

100% CONSTRUCTION DOCUMENTS  
FOR BID AND PERMIT  
FEBRUARY 03, 2015



FIRE ALARM REPLACEMENT TO:

## **USF MHC BUILDING**

4202 E. FOWLER AVE., MHC  
TAMPA, FLORIDA 33620

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# Specification Index

## DIVISION 16 - ELECTRICAL

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SECTION 16010 - BASIC ELECTRICAL REQUIREMENTS

PART I - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, apply to work of this Section.
- B. 16010 Basic Electrical Requirements
  - 16110 Raceways
  - 16120 Wires and Cables
  - 16135 Electrical Boxes and Fittings
  - 16142 Electrical Connections for Equipment
  - 16143 Wiring Devices
  - 16190 Supporting Devices
  - 16721 Fire Alarm System

1.2 CODES:

- A. The work shall be in conformance with the following:

NFPA70	National Electric Code	2010
NFPA 72	National Fire Alarm Code	2007
Florida Building Code		2010
Florida Fire Prevention Code		2014
- B. The installation shall also comply with all applicable rules and regulations of local and state laws and ordinances. Include in the work, without extra cost, any labor, materials, services, apparatus and drawings required to comply with all applicable laws, ordinances, rules and regulations. Inform the architect of any work or materials which conflict with any of the applicable codes, standards, laws, and regulations before submitting their bid.

1.3 ROUGH-IN:

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in Divisions 2 through 15 for rough-in requirements.

1.4 ELECTRICAL INSTALLATIONS:

- A. Existing services shall not be interrupted without prior consent of the owner's authorized representative and may be interrupted only at, and for, the specific time designated by the owner's authorized representative.
- B. Make a thorough examination of the site and the contract documents. No claim for extra compensation will be recognized if difficulties are encountered which an examination of site conditions and contract documents prior to executing contract would have revealed.
- C. Coordinate electrical equipment and materials installation with other building components.
- D. Verify all dimensions by field measurements.
- E. Arrange for chases, slots, and openings in other building components to allow for electrical installations.

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- F. 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. 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.
- G. Coordinate the cutting and patching of building components to accommodate the installation of electrical equipment and materials.
- H. Install electrical equipment to facilitate 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.
- I. Coordinate the installation of electrical materials and equipment above ceilings with suspension system, mechanical equipment and systems, and structural components.
- J. Temporary electrical service and construction lighting shall be provided under this section. Provide for all electrical service for construction period, making all connections and removal of same at job conclusion. Furnish and install temporary lighting for construction period. At job completion, all temporary lamps shall be removed and replaced with new lamps.
- K. All existing and new conduit/raceways within the project area shall be properly supported. Add support to existing conduit as required to comply with the NEC.

1.5 CUTTING AND PATCHING:

- A. Do not endanger or damage installed work through procedures and processes of cutting and patching.
- B. Arrange for repairs required to restore other work because of damage caused as a result of electrical installations.
- C. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.
- D. Perform cutting, fitting, and patching of electrical equipment and materials required to:
  - 1. uncover work to provide for installation of ill-timed work.
  - 2. remove and replace defective work.
  - 3. remove and replace work not conforming to requirements of the contract documents.
  - 4. remove samples of installed work as specified for testing.
  - 5. install equipment and materials in existing structures.
  - 6. Upon written instructions from the architect/engineer, uncover and restore work to provide for architect/engineer observation of concealed work.
- E. 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.
- F. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- G. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

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- H. Locate, identify, and protect electrical services passing through remodeling or demolition area and serving other areas required to be maintained operational. When transit services must be interrupted, provide temporary services for the affected areas and notify the owner prior to changeover.
- 1.6 ELECTRICAL SUBMITTALS:
- A. Submittal of shop drawings, product data, and samples will be accepted only when submitted by the contractor. Data submitted from subcontractors and material suppliers directly to the architect/engineer will not be processed.
- 1.7 PRODUCT LISTING:
- A. Prepare listing of major electrical equipment and materials for the project.
  - B. When two or more items of the same material or equipment are required, they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, wire, conduit, fittings, sheet metal, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in work, except as otherwise indicated.
  - C. Provide products which are compatible within systems and other connected items.
  - D. No substitution will be considered unless written request has been submitted to the architect at least ten (10) days prior to the date for receipt of bids.
- 1.8 DELIVERY, STORAGE, AND HANDLING:
- A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.
  - B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.
  - C. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installation.
- 1.9 RECORD DOCUMENTS:
- A. Mark drawings to indicate revisions to conduit size and location, both exterior and interior; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column lines; distribution and branch electrical circuitry; fuse and circuit breaker size and arrangements; support and hanger details; change orders; concealed control system devices.
  - B. Mark Specifications to indicate approved substitutions; change orders; actual equipment and materials used.
- 1.10 WARRANTIES:
- A. Compile and assemble the warranties specified in Division 16 into a separated set of vinyl-covered, three-ring binders, tabulated and indexed for easy reference.

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- B. Provide complete warranty information for each item to include product or equipment; date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

END OF SECTION 16010



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SECTION 16110 - RACEWAYS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions apply to work of this Section.
- B. This Section is a Division 16 Basic Electrical Materials and Methods section and is part of each Division 16 section making reference to electrical raceways specified herein.

1.2 DESCRIPTION OF WORK:

- A. All new fire alarm wiring shall be in conduit as shown by drawings and schedules.
- B. Types of raceways specified in this section include the following:
  - Electrical metallic tubing (EMT).
  - Liquid-tight flexible metal conduit.
  - Rigid metal conduit.
  - Flexible metal conduit.
  - Wireways.

1.3 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of raceway systems of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Installer's Qualifications: Firms with at least three (3) years of successful installation experience on projects with electrical raceway work similar to that required for this project.
- C. Codes and Standards:
  - 1. UL Compliance and Labeling: Comply with applicable requirements of UL safety standards pertaining to electrical raceway systems. Provide raceway products and components which have been UL listed and labeled.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING:

- A. General: Provide metal conduit, tubing, and fittings of types, grades, sizes, and weights (wall thicknesses) for each service indicated.
- B. Where types and grades are not indicated, provide proper selection determined by installer to fulfill wiring requirements, and comply with applicable portions of NEC for raceways.
- C. Rigid Steel Conduit: Provide rigid steel, hot dipped galvanized, threaded type.

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- D. Flexible Metal Conduit: UL 1 formed from continuous length of spirally-wound, interlocked, zinc-coated strip steel.
- E. Liquid-Tight Flexible Metal Conduit: Provide liquid-tight flexible metal conduit. Construct of single strip, flexible, continuous, interlocked, and double-wrapped steel; galvanized inside and outside. Coat with liquid-tight jacket of flexible polyvinyl chloride (PVC).
- F. Rigid Metal Conduit Fittings: Cast malleable iron, galvanized or cadmium plated.
  - 1. Use Type 1 fittings for rain-tight connections.
  - 2. Use Type 2 fittings for concrete tight connections.
- G. Flexible Metal Conduit Fittings: Provide conduit fittings for use with flexible steel conduit of threadless, hinged clamp type.
  - 1. Straight Terminal Connectors: One piece body, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.
  - 2. 45° or 90° Terminal Angle Connectors: Two-piece body construction with removable upper section, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.
- H. Liquid-Tight Flexible Metal Conduit Fittings: Provide cadmium plated, malleable iron fittings with compression-type, steel ferrule and neoprene gasket sealing rings, with insulated, or non-insulated throat.
- I. Electrical Metallic Tubing (EMT): UL 797.
- J. EMT Fittings: Couplings and connectors for conduit sizes 2" and smaller shall be steel hex-nut, expansion-gland type, zinc or cadmium plated. Set screw type fittings may be used for conduit sizes 2½" and larger.

2.2 WIREWAYS:

- A. General: Provide electrical wireways of types, grades, sizes, and number of channels for each type of service as indicated. Provide complete assembly of raceway including, but not limited to, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other components and accessories as required for complete system.
- B. Lay-in Wireways: Construct lay-in wireways with hinged covers in accordance with UL 870 and with components UL-listed, including lengths, connectors, and fittings. Select units to allow fastening hinged cover closed without use of parts other than standard lengths, fittings and connectors. Construct units to be capable of sealing cover in closed position with sealing wire. Provide wireways with knockouts.
  - 1. Connectors: Provide wireway connectors suitable for "lay-in" conductors, with connector covers permanently attached so that removal is not necessary to utilize the lay-in feature.
  - 2. Finish: Protect sheet metal parts with rust inhibiting coating and baked enamel finish. Plate finish hardware to prevent corrosion. Protect screws installed toward inside of wireway with spring nuts to prevent wire insulation damage.
- C. Rain-tight Wireway: Construct rain-tight lay-in wireways with hinged covers, in accordance with UL 870 and with components UL listed, including lengths, connectors, and fittings. Design units

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to allow fastening hinged cover closed without use of parts other than standard lengths, fittings and connectors. Construct units to be capable of sealing cover in closed position with sealing wire. Provide wireway units with knockouts only in bottom of troughs.

- D. Rain-tight Troughs: Construct in accordance with UL 870, with components UL-listed.
1. Construction: 16-gauge galvanized sheet metal parts for 4"x4" to 6"x6" sections, and 14-gauge parts for 8"x8" and larger sections. Provide knockouts only in bottom of troughs, with suitable adapters to facilitate attaching to other NEMA 3R enclosures. Do not use gasketing that can rip or tear during installation, or would compromise rain-tight capability of the trough. Do not use cover screws that will protrude into the trough area and damage wire insulation.
  2. Finish: Provide 14-gauge and 16-gauge galvanized sheet metal parts with corrosion-resistant phosphate primer and baked enamel finish. Plate hardware to prevent corrosion.

