

SECTION 16120 - CONDUCTORS AND CABLES

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 building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

- A. 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.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 CONDUCTORS AND CABLES (600 VOLT, OR LESS)

- A. Available Manufacturers:
 - 1. Alcan Aluminum Corporation; Alcan Cable Div.
 - 2. American Insulated Wire Corp.; a Leviton Company.

3. General Cable Corporation.
 4. Senator Wire & Cable Company.
 5. Southwire Company.
 6. Okonite.
- B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.
- C. Conductor Material: Copper complying with NEMA WC 5 or 7; stranded for No. 16 AWG and larger.
- D. Conductor Insulation Types: Type THW, THHN-THWN, and XHHW, complying with NEMA WC NEMA WC 5 or 7.

2.3 CONNECTORS AND SPLICES

- A. Available Manufacturers:
1. AFC Cable Systems, Inc.
 2. AMP Incorporated/Tyco International.
 3. Hubbell/Anderson.
 4. O-Z/Gedney; EGS Electrical Group LLC.
 5. 3M Company; Electrical Products Division.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATIONS

- A. Exposed Branch Circuits, including in Crawlspace: Type THW, THHN-THWN, or XHHW single conductors in raceway.
- B. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THW, THHN-THWN, or XHHW single conductors in raceway.
- C. Fire Alarm Circuits: Type THW, THHN-THWN, or XHHW single conductors in raceway and Power-limited, fire-protective, signaling circuit cable.
- D. Class 1 Control Circuits: Type THW, THHN-THWN, or XHHW single conductors in raceway.
- E. Class 2 Control Circuits: Type THW, THHN-THWN, or XHHW single conductors in raceway.
- F. Coordinate conductor insulation temperature rating and ampacity rating with the temperature and ampacity rating of their circuit protection devices.

3.2 INSTALLATION

- A. Install single conductors in raceways, unless otherwise indicated. The raceway sizes shown in the drawings are for copper conductors with THW type insulation. Maintain raceway sizes as shown or larger for conductors with other types of insulation, unless approved otherwise.
- B. 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. Provide pulling tension and sidewall pressure calculations where required by the Engineer.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Maintain cable bending radii in excess of those allowed by the manufacturer.
- F. Support cables according to Division 16 Section "Basic Electrical Materials and Methods."
- G. Seal around cables penetrating fire-rated elements.
- H. Neatly bundle and form conductors to fan into terminals at regular intervals inside panels, switchboards, control panels, and terminal cabinets.
- I. Identify and color-code conductors and cables according to Division 16 Section "Basic Electrical Materials and Methods."

3.3 CONNECTIONS

- A. 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.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

3.4 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
 - 2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

END OF SECTION 16120

SECTION 16130 - RACEWAYS AND BOXES

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 raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
 - 1. Division 16 Section "Basic Electrical Materials and Methods" for supports, anchors, and identification products.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. LFNC: Liquidtight flexible nonmetallic conduit.
- F. RNC: Rigid nonmetallic conduit.
- G. RSC: Rigid steel conduit.

1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.5 QUALITY ASSURANCE

- A. 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.

- B. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 METAL CONDUIT AND TUBING

- A. Available Manufacturer[s]:
 - 1. AFC Cable Systems, Inc.
 - 2. Alfex Inc.
 - 3. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - 4. Electri-Flex Co.
 - 5. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
 - 6. LTV Steel Tubular Products Company.
 - 7. Manhattan/CDT/Cole-Flex.
 - 8. O-Z Gedney; Unit of General Signal.
 - 9. Wheatland Tube Co.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. IMC: ANSI C80.6.
- D. EMT and Fittings: ANSI C80.3.
 - 1. Fittings: Set-screw or compression type.
- E. FMC: Zinc-coated steel.
- F. LFMC: Flexible steel conduit with PVC jacket, Federal Specification W-C-566C.
- G. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

2.3 BOXES, ENCLOSURES, AND CABINETS

A. Available Manufacturers:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. Emerson/General Signal; Appleton Electric Company.
3. Erickson Electrical Equipment Co.
4. Hoffman.
5. Hubbell, Inc.; Killark Electric Manufacturing Co.
6. O-Z/Gedney; Unit of General Signal.
7. RACO; Division of Hubbell, Inc.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet-PLM Division.
10. Spring City Electrical Manufacturing Co.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

F. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

G. 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. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

2.4 FACTORY FINISHES

- ### A. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard prime-coat finish ready for field painting.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Indoors:

1. Exposed: EMT.
2. Concealed: EMT.

3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFNC, LFMC where greater than 2 inch trade size, in damp or wet locations.
 4. Damp or Wet Locations: Rigid steel conduit.
 5. Boxes and Enclosures: NEMA 250, Type 1.
- B. Minimum Raceway Size: 1/2-inch trade size.
- C. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

- A. 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.
- B. Complete raceway installation before starting conductor installation.
- C. Support raceways as specified in Division 16 Section "Basic Electrical Materials and Methods."
- D. Install temporary closures to prevent foreign matter from entering raceways.
- E. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.
- F. Make bends and offsets so inside diameter is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.
- G. Install exposed raceways, and raceways within accessible spaces, parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
1. Run parallel or banked raceways together on common supports.
 2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- H. Join raceways with fittings designed and approved for that purpose and make joints tight.
1. Use insulating bushings to protect conductors.
- I. Tighten set screws of threadless fittings with suitable tools.
- J. Terminations:
1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
 2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used,

align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

- K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- L. Telephone, Data, and Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
- M. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.3 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to paint finishes with matching touchup coating recommended by manufacturer.

3.4 CLEANING

- A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION 16130

SECTION 16050 - 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. Electrical demolition.
 4. Cutting and patching for electrical construction.
 5. Touchup painting.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. RNC: Rigid nonmetallic conduit.

