

R.G. KREUSLER PARK RESTROOM BUILDING
AND ENTRY DRIVE MODIFICATIONS - #14204
Specifications

SECTION 16020
SCOPE OF WORK

PART 1 - GENERAL

1.01 DESCRIPTION OF SYSTEMS

- A. The work included consists of all supervision, labor, materials, equipment, facilities and installation required for the complete and approved Electrical System Modifications as indicated on the Contract Documents and called for in this Specification, or as may be reasonably implied by and for the installation of a complete Electrical System.
- B. All notes on the Drawings pertaining to the work of this Trade shall be considered as part of this Specification and Contract.
- C. In general, the Electrical Contractor shall make final connections to equipment furnished by other trades or by Owner.
- D. Refer to entire Contract Documents for coordination and demolition.
- E. Contractor shall confirm existing utilities are capped or shutdown prior to excavation or demolition.
- F. It is the Contractor's responsibility to visit the job site to inspect and confirm field conditions and systems. Advise Consultant of inconsistencies prior to bidding (14 days minimum).
- G. The Contractor shall install complete and operating electrical systems consisting of the following:
 - 1. Power distribution system including service entrance, feeders, panelboards, transformers, contactors, switches, branch circuits, etc. as required to serve all power and lighting systems within the buildings.
 - 2. Connection of all motors, electrically operated equipment and controls furnished under this or any other Division of these Specifications.
 - 3. Provision and installation of all lighting fixtures and general wiring devices such as receptacles, switches, time clocks, etc.
 - 4. System of empty raceways for telecommunications outlets and service entrance conduits for future use.
 - 5. Complete lightning protection system including UL Master Label Certification upon completion of construction.
 - 6. Temporary electrical power and lighting shall be furnished, installed and maintained for all trades as may be required for work, or in various locations throughout the building.

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7. Painting shall be specified in other Sections of these specifications (See "Painting" Section), except that all exposed raceways, fittings, boxes, supports, panelboards, etc., shall be prepared for painting, removing from them all oil, grease dirt, etc.
8. Miscellaneous items obviously required for a complete and operating systems, but not specifically called for on the drawings or in the specifications, shall be provided by the Contractor at no extra cost to the Owner, including but not limited to access panels, nuts and bolts, masonry anchors, conduit and equipment supports, drilling, welding, scaffolding, crane service, etc.
9. All specialty systems, conduits, wiring, controls, etc., as specified in Division 16 Contract Documents and in coordination with Division 15 Contract Documents.

PART 2 - PRODUCTS Not Applicable

PART 3 - EXECUTION Not Applicable

END OF SECTION

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SECTION 16025
CODES, FEES, AND STANDARDS

PART 1 GENERAL

1.01 CODES AND FEES

- A. The Contractor shall comply with applicable building and construction codes, Florida Building Code, NFPA, the 2011 edition of the National Electric Code, and requirements of the local Utility Company.

1.02 STANDARDS

- A. All materials shall be new, free of defects, and shall be U.L. listed, bear the U.L. label or be labeled or listed with an approved, nationally recognized Electrical Testing Agency. Where no labeling or listing service is available for certain types of equipment, test data shall be submitted to prove to the Engineer that equipment meets or exceeds available standards.

1.03 UTILITY COMPANY FEES, CHARGES, COSTS

- A. It is the contractor's responsibility to contact the appropriate Utility Company to determine if any fees, charges or costs will be due to the Utility Company, as required by the Utility Company for temporary power In/Out installations, hook-ups, etc. This fee, charge, or cost shall be included in this contractor's bid price.

END OF SECTION

SECTION 16050
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 WORK INCLUDES

- A. Electrical work shown on the Electrical Drawings and specified herein.

1.02 RELATED WORK

- A. Specified Elsewhere
 - 1. Division 1 - Drawings and General Provisions of Contract, including, but not limited to, general, special, and supplementary conditions and other Division 1 - Specification Sections, apply to the work of this section.
 - 2. Division 15 - Applicable sections.
 - 3. Division 16 - Applicable sections.

1.03 QUALITY ASSURANCE

- A. All work and materials shall be in accordance with the requirements and codes of the State of Florida, and all other applicable bodies having jurisdiction.
- B. If, in the opinion of the Contractor, any part of the specification or plans do not comply with the laws, codes and regulations, that matter shall be referred in writing to the attention of the Engineer for a decision before proceeding with that part of the work. There shall be no changes in the drawings or specifications made without approval of the Engineer. Where a discrepancy exists between the drawings and this specification, the more stringent shall apply.
- C. This Contractor shall secure and pay for all permits required by local authorities and shall provide the Owner with satisfactory interim and final inspection certificates.

1.04 REFERENCES TO STANDARDS

- A. All materials and equipment furnished and installed under this contract shall be in accordance with the current, accepted version of the following applicable technical society, organization or body.
 - 1. UL - Underwriter's Laboratories, Inc.
 - 2. NEC - National Electrical Code
 - 3. NFPA - National Fire Protection Association
 - 4. NEMA - National Electrical Manufacturers Association
 - 5. ASTM - American Society for Testing and Materials
 - 6. IEEE - Institute of Electrical and Electronic Engineers
 - 7. ANSI - American National Standards Institute, Inc.
- B. Reference to standards shall mean and intend the latest edition of such standards adopted and published at the date of bidding documents.

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1.05 SUBMITTALS

A. In accord with Division One.

1. Product Data

a. Fire Stopping Material

B. In accord with Division 0, at the completion of the project, Contractor submit operating instructions and maintenance manuals. Submit model number, catalog information, technical data sheets, shop drawings, test reports, wiring diagrams, parts lists and maintenance instructions where applicable for each of the following items of equipment.

1. Fire Alarm and Detection System Components

C. Throughout the progress of construction, keep a complete and detailed record of all deviations in the electrical installation from that indicated on the Drawings, specifications and/or shop drawings. At the completion of the project and prior to final payment this marked set of drawings shall be submitted to Architect/Engineer.

1.06 TEMPORARY ELECTRICAL SERVICES

A. In accord with Division One.

B. Provide temporary power and lighting for safety and security throughout the Project, as may be required. Coordinate with Owner's representative for requirements in specific areas of the building, or on the roof.

1.07 GUARANTEE

A. Guarantee all materials and workmanship for a period of one year in accord with the General Conditions.

1.08 DELIVERY, STORAGE AND HANDLING

A. Materials shall be suitably packaged by manufacturer to prevent damage during shipment. Damaged materials will not be acceptable for use.

B. Store materials on site in clean, dry storage area; when outside, elevated above grade and enclosed with durable watertight wrapping.

C. Handle all materials carefully to prevent damage. Minor scratches, marks or blemishes to finish shall be repaired.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General

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1. All equipment and material for permanent installation shall be new unless specifically indicated otherwise. In addition material shall:
 - a. Be without blemish or defect.
 - b. Not be used for temporary power or lighting without prior written authorization from the Owner.
 - c. Be in accordance with NEMA Standards.
 - d. Bear Underwriter's Label where subject to U.L. label service.

B. Fire Stopping Material

1. Fire stopping materials shall consist of commercially manufactured products capable of passing ASTM E-814 (UL 1479) Standard Method of Fire Test for Through Penetration Fire Stops.
2. Fire stopping materials shall maintain the rating of the wall, partition or floor opening that penetration is made.
3. Fire stopping materials shall be U.L. classified.
4. Acceptable Products
 - a. 3M - Fire Barrier
 - b. Thomas & Betts - Flame Safe

C. Water Seal

1. Seal penetrations of perimeter walls or floors below grade to prevent entry of water. Use materials compatible with wall or floor construction.
2. Seal penetrations of roof, with boots compatible with roof design.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All equipment and materials shall be installed and completed in a first-class workmanlike manner. The right is reserved to direct the removal and replacement of any item, which in the opinion of the Owner's Representative and/or Engineer does not present an orderly and reasonably neat or workmanlike appearance, provided such items can be properly installed in an orderly way by usual methods in such work.

3.02 LOCATION OF EQUIPMENT

- A. The approximate location of all equipment and devices is shown on the Drawings. The Owner's Representative and/or Engineer reserves the right to change the location of all equipment or devices 6 feet in any direction at no additional cost provided such changes are requested before final installation.

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- B. Install all equipment with ample space allowed for removal and repair. Provide ready accessibility to removable parts of equipment and to all wiring without moving equipment which is installed or which is already in place. Provide access panels for all devices installed above non-accessible ceilings and/or within walls or partitions.
- C. In mechanical and electrical equipment spaces, locate ceiling outlets and conduit with due consideration to ventilating ducts and mechanical piping. Where numerous ducts occur, install conduits and outlets after the ventilating ducts. Puncturing of duct work or hanging equipment such as light fixtures, ceiling hangers and conduits from duct work is prohibited unless specifically noted otherwise.
- D. Electrical equipment shall be installed to maintain minimum clearances per Article 110 of NEC and ANSI C2 (National Electrical Safety Code.)

3.03 COORDINATION

- A. Provide day-to-day coordination with the work of other contractors engaged in this project. Execute the work in a manner not to interfere with other contractors.
- B. Coordinate with other contractors regarding the location and size of pipes, raceways, ducts, openings, devices, so that there may be no interferences between installation or of the progress of any contractor.
- C. If conflict arises in the installation of work, the following preference schedules shall be followed:
 - 1. Recessed lighting fixtures.
 - 2. Roof drainage.
 - 3. Low pressure ductwork.
 - 4. Domestic water and vent lines.
 - 5. Electric conduits.

3.04 WALL AND ROOF PENETRATIONS AND SLEEVE INSTALLATION

- A. Provide sleeves for all electrical raceways, and wiring passing through walls and floors. Sleeves shall be of sufficient length to extend through the wall and roof. Wall sleeves shall have ends flush with finished thickness of walls. Interior diameter of sleeves shall provide 1/2 inch clearance all around conduit.
- B. Structural concrete beams shall be sleeved only in the middle 1/3 of span. Notify Engineer of any required deviation from this prior to placement of sleeve.
- C. Wall and roof penetration shall be made watertight. Roof penetration shall be sealed and flashed per roof manufacturers published recommendations.
- D. Where cutting is required to facilitate construction, this contractor shall patch and repair cut items to the original state. However, structural work shall not be cut without the written approval of the Engineer or his representative.

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- E. Holes through concrete and masonry in new and existing structures shall be cut with a diamond core drill or concrete saw. Pneumatic hammer impact, electric hand or manual hammer type drills, shall not be allowed, except where permitted by resident engineer as required by limited working space.

3.05 FIRESTOPPING

- A. Where conduits, wireway, bus duct and other electrical raceways pass through fire partitions, fire walls or walls and floors, install a firestop that provides an effective barrier against the spread of fire, smoke and gases. Fire-stop material shall be packed tight, and completely fill clearances between raceways and openings. Fire-stop material shall conform to the following:
 - 1. Fire-stopping material shall maintain its dimension and integrity while preventing the passage of flame, smoke and gases under conditions of installation and use when exposed to the ASTM #119 time-temperature curve for a time period equivalent to the rating of the assembly penetrated. Cotton waste shall not ignite when placed in contact with the non-fire side during the test. Fire-stopping material shall be non-combustible as defined by ASTM E136, and, in addition, for insulation materials, melt point shall be a minimum of 1700° F for 2-hour protection.
 - 2. Unused, spare sleeves in electrical closets shall be sealed with threaded steel caps on each end.
- B. Fire stopping materials shall be installed in accordance with manufacturers written instructions.

3.06 PROTECTION OF WORK

- A. Protect work from injury by keeping all conduit and boxes capped and plugged or otherwise protected. This includes damage by freezing and/or stoppage from building materials, sand, dirt, or concrete.
- B. Protect all equipment and fixtures from damages during the project, provide all tarpaulins, drop cloths, barricades, temporary heaters or auxiliary equipment.
- C. All materials or equipment damaged during construction shall be repaired or replaced with new items to the satisfaction of the Engineer.

3.07 PAINTING

- A. Finish painting shall be as specified in Section 09900.
- B. Provide touch-up painting of all electrical equipment marred in any way during shipment or installation.

3.08 CONNECTIONS TO EQUIPMENT

- A. Equipment: The Contractor shall make final electrical connections to all items of equipment. All power wiring from power source through starters, disconnects and control panels to equipment shall be provided.

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3.09 PERFORMANCE

- A. The Contractor shall employ a competent foreman on the job throughout the entire period of construction to see that his work will not conflict with other trades and that it is properly performed.
- B. The foreman shall have a thorough knowledge of the work to be installed under this contract, be a skilled mechanic experienced with projects of equal size and type. Foreman shall have valid Palm Beach County Journeyman License.

END OF SECTION

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SECTION 16110
RACEWAYS

PART 1 - GENERAL

1.01 WORK INCLUDES

- A. Feeders and branch circuit conduits for power and systems, and for conductors of all other electrical systems. Install conduit complete with outlet boxes, junction or pull boxes, and fittings, shown on the drawings or herein specified.

1.02 RELATED WORK

- A. SPECIFIED ELSEWHERE
 - 1. Division 1 - Drawings and General Provisions of Contract, including, but not limited to, general, special, and supplementary conditions and other Division 1 - Specification Sections, apply to the work of this section.
 - 2. Division 15 - Applicable sections.
 - 3. Division 16 - Applicable sections.