PART 3 - EXECUTION

3.1 OBSERVATION:

- A. Examine areas and conditions under which raceways are to be installed and substrate which will support raceways. Notify contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.2 INSTALLATION OF RACEWAYS:

- A. General: Raceways run below grade, under floors on grade, or in concrete shall be rigid steel conduit or PVC heavy wall type (schedule 40) conduit, provided rigid steel conduit is used on elbows and risers to boxes, cabinets, etc. All other raceways may be thin wall conduit. PVC conduit shall not be used in patient care areas.
- B. Conduit run above accessible ceilings shall be supported from the structure and shall not be supported from, or attached to, ceiling suspension system. Double locknuts shall be used on all rigid conduit terminations except threaded hubs. All conduit shall be made up tight and no running threads will be permitted. "Erickson" couplings shall be used where necessary. All metallic conduit runs below grade or under floors on grade shall be given one (1) coat of Rust-Oleum 'Gray Primer' and one (1) heavy coat of Rust-Oleum 'Flat Black' acrylic paint or a heavy coat of an approved non-bitumastic asphaltic type compound.
- C. Sizes of raceways shall be not less than NEC requirements and shall not in any case be less than indicated on the drawings. Larger size raceways and/or pull boxes shall be installed if there is excessive length of unbroken run or excessive number of bends. Combining of circuits other than those indicated on the drawings will not be permitted.
- D. Coordinate with other work, including wires/cables, boxes, and panel work, as necessary to interface installation of electrical raceways and components with other work.
1. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat surfaces with corrosion inhibiting compound before assembling.

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2. Use roughing-in dimensions of electrically operated unit furnished by supplier. Set conduit and boxes for connection to units only after receiving review of dimensions and after checking location with other trades.
3. Provide nylon pull cord in empty conduits where indicated. Test all empty conduits with ball mandrel. Clear any conduit which rejects ball mandrel. Pay costs involved for restoration of conduit and surrounding surfaces to original condition.
4. Use liquid-tight flexible conduit where subjected to one or more of the following conditions:
  - a. Exterior location.
  - b. Moist or humid atmosphere where condensate can be expected to accumulate.
  - c. Corrosive atmosphere.
  - d. Subjected to water spray or dripping oil, water, or grease.
- E. Cut conduits straight, ream properly, and cut threads for heavy wall conduit deep and clean.
- F. Field-bend conduit with benders designed for purpose so as not to distort nor vary internal diameter.
- G. Fasten conduit terminations in sheet metal enclosures by two (2) locknuts, and terminate with bushing. Install locknuts inside and outside enclosure.
- H. Conduits are not to cross pipe shafts or ventilating duct openings.
- I. Keep conduits a minimum distance of 6" from parallel runs of flues, hot water pipes, or other sources of heat. Do not install horizontal raceway runs below water and steam piping.
- J. Support riser conduit at each floor level with clamp hangers.
- K. Use of running threads at conduit joints and terminations is prohibited. Where required, use 3-piece union or split coupling.
- L. Complete installation of electrical raceways before starting installation of cables/wires within raceways.
- M. Concealed Conduits:
  1. Metallic raceways installed underground or in floors below grade, or outside are to have conduit threads painted with corrosion-inhibiting compound before couplings are assembled. Draw up coupling and conduit sufficiently tight to ensure water tightness.
  2. For floors-on-grade, install conduits under concrete slabs.
  3. Install underground conduits a minimum of 24" below finished grade.
- N. Conduits in Concrete Slabs:
  1. Place conduits between bottom reinforcing steel and top reinforcing steel. Place conduits either parallel or at 90 degrees to main reinforcing steel.
  2. Separate conduits by not less than diameter of largest conduit to ensure proper concrete bond.

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3. Conduits crossing in slab must be reviewed for proper cover by engineer.
  4. Embedded conduit diameter is not to exceed one-third (1/3) of slab thickness.
- O. Install conduits as not to damage or run through structural members. Avoid horizontal or cross runs in building partitions or side walls.
- P. Exposed Conduits:
1. Install exposed conduits and extensions from concealed conduit systems neatly, parallel with, or at right angles to walls of building.
  2. Install exposed conduit work as not to interfere with ceiling inserts, lights, or ventilation ducts or outlets.
  3. Support exposed conduits by use of hangers, clamps, or clips. Support conduits on each side of bends and on spacing not to exceed 8'-0".
  4. Run conduits for outlets on waterproof walls exposed. Set anchors for supporting conduit on waterproof wall in waterproof cement.
  5. Above requirements for exposed conduits also apply to conduits installed in space above hung ceilings, and in crawl spaces.
- Q. Conduit Fittings:
1. Construct locknuts for securing conduit to metal enclosure with sharp edge for digging into metal, and ridged outside circumference for proper fastening.
  2. Bushings for terminating conduits smaller than 1" are to have flared bottom and ribbed sides, with smooth upper edges to prevent injury to cable insulation.
  3. Install insulated type bushings for terminating conduits 1" and larger. Bushings are to have flared bottom and ribbed sides. Upper edge to have phenolic insulating ring molded into bushing.
  4. Bushing of standard or insulated type to have screw type grounding terminal.
  5. Miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split couplings, and plugs to be specifically designed for their particular application.
- 3.3 FIELD QUALITY CONTROL:
- A. General: Mechanically assemble metal enclosures and raceways for conductors to form continuous electrical conductor, and connect to electrical boxes, fittings and cabinets as to provide effective electrical continuity and rigid mechanical assembly.
  - B. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat all surfaces with corrosion-inhibiting compound before assembling.
  - C. Install expansion fittings in all raceways wherever structural expansion joints are crossed.

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- D. Make changes in direction of raceway run with proper fittings supplied by raceway manufacturer. No field bends of raceway sections will be permitted.
- E. Properly support and anchor raceways for their entire length by structural materials. Raceways are not to span any space unsupported.
- F. Use boxes as supplied by raceway manufacturer wherever junction, pull, or devices boxes are required. Standard electrical "handy" boxes, etc. shall not be permitted for use with surface raceway installations.
- G. Raceway penetrations of fire-rated walls and/or floors shall be sealed to maintain integrity of construction. All products, materials, and methods of installation shall be UL approved and meet NFPA requirements.
- H. Fire rating of construction assemblies are specified under architectural section of the contract documents.
- I. Unless otherwise noted on drawings, notified by architect and/or authorities having jurisdiction, the following materials may be used.
  - 1. Rock wool: Minimum four pound per cubic foot density; flame spread 15, smoke developed 0, fuel contribution 0 by ASTM 384; minimum melting point 2000°F.
  - 2. Concrete and masonry are also approved firestop materials by NFPA 90A.
  - 3. UL approved products such as Nelson Type CLK Silicon Sealant. Manufacturers recommendations shall be strictly followed.
- J. Submit complete data on fire-stopping materials and construction methods for review by architect before proceeding with work.

END OF SECTION 16110

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SECTION 16120 - WIRES AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, apply to work of this Section.
- B. This Section is a Division 16 Basic Electrical Materials and Methods section, and is part of each Division 16 section making reference to wires and cables specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of electrical wire and cable work is indicated by drawings and schedules.
- B. Types of electrical wire, cable, and connectors specified in this Section include the following:
  - Copper conductors.
  - Fixture wires.
  - Split-bolt connectors.
  - Wirenut connectors.
- C. Applications of electrical wire, cable, and connectors required for project are as follows:
  - 1. For power distribution circuits.
  - 2. For lighting circuits
  - 3. For appliance and equipment circuits.
  - 4. For motor-branch circuits.

1.3 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of electrical wire and cable products of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than five years.
- B. Installer's Qualifications: Firm with at least three years of successful installation experience with projects utilizing electrical wiring and cabling work similar to that required for this project.
- C. NEC Compliance: Comply with NEC requirements as applicable to construction, installation, and color coding of electrical wires and cables.
- D. IEEE Compliance: Comply with applicable requirements of IEEE Stds. 82, "Test Procedures for Impulse Voltage Tests on Insulated Conductors", and Std. 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to wiring systems.
- E. ASTM Compliance: Comply with applicable requirements of ASTM B1, 2, 3, 8 and D-753. Provide copper conductors with conductivity of not less than 98% at 20°C (68°F).

- F. The following systems of color coding shall be strictly adhered to:
- |                                      |                     |
|--------------------------------------|---------------------|
| grounded leads                       | Green               |
| grounded neutral leads               | white               |
| 120/208 volt, ungrounded phase wires | black, red and blue |
- G. The color code assigned to each phase wire shall be consistently followed throughout.

#### 1.4 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver wire and cable properly packaged in factory-fabricated type containers, or wound on NEMA specified type wire and cable reels.
- B. Store wire and cable in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
- C. Handle wire and cable carefully to avoid abrading, puncturing and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

### PART 2 - PRODUCTS

#### 2.1 BUILDING WIRES:

- A. Provide factory-fabricated wires of sizes, ampacity ratings, and materials for applications and services indicated.
- B. Conductor insulation shall be dual type THHN/THWN 75°C (167°F) for dry, damp, and wet locations. Conductor insulation with single type marking THHN 90°C (194°F) may be used for dry locations only.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION OF WIRES AND CABLES:

- A. General: Install electrical cables, wires and wiring connectors as indicated, in compliance with applicable requirements of NEC, NEMA, UL, and NECA's "Standard of Installation" and in accordance with recognized industry practices.
- B. Unless otherwise noted, all branch circuit conductors shall be No. 12 AWG. Branch circuits over 75 feet in length shall be No. 10 AWG unless noted otherwise.
- C. Install UL Type THWN or THHN wiring in conduit, for feeders and branch circuits.
- D. Pull conductors simultaneously where more than one is being installed in same raceway.
- E. Use pulling compound or lubricant, where necessary; compound used must not deteriorate conductor or insulation.
- F. Use pulling means including, fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceway.