1.4 QUALITY ASSURANCE

- A. 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.
- B. Comply with NFPA 70.

1.5 COORDINATION

- A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.

- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work.
- C. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

- A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.
- B. 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.
 - 1. Channel Thickness: Selected to suit structural loading.
 - 2. Fittings and Accessories: Products of the same manufacturer as channel supports.
- C. 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.
- D. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
- E. Expansion Anchors: Carbon-steel wedge or sleeve type.
- F. Toggle Bolts: All-steel springhead type.
- G. 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. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
- C. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.
- 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 white letters on red background.
- E. Interior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Preprinted, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.

- 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 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, stainless steel 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-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. 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.
 - 4. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
 - 5. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
 - 6. Light Steel: Sheet-metal screws.
 - 7. 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. 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. Color-code 208/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
 - 1. Phase A: Black.
 - 2. Phase B: Red.
 - 3. Phase C: Blue.
- G. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

3.5 FIRESTOPPING

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

3.6 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.

3.7 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.

3.8 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. Electrical demolition.
 - 4. Cutting and patching for electrical construction.
 - 5. Touchup painting.

3.9 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. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.10 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 16050

SECTION 16720 - FIRE ALARM & SUPPRESSION

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 fire alarm systems with manual stations, detectors, signal equipment, controls, and devices.

1.3 DEFINITIONS

- A. FACP: Fire alarm control panel.
- B. FSS: Fire Suppression System.
- C. LED: Light-emitting diode.
- D. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

1.4 SYSTEM DESCRIPTION

- A. General: Noncoded, addressable system with manual and automatic alarm initiation; and multiplexed signal transmission dedicated to fire alarm service only.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show details of graphic annunciator.
 - 1. Wiring Diagrams: Detail wiring and differentiate between manufacturer-installed and field-installed wiring. Include diagrams for equipment and for system with all terminals and interconnections identified.
 - 2. Battery: Sizing calculations.
 - 3. Floor Plans: Indicate final outlet locations and routings of raceway connections.
 - 4. Device Address List: Coordinate with final system programming.
 - 5. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.

- C. Operating Instructions: For mounting at the FACP.
- D. Product Certificates: Signed by manufacturers of system components certifying that products furnished comply with requirements.
- E. Installer Certificates: Signed by manufacturer certifying that installers comply with requirements.
- F. Field Test Reports: Indicate and interpret test results for compliance with performance requirements. Comply with NFPA 72.
- G. Maintenance Data: For fire alarm systems to include in maintenance manuals. Comply with NFPA 72.
- H. Submissions to Authorities Having Jurisdiction: In addition to distribution requirements for Submittals specified in Division 1 Section "Submittals," make an identical submission to authorities having jurisdiction. Include copies of annotated Contract Drawings as needed to depict component locations to facilitate review. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.
- I. Certificate of Completion: Comply with NFPA 72.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is an authorized representative of the FACP manufacturer for both installation and maintenance of units required for this Project.
- B. Manufacturer Qualifications: A firm experienced in manufacturing systems similar to those indicated for this Project and with a record of successful in-service performance.
- C. Source Limitations: Obtain fire alarm system components through one source from a single manufacturer.
- D. Compliance with Local Requirements: Comply with applicable building code, local ordinances and regulations, and requirements of authorities having jurisdiction.
- E. Comply with NFPA 72, NFPA 12A (Halon 1301), and the International Building Code..

1.7 SEQUENCING AND SCHEDULING

- A. Existing Fire Alarm Equipment: As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire alarm equipment "NOT IN SERVICE" until removed from the building.
- B. Equipment Removal: Remove from site and legally dispose of existing material not designated for other disposition.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but not less than one unit.
 - 2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but not less than one unit.
 - 3. Smoke Detectors, Fire Detectors, and Flame Detectors: Quantity equal to 10 percent of amount of each type installed, but not less than one unit of each type.
 - 4. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but not less than one unit of each type.
 - 5. Printer Ribbons: Six spares.
 - 6. Keys and Tools: One extra set for access to locked and tamperproofed components.

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:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ansul.
 - 2. Cerberus Pyrotronics
 - 3. Edwards Systems Technology; Unit of General Signal.
 - 4. Faraday, Inc.
 - 5. Federal Signal Corp.; Commercial Products Group.
 - 6. Fire Control Instruments, Inc.
 - 7. Fire Lite Alarms, Inc.
 - 8. Gamewell Co. (The).
 - 9. Grinnell Fire Protection Systems.
 - 10. Harrington Signal, Inc; Fire Alarm.
 - 11. Honeywell, Inc.
 - 12. Kidde.
 - 13. Notifier; Div. of Pittway Corp.
 - 14. Protectowire Co., Inc. (The).
 - 15. Silent Knight.
 - 16. Simplex Time Recorder Co.

2.2 FUNCTIONAL DESCRIPTION OF SYSTEM

- A. Control of System: By the FACP.