1.03 QUALITY ASSURANCE

- A. Provide all new materials, without blemish or defect, in accord with standards specified and UL listed or labeled.

1.04 SUBMITTALS

- A. Submit in accord with Division One.
- B. Product Data:
 - 1. Conduit and fittings.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Rigid steel conduit shall be sheradized or hot dipped galvanized steel pipe, bearing U.L. label and conforming to ANSI Publication C80-1.
 - 1. Acceptable Manufacturers:
 - a. Youngstown
 - b. Triangle - PWC
 - c. Republic
 - d. Allied Tube
- B. Couplings, connectors and fittings for rigid steel conduit shall be threaded galvanized steel or galvanized malleable iron specifically designed and manufactured for the purpose. Fittings shall conform to ANSI C80.4.

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- C. Electrical metallic tubing (EMT) shall be U.L. listed and shall conform to ANSI Publication C80-3. Conduit shall be thoroughly protected from corrosion by electro-galvanizing.
1. Acceptable Manufacturers:
 - a. Allied
 - b. Republic
 - c. Triangle - PWC
 - d. Youngstown
- D. EMT fittings shall be of the steel compression type, rain and concrete tight, with steel compression nuts. Connectors shall be insulated throat with case hardened locknuts. Fittings shall conform to ANSI C80.4.
1. Acceptable Manufacturers:
 - a. Appleton
 - b. Raco
 - c. Thomas and Betts
 - d. Efcor
- E. Flexible conduit and liquid-tight type. Comply with UL-1, and UL-360.
1. Acceptable Manufacturers:
 - a. Anaconda
 - b. Electri-Flex
 - c. Triangle - PWC
 - d. International Metal Hose.
- F. Connectors shall be compatible with flexible conduit and liquid-tight flexible conduit used and shall be UL listed for grounding means.
1. Acceptable Manufacturers:
 - a. Midwest
 - b. Raco
 - c. Thomas and Betts
 - d. Appleton
 - e. O - Z Gedney
 - f. Efcor
- G. Plastic conduit shall be PVC Type EPC-40 Heavy wall rated for 90 deg. C cable meeting NEMA Standard TC-2, and UL listed for concrete encasement. Nonmetallic conduit fittings and conduit bodies comply with NEMA TC-3.
1. Acceptable Manufacturers:
 - a. Carlon Products Company
 - b. Robintech
 - c. Can-Tex

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H. Conduit Bodies

1. Conduit bodies for RGS Applications (LB, T, LR, LL, C) shall be "Crouse Hinds", Form 7 "Feralloy" outlet bodies with galvanized sheet steel covers.
2. Conduit bodies used with EMT, when using compression fittings, shall be "Red Dot" aluminum bodies Type "AT", with "Red Dot" type "CV" covers.

I. Wireways: Provide electrical wireways of types, and sizes as indicated. Provide complete assembly or raceway including, but not limited to, couplings, offsets, elbows, expansion joints, adaptors, holddown straps, end caps, ceiling hangers, and other components and accessories as required for complete system.

1. Lay-In Type: Provide 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.
2. Connectors: Provide wireway connectors suitable for "lay-in" conductors, with connector covers permanently attached that removal is not necessary to utilize the lay-in feature.
3. 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.
4. Acceptable manufacturer's:
 - a. Square D
 - b. Hoffman
 - c. Wiegmann
 - d. Walker

J. Grounding Bushings: With screw termination for green bond wire.

1. Provide per NEC, all areas.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Conduit Schedule

1. Minimum conduit size shall be 3/4 inch unless otherwise specified.

B. Conduit shall be installed in accordance with the following:

1. All conduits in or below floor slabs and in masonry and concrete walls shall be rigid steel or PVC. All rigid steel conduit routed underground or in the concrete slab shall be painted with two coats of bitumastic compound. Provide RGS "EL"s in all feeder raceways stubbing through ground slabs.

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2. All branch circuit conduits in stud partitions and drop ceiling areas, and exposed 4 feet above finish floor may be EMT (thinwall) conduit.
3. All motor branch circuit conduits and conduits routed exposed below 4 feet above finished floor shall be rigid steel.
4. Conduit systems for telephone, fire alarm, and miscellaneous systems shall consist of EMT (thinwall) conduit in drop ceilings, and stud wall partitions and exposed above 4 feet of finish floor. All other conduit shall be rigid steel.
5. PVC conduit may be utilized for underground applications. Do not use PVC or non-metallic raceways within any building.
6. Flexible conduits shall be used to connect to lighting fixtures and as herein specified.

C. Conduit Runs

1. All conduit shall be sized as indicated on the Drawings, or, conduit sizes not shown, shall be in accordance with the National Electrical Code. All conduit systems shall be mechanically and electrically continuous from source of current to all outlets, and grounded in accordance with the National Electrical Code.
2. Conceal conduit wherever possible, or expose as shown or noted on the drawings and as specified hereinafter. Run all exposed conduit parallel to building walls using right angle bends. Exposed diagonal runs of conduit will not be permitted. Do not install conduit on roof surfaces unless specifically indicated on the Drawings.
3. All penetrations through roof shall be made using an approved conduit boot to seal the penetration water-tight. Refer to roofing specifications and drawings.
4. Install conduit 3 inches from cold water piping.
5. Ream conduit after threads are cut. Cut ends square, and butt solidly into couplings.
6. Prevent the accumulation of water, foreign matter or concrete in the conduits during the execution of the work. Temporarily plug conduit, blowout and swab before wires are pulled.
7. Where insulated bushings are used, fasten conduits to all sheet metal boxes and cabinets with two locknuts in accord with NEC.
8. Provide conduit expansion joints at building expansion joints for conduit runs 1-1/2 inches and larger. Provide conduit expansion joints or flexible conduit connection at building expansion joints for conduits less than 1-1/2 inches.
9. Where building construction or other conditions make it impossible to use standard threaded couplings, install watertight threaded unions.

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10. Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with conduit bending machine to avoid changing the internal diameter of the conduit and not damage its protective coating either inside or outside. Individual bends shall not exceed 90 degrees and not more than 270 degrees total bends will be allowed in any one conduit run. Where more bends are necessary, and conduit runs exceed 150 lineal feet, install a suitable pull box or junction box.
11. Provide empty conduits installed with a pull wire. Pull wire shall be No. 14 AWG zinc-coated steel, or of plastic having not less than 200 pound tensile strength. Leave not less than 12 inches of slack at each end of the pull wire.
12. Use liquid tight flexible conduit for final connection to motors, portable equipment, duct smoke detectors and for equipment subject to vibration and noise transmission. For each conduit size up to 1 inch trade size, flexible conduit shall be minimum length of 12 inches and a maximum length of 36 inches. For conduit sizes above 1 inch trade size, flexible conduit shall be minimum length of 20 inches and maximum length of 48 inches.
13. All exposed conduit in finished areas shall be painted to match the surrounding colors.

E. Raceway Support and Hangers

1. Securely fasten raceways in place and support from ceiling or walls at spacings not exceeding requirements indicated in the NEC.
2. Support rigid or EMT conduits within 3 feet of every outlet box, junction box, pull box, cabinet or termination. Support flexible conduit within 12 inches on each side of every outlet box or fitting.
3. Support vertical runs of conduits at each floor level and at interval not to exceed 10 feet.
4. Support conduits by pipe straps, wall brackets, hangers, or ceiling trapeze. The use of perforated iron or wire for supporting conduits is prohibited. Fasten with wood screws or screw nails to wood; by toggle bolts on hollow masonry units, by concrete inserts, or expansion bolts on concrete or spring-tension or threaded C-clamps for rigid steel conduits on steel. Do not weld conduits or pipe straps to steel structures unless specifically indicated.
5. The load applied to fasteners shall not exceed one-third the proof test load of the fasteners.
6. Fasteners attached to concrete shall be vibration and shock resistant.
7. In partitions of light steel construction, use sheet metal screws.
8. Where two or more conduits one inch trade size or larger run parallel, trapeze hangers may be used consisting of threaded solid rods, washers, nuts and galvanized "L" angle or channel iron. Individually fasten conduits to the cross member of every other trapeze hanger with one hole straps or clamp backs with proper size bolts, washers and nuts. When adjustable trapeze hangers are used, use U-bolt type

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clamps at end of conduit runs, at each elbow and at each third intermediate hanger to fasten each conduit.

9. All screws, bolts, washers and miscellaneous hardware used for conduit supports shall be fabricated from rust-resisting metal. Trapeze hangers shall have hanger assemblies protected with galvanized finish.

3.02 SPECIAL INSTALLATION

A. Hazardous Locations

1. Perform all work in hazardous locations as defined by the NEC in strict accordance with the NEC for the particular "Class", "Division", and "Group" of hazardous locations involved or indicated on the drawings. Provide conduit and cable seals in accordance with the NEC.

END OF SECTION

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SECTION 16120
WIRES & CABLES

PART 1 - GENERAL

1.01 WORK INCLUDES

- A. Wires and cables including splices, connections and supports for a complete installation as shown on the drawings and specified.

1.02 RELATED WORK

- A. Specified Elsewhere:
 - 1. Division 1 - Drawings and General Provisions of Contract, including, but not limited to, general, special, and supplementary conditions and other Division 1 - Specification Sections, apply to the work of this section.
 - 2. Division 15 - Applicable sections.
 - 3. Division 16 - Applicable sections.

1.03 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Wire, cable and installation thereof shall be in accord with the National Electrical Code.
 - 2. All materials shall be new, without blemish or defect, in accord with standards specified and UL listed or labeled.

1.04 REFERENCES

- A. ICEA S-61-402/NEMA WC-5 Thermoplastic Insulated Wire and Cable

1.05 SUBMITTALS

- A. In accord with Division One.
- B. Provide product data for all components.
 - 1. Building wire.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Materials shall be suitably packaged by manufacturer to prevent damage during shipment. Damaged materials will not be acceptable for use.
- B. Store materials on site in clean, dry storage area.
- C. Handle all materials carefully to preclude damage. Material with damaged insulation shall not be acceptable for use.

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PART 2 - PRODUCTS

2.01 BUILDING WIRE

- A. All wire and cable shall be annealed, coated copper per ASTM B 33 or B 189 with conductivity of not less than 98 percent. All wire shall be stranded, Class B per ASTM B 8, except for fire alarm conductors, which shall be solid for sizes #14 AWG and smaller.
- B. All wire shall have 600 volt insulation, UL listed and complying with UL 83, ICEA S-61-402 or ICEA S-66-524 for respective insulation type.
- C. Feeders and branch circuits larger than No. 6 AWG: 600 volt insulation Type THW or THWN.
- D. Feeders and branch circuits No. 6 AWG and smaller: 600 volt insulation Type THW or THWN.
- E. Control circuits: 600 volt insulation, THWN.
- F. Color code conductor insulation for No. 8 AWG or smaller. Provide color marking tape for No. 6 AWG and larger. Standard colors for power wiring and branch circuit:

| 3-Phase / 4-Wire | 208Y / 120V | 480Y / 277V |
|-------------------------|--------------------|--------------------|
| Phase A | Black | Brown |
| Phase B | Red | Orange |
| Phase C | Blue | Yellow |
| Neutral | White | Grey |
| Ground | Green | Green |

- G. Acceptable Manufacturers:
 - 1. Anaconda Wire & Cable Co.
 - 2. Collyer Insulated Wire Co.
 - 3. General Cable Corp.
 - 4. Phelps Dodge Cable & Wire Co.
 - 5. Triangle - PWC
 - 6. Crescent
 - 7. Okonite
 - 8. Pirelli

2.02 JOINTS & SPLICES

- A. Make terminations, taps and splices with an indent type pressure connector with insulating cover for No. 8 AWG and smaller.
 - 1. Acceptable Manufacturers:
 - a. Buchanan
 - b. Burndy Corp.
 - c. Thomas & Betts
 - d. Ideal Industries

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- B. In lieu of indent type connectors insulated spring compression connectors may be used for No. 10 AWG and smaller.
 - 1. Acceptable Products:
 - a. Buchanan, B-Cap
 - b. Ideal, Wing Nut
 - c. ITT Holub, Free Spring
 - d. 3M, Scotchlok
 - e. Thomas & Betts

- C. Use mechanical compression connector for No. 6 AWG or larger. Cover connector with insulating tape or heat shrinkable insulation equivalent to 150% conductor insulation.
 - 1. Acceptable Manufacturers:
 - a. AMP, Inc.
 - b. Burndy Corp.
 - c. General Electric Co.
 - d. Ideal Industries
 - e. ITT Weaver
 - f. 3M Co.
 - g. O.Z. Gedney Co.
 - h. Thomas & Betts
 - i. Anderson
 - j. Blackburn

PART 3 - EXECUTION

3.01 BASIC WIRING

- A. Minimum wire sizes shall in no case be less than shown on the drawings and/or specified herein:
 - 1. Power branch circuits:
 - a. Where the farthest outlet of a single branch circuit is less than 75 feet from the panelboard, use No. 12 AWG wire between all outlets and for the home run of that circuit.
 - b. Where the farthest outlet of a circuit is more than 75 feet from the panelboard, use No. 10 AWG wire for the home run of that circuit, and No. 12 AWG wire between all other outlets on that circuit except where larger sizes are indicated.
 - 2. 120 Volt Control and Signal Wiring: No. 14 AWG.
 - 3. Low Voltage Control Wiring: No. 16 AWG.