- G. Keep conductor splices to minimum.
- H. Install splices and tapes which possess equivalent-or-better mechanical strength and insulation ratings than conductors being spliced. Use splice and tap connectors which are compatible with conductor material.

3.2 FIELD QUALITY CONTROL:

- A. Prior to energization of circuitry, check installed feeder wires and cables with megohm meter to determine insulation resistance levels to ensure requirements are fulfilled. A list of feeders tested shall be submitted to the engineer indicating the insulation resistance level for each cable.
- B. Prior to energization, test wires and cables for electrical continuity and for short-circuits.
- C. Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION 16120



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SECTION 16135 - ELECTRICAL BOXES AND FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, apply to work of this Section.
- B. This Section is a Division 16 Basic Electrical Materials and Methods section, and is a part of each Division 16 section making reference to electrical wiring boxes and fittings specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of electrical box and associated fitting work is indicated by drawings and schedules.
- B. Types of electrical boxes and fittings specified in this Section include the following:
  - Outlet boxes.
  - Junction boxes.
  - Pull boxes.

1.3 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in the manufacture of electrical boxes and fittings of types, sizes, and capacities required, whose products have been in satisfactory use in similar service for not less than three (3) years.
- B. Installer's Qualifications: Firms with at least three (3) years of successful installation experience on projects utilizing electrical boxes and fittings similar to those required for this project.
- C. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wiring boxes and fittings.
- D. UL Compliance: Comply with applicable requirements of UL 50, UL 514-Series, and UL 886 pertaining to electrical boxes and fittings. Provide electrical boxes and fittings which are UL listed and labeled.

PART 2 - PRODUCTS

2.1 FABRICATED MATERIALS:

- A. Outlet Boxes: Provide galvanized coated flat-rolled sheet-steel outlet wiring boxes, of shapes, cubic inch capacities, and sizes (including box depths as indicated), suitable for installation at respective locations. Construct outlet boxes with mounting holes and with cable and conduit-size knockout openings in bottom and sides.

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1. Outlet Box Accessories: Provide outlet box accessories as required for each installation; including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used to fulfill installation requirements for individual wiring situations.
  2. Ceiling boxes shall be 4" square or octagonal, 1<sup>1</sup>/<sub>8</sub>" deep for exposed work or furred ceiling work and 3" deep for concrete work. Plaster rings and/or fixture studs shall be provided where required.
- B. Device Boxes: Provide galvanized coated flat-rolled sheet-steel, non-gangable device boxes, of shapes, cubic inch capacities, and sizes (including box depths as indicated), suitable for installation at respective locations. Construct device boxes for flush mounting with mounting holes, and with cable-size knockout openings in bottom and ends and with threaded screw holes in end plates for fastening devices. Provide cable clamps and corrosion-resistant screws for fastening cable clamps and for equipment type grounding.
1. Device Box Accessories: Provide device box accessories as required for each installation; including mounting brackets, device box extensions, switch box supports, plaster ears, and plaster board expandable grip fasteners, which are compatible with device boxes being utilized to fulfill installation requirements for individual wiring situations.
  2. Flush mounted wall outlets shall be 4" square boxes or gang boxes, not less than 1<sup>1</sup>/<sub>2</sub>" deep. Boxes shall be provided with extension rings and/or covers with sufficient depth to bring the covers flush with the finished wall.
  3. Boxes for flush mounting in concrete block work with one or two devices shall have covers with square corners on the raised portion of the cover. The covers shall have a sufficient amount of depth to be flush with the face of the block. Covers shall be Steel City 52-C series. Boxes for more than two devices shall be Steel City "GW" gang boxes. The bottom side of the covers or boxes shall be installed at the masonry course nearest to the dimension specified or noted.
  4. Outlet boxes for exposed wall mounting and outdoor installation shall be cast metal type "FS" or "FD" boxes with suitable cast aluminum covers. Weatherproof receptacle covers shall have spring hinged lids.
- C. Rain-Tight Outlet Boxes: Provide corrosion-resistant, cast-metal, rain-tight outlet wiring boxes; of types, shapes and sizes (including depth of boxes), with threaded conduit holes for fastening electrical conduit, cast-metal face plates with spring-hinged watertight caps suitably configured for each application, including face plate gaskets and corrosion-resistant plugs and fasteners.
- D. Junction and Pull Boxes: Provide galvanized, code-gauge sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.

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PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS:

- A. General: Install electrical boxes and fittings as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.
- C. Provide weather-tight outlets for interior and exterior locations exposed to weather or moisture.
- D. Provide knockout closures to cap unused knockout holes where blanks have been removed.
- E. Install electrical boxes in those locations which ensure ready accessibility to enclosed electrical wiring. All existing and new junction boxes within the project area shall be made accessible. Relocate existing junction boxes as required to comply with the NEC.
- F. Metallic and approved nonmetallic electrical outlet boxes may be installed in vertical fire resistive assemblies classified as 2-hour or less without affecting the fire classification, provided such openings occur on one side only in each framing space and that openings do not exceed 16 square inches. Boxes located opposite sides of walls or partitions shall be separated by a horizontal distance of 24".
- G. In openings larger than 16 square inches, the wall shall be built around openings so as not to interfere with the integrity of the wall rating.
- H. All clearances between such boxes and the gypsum board shall be completely filled with joint compound or other approved material.
- I. Position recessed outlet boxes accurately to allow for surface finish thickness.
- J. Set floor boxes level and flush with finish flooring material.
- K. Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.
- L. Subsequent to installation of boxes, protect boxes from construction debris and damage.
- M. Spot paint all new and existing "J" boxes, panelboards, and conduit within the project area. Conduit shall be identified to within 6" of the box or enclosure. Paint colors shall be as follow USF design standards :

Red                      Fire Alarm

END OF SECTION 16135

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SECTION 16142 - ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, apply to work of this Section.
- B. This Section is a Division 16 Basic Electrical Materials and Methods section, and is part of each Division 15 and Division 16 section making reference to electrical connections for equipment specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of electrical connections for equipment is indicated by drawings and schedules. Electrical connections are hereby defined to include connections used for providing electrical power to equipment.
- B. Electrical connections for equipment, not furnished as integral part of equipment, are specified in Division 15 and other Division 16 sections, and are work of this Section.
- C. Motor starters and controllers not furnished as integral part of equipment are specified in applicable Division 16 sections and are work of this Section.
- D. Junction boxes and disconnect switches required for connecting motors and other electrical units of equipment are specified in applicable Division 16 sections, and are work of this Section.
- E. Electrical identification for wire/cable conductors is specified in Division 16 section, "Electrical Identification", and is work of this Section.
- F. Raceways and wires/cables required for connecting motors and other electrical units of equipment are specified in applicable Division 16 sections, and are work of this Section.

1.3 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of electrical connection materials, including electrical insulating tape, soldering fluxes, connectors and terminals, of types and ratings required, and ancillary and cable ties; whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Installer's Qualifications: Firms with at least two (2) years of successful installation experience with projects utilizing electrical connections for equipment similar to that required for this project.
- C. NEC Compliance: Comply with applicable requirements of NEC as to type products used and installation of electrical power connections (terminals and splices) for junction boxes, motor starters, and disconnect switches.
- D. UL Compliance: Comply with UL Std 486A, "Wire Connectors and Soldering Lugs for Use With Copper Conductors" including, but not limited to, tightening of electrical connectors to torque

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values indicated. Provide electrical connection products and materials which are UL listed and labeled.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS:

- A. General: For each electrical connection indicated, provide complete assembly of materials; including, but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, cable ties, solderless wirenuts, and other items and accessories as needed to complete splices and terminations of types indicated.
- B. Metal Conduit, Tubing and Fittings, General: Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) indicated for each type service. Where types and grades are not indicated, provide proper selection as determined by installer to fulfill wiring requirements and comply with NEC requirements for raceways. Provide products complying with Division 16 Basic Electrical Materials and Methods section "Raceways", and in accordance with the following listing of metal conduit, tubing and fittings:
  - Rigid steel conduit.
  - Rigid metal conduit fittings.
  - Electrical metallic tubing.
  - EMT fittings.
  - Flexible metal conduit.
  - Flexible metal conduit fittings.
  - Liquid-tight flexible metal conduit.
  - Liquid-tight flexible metal conduit fittings.
- C. Wires, Cables, and Connectors:
  - 1. General: Provide wires, cables, and connectors complying with Division 16 basic electrical materials and methods section "Wires and Cables".
  - 2. Wires/Cables: Unless otherwise indicated, provide wires/cables (conductors) for electrical connections which match (including sizes and ratings) wires/cables which are supplying electrical power. Provide copper conductors with conductivity of not less than 98% at 20°C (68°F).
- D. Connectors and Terminals: Provide electrical connectors and terminals which mate and match (including sizes and ratings) with equipment terminals, and are recommended by equipment manufacturer for intended applications.

PART 3 - EXECUTION

3.1 OBSERVATION:

- A. Observe area and conditions under which electrical connections for equipment are to be installed and notify contractor in writing of conditions detrimental to proper completion of the work. Do



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not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

3.2 INSTALLATION OF ELECTRICAL CONNECTIONS:

- A. Install electrical connections as indicated; in accordance with equipment manufacturer's written instructions, with recognized industry practices, and complying with applicable requirements of UL and NEC to ensure that products fulfill requirements.
- B. Coordinate with other work, including wires/cables, raceway, and equipment installation as necessary to properly interface installation of electrical connections for equipment with other work.
- C. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.
- D. Maintain existing electrical service and feeders to occupied areas and operational facilities unless otherwise indicated, or when authorized otherwise in writing by owner or architect/engineer. Provide temporary service during interruptions to existing facilities. When necessary, schedule momentary outages for replacing existing wiring systems with new wiring systems. When that "cutting-over" has been successfully accomplished, remove, relocate, or abandon existing wiring as indicated.
- E. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity rating, than electrical insulation rating of those conductors being spliced.
- F. Prepare cables and wires by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.
- G. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing, and maintenance.
- H. Provide flexible conduit for motor connections and other electrical equipment connections where subject to movement and vibration.
- I. Provide liquid-tight flexible conduit for connection of motors and other electrical equipment where subject to movement and vibration; and also where connections are subjected to one or more of the following conditions:
  - 1. Exterior location.
  - 2. Moist or humid atmosphere where condensate can be expected to accumulate.
  - 3. Corrosive atmosphere.
  - 4. Water spray.
  - 5. Dripping oil, grease, or water.