- B. System Supervision: Automatically detect and report open circuits, shorts, and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
- C. Priority of Signals: Automatic alarm response functions resulting from an alarm signal from one zone or device are not altered by subsequent alarm, supervisory, or trouble signals. An alarm signal is the highest priority. Supervisory and trouble signals have second- and third-level priority. Higher-priority signals take precedence over signals of lower priority, even when the lower-priority condition occurs first. Annunciate and display all alarm, supervisory, and trouble signals regardless of priority or order received.
- D. Noninterference: A signal on one zone shall not prevent the receipt of signals from other zones.
- E. System Reset: All zones are manually resettable from the FACP after initiating devices are restored to normal.
- F. Transmission to Remote Alarm Receiving Station: Automatically route alarm, supervisory, and trouble signals to a remote alarm station by means of a digital alarm communicator transmitter and telephone lines.
- G. System Alarm Capability during Circuit Fault Conditions: System wiring and circuit arrangement prevent alarm capability reduction when a single ground or open circuit occurs in an initiating device circuit, signal line circuit, or notification-appliance circuit.
- H. Loss of primary power at the FACP initiates a trouble signal at the FACP. The FACP indicates when the fire alarm system is operating on the secondary power supply.
- I. Basic Alarm Performance Requirements: Unless otherwise indicated, operation of a manual station, automatic alarm operation of a smoke or flame or heat detector, or operation of a sprinkler flow device initiates the following:
 - 1. Notification-appliance operation.
 - 2. Identification at the FACP of the device originating the alarm.
 - 3. Transmission of an alarm signal to the remote alarm receiving station.
 - 4. Release of fire and smoke doors held open by magnetic door holders.
 - 5. Shutdown of fans and other air-handling equipment serving zone when alarm was initiated.
 - 6. Closing of smoke dampers in air ducts of system serving zone where alarm was initiated.
 - 7. Recording of the event in the system memory.
 - 8. Recording of the event by the system printer.
 - 9. Release of fire suppression agent with initiation as defined in the drawings.
- J. Alarm Silencing, System Reset and Indication: Controlled by switches in the FACP.
 - 1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
 - 2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
 - 3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.

- K. Operating a heat detector in the elevator shaft shuts down elevator power by operating a shunt trip in a circuit breaker feeding the elevator.
- L. Smoke detection for zones or detectors with alarm verification initiates the following:
 - 1. Audible and visible indication of an "alarm verification" signal at the FACP.
 - 2. Activation of a listed and approved "alarm verification" sequence at the FACP and the detector.
 - 3. Recording of the event by the system printer.
 - 4. General alarm if the alarm is verified.
 - 5. Cancellation of the FACP indication and system reset if the alarm is not verified.
- M. Low-pressure switch operation on a fire suppression system initiates the following:
 - 1. A supervisory, audible, and visible "trouble" signal indication at the FACP.
 - 2. Flashing of the device location-indicating light for the device that has operated.
 - 3. Recording of the event by the system printer.
 - 4. Transmission of trouble signal to remote central station.
- N. Remote Detector Sensitivity Adjustment: Manipulation of controls at the FACP causes the selection of specific addressable smoke detectors for adjustment, display of their current status and sensitivity settings, and control of changes in those settings. Same controls can be used to program repetitive, scheduled, automated changes in sensitivity of specific detectors. Sensitivity adjustments and sensitivity-adjustment schedule changes are recorded in system memory and are printed out by the system printer.
- O. Removal of an alarm-initiating device or a notification appliance initiates the following:
 - 1. A "trouble" signal indication at the FACP and the annunciator for the device or zone involved.
 - 2. Recording of the event by the system printer.
 - 3. Transmission of trouble signal to remote alarm receiving station.
- P. Printout of Events: On receipt of the signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble), and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including the same information for device, location, date, and time. Commands initiate the printout of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.
- Q. FACP Alphanumeric Display: Plain-English-language descriptions of alarm, supervisory, and trouble events; and addresses and locations of alarm-initiating or supervisory devices originating the report. Display monitoring actions, system and component status, system commands, programming information, and data from the system's historical memory.

2.3 MANUAL PULL STATIONS

- A. Description: Fabricated of metal or plastic, and finished in red with molded, raised-letter operating instructions of contrasting color.

1. Double-action mechanism requires two actions, such as a push and a pull, to initiate an alarm.
2. Station Reset: Key or wrench operated; double pole, double throw; switch rated for the voltage and current at which it operates.
3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure, hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false alarm operation.
4. Integral Addressable Module: Arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.

2.4 SMOKE DETECTORS

A. General: Include the following features:

1. Operating Voltage: 24-V dc, nominal.
2. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
3. 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.
4. Integral Visual-Indicating Light: LED type. Indicates detector has operated.
5. Sensitivity: Can be tested and adjusted in-place after installation.
6. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
7. Remote Controllability: Unless otherwise indicated, detectors are analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.

B. Photoelectric Smoke Detectors: Include the following features:

1. Sensor: LED or infrared light source with matching silicon-cell receiver.
2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.
3. Integral Thermal Detector: Fixed-temperature type with 135 deg F (57 deg C) setting.

C. Ionization Detector: Include the following features:

1. Responsive to both visible and invisible products of combustion.
2. Self-compensating for changes in environmental conditions.

D. Duct Smoke Detector: Ionization type.

1. Sampling Tube: Design and dimensions as recommended by the manufacturer for the specific duct size, air velocity, and installation conditions where applied.
2. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.5 OTHER DETECTORS

- A. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or rate of rise of temperature that exceeds 15 deg F per minute, unless otherwise indicated.
 - 1. Mounting: Plug-in base, interchangeable with smoke detector bases.
 - 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

2.6 NOTIFICATION APPLIANCES

- A. Description: Equip for mounting as indicated and have screw terminals for system connections.
 - 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.
- B. Bells: Electric-vibrating, 24-V dc, under-dome type; with provision for housing the operating mechanism behind the bell. When operating, bells provide a sound-pressure level of 94 dB, measured 10 feet from the bell. 10-inch size, unless otherwise indicated. Bells are weatherproof where indicated.
- C. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Horns produce a sound-pressure level of 90 dB, measured 10 feet from the horn.
- D. Visible Alarm Devices: Xenon strobe lights listed under UL 1971 with clear or nominal white polycarbonate lens. Mount lens on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.
 - 1. Rated Light Output: 75 candela.
 - 2. Strobe Leads: Factory connected to screw terminals.