- B. Where conductors are adjusted in size to compensate for voltage drop, equipment grounding conductors shall be adjusted proportionately.

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- C. Splice only in accessible junction or outlet boxes.
- D. Neatly train and lace wiring inside boxes, equipment and panelboards.
- E. Make conductor lengths for parallel circuits equal.
- F. Maintain color coding of conductors for all systems.
- G. For lighting circuits utilizing electronic ballasts, and all 120v branch circuits to receptacle outlet devices, the phase conductor shall have a dedicated neutral - neutrals shall not be shared between phase conductors.

3.02 CONNECTIONS AND TERMINATIONS

- A. Identify each conductor in panelboards, junction or pull boxes, or troughs with a permanent pressure sensitive label with suitable numbers or letters for easy recognition. Identify control wiring at each end and in junction boxes with numeric wire number corresponding to control wiring diagram.
- B. Thoroughly clean wire before installing lugs and connectors.
- C. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
- D. Terminate spare conductors with electrical tape and roll up in box. Verify such conductors are not connected to any source of power.

3.03 FIELD QUALITY CONTROL

- A. Inspect wiring for physical damage and proper connection.
- B. Torque conductor terminations to manufacturer's recommended values.
- C. Perform continuity tests on all power and branch circuit conductors. Verify proper phasing. Refer to Section 16950 for specific testing requirements.

END OF SECTION

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SECTION 16130
BOXES

PART 1 - GENERAL

1.01 WORK INCLUDES

- A. Outlet boxes, pull and junction boxes, and covers and fittings as specified below to complete the raceway systems.

1.02 RELATED REQUIREMENTS

- A. Specified Elsewhere:
 - 1. Division 1 - Drawings and General Provisions of Contract, including, but not limited to, general, special, and supplementary conditions and other Division 1 - Specification Sections, apply to the work of this section.
 - 2. Division 15 - Applicable sections.
 - 3. Division 16 - Applicable sections.

1.03 SUBMITTALS

- A. In accord with Division One.
 - 1. Product Data: All boxes.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Outlet Boxes
 - 1. Outlet boxes shall be galvanized or sherardized pressed steel conforming to UL Standard No. 514 and shall meet or exceed the National Electrical Code for size and material.
 - 2. Round boxes and handy boxes shall not be used.
 - 3. All boxes furnished shall be the type designed for the purpose served.
 - 4. All switch and receptacle boxes shall be minimum 4 inch square for up to two devices, or solid ganged boxes for over two devices. Boxes shall be complete with minimum 3/4 inch deep tile ring for glazed tile, concrete block or concrete walls and minimum 3/4 inch deep square ring and covers, for plaster, gypsum dry wall or wood paneled finished walls; covered with 1/2 inch raised galvanized device covers for exposed conduit work.
 - 5. Outlet boxes on exposed conduit systems shall be threaded-hub, cast-metal, conduit type fitting FS or FD suitable for wiring devices installed, complete with gasketed weatherproof cover.

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6. Acceptable Manufacturers:

- a. Crouse Hinds
- b. Appleton
- c. Killark
- d. Raco
- e. Steel City

B. Pull and Junction Boxes

1. Pull and junction boxes with volume greater than 100 cubic inches shall conform to UL Standard No. 50 and be sized in accordance with the National Electrical Code or as indicated on the drawings.
2. Boxes shall be made of code gauge galvanized steel or hot dip galvanized sheet steel. Covers shall be of same gauge of box and be secured to holes with rough head silicon bronze screws spaced at 12 inch centers maximum.
3. Pull or junction boxes with maximum side of 60 inches and a maximum area greater than 1400 square inches shall be made of 1-1/2 inch by 1-1/2 inch by 1/4 inch galvanized angle frame covered with 10 gauge galvanized sheet steel riveted or welded to frame. Cover plate shall be 11 gauge galvanized steel secured with round head silicon bronze machine screws spaced at 12 inch centers maximum.
4. Boxes mounted flush in walls shall have cover oversized two inches on all sides and shall be minimum 14 gauge steel.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Independently support all boxes. No parts of the weight of the box shall be borne by conduits terminating therein.
- B. Suitable pull boxes shall be installed in convenient intermediate locations in all conduit runs in excess of 150 linear feet and runs requiring more than three 90 degree bends.
- C. Plug all unused openings. Use threaded plugs for cast boxes and snap in metal plugs for sheet metal boxes.
- D. Common boxes used for gang installation with switches and receptacles and low voltage devices shall include barriers between the devices and the switches or receptacles to prevent voltage greater than 208 volts between devices.

END OF SECTION

R.G. KREUSLER PARK RESTROOM BUILDING
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Specifications

SECTION 16141
WIRING DEVICES

PART 1: GENERAL

1.01 SECTION INCLUDES

- A. Toggle switches.
- B. Receptacles.
- C. Device plates box covers.

1.02 REFERENCES

- A. NEMA WD 1 - General Purpose Wiring Devices.
- B. NEMA WD 6 - Wiring Device Configurations.

1.03 SUBMITTALS

- A. Submit under provisions of Division One.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
- C. Manufacturer's Instructions:
 - 1. Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements.
 - 2. Include instructions for storage, handling, protection, examination, preparation, operation and installation of product.

1.04 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years experience.

PART 2: PRODUCTS

2.01 TOGGLE SWITCHES

- A. Single Pole Switch:
 - 1. Hubbell Model 1221-IG.
 - 2. Leviton. Model 1221-2I.
 - 3. Bryant. Model 4901-GI.

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Specifications

2.02 RECEPTACLES

A. Duplex Convenience Receptacle:

1. Hubbell. Model 5352-W.
2. Leviton. Model 5896-W.
3. Bryant. Model 5362-W.

B. GFCI Receptacle:

1. Hubbell. Model GF5362-W.
2. Leviton. Model 6899-W.
3. Bryant. Model GFR53FT-W.

2.03 OCCUPANCY SENSOR

A. Ceiling mounted – large area – 360 degree coverage, 2,000 s.f.

1. Ceiling mounted occupancy sensors for large areas shall be dual technology type (ultrasonic and passive infrared) to prevent false tripping. Device may be line or low-voltage and shall be provided with control units/relays as necessary to control 120V or 277V lighting. Provide multiple sensors in areas where the coverage area is within 10% of the maximum coverage limits of the device. Devices shall have adjustable settings for ambient light, range sensitivity, and shut-off delay (30 seconds to 15 minutes). Provide control unit/relay power as required. Support from structure and provide trim rings for mounting in hard ceiling.

B. Wall mounted – small area – 180 degree coverage.

1. Wall mounted occupancy sensors for small areas shall be Decora Series type utilizing dual technology (ultrasonic and passive infrared). Sensor shall have line voltage (120V or 277V) dual relay functionality for control or outboard and inboard lamps independently. Single relay type may be used where dual level lighting is not required. Device shall have manual override and adjustable settings for ambient light, range sensitivity, and shut-off delay (30 seconds to 15 minutes). Sensor shall be semi-recessed mounted in a standard, single gang box.

2.04 TIMER SWITCH - MANUAL

- A. Digital timer switch, mountable in single gang box. Device shall have a maximum delay of 4-hours, equal to Wattstopper TS400.

2.05 COVER PLATES

- A. Weatherproof Cover Plate: Gasketed stainless steel with lockable hinged gasketed device cover, equal to Sierra Model WP-26L.

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- B. Cover Plates: Nylon, white or color to match existing.

PART 3: EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions.
- B. Verify outlet boxes are installed at proper height.
- C. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.02 PREPARATION

- A. Clean debris from outlet boxes.

3.03 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install devices plumb and level.
- C. Install switches with OFF position down.
- D. Install receptacles with grounding pole on bottom.
- E. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
- F. Connect wiring devices by wrapping conductor around screw terminal.
- G. When GFCI is specified, use only GFCI receptacles. Do not protect "down stream" receptacles with GFCI receptacles.
- H. Do not use push-in connections on any device.
- I. All devices, receptacles, and switches shall have separate grounding terminal.
- J. Terminal boxes are provided with integral control power transformer, C.P.T. (120v-24vac). Provide 120 v circuit to each box and provide and install toggle switch in circuit as disconnect switch on line side of C.P.T. Complete wiring from switch to line terminals of C.P.T.

3.04 FIELD QUALITY CONTROL

- A. Inspect each wiring device for defects.
- B. Operate each toggle switch with circuit energized and verify proper operation.
- C. Verify that each receptacle device is energized.

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- D. Test each receptacle device for proper polarity.
- E. Test each GFCI receptacle device for proper operation.

3.05 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

END OF SECTION

SECTION 16190
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 WORK INCLUDED:

- A. Conduit and equipment supports.
- B. Fastening hardware.

1.02 COORDINATION

- A. Coordinate size, shape and location of concrete pads with Division 1.

1.03 QUALITY ASSURANCE

- A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

PART 2 PRODUCTS

2.01 MATERIAL

- A. Support Channel: Galvanized steel.
- B. Hardware: Corrosion resistant.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors, beam clamps, spring steel clips.
- B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.
- C. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.
- D. Do not use powder-actuated anchors.
- E. Do not drill structural steel members.
- F. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

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- G. Install free-standing electrical equipment on a housekeeping pad, minimum 4" thick and 4" overhang.
- H. Install surface-mounted cabinets and panelboards with minimum of four anchors. Provide steel channel supports to stand cabinet 3/4 inch off wall.
- I. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.

END OF SECTION

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SECTION 16195
ELECTRICAL IDENTIFICATION

PART 1: GENERAL

1.01 WORK INCLUDED

- A. Nameplates.
- B. Wire markers.
- C. Box color coding.
- D. Lighting and power junction boxes.
- E. Panel directories.

1.02 SUBMITTALS

- A. Submit shop drawings under provisions of Division One.
- B. Include schedule for nameplates.

PART 2: PRODUCTS

2.01 MATERIALS

- A. Nameplates: Engraved three-layer laminated plastic, white letters on a black background.
- B. Wire and Cable Markers: Cloth markers, split sleeve or tubing type.

PART 3: EXECUTION

3.01 INSTALLATION

- A. Degrease and clean surfaces to receive nameplates.
- B. Install nameplates parallel to equipment lines.
- C. Secure nameplates to equipment fronts using sheet metal screws. Secure nameplate to outside face of recessed panelboard doors in finished locations.
- D. Embossed tape will not be permitted for any application.
- E. Provide underground-type plastic line marker above exterior underground conduits. Bury 6 to 8 inches below finish grade. Provide line markers on each side of trench if wider than 16 inches.

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3.02 WIRE IDENTIFICATION

- A. Phase Color Coding:
 - 1. 120/208 volt system, "A" phase - black, "B" phase - red, "C" phase - blue, neutral - white, and ground green.
- B. Maintain A, B, C, phase relation left to right or top to bottom when viewed from front. Maintain color coding throughout entire project.
- C. Phase conductors, size #10 and smaller, and neutral and ground conductors, size #6 and smaller, shall have continuous outer finish color as indicated above. Larger conductors shall have black insulation and be color coded with a six inch band of colored tape at all junctions and terminators.

3.03 NAMEPLATE ENGRAVING SCHEDULE

- A. Provide nameplates of minimum letter height as scheduled below.
- B. Panelboards, Switchboards and Motor Control Centers: 1/2 inch; identify equipment designation. 1/4 inch; identify voltage rating.
- C. Individual Circuit Breakers, Switches, and Motor Starters, Switchboards, and Motor Control Centers: 3/8 inch; identify circuit and load served, including location.
- D. Safety Switches, Enclosed Switches, and Motor Starters: 1/4 inch; identify load served.
- E. Transformers: 3/8 inch; identify equipment designation. 1/4 inch; identify primary and secondary voltages.
- F. Electrical Cabinets and Enclosures: 3/8 inch; identify equipment designation.
- G. System Terminal Cabinets: 3/8 inch; identify equipment designation.
- H. Switches Not Within Sight of the Equipment or Light(s) Controlled: 1/8 inch; identify load served.

3.04 BOX COLOR CODING SCHEDULE

- A. Paint junction box and cover in the following manner:
 - 1. Fire alarm – Match orange.
 - 2. AC and EMS controls - Existing or purple.
 - 3. Telecom – Match existing or yellow.
- B. Paint emergency power panels and disconnect switches, red.

3.05 LIGHTING AND POWER JUNCTION BOX IDENTIFICATION

- A. Permanently identify lighting and power junction box covers with circuit and panelboard number on the outside.

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- B. In exposed finished painted areas, place circuit and panelboard number on inside of cover.

3.06 PANEL DIRECTORY

- A. Shall be typewritten, indicate specific and clear area of control, using official room numbers, and be protected by a plastic covering.

END OF SECTION

SECTION 16420
600 VOLT ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.01 SESSION INCLUDES:

- A. Arrangement with Utility Company for permanent electric service.
- B. Underground service entrance.

1.02 SYSTEM DESCRIPTION

- A. Power:
 - 1. System Voltage: 120/208 volts, three phase, four-wire, 60 Hertz.
 - 2. Service Entrance: Main

1.03 QUALITY ASSURANCE

- A. Power Utility Company: Lake Worth Utilities.
- B. Install service entrance in accordance with Utility Company's rules and regulations.

1.04 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Division 1.
- B. Submit Utility Company prepared drawings.