3.3 FIELD QUALITY CONTROL:

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- A. Upon completion of installation of electrical connections, and after circuitry has been energized with rated power source, test connections to demonstrate capability and compliance with requirements. Ensure that direction of rotation of each motor fulfills requirement. Correct malfunctioning units at site, then retest to demonstrate compliance.

END OF SECTION 16142

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SECTION 16143 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, apply to work of this Section.
- B. This Section is a Division 16 Basic Electrical Materials and Methods section, and is part of each Division 16 section making reference to wiring devices specified herein.

1.2 DESCRIPTION OF WORK:

- A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems which are intended to carry but not utilize electric energy.
- B. Types of electrical wiring devices in this section include the following:
  - Receptacles.
  - Ground-fault circuit interrupters.
  - Switches.
  - Wallplates.

1.3 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of electrical wiring devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than three (3) years.
- B. Installer's Qualifications: Firm with at least two (2) years of successful installation experience on projects utilizing wiring devices similar to those required for this project.
- C. NEC Compliance: Comply with NEC as applicable to installation and wiring of electrical wiring devices.
- D. UL Compliance: Provide wiring devices which are UL listed and labeled.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on electrical wiring devices.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

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- A. Manufacturers: Subject to compliance with requirements, manufacturers providing wiring devices which may be incorporated in the work include; but are not limited to, the following (for each type and rating of wiring device):

Arrow-Hart, Cooper Industries  
Harvey Hubbell Inc.  
Pass and Seymour Inc.  
Leviton Manufacturing Co. Inc.

2.2 FABRICATED WIRING DEVICES:

- A. General: Provide factory-fabricated wiring devices, in types, colors, and electrical ratings for applications indicated and which comply with NEMA Stds. Pub/No. WD 1. Provide ivory color devices except as otherwise indicated.
- B. Receptacles:
1. All receptacles shall be the grounding type with ground connection made through an extra pole which shall be permanently connected to the green grounding conductor.
  2. Duplex receptacles for 20 ampere, 120 volt service shall be two-pole, three-wire receptacles, rated 20 amperes at 125 volts. Receptacles shall be Harvey Hubbell, Inc., Catalog No. HBL5362-I.
  3. Single receptacles for 20 amps, 120 volts service shall be two-pole, three-wire rated 20 amperes at 125 volts. Receptacles shall be Harvey Hubbell Inc., Catalog No. HBL5361-I.
  4. Ground-fault interrupters shall be Harvey Hubbell, Inc., Catalog No. GF5352-I.

2.3 WIRING DEVICE ACCESSORIES:

- A. Wallplates: Provide wallplates for single and combination wiring devices, of types, sizes, and with ganging and cutouts as indicated. Select plates which mate and match wiring devices to which attached. Construct with metal screws for securing plates to devices; screw heads colored to match finish of plates, wallplates colored to match wiring devices.
- B. Cover plates for flush mounted wall boxes shall be vinyl and suitable for the device covered and/or purpose intended. Color shall match device. Cover plates for receptacles connected to the Essential Electrical System and normal system shall have one-fourth inch (1/4") high engraved letters and numbers indicating panelboard name and circuit number. Engraving for devices on essential systems shall be red color with white letters; engraving for devices on normal system shall be black color with white letters.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRING DEVICES:

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- A. Install wiring devices as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.
- B. Install wiring devices only in electrical boxes which are clean; free from excess building materials, dirt, and debris.
- C. Install wiring devices after wiring work is completed.
- D. Install wallplates after painting work is completed.

3.2 PROTECTION OF WALLPLATES AND RECEPTACLES:

- A. Upon installation of wallplates and receptacles, advise contractor regarding proper and cautious use of convenience outlets. At time of substantial completion, replace those items which have been damaged, including those burned and scored by faulty plugs.

3.3 GROUNDING:

- A. Provide equipment grounding connections for all wiring devices, unless otherwise indicated.

3.4 TESTING:

- A. Prior to energizing circuitry, test wiring for electrical continuity and for short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energization, test wiring devices to demonstrate compliance with requirements.

END OF SECTION 16143

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SECTION 16190 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, apply to work of this Section.
- B. This Section is a Division 16 Basic Electrical Materials and Methods section, and is a part of each Division 16 section making reference to electrical supporting devices specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of supports, anchors, sleeves, and seals is indicated by drawings and schedules and/or specified in other Division 16 sections.
- B. Types of supports, anchors, sleeves, and seals specified in this Section include the following:
  - Clevis hangers.
  - One-hole conduit straps.
  - Two-hole conduit straps.
  - Round steel rods.
  - Expansion anchors.
  - Toggle bolts.
  - Wall and floor seals.
  - Corn Clamps.
- C. Supports, anchors, sleeves, and seals furnished as part of factory fabricated equipment are specified as part of that equipment assembly in other Division 16 sections.

1.3 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of supporting devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than three (3) years.
- B. Installer's Qualifications: Firm with at least three (3) years of successful installation experience with projects utilizing electrical supporting device work similar to that required for this project.
- C. NECA Compliance: Comply with National Electrical Contractors Association's "Standard of Installation", pertaining to anchors, fasteners, hangers, supports, and equipment mounting.
- D. UL Compliance: Provide electrical components which are UL listed and labeled.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on supporting devices, including catalog cuts, specifications, and installation instructions for each type of support, anchor, sleeve, and seal.

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PART 2 - PRODUCTS

2.1 MANUFACTURED SUPPORTING DEVICES:

- A. General: Provide supporting devices which comply with manufacturer's standard materials, design and construction, in accordance with published product information and as required for complete installation and as herein specified. Where more than one type of supporting device meets indicated requirements, selection is installer's option.
- B. Supports: Provide supporting devices of types, sizes, and materials indicated and having the following construction features:
1. Clevis Hangers: For supporting metal conduit; galvanized steel, with ½" diameter hole for round steel rod, approximately 54 pounds per 100 units.
  2. Reducing Couplings: Steel rod reducing coupling, ½" by 5/8", approximately 16 pounds per hundred 100 units.
  3. One-Hole Conduit Straps: For supporting metal conduit; galvanized steel, approximately 7 pounds per 100 units.
  4. Two-Hole Conduit Straps: For supporting metal conduit; galvanized steel.
  5. Hexagon Nuts: For ½" rod size, galvanized steel, approximately 4 pounds per 100 units.
  6. Round Steel Rod: ½" diameter, approximately 67 pounds per 100'.
  7. Offset Conduit Clamps: For supporting 2" rigid metal conduit; galvanized steel, approximately 200 pounds per 100 units.
- C. Anchors: Provide anchors of types, sizes, and materials indicated with the following construction features:
1. Expansion Anchors: ½", approximately thirty-eight 38 pounds per hundred 100 units.
  2. Toggle Bolts: Springhead, 3/16" by 4"; approximately five (5) pounds per hundred 100 units.
- D. Sleeves and Seals: Provide sleeves and seals, of types, sizes and materials indicated, with the following construction features:
1. Wall and Floor Seals: Provide factory-assembled watertight wall and floor seals, of types and sizes indicated, suitable for sealing around conduit, pipe, or tubing passing through concrete floors and walls. Construct seals with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws. Seals shall be fire-rated where required.
- E. U-Channel Strut Systems: Provide U-channel strut system for supporting electrical equipment; 12-gauge hot-dip galvanized steel of types and sizes indicated. Construct with 3/16" diameter holes, 8" O.C. on top surface, and with the following fittings which mate and match with U-channel:
- Fixture hangers.



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Channel hangers.  
End caps.

Beam clamps.  
Wiring studs.  
Thinwall conduit clamps.  
Rigid conduit clamps.  
Conduit hangers.

2.2 FABRICATED SUPPORTING DEVICES:

- A. Pipe Sleeves: Provide pipe sleeves of one of the following:
  - 1. Steel Pipe: Fabricate from schedule 40 galvanized steel pipe. Remove burrs.
  - 2. Plastic Pipe: Fabricate from schedule 40 PVC plastic pipe. Remove burrs.
- B. Sleeve Seals: Provide sleeves for piping which penetrate foundation walls below grade or exterior walls. Caulk between sleeve and pipe with nontoxic, UL classified caulking material to ensure watertight seal. Seals shall be fire-rated where required.

PART 3 - EXECUTION

3.1 INSTALLATION OF SUPPORTING DEVICES:

- A. Install hangers, anchors, sleeves, and seals as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA and NEC for installation of supporting devices.
- B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.
- C. Install hangers, supports and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. Install supports with spacings indicated and in compliance with NEC requirements.

END OF SECTION 16190

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SECTION 16721 – FIRE-ALARM SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, apply to work of this Section.
- B. This Section is a Division 16 Basic Electrical Materials and Methods section, and is part of each Division 16 Section making reference to fire alarm systems specified herein.