2.7 REMOTE DEVICE LOCATION-INDICATING LIGHTS AND IDENTIFICATION PLATES

- A. Description: LED indicating light near each smoke detector that may not be readily visible, and each halon flow switch and valve-tamper switch. Light is connected to flash when the associated device is in an alarm or trouble mode. Lamp is flush mounted in a single gang wall plate. A red, laminated, phenolic-resin identification plate at the indicating light identifies, in engraved white letters, device initiating the signal and room where the smoke detector or valve is located. For halon switches, the identification plate also designates protected spaces downstream from the switch.

2.8 MAGNETIC DOOR HOLDERS

- A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching door plate.

1. Electromagnet: Requires no more than 3 W to develop 25-lbf holding force.
2. Wall-Mounted Units: Flush mounted, unless otherwise indicated.
3. Rating: 24-V ac or dc, or 120-V ac.

B. Material and Finish: Match door hardware.

2.9 CENTRAL FACP

A. Cabinet: Lockable steel enclosure. Arrange interior components so operations required for testing or for normal maintenance of the system are performed from the front of the enclosure. If more than one unit is required to form a complete control panel, fabricate with matching modular unit enclosure to accommodate components and to allow ample gutter space for field wiring and interconnecting panels.

1. Identify each enclosure with an engraved, red, laminated, phenolic-resin nameplate with lettering not less than 1 inch high. Identify individual components and modules within cabinets with permanent labels.
2. Mounting: Surface.

B. Alarm and Supervisory Systems: Separate and independent in the FACP. Alarm-initiating zone boards consist of plug-in cards. Construction requiring removal of field wiring for module replacement is unacceptable.

C. Control Modules: Include types and capacities required to perform all functions of fire alarm systems.

D. Indications: Local, visible, and audible signals announce alarm, supervisory, and trouble conditions. Each type of audible alarm has a different sound.

E. Indicating Lights and System Controls: Individual LED devices identify zones transmitting signals. Zone lights distinguish between alarm and trouble signals, and indicate the type of device originating the signal. Manual switches and push-to-test buttons do not require a key to operate. Controls include the following:

1. Alarm acknowledge switch.
2. Alarm silence switch.
3. System reset switch.
4. LED test switch.

F. Resetting Controls: Prevent the resetting of alarm, supervisory, or trouble signals while the alarm or trouble condition still exists.

G. Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP and addressable system components, including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Display: Liquid-crystal type, 40 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

- H. Instructions: Printed or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.10 EMERGENCY POWER SUPPLY

- A. General: Components include valve-regulated, recombinant lead acid battery; charger; and an automatic transfer switch.
 - 1. Battery Nominal Life Expectancy: 10 years, minimum.
- B. Battery Capacity: Comply with NFPA 72.
 - 1. Magnetic door holders are not served by emergency power. Magnetic door holders are released when normal power fails.
- C. 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.
- D. Integral Automatic Transfer Switch: Transfers the load to the battery without loss of signals or status indications when normal power fails.

2.11 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module listed for use in providing a multiplex system address for listed fire and sprinkler alarm-initiating devices with normally open contacts.
- B. Integral Relay: Capable of providing a direct signal to the elevator controller to initiate elevator recall or to a circuit-breaker shunt trip for power shutdown.

2.12 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Listed and labeled under UL 864 and NFPA 72.
- B. Functional Performance: Unit receives an alarm, supervisory, or trouble signal from the FACP panel, and automatically captures one or two telephone lines and dials a preset number for a remote central station. When contact is made with the central station(s), the signal is transmitted. The unit supervises up to two telephone lines. Where supervising two lines, if service on either line is interrupted for longer than 45 seconds, the unit initiates a local trouble signal and transmits a signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. When telephone service is restored, unit automatically reports that event to the central station. If service is lost on both telephone lines, the local trouble signal is initiated.
- C. Secondary Power: Integral rechargeable battery and automatic charger. Battery capacity is adequate to comply with NFPA 72 requirements.

- D. Self Test: Conducted automatically every 24 hours with report transmitted to central station.

2.13 SYSTEM PRINTER

- A. Description: Listed and labeled as an integral part of the fire alarm system.

2.14 WIRE

- A. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
 - 1. Low-Voltage Circuits: No. 16 AWG, minimum.
 - 2. Line-Voltage Circuits: No. 12 AWG, minimum.
- B. Power-Limited Circuits: NFPA 70, Types FPL, FPLR, or FPLP, as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Manual Pull Stations: Mount semiflush in recessed back boxes.
- B. Ceiling-Mounted Smoke Detectors: Not less than 4 inches from a side wall to the near edge. For exposed solid-joist construction, mount detectors on the bottom of joists. On smooth ceilings, install not more than 30 feet apart in any direction.
- C. Wall-Mounted Smoke Detectors: At least 4 inches, but not more than 12 inches, below the ceiling.
- D. Smoke Detectors near Air Registers: Install no closer than 60 inches.
- E. Duct Smoke Detectors: Comply with manufacturer's written instructions.
 - 1. Verify that each unit is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 - 2. Install sampling tubes so they extend the full width of the duct.
- F. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Combine audible and visible alarms at the same location into a single unit.
- G. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.
- H. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- I. FACP: Surface mount with tops of cabinets not more than 72 inches above the finished floor.

3.2 WIRING INSTALLATION

- A. Wiring Method: Install wiring in metal raceway according to Division 16 Section "Raceways and Boxes." Conceal raceway except in unfinished spaces and as indicated.
- B. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by the manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- C. Cable Taps: Use numbered terminal strips in junction, pull and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- D. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- E. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signal from other floors or zones.
- F. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals according to Division 16 Section "Basic Electrical Materials and Methods."
- B. Identify system components, wiring, cabling, and terminals according to Division 16 Section "Electrical Identification."
- C. Install instructions frame in a location visible from the FACP.
- D. Paint power-supply disconnect switch red and label "FIRE ALARM.& SUPPRESSION"

3.4 GROUNDING

- A. Ground cable shields and equipment according to system manufacturer's written instructions to eliminate shock hazard and to minimize, to the greatest extent possible, ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- B. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding.