PART 2 PRODUCTS

2.01 POWER METERING EQUIPMENT

- A. Meter; meter base and transformer cabinet.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Power:
 - 1. Make arrangements with Utility Company to obtain electric service to the Project.
 - 2. Underground: Install service entrance conduits at a minimum depth of 36" from Utility Company's pad-mounted transformer or Utility Company's pole mounted transformer to building service entrance equipment. Utility Company will connect service lateral conductors to service entrance conductors.
 - 3. Provide concrete pad for transformer.
 - 4. Install primary conduits (conduits furnished by Utility Company) from project's property line as determined by Utility Company. Locate conduits at a minimum depth of 36"; cover conduits with three inches thick by trench width concrete and warning tape.

END OF SECTION

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Specifications

SECTION 16440
CIRCUIT & MOTOR DISCONNECTS

PART 1 - GENERAL

1.01 WORK INCLUDES

- A. All disconnect switches for each motor and piece of electrically operated equipment shown on the Drawings or herein specified.

1.02 RELATED WORK

- A. Specified elsewhere:
 - 1. Division 1 - Drawings and General Provisions of Contract, including, but not limited to, general, special, and supplementary conditions and other Division 1 - Specification Sections, apply to the work of this section.
 - 2. Division 15 - Applicable sections.
 - 3. Division 16 - Applicable sections.

1.03 SUBMITTALS

- A. In accord with Division One.
 - 1. Product Data: All disconnect switches.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Disconnect Switches
 - 1. Provide switches fusible or non-fusible as indicated, heavy duty, and incorporate a quick-make, quick-break operating mechanism. Cover shall be interlocked with handle and be suitable for padlocking in "OFF" position using up to three padlocks.
 - 2. Switches shall be furnished in NEMA 1 general purpose enclosures, unless mounted outdoors, in which case a NEMA 4X-SS enclosure is required. Covers on NEMA 1 enclosures shall be attached with pin type hinges. NEMA 4X-SS covers shall be securable in the open position. NEMA 4X-SS enclosures for switches thru 200 amperes shall have provisions for interchangeable bolt-on hubs. NEMA 4X-SS enclosures shall be manufactured from stainless steel. Enclosures shall have a gray baked enamel finish, electrodeposited on cleaned, phosphatized steel.
 - 3. Switches shall be horsepower rated for ac and/or dc as indicated by the plans. All fusible switches rated 100 thru 600 amperes at 240 volts and 30 thru 600 amperes at 600 volts shall have a UL approved method of field conversion from standard Class H fuse spacing to Class J fuse spacing. The switch also must accept Class R fuses and have provisions for field installation of a UL listed rejection feature to reject all fuses except Class R. The UL listed short circuit rating of the switches shall be 200,000 rms symmetrical amperes when Class R or Class J fuses are used with the appropriate rejection scheme. The UL listed short circuit rating of the switch, when equipped with

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Specifications

Class H fuses, shall be 10,000 rms symmetrical amperes. 800 and 1200 ampere switches shall have provisions for Class L fuses and shall have a UL listed short circuit range of 200,000 rms symmetrical amperes.

2.02 ACCEPTABLE MANUFACTURERS

- A. Square D
- B. General Electric
- C. Cutler-Hammer
- D. Siemens I.T.E.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Mount switches 5 feet - 0 inch to top. Provide anchoring point at each mounting hole provided in enclosure. Mount switches on roof-top HVAC units in accordance with Manufacturer's recommendations. Coordinate with approved manufacture's shop drawings to ensure proper conduit rough-in location. Disconnect switch shall not be mounted on removable access panel of HVAC unit. Mount only on fixed panel that will not infringe on unit access.
- B. Provide nameplate in accord with 16195 to indicate equipment served or function of switch.

END OF SECTION

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Specifications

SECTION 16450
GROUNDING

PART 1 - GENERAL

1.01 WORK INCLUDES

- A. Base Bid:
 - 1. Electrical Contractor provide:
- B. Grounding for Separately Derived Systems
 - 1. Grounding for equipment.

1.02 SYSTEM DESCRIPTION

- A. Ground each separately derived system neutral to structural member of building.
- B. Ground raceways and electrical equipment; use double locknuts at all panels; use bonding jumpers where conduits are installed in concentric knockouts. Ground panels, switches, motor frames, motor starters fixtures, and outlets with separate ground conductor in conduit system.
- C. Bond together system neutrals, service entrance enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground terminals.

1.03 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with NFPA 70, National Electric Code, 2011.
 - 2. UL 467: Grounding and Bonding Equipment.

1.04 SUBMITTALS

- A. In accord with Division One.
- B. Test data in accord with 16950.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Materials used for grounding conductors shall be in accordance with N.E.C. Article 250-91.
- B. Ground Rods: Steel, copper-encased, 5/8 inch O.D. x 10'-0".

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- C. Connections: Exothermic weld type for inaccessible locations, mechanical clamp type for accessible locations.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Use driven ground rod where shown on drawings.
- B. Bond all grounding systems together.
- C. Separately Derived Systems: Provide connection to building steel bonded to neutral of transformer.
- D. Provide green equipment grounding conductor sized in accordance with Table 250-95 of the N.E.C., in all raceways including conduits, wireways, ducts, and equipment components. Bond equipment grounding conductor to each section of the system being grounded using a continuous conductor and lay-in type grounding lugs bolted to the housing.

3.02 FIELD QUALITY CONTROL

- A. Measure ground resistance in accord with 16950.

END OF SECTION

SECTION 16460

600 VOLT DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including, but not limited to, General, Special, and Supplementary Conditions and other Division-1 Specification Sections, apply to the work of this section.

1.02 SCOPE

- A. Provide:
 - 1. Step-down transformers air cooled, dry, indoor type, with KVA ratings and connections as shown on the drawings. Where indicated, transformers shall be non-linear type, K-13 rated.

1.03 SUBMITTALS

- A. Product Data: On all transformers
- B. Shop Drawings: Transformer drawings containing manufacturer's certified dimensions, weights, insulation type/temperature class, and sound ratings.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Transformers shall be non-explosive and fire resistant and be cooled by natural circulation of air through the windings. Transformers shall be of the continuous wound construction and shall be impregnated with non-hygroscopic, thermosetting varnish. Subject transformers to potential tests in accord with NEMA standards applying to dry type apparatus. Provide panelboards that are "fully rated" for the available short circuit amperes at the point of application.
- B. Transformer cores shall be constructed of high grade silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Magnetic flux densities shall be kept well below the saturation point.

The core laminations shall be clamped together with structural steel angles. The complete core and coil shall be isolated from the enclosure by means of rubber, vibration-absorbing mounts. There shall be no metal-to-metal contact between the core and coil and the enclosure. The vibration isolating system shall be designed to provide a permanent fastening of the core and coil to the enclosure.
- C. Windings may be copper and totally enclosed, and the transformers shall be capable of continuous operation at rated load, voltage and frequency in accord with ANSI C57.96. The coils shall be thoroughly insulated from the bushings and from each other.

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Specifications

Bushings shall be built into coils. The complete coil and core assembly shall be impregnated with waterproofing material having high-insulating and good heat-conducting properties, in accord with NEMA ST-20.

1. Winding temperature rise above ambient temperature of 40 degrees C.:
 - a. 75 kVA and below: 115 degree C. for Class 220 degree C insulation.
 - b. 112 1/2 kVA and above: 80 or 115 degree C. for Class 220 degree C insulation.

- D. Enclose transformers in sheet steel housing with openings in the bottom and near the top, at front and rear for adequate ventilation. Enclosures shall be suitable for primary and secondary conductor entrances from sides, rear and top. Provide corrosion-resistant coating of manufacturer's standard color.

- E. Construct transformers and test in accord with current standards and revisions of ANSI and NEMA.

- F. Transformer sound ratings shall not exceed the following when measured in accordance with ANSI Standards for dry type transformers.
 1. 0 - 9 kVA --- 40 dB
 2. 10 - 50 kVA --- 45dB
 3. 51 - 150 kVA --- 50 dB
 4. 151 - 300 kVA --- 55 dB
 5. 301 - 500 kVA --- 60 dB
 6. 501 - 700 kVA --- 62dB
 7. 701 - 1000 kVA --- 64 dB

- G. Ratings:
 1. Step-down transformers:
 - a. 480 volts delta to 208Y/120 volts, 3-phase, 4-wire, with four 2 1/2% taps - two above and two below rated voltage, kVA capacity as shown on the drawing.
 - b. Rated for non-linear loads (K-13 rating), where indicated.

- H. Acceptable Products:
 1. Square D Company
 2. General Electric

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Specifications

3. Cutler Hammer
 4. Siemens
- I. Transformers shall meet the energy efficiency standards requirements of NEMA Standard TP-1.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Wall mount or floor-mount transformers as shown on the Drawings.
- B. All conduit connections to transformers shall have a minimum of 24 inch length of flexible conduit to minimize vibration transmission.
- C. Set transformers on isolation pads of proper size and thickness to prevent transmission of sound into building structure.
 1. Acceptable Products:
 - a. Isomode
 - b. Keldur
 - c. Korfund
- D. Ground secondary of transformer in accord with the National Electrical Code.
- E. Provide 4" high concrete housekeeping pad for all floor mounted transformers.

END OF SECTION

SECTION 16471

CIRCUIT BREAKER PANELBOARDS

PART 1 - GENERAL

1.01 WORK INCLUDES

A. Base Bid:

1. Electrical Contractor provide:
 - a. Panelboards herein specified and shown on the drawings.

1.02 RELATED WORK

A. Specified Elsewhere:

1. Drawings and general provisions of Contract, including, but not limited to, General, Special and Supplementary Conditions and other Division-1 Specification Sections, apply to the work of this Section.
2. Division 15 - applicable sections.
3. Division 16 - applicable sections.

1.03 SUBMITTALS

A. In accord with Division 0.

1. Shop Drawings: Panelboards
2. Product Data: Circuit breakers

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Panelboards shall have copper bus structure braced fault current as indicated on the drawings. All copper parts shall be plated to prevent corrosion. Provide panelboards that are "fully rated" for the available short circuit amperes at the point of application.
1. All panelboards shall be Dead-Front Safety Type, equipped with thermal-magnetic molded case breakers, and solid neutral bus.
 2. Bus bar connections to the branch circuit breakers shall be the "Distributed Phase" or "Phase Sequence" type. Bussing shall be such that adjacent single pole breakers will be on different phases or polarities, and that two or three pole breakers can be installed at any location.

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3. Panelboard numbering shall be such that starting at the top, odd numbers shall be used in sequence down the left hand side and even numbers shall be used in sequence down the right hand side.
- B. Cabinets shall be fabricated of code gauge galvanized steel with gutters per National Electrical Code. Fronts shall have doors with matching one piece trim, be code gauge and be finished with rust inhibiting primer and baked enamel. Fronts shall have adjustable indicating trim clamps completely concealed when door is closed. Provide a circuit directory frame and card with a clear plastic covering on the inside of the doors. Fronts shall have flush locks, and be furnished with two keys per lock.
- C. Provide circuit breakers, quick-make, quick-break, thermal-magnetic, trip indicating, and common trip on all multi-pole breakers. Branch circuit breakers feeding convenience outlets shall have sensitive instantaneous trip settings of not more than 10 times the trip rating of the breaker. Circuit breakers shall have bolt-on connections to the bus. Ratings are shown on the panelboard schedule.
- D. Main circuit breaker: Circuit breaker ampere rating as shown on drawings, 3-pole, single-throw, front connected. Molded case, thermal-magnetic, common trip, quick-make, quick-break, adjustable magnetic trip elements, minimum ampere RMS interrupting rating, as specified. Provide where indicated on drawings.
- E. Breakers intended to switch fluorescent lighting loads on a regular basis shall be rated for switching duty.
- F. Provide ground fault circuit interrupter circuit breakers rated to trip at 30 milliamperes for circuits as shown on drawings.
- G. Panelboards shall be furnished with ground bus and separate insulated neutral bus.
- H. Panelboards:
 1. Acceptable Products:
 - a. Square D (Basis of Design)

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Locate as shown on drawings. Maximum distance from floor to highest breaker: 6 feet - 6 inches.
- B. Provide mounting materials required; make connections specified or shown. Use collars around mounting bolts, or equivalent means to provide 1/4" minimum air space between panel and wall for surface mounted panel.
- C. Provide nameplate for each panel in accord 16195.

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- D. Provide typed circuit directory for each panel indicating load served. Leave spare circuit breakers and circuit breaker space blank on directory. Load served description shall indicate type, room or area designation, ex: circuit 1 -Rooms 100, 101, 102, lighting.
- E. Where double-panels are indicated, provide single common trim or allow for two individual covers when mounting cabinets.

END OF SECTION

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SECTION 16475
OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.01 WORK INCLUDES

- A. Fuses for all fusible equipment installed on the project regardless of which contractor has provided the equipment.
- B. Enclosed circuit breakers as indicated on the drawings and herein specified.
- C. Circuit breakers for existing panelboards for new branch circuit overcurrent protection.

1.02 RELATED WORK

- A. Specified Elsewhere:
 - 1. Drawings and general provisions of Contract, including, but not limited to, General, Special, and Supplementary Conditions and other Division-1 Specification Sections, apply to the work of this Section.
 - 2. Division 15 - applicable sections.
 - 3. Division 16 - applicable sections.

