copies of the following:
  - 1. As-built floor plans with device numbers, wiring and conduit layout diagrams, including wire color code and/or label numbers, and showing all interconnections in the system. Provide on paper and in AutoCAD 2000 or later electronic media format.
  - 2. Electronic circuit diagrams of all control panels, modules, annunciators, communications panels, etc.
  - 3. Technical literature on all major parts of the system, including control panels, batteries, detectors, manual stations, alarm indicating appliances, power supplies, and remote alarm transmission means.
- B. The Contractor shall provide the Owner with three (3) interconnection cables to connect the fire alarm system to a PC.

#### 4.5 ON-SITE ASSISTANCE

- A. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels, controls, and sensitivities to suit actual occupied conditions. Provide up to three requested visits to Project site for this purpose.

END OF SECTION 268311