- C. Ground equipment and conductor and cable shields.

3.5 FIELD QUALITY CONTROL

- A. **Manufacturer's Field Service:** Engage a factory-authorized service representative to inspect field-assembled components and connections and to supervise pretesting, testing, and adjustment of the system. Report results in writing.
- B. **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.
- C. **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.
- D. **Final Test Notice:** Provide a minimum of 10 days' notice in writing when the system is ready for final acceptance testing.
- E. **Minimum System Tests:** Test the system according to procedures outlined in NFPA 72. Minimum required tests are as follows:
 - 1. Verify the absence of unwanted voltages between circuit conductors and ground.
 - 2. Test all conductors for short circuits using an insulation-testing device.
 - 3. 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.
 - 4. Verify that the control unit is in the normal condition as detailed in the manufacturer's operation and maintenance manual.
 - 5. 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.
 - 6. Test each initiating and indicating device for alarm operation and proper response at the control unit. Test smoke detectors with actual products of combustion.
 - 7. 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 voice audio for routing, clarity, quality, freedom from noise and distortion, and proper volume level.
 - 8. **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.
- F. **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.

- G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Include results for each device inspected and tested. Submit log on the satisfactory completion of tests.
- H. Tag all equipment, stations, and other components at which tests have been satisfactorily completed.

3.6 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.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:
 - 1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, adjusting, and maintaining equipment and schedules. Provide a minimum of 8 hours' training.
 - 2. Training Aid: Use the approved final version of the operation and maintenance manual as a training aid.
 - 3. Schedule training with Owner with at least seven days' advance notice.

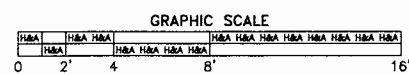
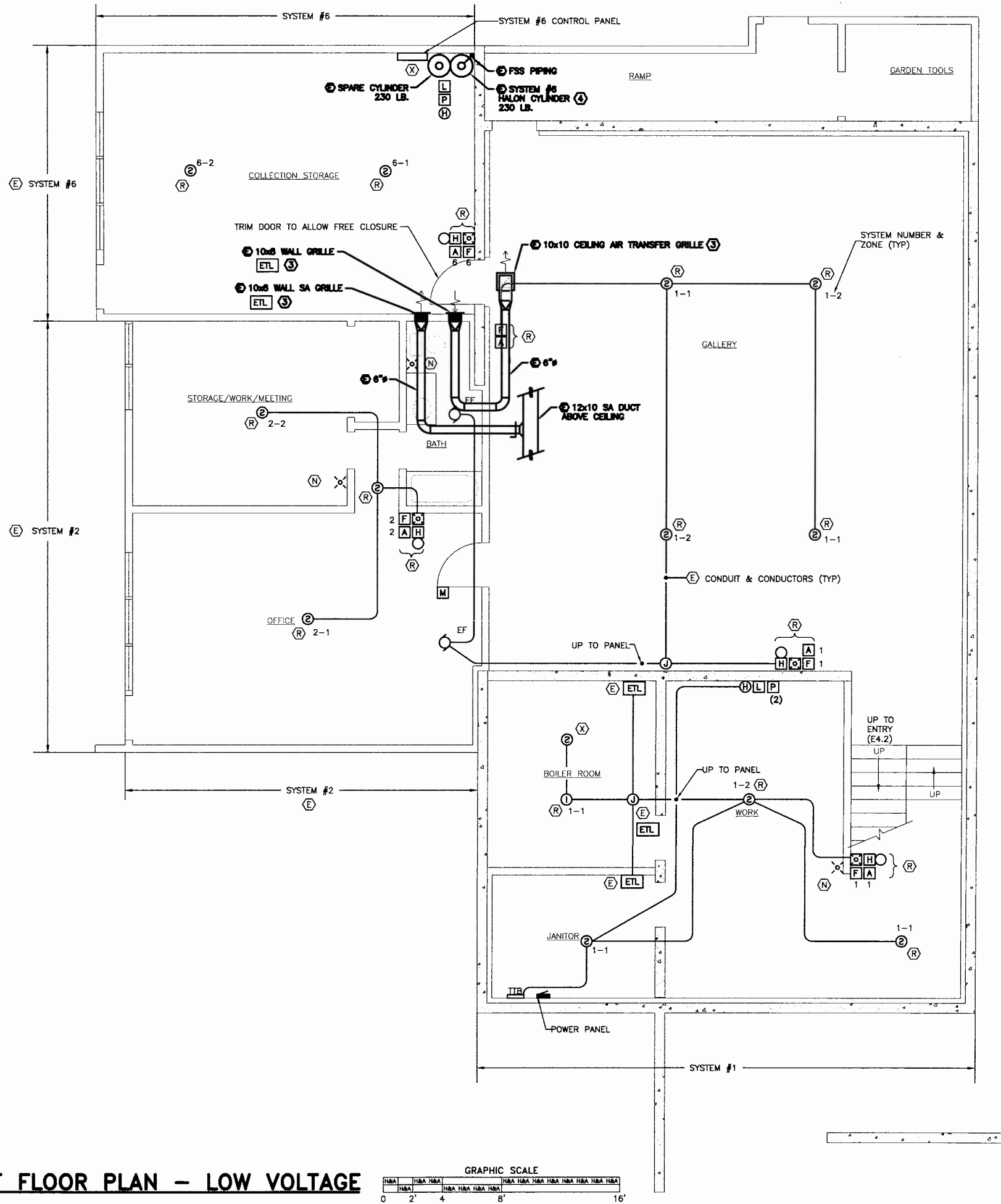
3.8 ON-SITE ASSISTANCE

- 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 16720

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FIRST FLOOR PLAN - LOW VOLTAGE