1.02 DESCRIPTION OF WORK:

The fire alarm work in this project consists of replacing the existing Simplex system including all devices and cabling and providing new devices as indicated on the construction documents. The devices shall be connected to the new Notifier control panel with voice evacuation. The existing Simplex system shall remain in use and operational until new system is installed. The system consist of, but not be limited to the following:

- 1.Fire alarm control panel with voice evacuation
- 2.Mass Voice System
- 3.Addressable manual fire alarm stations
- 4.Addressable analog area smoke detectors,
- 5.Addressable analog duct smoke detectors.
- 6.Addressable analog heat detectors.
- 7.Sprinkler waterflow alarm switch.
- 8.Audible notification appliances; speakers
- 9.Visual notification appliances; strobes.
- 10.Air handling systems shutdown control.
- 11.Sprinkler tamper switch supervision.
- 12.Addressable control modules for Door Holders, Mag Lock release, and other miscellaneous controls.
- 13.Battery standby.

1.03 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of fire alarm systems of types, sizes, and electrical characteristics required; whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Installer's Qualifications: Firm with at least five (5) years of successful installation experience on projects with fire alarm systems work similar to that required for this project; firm with manufacturer's factory trained personnel.
- C. Codes and Standards:
  - 1. NEC Compliance: Comply with applicable requirements of NEC standards pertaining to fire alarm systems.
  - 2. UL Compliance and Labeling: Comply with provisions of UL safety standards pertaining to fire alarm systems, and provide products and components which are UL listed and labeled.

1.04 SUBMITTALS:

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- A. Product Data: Submit manufacturer's technical product data, including specifications and installation instructions, for each type of fire alarm system equipment. Include standard or typical riser and wiring diagrams and operation and maintenance instructions for inclusion in maintenance manuals.
- B. 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 in accordance with requirements of Division 1.

1.05 DELIVERY, STORAGE, AND HANDLING:

- A. Handle fire alarm equipment carefully to prevent damage, breaking, and scoring. Do not install damaged equipment or components; replace with new.
- B. Store fire alarm equipment in clean, dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Available Manufacturers: The Subject to compliance with requirements, manufacturers offering fire alarm systems which may be incorporated in the work include, but are not limited to, the following:

- 1. Notifier

2.02 Scope of Work:

- A. The Contractor, shall provide devices as shown on drawings and connect to new circuit in respective fire zone.

2.03 SYSTEM OPERATION

- A. Upon activation of any alarm initiating device (manual station, flow switch, heat detector, or smoke detector) the following shall occur:

- 1. Energize all alarm signalling devices.
- 2. Sound all audible alarms and flash visual signals throughout the facility.
- 3. Alert the local fire department directly by way of the proprietary system.
- 4. Cause the alarm location to be displayed on the annunciator section of the control panel and at each remote annunciator.
- 5. Close all doors held open by automatic release devices throughout the facility.

2.04 SYSTEM COMPONENTS

- A. Main FACP or network node shall be a NOTIFIER Model NFS2-640 and shall contain a microprocessor based Central Processing Unit (CPU) and power supply in an economical space saving single board design. The CPU shall communicate with and control the following types of equipment used

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to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system controlled devices.

B. Operator Control

1. Acknowledge Switch:

- a. Activation of the control panel acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the LCD display to the next alarm or trouble condition.
- b. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.

2. Alarm Silence Switch:

Activation of the alarm silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silenceable by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.

3. Alarm Activate (Drill) Switch:

The Alarm Activate switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.

4. System Reset Switch:

Activation of the System Reset switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.

5. Lamp Test:

The Lamp Test switch shall activate all local system LEDs, light each segment of the liquid crystal display and display the panel software revision for service personal.

C. System Capacity and General Operation

1. The control panel or each network node shall provide, or be capable of expansion to 636 intelligent/addressable devices.
2. The control panel or each network node shall include Form-C alarm, trouble, supervisory, and security relays rated at a minimum of 2.0 amps @ 30 VDC.
3. It shall also include four Class B (NFPA Style Y) or Class A (NFPA Style Z) programmable Notification Appliance Circuits.
4. The Notification Appliance Circuits shall be programmable to Synchronize with System Sensor, Gentex and Wheelock Notification Appliances.
5. The system shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color coded system status LEDs, and an alphanumeric keypad with easy touch rubber keys for the field programming and control of the fire

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alarm system.

6. The system shall be programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes.
7. The system shall allow the programming of any input to activate any output or group of outputs. Systems that have limited programming (such as general alarm), have complicated programming (such as a diode matrix), or require a laptop personal computer are not considered suitable substitutes.

The FACP shall support up to 20 logic equations, including "and," "or," and "not," or time delay equations to be used for advanced programming. Logic equations shall require the use of a PC with a software utility designed for programming.

8. The FACP or each network node shall provide the following features:
  - a. Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.
  - b. Detector sensitivity test, meeting requirements of NFPA 72.
  - c. Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.
  - d. Nine sensitivity levels for alarm, selected by detector. The alarm level range shall be .5 to 2.35 percent per foot for photoelectric detectors and 0.5 to 2.5 percent per foot for ionization detectors. The system shall also support sensitive advanced detection laser detectors with an alarm level range of .02 percent per foot to 2.0 percent per foot. The system shall also include up to nine levels of Prealarm, selected by detector, to indicate impending alarms to maintenance personnel.
  - e. The ability to display or print system reports.
  - f. Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification 20 times.
  - g. PAS presignal, meeting NFPA 72 requirements.
  - h. Rapid manual station reporting (under 3 seconds) and shall meet NFPA 72 requirements for activation of notification circuits within 10 seconds of initiating device activation.
  - i. Periodic detector test, conducted automatically by the software.
  - j. Self optimizing pre-alarm for advanced fire warning, which allows each detector to learn its particular environment and set its prealarm level to just above normal peaks.
  - k. Cross zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.
  - l. Walk test, with a check for two detectors set to same address.
  - m. Control-by-time for non-fire operations, with holiday schedules.
  - n. Day/night automatic adjustment of detector sensitivity.
  - o. Device blink control for sleeping areas.
9. The FACP shall be capable of coding main panel node notification circuits in March Time (120 PPM), Temporal (NFPA 72), and California Code. Panel notification circuits (NAC 1, 2, 3 and 4) shall also support Two-Stage operation, Canadian Dual Stage (3 minutes) and Canadian Dual Stage (5 minutes). Two stage operation shall allow 20 Pulses Per Minute (PPM) on alarm and 120 PPM after 5 minutes or when a second device activates. Canadian Dual stage is the same as Two-Stage except will only switch to second stage by activation of Drill Switch 3 or 5 minute timer. The panel shall also provide a coding option that will synchronize specific strobe lights designed to accept a specific "sync pulse."
10. Network Communication
  - a. The FACP shall be capable of communicating on a Local Area Network (LAN), a firmware package that utilizes a peer-to-peer, inherently regenerative communication format and protocol.

D. Central Microprocessor

1. The microprocessor shall be a state-of-the-art, high speed, 16-bit RISC device and it shall communicate with, monitor and control all external interfaces. It shall include an EPROM for system program storage, Flash memory for building-specific program storage, and a "watch dog" timer circuit to detect and report microprocessor failure.
2. The microprocessor shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Control-by-event equations shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.
3. The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file. The time-of-day and date shall not be lost if system primary and secondary power supplies fail. The real time clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.
4. A special program check function shall be provided to detect common operator errors.
5. An auto-program (self-learn) function shall be provided to quickly install initial functions and make the system operational.
6. For flexibility and to ensure program validity, an optional Windows(TM) based program utility shall be available. This program shall be used to off-line program the system with batch upload/download, and have the ability to upgrade the manufacturers (FLASH) system code changes. This program shall also have a verification utility, which scans the program files, identifying possible errors. It shall also have the ability to compare old program files to new ones, identifying differences in the two files to allow complete testing of any system operating changes. This shall be in compliance with the NFPA 72 requirements for testing after system modification.

E. System Display

1. The system shall support the following display mode options:
  - a. The CPU with no display option shall allow the fire alarm control panel to function as a data-gathering panel when the panel is connected to a network with a Network Control Station (NCS), ONYXWorks workstation (OW) or Network Control Annunciator (NCA). In this application, the NCS, OW or NCA shall provide all of the necessary controls and indicators to be used by the system operator. Programming of the CPU may be accomplished from the NCS/OW or by use of a laptop PC with the software programming utility connected directly to the CPU.

F. System Display

1. The system shall support the following display mode options:
  - a. 80 character display option. The display shall include an 80-character backlit alphanumeric Liquid Crystal Display (LCD) and a full PC style QWERTY keypad.
2. The display shall provide all the controls and indicators used by the system operator:
  - a. The 80-character display shall include the following operator control switches: ACKNOWLEDGE, ALARM SILENCE, ALARM ACTIVATE (drill), SYSTEM RESET, and LAMP TEST.
3. The display shall annunciate status information and custom alphanumeric labels for all intelligent

- detectors, addressable modules, internal panel circuits, and software zones.
4. The display shall also provide Light-Emitting Diodes.
    - a. The 80-character display shall provide 12 Light-Emitting-Diodes (LEDs), that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM WARNING, SECURITY ALARM, SUPERVISORY SIGNAL, SYSTEM TROUBLE, DISABLED POINTS, ALARM SILENCED, Controls Active, Pre-Discharge, Discharge and Abort.
  5. The display shall have QWERTY type keypad.
    - a. The 80-character display keypad shall be an easy to use QWERTY type keypad, similar to a PC keyboard. This shall be part of the standard system and have the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.
  6. The system shall support the display of battery charging current and voltage on the 80-character LCD display.