1.03 SUBMITTALS

- A. In accord with Division One.
 - 1. Shop Drawings: Enclosed circuit breakers
 - 2. Product Data
 - a. Fuses
 - b. Enclosed circuit breakers
 - c. Provide OCPD characteristic curves, full size transparencies.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Fuses rated 601 amperes to 6000 amperes, 600 volt and below, shall be U.L. listed Class L current limiting type, 200,000 amperes, RMS interrupting.
 - 1. Acceptable Products
 - a. Bussman Limitron - Type KLU
 - b. Little Fuse - Type KLLU
 - c. Gould Shawmut- Type A4B

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- B. Fuses rated 15 to 600 ampere (except for motor branch circuit protection), 600 volt and below, U.L. listed Class RK-1 current limiting type, 200,000 amperes RMS interrupting.

1. Acceptable Products

- a. Bussman Limitron - Type KTS-R
- b. Little Fuse - Type KLSR
- c. Gould Shawmut - Type A2K (250 vac)/A6K (600 vac)

- C. Fuses for motor branch circuit and transformer protection U.L. listed Class RK-5 dual element type, 200,000 amperes RMS interrupting.

1. Acceptable Products

- a. Bussman Fusetron - Type FRS-R
- b. Little Fuse - Slo-Blo, Type FLS-R
- c. Gould Shawmut - Type TR (250 vac)/TRS (600 vac)

- D. Furnish and install individually enclosed circuit breakers as indicated on the plans. All circuit breakers shall meet Federal Specification W-C-375B, and both the circuit breaker and the enclosure shall be UL listed.

Circuit breakers shall have overcenter toggle type mechanisms, providing quick-make, quick-break action. Breakers shall have current and interrupting rating as indicated on the plans. Each circuit breaker shall have trip indication by handle position and shall be trip-free. Two and three pole breakers shall be common trip. Each breaker shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole.

Enclosures shall be of the NEMA type indicated on the plans.

NEMA 1 enclosures shall be furnished with knockouts where practical and shall be fabricated from sheet steel which conforms to UL 50. The enclosure shall be given an electrodeposited, gray baked enamel finish. Padlocking provisions shall be provided to allow locking the circuit breaker in the "OFF" position. Enclosures shall be UL listed.

NEMA 4X-SS enclosures for circuit breakers rated thru the 225 ampere frame size shall be furnished with provisions for interchangeable, bolt-on hubs. Enclosures shall be fabricated from galvanized steel and shall be given an electrodeposited, gray baked enamel finish. Enclosure covers shall be securable in the open position. Padlocking provisions shall be provided to allow locking the enclosure cover closed. Enclosures shall be UL listed.

- E. Existing circuit breakers in existing panelboards may be reused. The Contractor shall verify that the breaker is in good operating condition and will provide the proper protection for the respective circuit conductors. Should a new breaker be required, it shall be provided and installed by this Contractor. All new circuit breakers shall be compatible with the panelboard for which it is intended, be of the proper A.I.C. rating, and be of the proper trip rating for the application.

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PART 3 - EXECUTION

3.01 INSTALLATION

- A. Fused distribution system is designed to provide selectivity, coordination, and component protection. To guarantee this system, all fuses shall be from the same manufacturer. Substitution provisions are specified in Division One.
- B. Place a fuse identification label showing size and type of fuses installed inside the cover of each switch.
- C. Furnish Owner at completion of project, one spare set (3) of each size of fuse rated over 100 amperes. Obtain a written receipt for same from the Owner.
- D. Provide a nameplate for each enclosed circuit breaker in accordance with Section 16195.

END OF SECTION

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SECTION 16480
MOTOR CONTROL

PART 1 - GENERAL

1.01 WORK INCLUDES

A. Base Bid:

1. Electrical Contractor provide:
 - a. All motor starters and controllers as shown on the drawings and as required to complete all power wiring to motor loads and miscellaneous mounting hardware.

1.02 RELATED WORK

A. Specified Elsewhere:

1. Drawings and general provisions of Contract, including, but not limited to, General, Special and Supplementary Conditions and other Division-1 Specification Sections, apply to the work of this Section.
2. Division 15 - applicable sections
2. Division 16 - applicable sections

1.03 SUBMITTALS

A. In accord with Division 1.

1. Shop Drawings: All motor starters and enclosures.
2. Product Data: All components.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Fractional horsepower manual motor starters shall be single pole toggle type with thermal overload protection and trip free operation. Provide starter in NEMA 1 flush or surface enclosure unless otherwise specified or required. Provide red pilot light.

1. Acceptable Products:
 - a. G.E.
 - b. Square D
 - c. Cutler-Hammer
 - d. Furnas
 - e. Siemens

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- B. Combination magnetic starters shall be across-the-line fusible type. Disconnect shall be front operated, capable of being locked in the open position and have cover interlocked with handle. Starters shall be NEMA rated for the horsepower loads at the rated voltage and shall include a control transformer with primary fuse protection and a 120 volt fused control circuit, under-voltage protection, loss of phase and phase reversal, (for motors of 1-1/2 HP and greater), external manual reset, and solid-state overloads. Phase failure and under voltage relay shall have adjustable response time delay. Provide adjustable time delay relay (0-10 minutes) for start-up after power failure to allow stagger starts and minimize inrush on system. Enclosure shall be NEMA 1 unless otherwise specified or required. Exterior mounted units shall be NEMA 4X-SS.
1. Acceptable Products:
- a. Square D
 - b. G.E.
 - c. Furnas
 - d. Siemens
- C. Each combination starter shall be furnished with a minimum of one N.O. and one N.C. auxiliary contact for spare or future purposes (this is additional to required active auxiliary contacts).
- D. Provide motor starters with 'hand-off-auto' selector switches and 'red-run' indicating pilot light in cover.
- E. Connections to the selector switch shall be such that only the normal automatic regulatory control devices will be bypassed when the switch is in the "hand" position. All safety control devices such as low and high pressure cutouts, high temperature cutouts, and motor overload protective devices, life safety/fire alarm controls shall be connected in the motor control circuit in both the "hand" and the "automatic" positions.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Furnish overloads based on the nameplate rating of the motor to be controlled.
- B. Each motor shall be supplied by an individual branch circuit in separate branch conduit, except where otherwise shown.
- C. All final connections to motor shall be made with flexible conduit, not less than 18 inches or more than 24 inches long. Provide ground wire to motor frame. Conduit shall be adequately supported at each motor.
- D. Proper direction of rotation of all motors shall be the responsibility of this Contractor.

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- E. All disconnects, combination starters, starters, and control devices, etc., shall have nameplates or legends indicating the equipment served and/or the functions of the device. These nameplates or legends shall be sized relative to the device, be made of engraved phenolic compound, and properly secured to the device. Refer to Section 16195.
- F. It is understood that motor sizes called for in schedules and locations of same are for estimating purposes only, and it shall be the responsibility of the Contractor for work under this Section to confer with the Contractors of other trades involved and provide connections of proper capacity at proper locations thereof. This Contractor shall be fully responsible to furnish and install proper fuses, starters, conduit, thermal heaters and conductors to the individual starters, leaving same ready for operation.
- G. Where starters and other devices are furnished with the equipment, this Contractor shall receive these starters and other devices in connection with the units and do all necessary power field wiring between equipment starters. This work is to be done under the supervision of the respective Contractor, or Subcontractor, who shall be fully responsible for providing adequate and correct wiring diagrams and instructions.
- H. Install motor starters as follows:
1. Location: Approximately as shown. Choose precise location to provide ample space for operation and maintenance; confirm with Architect/Engineer.
 2. Mounting Method:
 - a. Wall Mounting: Use expansion anchors and bolts. Install collars around mounting bolts, to provide air space between wall and device enclosure.
 - b. Structural Steel Mountings: Bolt to steel or brackets welded to steel. Provide air space between steel and device enclosure.
 - c. Angle Iron Framework Mounting: Provide where walls or structural steel not available. Bolt device enclosure or enclosures to angle iron or to steel panel attached to iron as directed.
 - d. Floor Mounting: Install on 4" high concrete equipment pad, in plumb and level attitude. Use expansion anchors and bolts as required.
 3. Painting: Refer to Division 9.

END OF SECTION

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SECTION 16490

CONTACTORS

PART 1 GENERAL

1.01 SECTION INCLUDES:

- A. General purpose contactors.
- B. Lighting contactors.

1.02 REFERENCES

- A. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
- B. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
- C. ANSI/NFPA 70 - National Electrical Code.

1.03 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Include dimensions, size, voltage ratings and current ratings.

1.04 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 01700.
- B. Accurately record actual locations of each contactor and indicate circuits controlled.

1.05 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 01700.
- B. Maintenance Data: Include instructions for replacing and maintaining coil and contacts.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS - GENERAL PURPOSE CONTACTORS

- A. Square D.

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- B. General Electric.
- C. Allen-Bradley.
- D. Cutler Hammer.
- E. Siemens/ITE.

2.02 GENERAL PURPOSE CONTACTORS

- A. Description: NEMA ICS 2, AC general purpose magnetic contactor.
- B. Coil Voltage: 120 volts, 60 Hertz.
- C. Poles: As indicated.
- D. Size: As indicated.
- E. Enclosure: ANSI/NEMA ICS 6, Type as required to meet conditions of installation, unless indicated on the Drawings.
- F. Accessories:
 - 1. Pushbutton: ON/OFF
 - 2. Selector Switch: ON/OFF
 - 3. Indicating Light: RED.
 - 4. Auxiliary Contacts: 2, (1) normally open and (1) normally closed, field convertible.

2.03 MANUFACTURERS - LIGHTING CONTACTORS

- A. Square D.
- B. General Electric.
- C. Allen-Bradley.
- D. Cutler Hammer.
- E. Siemens/ITE.

2.04 LIGHTING CONTACTORS

- A. Description: NEMA ICS 2, magnetic lighting contactor.
- B. Configuration: Electrically held.
- C. Coil Voltage: 120 volts, 60 Hertz.
- D. Poles: As indicated.

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- E. Contact Rating: Match branch circuit overcurrent protection, considering derating for continuous loads.
- F. Enclosure: ANSI/NEMA ICS 6, Type as required to meet conditions of installation unless indicated on the Drawings.
- G. Accessories:
 - 1. Selector Switch: ON/OFF/AUTOMATIC.
 - 2. Indicating Light: RED.
 - 3. Auxiliary Contacts: 2, (1) normally open and (1) normally closed, field convertible.

2.05 ACCESSORIES

- A. Pushbuttons and Selector Switches: NEMA ICS 2, heavy duty type.
- B. Indicating Lights: NEMA ICS 2, type.
- C. Auxiliary Contacts: NEMA ICS 2, Class A300.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

END OF SECTION

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Specifications

SECTION 16500
INTERIOR LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this Section.

1.02 SCOPE

- A. Provide lighting fixtures, accessories, labor and supervision necessary to install a complete Interior Lighting System.

1.03 STANDARDS AND CODES

- A. Except where otherwise required by this Section, the following Standards and Codes shall govern:
 - 1. NEC Article 410
 - 2. UL Listed

1.04 SUBMITTALS

- A. Submit catalog cuts giving complete description of fixtures to include photometric curves and method of installation.
- B. Submit index listing all fixtures and complete model with submittal.

1.05 QUALIFICATION

- A. The lighting fixtures listed in the fixture schedule are the basis of design for the lighting systems. Substitutions will not be considered.
- B. Final review for fixtures will be when shop drawings are submitted. The Architect reserves the right to reject any fixtures which, in his opinion, do not meet the overall lighting system design. Upon request, the fixture supplier shall submit sample fixtures.

PART 2 - PRODUCTS

2.01 FLUORESCENT FIXTURES

- A. Fluorescent fixture housings shall be die-formed of cold rolled steel of not less than 22 gauge. Construction shall provide an approved method of locking lens or shielding in place. Enamel finish for light reflectance shall have a hardness between H and 3H. Before enamel is applied, the metal shall be cleaned and prepared by "Bonderizing" or an equivalent process. All paint shall have a minimum reflectivity of 88%.

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- B. Plastic lenses for fluorescent fixtures shall be 100% virgin acrylic, not less than 1/8" nominal thickness. All lenses in kitchen and damp areas shall have smooth side down and shall have triple gaskets.
- C. Temperature around ballast and in fixture housing shall not exceed 90-degrees C with ambient room temperature of 27-degrees C.
- D. All fluorescent luminaires shall use electronic ballasts. All luminaires required to meet National Appliance Energy Conservation Amendments shall be equipped with energy efficient ballast with the proper ballast efficiency factor (BEF) as prescribed in Public Law 100-357. All electronic ballasts shall have a THD less than 10%, have integral transient voltage surge suppression, and be provided with a five (5) year warranty.
- E. All fluorescent fixtures shall be equipped with a ground screw or lug to ensure mechanical bond.
- F. All fluorescent fixtures including compact fluorescent shall have an "in-line" fuse on the ungrounded primary contactor of each ballast. They shall be buss type GLR holders with GLR fuses of size required.
- G. Recessed fixtures in plaster ceilings shall be furnished with plaster frames.
- H. Fluorescent fixtures that, according to drawing symbol list, are to have emergency battery back-up shall have a Bodine "B-50" unit or equivalent installed. The unit shall be UL approved according to "UL-924" and provide a minimum of 1400 lumen output while on battery power for a minimum of 90 minutes. It shall mount in fixture wireway, be compatible with standard and energy saving lamps, and have dual primary leads for use on either 120 volt circuits.
- I. Prior to placing orders for recessed fluorescent fixtures, Contractor shall verify the types of ceilings and suspension systems that have been approved for the project and shall order fixtures with flanges as required to fit in the approved ceilings.
- J. Where multi-level switching is shown, the correct number of ballasts shall be provided in each fixture to accommodate the switching scheme.
- K. Provide program start ballasts for fluorescent fixtures controlled by occupancy sensors.