LEGEND

- | | | | |
|-----|----------------------------------|-----|------------------------------|
| F | MANUAL PULL STATION, 48" AFF | P | PRESSURE SWITCH |
| A | ABORT STATION, 48" AFF | X | REMOVE |
| ⊙ | SMOKE DETECTOR | R | REPLACE EXISTING |
| ⊙ | THERMAL DETECTOR | N | NEW |
| ⊙ | HORN/STROBE | E | EXISTING |
| ⊙ | STROBE | A | ACCESS DOOR |
| H | HALON ALARM BELL | AFF | ABOVE FINISHED FLOOR |
| ETL | ELECTRONIC THERMAL LINK ASSEMBLY | ∅ | DUCT DIAMETER |
| EOL | END OF LINE DEVICE | FD | FIRE DAMPER 1-1/2 HOUR RATED |
| M | DOOR HOLD MAGNET | FSS | FIRE SUPPRESSION SYSTEM |
| H | HALON ACTUATOR | SA | SUPPLY AIR |
| L | LOW PRESSURE SWITCH | TTB | TELEPHONE TERMINAL BOARD |

NOTES

- REPOSITION ALL WALL MOUNTED DEVICES TO COMPLY WITH CODES
- ALL DEVICES EXISTING, UNLESS OTHERWISE NOTED.
- REPLACE FIRE DAMPER/ ELECTRO LINK ASSEMBLY WITH LOW LEAKAGE 1-1/2 HOUR FIRE DAMPER, ACTUATOR, AND ELECTRONIC THERMAL LINK ASSEMBLY. CUT AND PATCH IF REQUIRED TO MATCH EXISTING. DAMPER TO CLOSE UPON ACTIVATION OF FSS. VERIFY OPERATION.
- PERFORM FUNCTIONAL TESTING PER NFPA 12A. DISABLE ELECTRICALLY ACTIVATED RELEASE MECHANISM FOR TESTING SO ACTIVATION OF RELEASE CIRCUIT WILL NOT RELEASE AGENT. VERIFY FUNCTIONALITY AND RECONNECT RELEASE MECHANISM TO STORAGE CYLINDER. CHECK FOR PROPER RESPONSE AND REPORT DEFICIENCIES.
- KNOWN CIRCUITING IS SHOWN. PROVIDE ADDITIONAL CIRCUITING TO NEW DEVICES AS NEEDED.

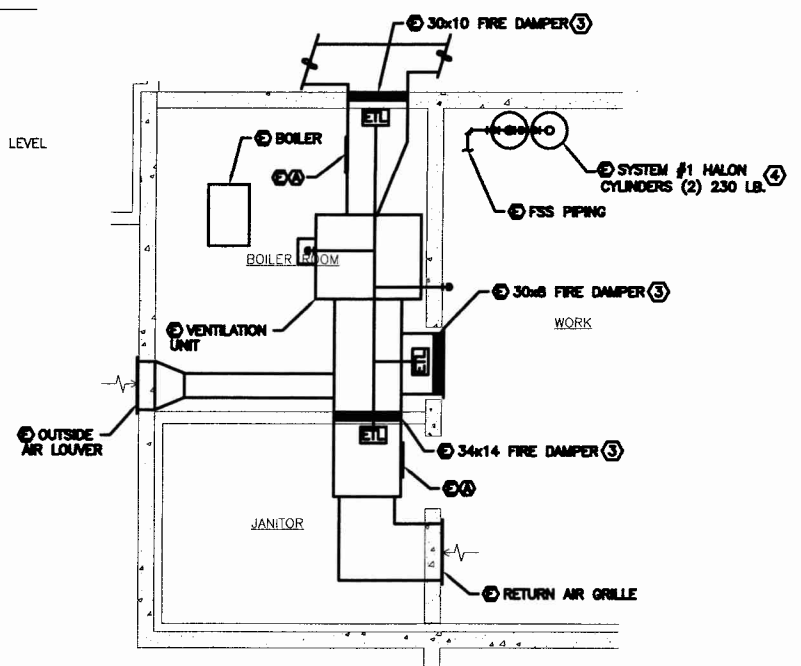
SCOPE OF WORK:

- REPLACE THE ENTIRE FIRE MONITORING AND SUPPRESSION CONTROL SYSTEM. UTILIZE EXISTING CIRCUITING WHERE POSSIBLE. PROVIDE TEST REPORTS OF ENTIRE SYSTEM CERTIFYING OPERATION. EXISTING SHOP DRAWINGS OF THE HALON SYSTEM ARE AVAILABLE IN SCANNED ELECTRONIC FORMAT.
- ADD NOTIFICATION DEVICES TO COMPLY WITH CODES.
- THE EXHAUST FANS, DAMPERS, AND DOOR HOLDERS ARE PRESENTLY CONNECTED TO RELEASE WITH THE CURRENT SYSTEM. THE CIRCULATION FANS IN THE UPPER LEVEL GALLERY ARE NOT.
- INSPECT, TEST, AND PROVIDE DEFICIENCY LIST OF EXISTING HALON CYLINDERS, SOLENOID VALVES AND RELATED TRIM, PIPING, AND NOZZLES. PROVIDE AIR TIGHTNESS TEST OF FACILITY AFTER RENOVATIONS ARE COMPLETE. PROVIDE FUNCTIONAL TESTING OF HALON SYSTEM PER NFPA 12A.
- ALL WORK SHALL BE DONE IN ACCORDANCE WITH 2006 INTERNATIONAL BUILDING CODES, 2008 NATIONAL ELECTRICAL CODE, 2008 NFPA CHAPTER 12A HALON 1301 FIRE EXTINGUISHING SYSTEMS, AND STATE OF ALASKA REQUIREMENTS.