G. System Display

1. The system shall support the following display mode options:
  - a. 640-character display option. The design of the CPU shall provide for a configuration with the 640 Character display mounted on the front of the CPU in place of the standard 80-character display.
2. The display shall provide all the controls and indicators used by the system operator:
  - a. The 640-character display shall include the following operator control switches: ACKNOWLEDGE, ALARM SILENCE, ALARM ACTIVATE (drill), SYSTEM RESET, and LAMP TEST.
3. The display shall annunciate status information and custom alphanumeric labels for all intelligent detectors, addressable modules, internal panel circuits, and software zones.
4. The 640-character display shall provide 11 Light-Emitting-Diodes (LEDs), that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM WARNING, SECURITY ALARM, SUPERVISORY EVENT, SYSTEM TROUBLE, ALARM SILENCED, DISABLED POINTS, OTHER EVENTS, CPU FAILURE and Controls Active.
5. The display shall have QWERTY type keypad.
  - a. The 640-character display shall use 10 "soft" keys for screen navigation or to accomplish dedicated programming functions. Full programming access shall require use of a laptop and the proper programming utility.

H. Signaling Line Circuits (SLC)

1. Each FACP or FACP network node shall support up to two SLCs. Each SLC interface shall provide power to and communicate with up to 159 intelligent detectors (ionization, photoelectric or thermal) and 159 intelligent modules (monitor or control) for a loop capacity of 318 devices. The addition of the optional second loop shall double the device capacity, supporting a total of 636



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- devices. Each SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.
2. CPU shall receive analog information from all intelligent detectors to be processed to determine whether normal, alarm, prealarm, or trouble conditions exist for each detector. The software shall 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 shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

I. Serial Interfaces

1. The system shall include two serial EIA-232 interfaces. Each interface shall be a means of connecting UL Listed Information Technology Equipment (ITE) peripherals.
  - a. The system shall include an EIA-485 port for the serial connection of optional annunciators and remote LCD displays.
  - b. The EIA-485 interface may be used for network connection to a proprietary-receiving unit.

J. Enclosures:

1. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
2. The back box and door shall be constructed of 0.060 steel with provisions for electrical conduit connections into the sides and top.
3. 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 site configured for either right or left hand hinging.

K. Power Supply:

1. A high tech off-line switching power supply shall be available for the fire alarm control panel or network node and provide 6.0 amps of available power for the control panel and peripheral devices.
2. Provisions will be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.
3. Positive-Temperature-Coefficient (PTC) thermistors, circuit breakers, or other over-current protection shall be provided on all power outputs. The power supply shall provide an integral battery charger for use with batteries up to 200 AH or may be used with an external battery and charger system. Battery arrangement may be configured in the field.
4. The power supply shall continuously monitor all field wires for earth ground conditions, and shall have the following LED indicators:

Ground Fault LED  
AC Power Fail LED  
NAC on LED (4)

5. The main power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.
6. The main power supply shall provide a battery charger using dual-rate charging techniques for fast battery recharge and be capable of charging batteries up to 200 AH.
7. All circuits shall be power-limited, per UL864 requirements.

L. Auxiliary Field Power Supply - Addressable

1. The auxiliary addressable power supply is a remote 24 VDC power supply used to power Notification Devices and field devices that require regulated 24VDC power. The power supply shall also include and charge backup batteries.
2. The addressable power supply for the fire alarm system shall provide up a minimum of 10.0 amps of 24 volt DC regulated power for Notification Appliance Circuit (NAC) power or 5 amps of 24 volt DC general power. The power supply shall have an additional .5 amp of 24 VDC auxiliary power for use within the same cabinet as the power supply. It shall include an integral charger designed to charge 7.0 - 200.0 amp hour batteries.
3. The addressable power supply shall provide four individually addressable Notification Appliance Circuits that may be configured as two Class "A" and two Class "B" or four Class "B" only circuits. All circuits shall be power-limited per UL 864 requirements.
4. The addressable power supply shall provide built-in synchronization for certain Notification Appliances on each circuit without the need for additional synchronization modules. The power supply's output circuits shall be individually selected for synchronization. A single addressable power supply shall be capable of supporting both synchronized and non-synchronized Notification Devices at the same time.
5. The addressable power supply shall operate on 120 or 240 VAC, 50/60 Hz.
6. The interface to the power supply from the Fire Alarm Control Panel (FACP) shall be via the Signaling Line Circuit (SLC) or other multiplexed means Power supplies that do not use an intelligent interface are not suitable substitutes. The required wiring from the FACP to the addressable power supply shall be a single unshielded twisted pair wire. Data on the SLC shall be transmitted between 24 VDC, 5 VDC and 0 VDC at approximately 3.33k baud.
7. The addressable power supply shall supervise for battery charging failure, AC power loss, power brownout, battery failure, NAC loss, and optional ground fault detection. In the event of a trouble condition, the addressable power supply shall report the incident and the applicable address to the FACP via the SLC.
8. The addressable power supply shall have an AC Power Loss Delay option. If this option is utilized and the addressable power supply experiences an AC power loss, reporting of the incident to the FACP will be delayed. A delay time of zero, two, eight or sixteen hours shall be programmable.
9. The addressable power supply shall be programmable for Canadian Trouble Reporting.
10. The addressable power supply mounts in either the FACP backbox or its own dedicated surface mounted backbox with cover.
11. Each of the power supply's four output circuits shall be programmed for Notification Appliance Circuit or General Purpose 24 VDC power. Any output circuit shall be able to provide up to 2.5 amps of 24 VDC power.
12. The addressable power supply's output circuits shall be individually supervised when they are selected to be either a Notification Appliance Circuit when wired Class "A" or by the use of an end-of-line resistor. When the power supply's output circuit is selected as General 24VDC power, the circuit shall be individually supervised when an end-of-line relay is used.
13. When selected for Notification Appliance Circuits, the output circuits shall be individually programmed for Steady, March Time, Dual Stage or Temporal.
14. When selected as a Notification Appliance Circuit, the output circuits of the addressable power supply shall have the option to be coded by the use of a universal zone coder.
15. The addressable power supply shall interface and synchronize with other power supplies of the same type. The required wiring to interface multiple addressable power supplies shall be a single unshielded, twisted pair wire.
16. An individual or multiple interfaced addressable power supplies shall have the option to use an external charger for battery charging. Interfaced power supplies shall have the option to share backup battery power.

M. Field Charging Power Supply (FCPS)

The FCPS-24S6/8 is a device designed for use as either a remote 24 volt power supply or used to power Notification Appliances.

1. The FCPS-24S6 shall offer up to 6.0 amps (4.0 amps continuous) of regulated 24 volt power. It shall include an integral charger designed to charge up to 18.0 amp hour batteries and to support 60 hour standby. The FCPS-24S8 shall offer up to 8.0 amps (6.0 amps continuous) of regulated 24 volt power. It shall include an integral charger designed to charge up to 18.0 amp hour batteries and to support 60 hour standby.
2. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a relay. Four outputs (two Style Y or Z and two style Y) shall be available for connection to the Notification devices.
3. The FCPS shall include an attractive surface mount backbox.
4. The Field Charging Power Supply shall include the ability to delay the AC fail delay per NFPA requirements.
5. The FCPS include power limited circuitry, per 1995 UL standards.

N. Specific System Operations

1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.
2. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 5 to 30 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
3. Point Disable: Any addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.
4. Point Read: The system shall be able to display or print the following point status diagnostic functions:
  - a. Device status
  - b. Device type
  - c. Custom device label
  - d. View analog detector values
  - e. Device zone assignments
  - f. All program parameters
5. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system status.
6. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 800 events. Up to 200 events shall be dedicated to alarm and the remaining events are general purpose. Systems that do not have dedicated alarm storage, where events are overridden by non-alarm type events, are not suitable substitutes. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, or printed in its entirety. The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable substitutes.
7. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate

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each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be annunciated on the system display, and printed on the optional printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.

8. Pre-Alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.
9. Software Zones: The FACP shall provide 100 software zones, 10 additional special function zones, 10 releasing zones, and 20 logic zones.
10. The fire alarm control panel shall include a walk test feature. It shall include the ability to test initiating device circuits and notification appliance circuits from the field without returning to the panel to reset the system. Operation shall be as follows:
  - a. Alarming an initiating device shall activate programmed outputs, which are selected to participate in walk test, for 3 seconds.
  - b. Introducing a trouble into the initiating device shall activate the programmed outputs for 8 seconds.
  - c. All devices tested in walk test shall be recorded in the history buffer.
11. Waterflow Operation  
An alarm from a waterflow detection device shall activate the appropriate alarm message on the main panel display, turn on all programmed notification appliance circuits and shall not be affected by the signal silence switch.
12. Supervisory Operation  
An alarm from a supervisory device shall cause the appropriate indication on the system display, light a common supervisory LED, but will not cause the system to enter the trouble mode.
13. Signal Silence Operation  
The FACP shall have the ability to program each output circuit (notification, relay, speaker etc) to deactivate upon depression of the signal silence switch.
14. Non-Alarm Input Operation  
Any addressable initiating device in the system may be used as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a lower priority than fire alarm initiating devices.

2.4. SYSTEM COMPONENTS:

A. Speakers:

1. All speakers shall operate on 25 VRMS or with field selectable output taps from 0.5 to 2.0 Watts.
2. Speakers in corridors and public spaces shall produce a nominal sound output of 84 dBA at 10 feet (3m).
3. Frequency response shall be a minimum of 400 HZ to 4000 HZ.
4. The back of each speaker shall be sealed to protect the speaker cone from damage and dust.

B. Audible/Visual Combination Devices:

1. Shall meet the applicable requirements of Section A listed above for audibility.
2. Shall meet the requirements of Section B listed above for visibility.

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C. Programmable Electronic Sounders:

1. Electronic sounders shall operate on 24 VDC nominal.
2. Electronic sounders shall be field programmable without the use of special tools, at a sound level of at least 90 dBA measured at 10 feet from the device.
3. Shall be flush or surface mounted as shown on plans.

D. Strobe lights shall meet the requirements of the ADA, UL Standard 1971, be fully synchronized, and shall meet the following criteria:

1. The maximum pulse duration shall be 2/10 of one second
2. Strobe intensity shall meet the requirements of UL 1971.
3. The flash rate shall meet the requirements of UL 1971.