2.02 INCANDESCENT FIXTURES

- A. Recessed fixtures shall be furnished with gaskets, so designed and installed that they will completely eliminate light leakage between flanges and ceilings.

2.03 HID FIXTURES

- A. HID Fixtures shall have type HEB fuse holders with KTK type fuses.

2.04 LAMPS

- A. Lamps shall be General Electric, Westinghouse or Sylvania. PL lamps are to be Phillips.

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- B. Furnish lamps for all fixtures as per schedule on Drawings.
- C. Fluorescent lamps to be rapid start T-8, Energy Saving cool white.
- D. Metal halide and mercury vapor types, which are installed in fixtures not equipped with ultraviolet-blocking glass lenses, shall be of the self-extinguishing type. The lamps shall automatically extinguish within 15 minutes after the outer glass bulb of the lamp is punctured or broken in accordance with Federal Standard 21 CFR 1040.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install fixtures; coordinate exact location with Architect's reflected ceiling plan.
- B. Recessed fixtures in removable ceilings shall be connected to the branch circuit with 1/2" minimum flexible conduit and branch circuit wire no smaller than No. 12 from an accessible junction box. Where fluorescent fixture housings are connected together, use 90 degree C wire for branch circuit feed through fixture channels. All flex fittings shall be steel set screw type with insulated throats.
- C. Fixtures shall be grounded. Lamp sockets shall be wired so that the outer shell is connected to the neutral grounded conductor.
- D. Fixtures recessed in furred ceiling shall be installed so that they can be removed from below the ceiling.
- E. Fixtures installed in plastered ceiling shall not be supported directly from the ceiling. Support fixtures from the ceiling supports.
- F. Fixtures installed in acoustical tile ceilings shall be attached to the ceiling grid at all four corners with Hurricane Clips. The main runners of the ceiling grid shall be supported within 6" of each corner of the fixture.

END OF SECTION

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SECTION 16535
EMERGENCY LIGHTING EQUIPMENT

PART 1 GENERAL

1.01 WORK INCLUDED:

- A. Emergency lighting units.
- B. Emergency LED exit signs.
- C. Emergency fluorescent lamp power supplies.

1.02 REFERENCES

- A. FS W-L-305 - Light Set, General Illumination (Emergency or Auxiliary)
- B. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures
- C. NEMA WD1 - General-Purpose Wiring Devices.

1.03 SUBMITTALS

- A. Submit product data under provisions of Section 01300.
- B. Provide product data on emergency lighting units, exit signs, and emergency fluorescent lamp power supply units.

PART 2 PRODUCTS

2.01 LED EMERGENCY LIGHTING UNITS

- A. Emergency Lighting Unit: Self-contained unit with rechargeable storage batteries, transfer switch, charger, and lamps.
- B. Battery: 6 volt, nickel-cadmium type, with 1.5 hour capacity to supply the connected lamp load.
- C. Charger: Dual-rate charger, capable of maintaining the battery in a full-charge state during normal conditions and capable of recharging discharged battery to full charged within 12 hours.
- D. Lamps: LED.
- E. Unit Housing: Injection molded, flame retardant, high impact thermoplastic housing.
- F. Indicators: Provide lamps to indicate AC ON and RECHARGING.

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- G. Provide switch to transfer unit from normal supply to battery supply.
- H. Electrical Connection: Knockout for conduit connection.
- I. Unit shall be provided with self-exercising/testing circuit programmed for 90-minute test every thirty (30) days.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install units plumb and level.
- B. Aim directional lampheads as directed.

END OF SECTION

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Specifications

SECTION 16670
LIGHTNING PROTECTION FOR STRUCTURES

PART I - GENERAL

1.1 WORK INCLUDES

- A. Work includes furnishing and installing a complete lightning protection system on all structures.

1.2 QUALITY ASSURANCE

- A. All work shall be accomplished by personnel regularly engaged in the installation of lightning protection systems.
- B. Contractor shall provide the owner with a U.L. Master Label lightning protection system certificate.

1.3 RELATED WORK

- A. Specified Elsewhere:
 - 1. Electrical Specifications - Basic Materials and Methods
 - a. All general conditions and installation requirements apply.

1.4 SUBMITTALS

- A. Shop Drawings - Installation drawings and pertinent details for installation on the structure.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Materials and fittings shall be resistant to or protected against corrosion.
- B. Materials in combination with each other or structure surfaces shall not form galvanic action.
- C. Materials below grade to 18 in. (0.46m) above grade, shall be copper.
- D. Air terminals shall be solid copper 20" high, ½" diameter with point coating, minimum 1/16" (1mm) lead.
- E. Fasteners and attachments shall be of same materials as air terminals.
- F. Main conductors shall be copper cable, minimum weight 187.5 lbs./1,000 ft. (278 kg 1/1,000m); minimum wire size No. 17 AWG.
- G. Secondary conductors shall be copper cable, minimum 13 strand No. 17 AWG.

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- H. Fasteners shall be same material as conductor. Galvanized fasteners are not acceptable.
- I. Connectors and disconnectors shall be compression type designed to withstand 200 lbs. Pull or exothermic welding type.
- J. Depth indicator tags shall be copper.
- K. Ground electrodes shall be 10' copper clad steel rods 3/4" diameter.

2.2 ACCEPTABLE MANUFACTURERS

- A. Erico

PART 3. EXECUTION

3.1 INSTALLATION

- A. Install system in accordance with manufacturer's instructions. Down conductors shall be routed concealed in PVC sleeves installed in the structure.
- B. Air Terminals: Install in plumb position securely fastened to withstand overturning.
- C. Bond all roof mounted equipment and metal structural appurtenances such as screen walls, ladders, catwalks, etc., to the system via intermediate cross conductors.
- D. Conductors:
 - 1. Fastening:
 - a. Fasten conductors to structure at 3' (0.9m) maximum intervals.
 - b. Connections above grade shall be by mechanical means, connectors below grade shall be by exothermic (welded) bonding methods.
 - 2. Conductor Runs:
 - a. Bend to radii greater than 8 in (200m).
 - b. Limit angle of turns to 90 degrees.
 - c. Route horizontal conductors around obstructions in horizontal plane.
 - d. Route conductors in horizontal or vertical planes only.
 - 3. Connect main conductor to metal bodies of conductance using bolt tension fittings.
 - 4. Connect conductor to metal bodies of conductance located within 6' (1.8m), by secondary conductor.
 - 5. Install disconnecter on all but one down lead.
 - 6. Conductor Guards:

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a. Bond nonferrous metal guards to conductors at top.

7. Ground: Extend minimum of 10' (3.05m) into earth.

3.2 FIELD QUALITY CONTROL

A. Ground Resistance Testing:

1. Measure ground resistance with bridge type meter designed for testing grounds.

2. Record readings, conditions of soil, model of meter and name of tester.

3. Conduct test in presence of Owner or Representative.

B. Do not conceal conducting components until inspected and accepted by Owner or Representative.

C. System shall be inspected by Underwriter's Laboratories, Inc., for compliance with Master Label requirements. Provide Master Label Certificate framed under glass, mounted in main electric room.

END OF SECTION

**SECTION 16721
FIRE DETECTION AND ALARM GUIDELINES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire alarm system installation, including all components, wiring, and conduit.
- B. Transmitters for communication with supervising station.
- C. Circuits from protected premises to supervising station, including conduit.
- D. Replacement, modification and/or removal of existing fire alarm system components, wiring, and conduit indicated.

1.02 RELATED REQUIREMENTS

- A. Section 07 8400 - Fire stopping: Materials and methods for work to be performed by this installer.
- B. Section 08 3323 - Overhead Coiling Doors: Coiling fire doors to be released by fire alarm system.
- C. Section 08 7100 - Door Hardware: Electrically operated locks and door holder devices to be monitored and released by fire alarm system.
- D. Section 21 3000 - Fire Pumps: Supervisory devices.
- E. Section 21 1300 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.
- F. Section 21 2200 - Clean-Agent Fire Extinguishing System: Supervisory, alarm, and releasing devices installed in extinguishing system.
- G. Section 14 2010 - Passenger Elevators: Elevator systems monitored and controlled by fire alarm system.
- H. Section 14 9100 - Facility Chutes: Sensors and interlocks monitored by fire alarm system.
- I. Section 23 3300 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.

1.03 REFERENCE STANDARDS

- A. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits; latest addition.
- B. NFPA 70 - National Electrical Code; latest addition.
- C. NFPA 72 - National Fire Alarm Code and Signaling Code; latest addition.
- D. NFPA 101 - Life Safety Code; latest addition.
- E. NFPA 601 - Standard for Security Services in Fire Loss Prevention; latest addition.
- F. Occupational Safety and Health Act (OSHA); latest edition.
- G. Florida Accessibility Code
- H. Factory Mutual System (FM) requirements.

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- I. U.L. Underwriters Laboratories and U.L. System Certification.
- J. ETL Intertek Certification.
- K. Federal, state and city codes, regulations and ordinances.
- L. Palm Beach County Fire Code Ordinance; latest edition.
- M. Palm Beach County ESS typical installation diagram (Appendix A).
- N. Palm Beach County ESS pre-drywall inspection checklist (Appendix B).
- O. Palm Beach County ESS above-ceiling inspection checklist (Appendix C).
- P. Palm Beach County ESS system acceptance checklist (Appendix D).
- Q. Palm Beach County ESS Warranty Sign-Off (Appendix E).
- R. Palm Beach County ESS typical DC to AC interfaces (Appendix F).

1.04 SUBMITTALS

- A. Evidence of designer qualifications as specified in section 1.05B “Designer Qualifications”.
- B. Design Drawings: Shall be detailed and include the system operation in a matrix format listing conditions and actions of the system. The drawings shall include PBC ESS typical fire alarm diagram inserted as reference for installation.
 - 1. System zone boundaries and interfaces to fire safety systems. Show all wiring paths device to device in the design drawing and in riser diagram.
 - 2. Clear and concise description sequence of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9). See NFPA 3 for examples of a complete commissioning structure to show the operation of all building systems connected to the FACP for life safety functions.
 - 3. Circuit layouts; number, size, and type of raceways and conductors and conduit fill calculations.
 - 4. Location of all components by type.
- C. FACP Contractor Shop Drawings and Product Information: The FACP Contractor shall submit all information required for plan review and permitting by authorities having jurisdiction. This will be submitted to Owner as a complete package of the total system, including the proposed FACP controller data paper sheets, device data paper sheets, full size paper drawing set, and electronic CAD DWG drawings with all references on a memory stick. The drawings shall include the proposed system, sequence of operation matrix, actual battery calculations, and an actual riser diagram of the system. The device types and counts must match in all three areas (floor, battery, & riser). In the event Electronics Services and Security (ESS) identifies items that require correction, ESS will return the total package with comments and the FACP contractor will re-submit. This process will take place until approval and then submitted for permitting.
 - 1. List of data required by authority having jurisdiction.
 - 2. Clear and concise description sequence of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.

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3. System zone boundaries and interfaces to fire safety systems.
 4. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
 5. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
 6. List of all devices on each signaling line circuit (SLC), with spare capacity indicated.
 7. List of all devices on each notification circuit (NAC), with spare capacity indicated.
 8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
 9. Description of power supplies; for secondary power by battery, include calculations demonstrating adequate battery power.
 10. Detailed drawing of graphic enunciator(s).
- D. Permitted FACP Shop Drawings sets requiring revisions due to installation changes: Typically pre- ESS system acceptance sequence. All permit drawing sets with changes that require a fire rescue plans review approval shall be submitted to Owner prior to Fire Rescue for approval. Once Owner approves the changes, the contractor will submit to Fire Rescue and upon their approval finalize the construction drawing set. The contractor will make available the approved drawings to ESS for inspections. .
- E. Evidence of installer qualifications as defined in section 1.05 C "Installer Qualifications".
- F. Training lesson plan outline. Provide a detailed training plan to the Owner for each group type training to allow the Owner to evaluate the trainees and training performed at the start of the project. Provide the Owner with a sign in sheet with each Trainee present at the training by group type.
- G. Inspection and Test Reports:
1. Submit inspection and test plan prior to activities as defined in section 3.02A 1 thru 5.
 2. Submit, completed NFPA 72 "Inspection and Testing Form.
- H. Operating and Maintenance Data: have one set available during closeout demonstration:
1. Complete set of permit documents, as approved by authority having jurisdiction.
 2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
 3. Contact information for firm that will be providing warranty service as defined in section 1.06.
 4. List of recommended spare parts, tools, and instruments for testing.
 5. Detailed troubleshooting guide and operation sequence detailing inputs/outputs in a matrix form.
 6. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide electronic (MS Word or MS Excel) and hard copy.
- I. Project Record Documents: "**Required at CO**":
1. Final Issue Two (2) NFPA Inspection and Testing forms documenting a 100% system test with no deficiencies.