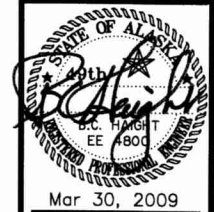
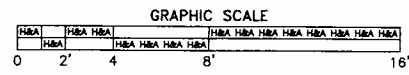
SYSTEM OPERATING PROTOCOL:

- ALL THERMAL & SMOKE DETECTORS, AND MANUAL PULL STATIONS INITIATE ALARMS THROUGHOUT THE FACILITY.
- INITIATION OF OUTPUT FROM DETECTORS OF BOTH ZONES OR ANY TWO DETECTORS IN ONE SYSTEM ACTIVATES THAT SUPPRESSION SYSTEM. INITIATION OF A MANUAL PULL STATION IN A SYSTEM ALSO ACTIVATES THAT SUPPRESSION SYSTEM.
- INITIATION OF AN ABORT STATION IN A SYSTEM INHIBITS THAT SUPPRESSION SYSTEM ACTIVATION.
- ALARM ACTIVATION INCLUDES HORNS, STROBES, PRINTER, ANNUNCIATOR DISPLAY, AND COMMUNICATOR.
- ALARMS ALSO RELEASE DAMPERS & DOORS, AND INHIBIT EXHAUST FAN & CIRCULATION FAN OPERATION.
- THE CYLINDER LOW PRESSURE SWITCHES SHALL INITIATE SUPERVISORY TROUBLE ALARMS.

MID LEVEL
LOWER LEVEL



BOILER ROOM - MECHANICAL



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CONSULTING ELECTRICAL ENGINEERS

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FIRE SUPPRESSION SYSTEM REHABILITATION
SHELDON MUSEUM
HAINES, ALASKA

FIRST FLOOR PLAN
LOW VOLTAGE

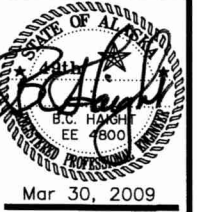
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FIRE SUPPRESSION SYSTEM REHABILITATION
SHELDON MUSEUM
 HAINES, ALASKA