E. Speaker/Strobes:

1. Operate on 24 VDC
2. Have two selectable tone options of temporal 3 and non-temporal continuous pattern.
3. Have at least 2 audibility options
4. Maximum Pulse Duration: 0.2 second.
5. Strobe Intensity: UL 1971.
6. Flash Rate: UL 1971.
7. Strobe Candela Rating: Determine by positioning selector switch on back of device.

F. Manual Fire Alarm Stations

1. Manual fire alarm stations shall be non-code, non-breakglass type, equipped with key lock so that they may be tested without operating the handle.
2. Stations must be designed such that after an actual activation, they cannot be restored to normal except by key reset.
3. An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of 100 feet (30.5 m) front or side.
4. Manual stations shall be constructed of high impact Lexan, with operating instructions provided on the cover. The word FIRE shall appear on the manual station in letters one half inch (12.7 mm) in size or larger.

G. Conventional Photoelectric Area Smoke Detectors

1. Photoelectric smoke detectors shall be a 24 VDC, two wire, ceiling-mounted, light scattering type using an LED light source.
2. Each detector shall contain a remote LED output and a built-in test switch.
3. Detector shall be provided on a twist-lock base.
4. It shall be possible to perform a calibrated sensitivity and performance test on the detector without the need for the generation of smoke. The test method shall test all detector circuits.
5. A visual indication of an alarm shall be provided by dual latching Light Emitting Diodes (LEDs), on the detector, which may be seen from ground level over 360 degrees. These LEDs shall flash at least every 10 seconds, indicating that power is applied to the detector.
6. The detector shall not go into alarm when exposed to air velocities of up to 3000 feet (914.4 m) per minute.
7. The detector screen and cover assembly shall be easily removable for field cleaning of the detector chamber.
8. All field wire connections shall be made to the base through the use of a clamping plate and screw.

H. Conventional Ionization Type Area Smoke Detectors

1. Ionization type smoke detectors shall be a two wire, 24 VDC type using a dual unipolar chamber.
2. Each detector shall contain a remote LED output and a built-in test switch.
3. Detector shall be provided on a twist-lock base.
4. It shall be possible to perform a calibration sensitivity and performance test on the detector without the need for the generation of smoke.
5. A visual indication of an alarm shall be provided by dual latching Light Emitting Diodes (LEDs) over 360 degrees, on the detector, which may be seen from ground level. This LED shall flash every 10 seconds, indicating that power is applied to the detector.
6. The detector shall not alarm when exposed to air velocities of up to 1,200 feet (365.76 m) per minute. The detector screen and cover assembly shall be easily removable for field cleaning of the detector chamber.
7. All field wire connections shall be made to the base through the use of a clamping plate and screw.

I. Duct Smoke Detectors

Duct smoke detectors shall be a 24 VDC type with visual alarm and power indicators, and a reset switch. Each detector shall be installed upon the composite supply/return air ducts(s), with properly sized air sampling tubes.

J. Projected Beam Detectors

1. The projected beam type shall be a 4-wire 24 VDC device.
2. The detector shall be listed to UL 268 and shall consist of a separate transmitter and receiver capable of being powered separately or together.
3. The detector shall operate in either a short range (30' - 100') or long range (100' - 330') mode.
4. The temperature range of the device shall be -22 degrees F to 131 degrees F.
5. The detector shall feature a bank of four alignment LEDs on both the receiver and the transmitter that are used to ensure proper alignment of unit without special tools.
6. Beam detectors shall feature automatic gain control which will compensate for gradual signal deterioration from dirt accumulation on lenses.
7. The unit shall be both ceiling and wall mountable.
8. The detector shall have the ability to be tested using calibrated test filters or magnet activated remote test station.

K. Automatic Conventional Heat Detectors

1. Automatic heat detectors shall have a combination rate of rise and fixed temperature rated at 135 degrees Fahrenheit (57.2 Celsius) for areas where ambient temperatures do not exceed 100 degrees (37.7 Celsius), and 200 degrees (93.33 Celsius) for areas where the temperature does not exceed 150 degrees (65.5 Celsius).
2. Automatic heat detectors shall be a low profile, ceiling mount type with positive indication of activation.
3. The rate of rise element shall consist of an air chamber, a flexible metal diaphragm, and a factory calibrated, moisture-proof, trouble free vent, and shall operate when the rate of temperature rise exceeds 15 degrees F (9.4 degrees C) per minute.
4. The fixed temperature element shall consist of a fusible alloy retainer and actuator shaft.
5. Automatic heat detectors shall have a smooth ceiling rating of 2500 square feet (762 square meters).

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L. Waterflow Indicator:

1. Waterflow Switches shall be an integral, mechanical, non-coded, non-accumulative retard type.
2. Waterflow Switches shall have an alarm transmission delay time which is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds.
3. All waterflow switches shall come from a single manufacturer and series.
4. Waterflow switches shall be provided and connected under this section but installed by the mechanical contractor.
5. Where possible, locate waterflow switches a minimum of one (1) foot from a fitting which changes the direction of the flow and a minimum of three (3) feet from a valve.

M. Sprinkler and Standpipe Valve Supervisory Switches:

1. Each sprinkler system water supply control valve riser, zone control valve, and standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.
2. PIV (post indicator valve) or main gate valves shall be equipped with a supervisory switch.
3. The switch shall be mounted so as not to interfere with the normal operation of the valve and adjusted to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.
4. The supervisory switch shall be contained in a weatherproof aluminum housing, which shall provide a 3/4 inch (19 mm) conduit entrance and incorporate the necessary facilities for attachment to the valves.
5. The switch housing shall be finished in red baked enamel.
6. The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.
7. Valve supervisory switches shall be provided and connected under this section and installed by mechanical contractor.
  - a. This unit shall provide for each zone: alarm indications, using a red alarm and yellow trouble long-life LEDs and control switches for the control of fire alarm control panel functions. The annunciator will also have an ON-LINE LED, local piezo electric signal, local acknowledge/lamp test switch, and custom slide-in zone/function identification labels.
  - b. Switches shall be available for remote annunciation and control of output points in the system, system acknowledge, telephone zone select, speaker select, global signal silence, and global system reset within the confines of all applicable standards.

N. Alphanumeric LCD Type Annunciator:

1. 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.
2. The LCD annunciator shall display all alarm and trouble conditions in the system.
3. An audible indication of alarm shall be integral to the alphanumeric display.
4. The display shall be UL listed for fire alarm application.
5. It shall be possible to connect up to 32 LCD displays and be capable of wiring distances up to 6,000 feet from the control panel.
6. The annunciator shall connect to a separate, dedicated "terminal mode" EIA-485 interface. This is a two-wire loop connection and shall be capable of distances to 6,000 feet. Each terminal mode LCD display shall mimic the main control panel.
7. The system shall allow a minimum of 32 terminal mode LCD annunciators that shall be capable of the following system functions: Acknowledge, Signal Silence and Reset, which shall be protected from unauthorized use by a key switch or password.

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8. The LED annunciator shall offer an interface to a graphic style annunciator and provide each of the features listed above.

O. Interactive Display

1. The system shall be an ONYX FirstVision™.
2. The system shall operate on an UL listed Embedded platform operating at no less than 700 MHz on the Microsoft® Windows® XP Embedded platform.
3. The Embedded platform shall have: no less than 256 megabytes of RAM, a flash drive with no less than 1 Gigabytes of storage space, 100 Base-T Ethernet NIC card, and USB ports.
4. The Embedded platform shall have a minimum 17" touch screen display.
5. The Embedded platform shall come equipped with all necessary gateway modules to allow connection to the network it monitors as standard equipment.

- a. A UL listed Ethernet Hub shall be provided for connection of multiple interactive displays and/or gateways.

P. Universal Digital Alarm Communicator Transmitter (UDACT). The UDACT is an interface for communicating digital information between a fire alarm control panel and an UL-Listed central station.

1. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.
2. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to three different telephone numbers.
3. The UDACT shall be completely field programmable from a built-in keypad and 4 character red, seven segment display.
4. The UDACT shall be capable of transmitting events in at least 15 different formats. This ensures compatibility with existing and future transmission formats.
5. Communication shall include vital system status such as:

- Independent Zone (Alarm, trouble, non-alarm, supervisory)
- Independent Addressable Device Status
- AC (Mains) Power Loss
- Low Battery and Earth Fault
- System Off Normal
- 12 and 24 Hour Test Signal
- Abnormal Test Signal (per UL requirements)
- EIA-485 Communications Failure
- Phone Line Failure

6. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 2,040 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.
7. AN IP Communicator option shall be available to interface to the UDACT and be capable of transmitting signals over the internet/intranet to a compatible receiver.



Q. Field Wiring Terminal Blocks

For ease of service all panel I/O wiring terminal blocks shall be removable, plug-in types and have sufficient capacity for #18 to #12 AWG wire. Terminal blocks that are permanently fixed are not acceptable.

2.5. SYSTEM COMPONENTS - ADDRESSABLE DEVICES

A. Addressable Devices - General

1. Addressable devices shall use simple to install and maintain decade, decimal address switches. Devices shall be capable of being set to an address in a range of 001 to 159.
2. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.
3. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the fire alarm control panel Signaling Line Circuits.
4. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
5. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. The panel on a time-of-day basis shall automatically adjust sensitivity.
6. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.
7. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base options shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base designed for Style 7 applications.
8. 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.
9. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
10. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.
11. Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.
12. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.
13. Addressable modules shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box. An optional surface mount Lexan enclosure shall be available.

B. Addressable Manual Fire Alarm Box (manual station)

1. Addressable manual fire alarm boxes shall, on command from the control panel, send data to the

panel representing the state of the manual switch and the addressable communication module status. They shall 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.