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2. Final issue two (2) NFPA Record of Completion forms filled in and signed off.
3. A copy of FACP contractor shop drawings with sequence of operation matrix and battery calculations as installed must be left on site.
4. Electronic copy of FACP utility and program as installed left onsite in panel.
5. Temporary Graphic Floor Plan
6. List of programming/access codes for control and disables for ESS service.
7. Emergency 24/7 contact information issued to ESS and labeled at the FACP controller.

J. Closeout Documents: " **Required at Substantial Completion**"

1. Two (2) Sets of final floor plans (graphic layout 11"x17") framed or laminated depicting the building orientation exactly as viewed in the location where it is mounted. This drawing will show all devices installed by type and address. Provide this in a laminated with north indicator. To be installed at the control panel and when the control panel is location in a public area, these plans need to be in a pre-approved plan holder. See section 2.06 for plan box requirements.
2. Two each (2) FACP final stamped and approved as built (record drawings), Full complete set and supporting pages in full size paper documents and electronic CAD DWG drawings with all references stored on a memory stick. The complete package including the electronic format shall be submitted no later than 30 days after CO inspection.
3. Two (2) final sets of FACP final Sequence of operation Matrix and battery calculations.
4. Two (2) Set of data cut sheets on all installed devices. One hard copy & one electronic.
5. Two (2) copies, electronic stored on memory sticks, of the FACP programmer and program as installed.
6. Issue Electronic Key or software if required to open programming, see Section 2.01 paragraph C.
7. One (1) hard copy print out of the FACP system program.
8. 10% Spare Parts of all device types (Initiating, Monitoring, Notifying, and Control) and issued to ESS.
9. Two (2) of each, installation, programming, and troubleshoot/training manuals.
10. Training by installer, operation and troubleshooting, see Section 3.03.
11. Manufacturer's published product warranties and PBC warranty sign off with instructions and expiration date issued to ESS, see Section 1.06 and Appendix E.
12. Final emergency contact telephone information and a listing of key holders for 24/7 access.
13. If all items listed are not met in the 30 day period set from CO, Owner reserves the right to hire an outside vendor to secure any missing or incomplete item deficiencies, and to back charge the costs for all expenses occurred.

K. Maintenance Materials, Tools, Spare Parts and Software: Furnish the following for Owner's use in maintenance of project.

1. Maintenance Materials: Any manufacturer specialized materials, parts, attachments needed for maintenance of the specific system.
2. Tools: Any manufacturer specialized tools, parts, attachments needed for maintenance of the specific system.
3. Spare parts: Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging and label in same manner as operating and maintenance data. A spare parts inventory of (10%) ten percent for all device types shall be supplied prior to final closeout. When 10% of the device type count does not equal one device, at minimum, one of each device type shall be provided (See as-built drawing device legend listing and count for each type considered for spare parts). When 10% of the device type count does not equal a round whole number, the lesser will prevail, 1.7 devices equates to 1 device. (Duct Detector complete assemblies are included in spare parts as a device type).

4. Software: All passwords, software keys, specialized cable, device readers and any documentation necessary to modify the fire alarm system programming.

1.05 QUALITY ASSURANCE

- A. Copies of Design Criteria Documents: Maintain at the project site for the duration of the project, bound together, a copy of NFPA 72, the relevant portions of applicable codes, and instructions and guidelines of authorities having jurisdiction.
- B. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.
- C. Installer Qualifications: Firm with minimum 5 years documented experience installing fire alarm systems of the specified type and providing warranty maintenance service as a regular part of their business.
 1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
 2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
 3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
 4. Contract maintenance office located within 50 miles (80 km) of project site.
 5. Certified in the State of Florida.
- D. Instructor Qualifications: From FACP installer company.

1.06 WARRANTY

- A. Comply fully with manufacturers' instructions, including each step in sequence. Should manufacturers' instructions conflict with contract documents, request clarification from designer before proceeding, and document any instructions or directions that may invalidate a warranty.
- B. Provide manufacturer's warranty of the system and components with coverage of no less than 1 year after date of Substantial Completion if Owner has accepted the system prior to and has received all closeout items and documents. If not, the warranty period of 1 year will start when the system is finally accepted by Owner and has received all closeout items and documents.
- C. Provide installer's performance warranty for 1 year after date of Substantial Completion with instruction and contact information. Owner must have accepted the system and received all closeout items and documents. See warranty page terms in Appendix E. The installer will include all repair or replacement during the performance warranty period at no cost to Owner. The installers Performance Warranty will cover all components, parts, assemblies and software that shall be guaranteed against defects in materials, installation, and workmanship, for a period of a least (1) year, beginning on the date Substantial Completion. If surge protection or grounding is found to be incorrect, the performance warranty will apply as listed above. All repairs performed during warranty period shall be completed within the time limitations imposed by governing by NFPA and Florida Building Codes.

The warranty procedure will be as follows: Initial trouble calls during the warranty will be handled by the ESS staff to determine the cause. ESS will notify the warranty provider of defects covered and submit the warranty claim. The provider must be available to receive the claim on a 24-hour basis. Defective devices must be replaced within 24-hours of receiving the claim. System outages must be resolved within 4-hours of receiving the claim.

The warranty start date is listed as 1 year from date of the Substantial Completion, but will be modified if the closeout package is not completed, received, and accepted by Owner. The new warranty date will be based on the date all items are completed, received and has Owner acceptance, if not received by the project Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Alarm Control Panel (FACP) - Provide all control units made by the same manufacturer. The following are acceptable:
1. Honeywell Security & Fire Solutions/Fire-Lite: www.firelite.com.
 - i. Product: 9200, 9600
 2. Honeywell Security & Fire Solutions/Notifier: www.notifier.com.
 - i. Product: 50, 100, (320, 640, 3030 (Program software release required))
 3. SimplexGrinnell: www.simplexgrinnell.com.
 - i. Product: 4010 with RS232, 4100U & ES lines
 4. Edwards: www.edwards.ca/
 - i. Product: EST Quick start, QS1 & I/O 500 (1 SLC Only)
- B. Initiating Devices and Notification Appliances: Same manufacturer as FACP. Provide all initiating devices and notification appliances made by the same manufacturer. The following (or equivalent) are acceptable components:
1. Smoke Detectors
 - a. Product: Notifier FSP 751
 - b. Product: Simplex 4098-9714, 4098-9757, 4098-9701, 4098-9710
 - c. Product: Firelite SD350
 - d. Product: Edwards SIGA-PS, SIGA-IS, SIGA-HS
 2. Heat Detectors: rate-of-rise type only.
 - a. Product: Notifier FST 551, 851R
 - b. Product: Simplex 4098-9732
 - c. Product: Firelite H350R
 - d. Product: Edwards SIGA-HRS, SIGA-HFS
 3. Duct Smoke Detectors
 - a. Product: Notifier DHX 502
 - b. Product: Simplex 4098-9752
 - c. Product: Firelite D350RPL
 - d. Product: Edwards SIGA-SD/TEST, SD-TRK, SD-SERIES TUBE
 4. Horn and Strobe
 - a. Product: Notifier SHG24-110-1WP
 - b. Product: Simplex 4903-9146, 4903-9219
 - c. Product: Firelite S2475, SP2R
 - d. Product: Edwards G1F-VM, G1F-DVM, MG1RF-VM, MG1R-VM, G4 SERIES
 - e. Product: Gentex HS24, ST24 Series
 - f. Product: System Sensor S1224MC, SP2R1224MC
 5. Pull Stations
 - a. Product: Notifier NBG12LX
 - b. Product: Simplex 4099-9003, 2099-9761
 - c. Product: Firelite BG12LX
 - d. Product: Edwards SIGA-278
 6. Digital Communicator (Point Contact I.D.)
 - a. Product: Notifier UDACT
 - b. Product: Simplex 4010-9816, 4020-0155, 4100-0155
 - c. Product: Firelite DACT-UD

d. Product: Edwards DLD, 3-MODCOM

- C. Contractor must provide all required training and all programming codes and rights to ESS for all systems above specified.

2.02 FIRE ALARM SYSTEM

- A. Fire Alarm Control Panel (FACP): Provide new, automatic, electrically supervised fire detection and alarm system with alarm initiating and signaling circuits. All components of the system must be listed by U.L. and listed by the manufacturer for use. The system must be installed with the necessary hardware to accommodate connection to the County's U.L. Certified Proprietary alarm monitoring station. Additionally, the system will be required to be U.L. certified or ETL certified by ESS.

The FACP will communicate with its sensing devices (heat/smoke) in order to receive measured information in analog form (e.g., measured level of obscuration, measured level of dirt/dust particles, measured level of temperature) and report this information to the FACP. The obscuration rates must be adjustable and controllable.

The FACP will be equipped or installed with a communication port to allow sensitivity testing and reporting on a computer via RS232 or equivalent. The panel will be programmed such that dirt accumulation or variations in obscuration, and temperature can be quantified to produce warnings in advance of the device going into alarm.

The FACP shall include a (green) system power, (yellow) trouble and (red) alarm indicators. It will annunciate on an alphanumeric display providing device number and location plus diagnosis of trouble.

1. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones in addition to general evacuation of entire premises.
2. Voice Notification: Provide emergency voice/alarm communications. It shall produce a message to the audible devices sufficient to produce an audio signal (15) fifteen decibels over ambient noise. Where NFPA rules require voice evacuation systems, it shall be augmented by the ability for manual activation of the system.
3. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated with alarm notification in all zones on the same floor, on the floor above and the floor below.
4. Staff Response Zones: For each smoke zone where occupants are not ambulatory, program notification zone as directed to notify staff in areas outside the normal notification zone and in other buildings for response to assist in evacuation.
5. Program notification zones and voice messages as directed by Owner.
6. Hearing Impaired Occupants: Provide visible notification devices in all public areas and in dwelling units.

B. Supervising Stations and Fire Department Connections:

1. Public Fire Department Notification: By on-premises supervising station (Jail Only).
 - a. Means of Transmission to On-Premises Supervising Station: Directly connected non-coded system.
2. Remote Supervising Station: Existing proprietary station operated by Owner, located at Palm Beach County Emergency Operations Center / Fire Rescue Dispatch Center.

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- a. Means of Transmission to Remote Supervising Station: Digital alarm communicator transmitter (DACT), 2 telephone lines, sends individual point annunciation using Point Contact I.D. format. The contractor is responsible for wiring telephone lines from the punch down block to the DACT.
- C. Circuits: all circuits wired as Class A. Each device will be uniquely identified with one address (no dual addressable devices allowed). An open circuit will cause a trouble indication. All strobe circuits, during an alarm condition, will have the option of remaining active after a signal silence and only turn off on a panel reset or turning off after the signal silence is activated. All visual indicating devices must be in synchronized with each other.
1. Initiating Device Circuits (IDC): Class A, Style A.
 2. Signaling Line Circuits (SLC) Within Single Building: Class A, Style 6.
 3. Signaling Line Circuits (SLC) Between Buildings: Class A, Style 2.
 4. Notification Appliance Circuits (NAC): Class A, Style Z.
- D. Spare Capacity:
1. Initiating Device Circuits: Minimum 25 percent spare capacity.
 2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
 3. Speaker Amplifiers: Minimum 25 percent spare capacity.
 4. FACP: Sized to allow for 25 percent spare capacity without adding additional circuit cards.
- E. Power Sources: All power must be run to the manufacturer's prefabricated knockout location in the FACP to meet U.L. certification requirements. No custom drill holes in FACP allowed.
1. Primary: Dedicated branch circuits of the facility power distribution system shall serve all FACP panels and components.
 2. Secondary: Batteries shall be sized to provide (24) twenty-four hours of standby operation followed by (5) five minutes of alarm. Loss of commercial power or battery power shall be annunciated as a system trouble.
 3. Building Generator: If installed, will also be available to the FACP. No generator functions will be monitored by the fire alarm system.
 4. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
 5. Each Computer System: Provide uninterruptible power supply (UPS).

2.03 RENOVATIONS – EXISTING FACP SYSTEMS & COMPONENTS

- A. Modifications, full system replacements, additions, changes, alterations or programming changes that are required to an existing fire alarm system and or life safety features, the contractor is required to:
1. Meet all of the guidelines listed in this specification regarding types, installation instructions, wiring, submittals, methods, devices, manufacturers and meet all NFPA 72 requirements including testing and documentation.

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2. Upon request by Contractor, Owner will perform onsite function test of the system prior to any new work commencing.
 3. Contractor will not remove or disconnect any existing components from an operating system until new portions are fully operational, tested, and connected to existing system and approved by Owner.
 4. All FACP replacement projects will be installed alongside the existing operational FACP system in occupied buildings. The existing FACP system will not be de-commissioned or altered until the new FACP system has a final CO.
 5. All full replacement projects will follow the same specifications and requirements listed in this standard as a new FACP system installation.
 6. All system modifications, additions, changes and alterations do not require Section 3.03 training.
 7. The scope of the project may include the removal of the old FACP, devices, and infrastructure. All system components, devices and panels will be returned to Owner.
 8. All wiring must be replaced and meet this specification standard based on type, location, and circuit type.
 9. Contractor is responsible to clearly label components that are "Not in Service."
 10. If a site condition conflicts with the standard, a request for information (RFI) is formalized by the contractor to the owner for direction or deviation from the standard.
 11. Provide a revised set of the building's Fire Alarm System CAD DWG drawings with all references as a whole, dated all pages including all supporting pages to include new battery calculations, new riser diagram, and a new sequence of operation in matrix form. This matrix defines all building systems and life safety functions that connect to the fire alarm system from each building system.
 12. Drawings are to be provided in (2) paper full sets and in a memory stick, electronic, CAD DWG drawings with all references.
 13. A new record of completion issued by the fire alarm contractor who modified the system.
 14. A new NFPA 72 test record showing re-acceptance testing was performed with signals from central station if monitored.
 15. New graphic floor plans with changes included meeting this specification.
 16. A new copy of the FACP program on paper format and electronic if modified on a memory stick.
 17. Data sheets on devices that are different than currently installed.
 18. ESS Warranty Sign off.
- B. When no modifications, additions, changes, alterations or programming changes are required to the fire alarm system and or life safety features, the contractor is only required to:
1. Protect and cover all fire alarm detection devices from construction debris.