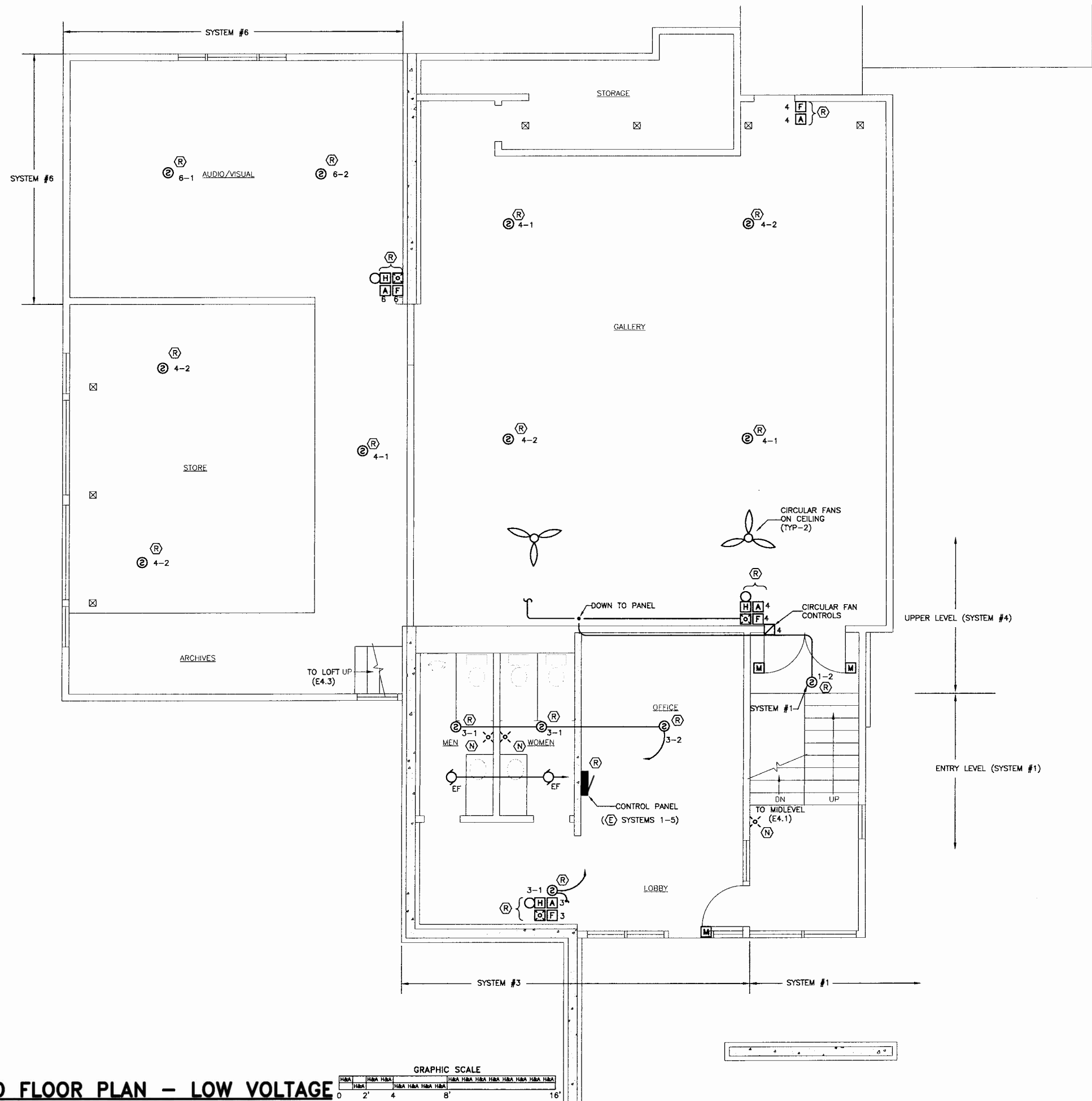
SECOND FLOOR PLAN
 LOW VOLTAGE

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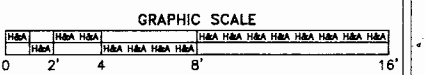
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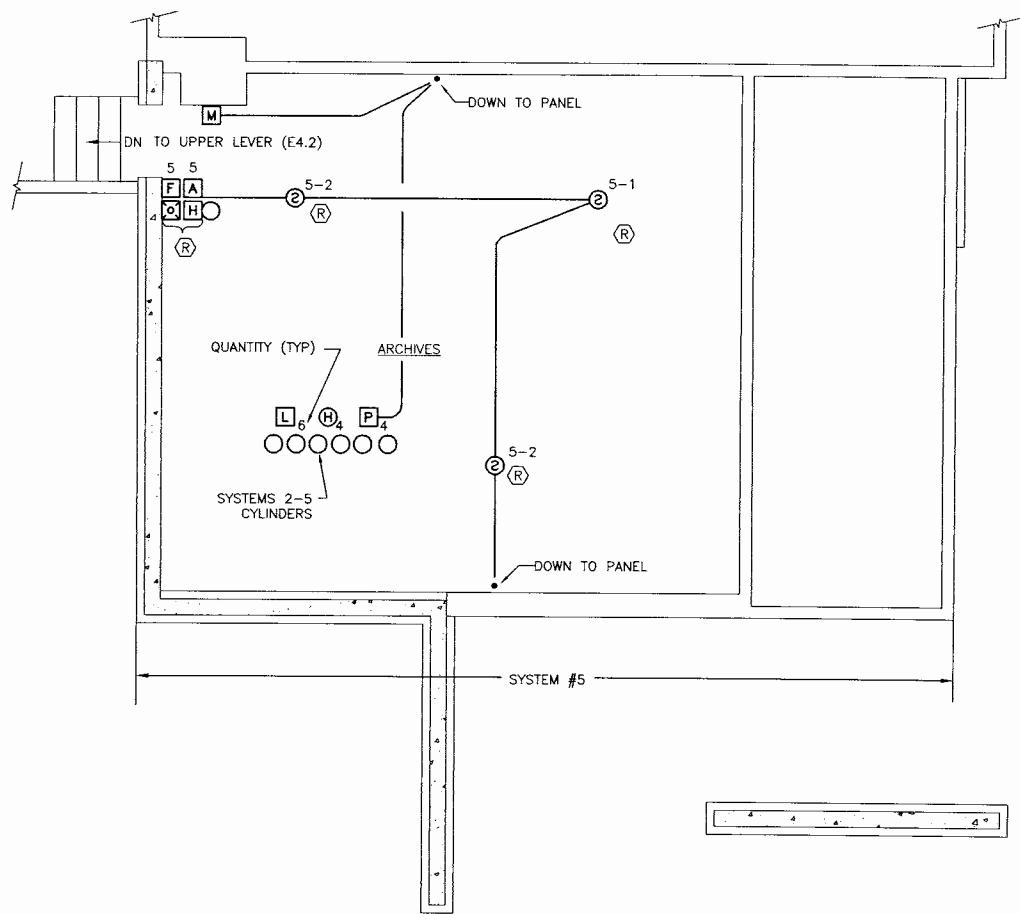
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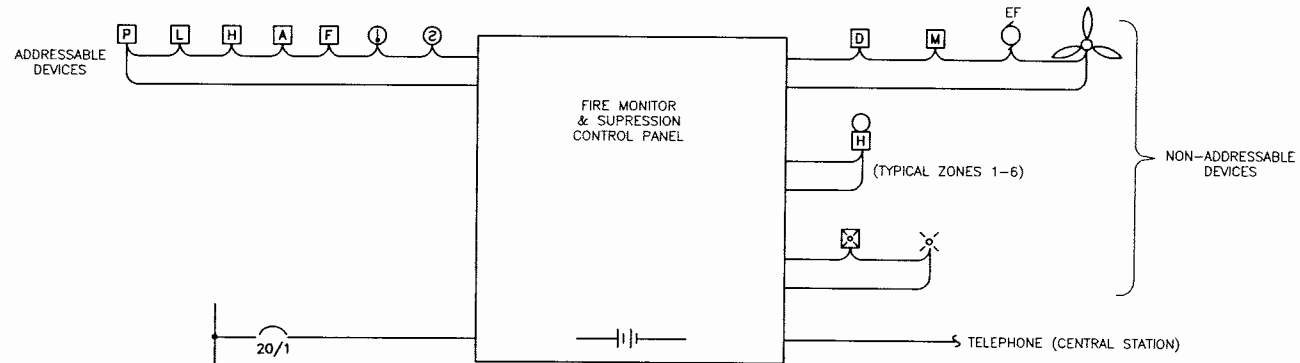
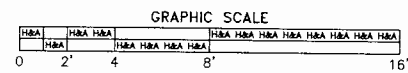
SECOND FLOOR PLAN - LOW VOLTAGE



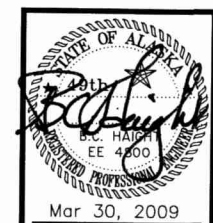
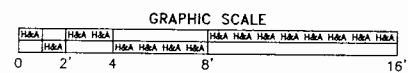
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THIRD FLOOR (LOFT) PLAN - LOW VOLTAGE



LINE DIAGRAM - MONITORING & SUPPRESSION CONTROLS



Mar 30, 2009



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FIRE SUPPRESSION SYSTEM REHABILITATION
SHELDON MUSEUM
 HAINES, ALASKA

THIRD FLOOR (LOFT) PLAN
LOW VOLTAGE

REVISION	DESCRIPTION	DATE

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 DATE: MARCH 2009