2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Manual fire alarm boxes shall be constructed of Lexan 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 (44 mm) or larger.

C. Intelligent Photoelectric Smoke Detector

1. The 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.

D. Intelligent Laser Photo Smoke Detector

1. The intelligent laser photo smoke detector shall be a spot type detector that incorporates an extremely bright laser diode and an integral lens that focuses the light beam to a very small volume near a receiving photo sensor. The scattering of smoke particles shall activate the photo sensor.
2. The laser detector shall have conductive plastic so that dust accumulation is reduced significantly.
3. The intelligent laser photo detector shall have nine sensitivity levels and be sensitive to a minimum obscuration of 0.02 percent per foot.
4. The laser detector shall not require expensive conduit, special fittings or PVC pipe.
5. The intelligent laser photo detector shall support standard, relay, isolator and sounder detector bases.
6. The laser photo detector shall not require other cleaning requirements than those listed in NFPA 72. Replacement, refurbishment or specialized cleaning of the detector head shall not be required.
7. The laser photo detector shall include two bicolor LEDs that flash green in normal operation and turn on steady red in alarm.

E. Intelligent Ionization Smoke Detector

1. The detectors shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.

F. Intelligent Multi Criteria Acclimating Detector

1. The intelligent multi criteria Acclimate detector shall be an addressable device that is designed to monitor a minimum of photoelectric and thermal technologies in a single sensing device. The design shall include the ability to adapt to its environment by utilizing a built-in microprocessor to determine its environment and choose the appropriate sensing settings. The detector design shall allow a wide sensitivity window, no less than 1 to 4% per foot obscuration. This detector shall utilize advanced electronics that react to slow smoldering fires and thermal properties all within a single sensing device.
2. The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes (as walls are moved or as the occupancy changes).
3. The intelligent multi criteria detection device shall include the ability to combine the signal of the thermal sensor with the signal of the photoelectric signal in an effort to react hastily in the event of

a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a false alarm condition by examining the characteristics of the thermal and smoke sensing chambers and comparing them to a database of actual fire and deceptive phenomena.

G. Intelligent Thermal Detectors

1. Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.

H. Intelligent Duct Smoke Detector

1. The smoke detector housing shall accommodate either an intelligent ionization detector or an intelligent photoelectric detector, of that provides continuous analog monitoring and alarm verification from the panel.
2. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

I. Advanced Multi-Criteria Intelligent Detector

1. The intelligent multi criteria IntelliQuad detector shall be an addressable device combining four sensing elements in a single sensing device providing the ability to detect all four major elements of a fire. The detector design shall allow sensitivity setting between 1% to 4% per foot obscuration.
2. The detector shall include a photoelectric sensing element, thermal sensing element, IR (Infrared) sensing element and CO (carbon monoxide) sensor.

J. Addressable Dry Contact Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs.
2. The IDC zone shall be suitable for Style D or Style B operation. 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.
3. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.
4. For multiple dry contact monitoring a module shall be available that provides 10 Style B or 5 Style D input circuits.

K. Two Wire Detector Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device).
2. The IDC zone may be wired for Class A or B (Style D or Style B) operation. 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.
3. For multiple 2-wire smoke detector circuit monitoring a module shall be available that provides 6 Style B or 3 Style D input circuits.

L. Addressable Control Module

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1. Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances.
2. The control module NAC may be wired for Style Z or Style Y (Class A/B) with a current rating of 2 Amps for Style Z and 3 Amps for Style Y. For speaker applications the module is rated for 50 watts at 25 or 70.7 Vrms.
3. Audio/visual power shall be provided by a separate supervised power circuit from the main fire alarm control panel or from a supervised UL listed remote power supply.
4. For multiple circuit control a module shall be available that provides 6 Style B or 3 Style D control circuits.

M. Addressable Releasing Control Module

1. An addressable FlashScan releasing module shall be available to supervise and control compatible releasing agent solenoids.
2. The module shall operate on a redundant protocol for added protection.
3. The module shall be configurable for Style Z or Style Y (Class A/B) and support one 24 volt or two 12 volt solenoids.

N. Addressable Relay Module

1. Addressable Relay Modules shall be available for HVAC control and other building functions. The module shall provide two form C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary devices energize at the same time on the same pair of wires.
2. For multiple relay control a module shall be available that provides 6 programmable Form-C relays.

O. Isolator Module

1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch. 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 segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.
2. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
3. The isolator module shall not require 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.
4. The isolator module 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.

P. Smoke Control Annunciator

1. On/Auto/Off switches and status indicators (LEDS) shall be provided for monitoring and manual control of each fan, damper, HVAC control unit, stairwell pressurization fan, and smoke exhaust fan. To ensure compliance the units supplied shall meet the following UL categories: UUKL, PAZX, UDTZ, QVAX as well as the requirements of NFPA 90A, HVAC, and NFPA 92A & 92B, Smoke Control. The control System shall be field programmable for either 90A operation or 92A/B

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- operation to allow for future use and system expansion.
2. The OFF LED shall be Yellow, the ON LED shall be green, the Trouble/Fault LED shall be Amber/Orange for each switch. The Trouble/Fault indicator shall indicate a trouble in the control and/or monitor points associated with that switch. In addition, each group of eight switches shall have two LEDs and one momentary switch which allow the following functions: An Amber LED to indicate an OFF-NORMAL switch position, in the ON or OFF position; A Green LED to indicate ALL AUTO switch position; A Local Acknowledge/Lamp Test momentary switch.
  3. Each switch shall have the capability to monitor and control two addressable inputs and two addressable outputs. In all modes, the ON and OFF indicators shall continuously follow the device status not the switch position. Positive feedback shall be employed to verify correct operation of the device being controlled. Systems that indicate on/off/auto by physical switch position only are not acceptable.
  4. All HVAC switches (i.e., limit switches, vane switches, etc.) shall be provided and installed by the HVAC contractor.
  5. It shall be possible to meet the requirements mentioned above utilizing wall mounted custom graphic.

2.6. BATTERIES:

- A. The battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 5 minutes of alarm upon a normal AC power failure.
- B. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.
- C. If necessary to meet standby requirements, external battery and charger systems may be used.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which fire alarm systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.02 INSTALLATION OF BASIC WIRING SYSTEM MATERIALS:

- A. Install wiring, raceways, and electrical boxes and fittings in accordance with Division 16 Basic Electrical Materials and Methods sections, "Raceways", "Wires and Cables", and "Electrical Boxes and Fittings" for wiring of non power-limited circuits.
- B. The manufacturer shall furnish complete wiring diagrams and installation and operation instruction for the system. The required interconnecting wiring may vary with different equipment manufacturers; therefore, the wiring indicated on the drawings is intended only a guide, and necessary adjustments in number of conductors and raceway sizes shall be made to suit the particular system being furnished at no extra cost.
- C. All wiring shall be in conduit color coded in accordance with the facility standard color code and manufacturer's recommendations and shall be terminated with spade type lugs. Termination at the control unit shall be identified as to zone and use. All wiring shall test free from opens and grounds prior to final connections.

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- D. Install wires and cables without splices. Make connections at terminal strips in cabinets or at equipment terminals. Make soldered splices in electronic circuits in control cabinets.
- E. Wiring control equipment incorporating standby power: The control equipment shall be provided with operating power from a fused 2 wire, 120 volt, single phase, 60 hertz source. This power shall be converted to 24 volts DC for system operation. Transformers must be mounted with the cabinet. In the event of failure of the operating supply, the system shall transfer automatically to a standby battery. The battery shall be of the nickel cadmium type, with sufficient capacity to operate the system under normal supervision for up to 24 hours.
- F. Wiring of control equipment not incorporating standby power. The system shall operate from 2 phase and a neutral of a 208 volt, 3 phase, 4 wire service. The main operating power shall be taken from one side to neutral, the trouble signal circuit shall be taken from the other side to neutral.
- G. Conductors color coding shall be per USF Design and Construction Guidelines:

ITEM	COLOR
Initiation Device Addressable Loop	Red
Indicating Appliance - Audible	Red & Black
Indicating Appliance - Visual	Purple and Orange
AHU Shut Down	Gray - White
Remote Indicator/Test	Black, Red, Blue, Purple
Auxiliary Control Wire	White – White + ID Tag
Duct Smoke Detector Power	Black – Blue + ID Tag
Spare Wires	Any Different Color

Color Coding must be adhered to, no deviations will be accepted

3.03 FIELD QUALITY CONTROL:

- A. System Test and Approval: Prior to final acceptance of systems, manufacturer of system shall, in presence of contractor, owner's representative and architect's/engineer's representative, test each sensing or detection and alarm device.
- B. Submit copy of test results in duplicate after signed by owner's representative to architect/engineer.

3.04 TESTING:

- A. All new detectors within the project fire alarm zones shall be tested per NFPA 72. A detector sensitivity test report shall be completed prior to Fire Marshal inspection.
- B. To assure that each smoke detector is operative and produces the intended response, it shall be caused to initiate an alarm at its installed location with smoke or other aerosol acceptable to the manufacturer, that demonstrates that smoke can enter the chamber and initiate an alarm.
- C. The detector sensitivity shall not be tested or measured using any spray device that administers an unmeasured concentration of aerosol into the detector. To assure that each smoke detector is within its listed and marked sensitivity range, it shall be tested using either:
  1. A calibrated test method, or
  2. The manufacturer's calibrated sensitivity test instrument, or
  3. Listed control equipment arranged for the purpose, or

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4. Other calibrated sensitivity test method acceptable to the authority having jurisdiction.
- D. Detectors found to have a sensitivity outside the approved range shall be replaced. As an exception, detectors listed as field adjustable may be either adjusted within an approved range or replaced.

END OF SECTION

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