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2. Place the fire alarm system in test during possible work that will cause a false fire alarm to prevent dispatch of fire rescue. The contractor will be responsible for all Fire Rescue fines and fees for false alarms that are dispatched.
 3. Perform and be responsible for all required fire watches due to the construction renovation.
 4. Will be responsible for fire alarm system device that are damaged or dirty to be replaced with replacement with new devices.
 5. Perform at substantial completion a walk thru review and minor ESS test to check out the systems functionality and to run a sensitivity report and compare it to construction start to determine if the detection devices have been rendered dirty due to construction activity with no coverings.
- C. When no modifications, additions, changes, alterations or programming changes are required to the fire alarm system and or life safety features, the contractor is not required to:
1. Provide spare parts.
 2. Provide training.
 3. Provide FACP Terminal Cabinet.
 4. Meet new specification for wire type on new underground and outside wiring.

2.04 FIRE SAFETY SYSTEMS INTERFACES

- A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
1. Sprinkler water control valves.
 2. Backflow preventers.
 3. Outside post indicator valve (PIV).
 4. Duct Smoke Detector alarms.
 5. Smoke evacuation systems.
 6. Dry-pipe sprinkler systems and control panels.
 7. Fire pump(s).
 8. Elevator shut-down control circuits.
 9. Chute interlocks and controls.
- B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
1. Sprinkler water flow.
 2. Total flooding suppression system activation.
 3. Kitchen Hood Suppression activation; also disconnect fuel source from cooking equipment with hood suppression system alarm only. The FACP only monitors the hood system. All control functions are performed by the hood system including the gas shutoff.
 4. Elevator lobby, elevator hoist way, and elevator machine room smoke detectors.
 5. Generator room heat detector.
 6. Pull Stations.
- C. Smoke Evacuation Control Systems:
1. The FACP will provide this building system signaling from FACP control relays or modules to initiate the systems programmed control functions.
 2. All 120 VAC building devices controlled should be directly connected to the smoke evacuation control system and not interfaced to the FACP.

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D. Dry Pipe Control Panels, Devices, and Installation:

1. The control panel shall be addressable with intelligent devices and rated for releasing with cross device zone logic. If possible, use a control panel by the same selected FACP manufacture on this project site that is rated for releasing.
2. The installation, documentation and installer requirements of the dry pipe control panel/devices are identical to the FACP specifications on this project site.
3. The control panel will be programmed to cross zone low air pressure and smoke detectors with activation of both device types together only to electronically release the interlock valve to release water into the system. This panel will be monitored by the building FACP for all alarm, water flow, supervisory and trouble signals
4. No mixing of FACP Building notification devices with releasing panel notification devices. The releasing panel will only have a bell activated upon release.

E. Elevators:

1. Elevator lobby, hoist way, and machine room smoke detectors: Elevator recall for fire fighters' service.
2. Elevator Machine Room Heat Detector: Shut down elevator power prior to hoist way sprinkler activation.
3. Sprinkler pressure or water flow: Shut down elevator power prior to hoist way sprinkler activation.

F. HVAC:

1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.
2. See Appendix F for details to interface any FACP dc voltage device interfacing to ac voltage building devices.

G. Doors:

1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor.
2. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from.
3. Overhead Coiling Fire Doors: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor.

H. High Voltage AC Building Device or System Interfacing:

1. See Appendix F for detailed connections.
2. Carbon Monoxide Sensors: for conventional fire alarm system the CO Sensors have no interconnection with any other conventional fire alarm devices and shall be standalone. UL2034 sensors will be powered by the 120V building electrical system and have a 9-volt battery backup, local annunciation. This is the PBC preferred standardization of installation.
 - a. CO detectors shall be dated on original installation
3. Also see PBC local amendment to Florida Fire Prevention Code 2012 for addressable applications.
4. Addressable systems, carbon monoxide detection shall activate an alarm signal. The monitoring station shall process the alarm signal according to NFPA 720. A

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verification/notification call to the premise is initiated and then retransmitted to the fire department to dispatch.

- a. CO detectors shall be dated on original installation

2.05 COMPONENTS

A. General:

1. Provide flush mounted units were installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Control Units, Initiating Devices, and Notification Appliances: Analog, addressable type; listed by Underwriters Laboratories as suitable for the purpose intended.

C. FACP: As specified for Basis of Design above, or equivalent.

D. Remote Enunciators: LCD design;

E. Initiating Devices:

1. Manual Pull Stations: semi-flush mounted, double action equipped with an addressable interface module. Field programmable and mounted between 42-48" to center from the finished floor. Exterior locations, outside bay areas, wash down areas, and high-traffic areas with children require a clear protective weatherproof Lexan cover. (Fire Station bay areas, vehicle service bay areas, head start, day care, senior centers etc.)
2. Key Operated Pull Stations: semi-flush mounted, double action equipped with an addressable interface module. Field programmable and mounted between 42-48" to center from the finished floor. Exterior and high-traffic areas with children require a clear protective weatherproof Lexan cover.
3. Smoke Detectors and Beam Smoke Detectors: Photoelectric type with adjustable sensitivity, removable from base, auxiliary relay contact, visual indication of detector actuation and suitable for mounting on 4" outlet box. Detection areas heights greater than 16' require beam smoke detectors with remote test switches mounted at 48" to center from the finished floor.
4. Duct Smoke Detectors: Photoelectric type with auxiliary SPDT relay contact, full-width duct sampling tubes and visual indicator of detector actuation. Remote alarm lamp assembly flush-mounted with red LED to indicate obscured view. Power source from fire alarm control panel only. Duct access panels installed adjacent to all sampling tubes. Remote test switch grouped together and installed 48" to center from finished floor in designated mechanical/electrical room. Programmed as supervisory alarm and will shut down HVAC until the fire control panel is reset. The supervisory signal will not activate notification appliances. Duct Detector housings should be installed with an insulation ¼ inches or greater fiber board or isolated recommended by the manufacturer. This insulator or isolator separates the duct housing from the duct metal to prevent condensation from forming inside the duct detector housing.
5. Heat Detectors: Combination rate-of-rise and fixed temperature. Visibly labeled, addressed and field programmed at the fire alarm control panel. Center mounted, 3' from air conditioning components and 4" from the vertical wall. Preference for no vertical mounting, but when required must be 4" from the ceiling.
6. Addressable Interface Devices: must be utilized to make conventional-type devices an addressable, monitored point in the fire alarm system.

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F. Notification Appliances: all Exterior locations, outside bay areas, wash down areas, and high-traffic areas with children require a clear protective weatherproof Lexan cover (Fire Station bay areas, vehicle service bay areas, head start, day care, senior centers etc.), designed for this application and will protect it from the weather elements but allow visual and sound notification. All strobe circuits, during an alarm condition, will have the option of remaining active after a signal silence and only turn off on a panel reset or turning off after the signal silence is activated. (Fire Station bay areas, vehicle service bay area's etc.)

1. Combination Horn/Strobe: NFPA 72; flush type with wall trim plate. Provide additional integral strobe lamp and flasher lettered FIRE. All will be mounted such that the entire lens of the strobe is not less than 80 inches and not greater than 96 inches above the finished floor or 6 inches below ceiling, whichever is lower.
2. Combination Speakers/Strobe: NFPA 72; flush type with wall trim plate. Provide additional integral strobe lamp and flasher lettered FIRE. All shall be mounted such that the entire lens of the strobe is not less than 80 inches and not greater than 96 inches above the finished floor or 6 inches below ceiling, whichever is lower.
3. Strobe Only: NFPA 72; strobe lamp and flasher lettered FIRE. Will be mounted such that the entire lens of the strobe is not less than 80 eighty inches and not greater than 96 inches above the finished floor or 6 inches below ceiling, whichever is lower.
4. Notification Appliance Circuit (NAC) Panel: supervised booster panels or remote power supplies used to power and supervise the notification appliance circuits. Provide surge protection at each NAC panels on both the AC power circuit and exterior installed NAC circuits.
5. Synchronization Modules: Supervised march time signal modules (SYNC), sufficient for signal devices connected to system to synchronize the strobe lights.

G. Control Devices:

1. Auxiliary Addressable Relay Modules: Auxiliary relay modules, addressable and provide sufficient SPDT auxiliary relay contacts to provide accessory functions specified.
2. Door Release: Magnetic door holder with integral diodes to reduce buzzing, 24 VAC coil voltage. Armature shall be mounted with bolts extending through the entire depth of the door (through bolted).

2.06 SUPPORTING INFRASTRUCTURE

A. Circuit Wiring: Wire entering and leaving the fire alarm panel and junction boxes will be permanently labeled indicating the type of device and its location. Wire shall terminate through terminal strips (one per connector). Label each conductor by the circuit number at each end.

1. Underground and Outside Wire: must be Aqua seal type or equal, twisted, shielded and have surge protection at the panel limiting voltage to no more than 10% above the peak operating voltage of the connected devices. Phase tapping will be required at each end to match the type of circuit.
 - i. Product: Westpenn Aqua seal; www.westpenn-wpw.com or approved equal.
2. FACP networking: panels must be linked together with fiber optic cabling unless otherwise specified by the manufacturer.
3. Initiating Device Circuits: Data grade fire alarm cable for addressable systems. UL/ETL listed type FPLR-NEC Article 760, 300 volt. Two (2) conductors, copper, twisted and shielded 16 or 18 AWG, or recommended size by manufacturer in RED casing.

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4. Addressable Interface Device Circuits:
 - i. Addressable side: Data grade fire alarm cable for addressable systems. UL/ETL listed type FPLR-NEC Article 760, 300 volt. Two (2) conductors, copper, twisted and shielded #16/18 AWG, or recommended size by manufacturer in RED casing.
 - ii. Device side: THHN type, #14/16 AWG, black and red casing color.
5. Combination Horn/Strobe Circuit:
 - i. Four (4) Wire
 1. Horn side: THHN type, #14/16 AWG Orange case (positive), #14/16 AWG Brown (negative) or recommended size by manufacturer.
 2. Strobe side: THHN type, #14/16 AWG Yellow case (positive), #14/16 AWG Gray (negative) or recommended size by manufacturer.
 - ii. Two (2) Wire:
 1. Data grade fire alarm cable for addressable systems, UL/ETL listed type FPLR-NEC Article 760, 300 volt. Two (2) conductors, copper, twisted and shielded #16/18 AWG, no red casing (any other color approved); or THHN type, #14/16 AWG Orange case (positive), #14/16 AWG Brown (negative); or recommended size by manufacturer.
6. Combination Speaker/Strobe: Four (4) Wire:
 - i. Speaker circuit: Data grade fire alarm cable for addressable systems. UL/ETL listed type FPLR-NEC Article 760-300 volt. Two (2) conductors, copper, twisted and shielded #16/18 AWG, no red casing (any other color approved); or recommended size by manufacturer.
 - ii. Strobe circuit: THHN type, #14/16 AWG, yellow (positive) and THHN type, #14/16, AWG, grey (negative); or size recommended by manufacturer.
7. Strobe Only Circuit: THHN type, #14/16 AWG, yellow (positive), grey (negative); or size recommended by manufacturer.
8. Synchronization Module Circuit: Data grade fire alarm cable for addressable systems. UL/ETL listed type FPLR-NEC Article 760, 300 volt. Two (2) conductors, copper, twisted and shielded #16/18 AWG, no red casing (any other color approved); or recommended size by manufacturer.
9. Door Release Circuit: THHN type, #14/16 AWG, white (positive), blue (negative); or recommended size by manufacturer.
10. Enunciator Point Circuit:
 - i. Addressable Side: Data grade fire alarm cable for addressable systems. UL/ETL listed type FPLR-NEC Article 760, 300 volt. Two (2) conductors, copper, twisted and shielded 16 or 18 AWG, or recommended size by manufacturer in red casing.
 - ii. Power Side: THHN type, #14/16 AWG, red (positive) and THHN type, #14/16 AWG black (negative) power; or recommended size by manufacturer.

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11. Auxiliary Addressable Relay Modules:

- i. Addressable side: Data grade, fire alarm cable. UL/ETL listed type FPLR-NEC Article 760-300 volt. Two (2) conductors, copper, twisted and shielded 16 or 18 AWG, in red casing; or recommended size by manufacturer.
- ii. Device side: THHN type, 14/16 AWG, black and red casing color.
- iii. See Appendix F for detailed interfacing of FACP modules to building AC devices or systems.

12. Equipment Grounding Circuit: THHN type, #14 AWG twisted and shielded, green casing; or recommended size by manufacturer.

B. Surge Protection: In accordance with IEEE C62.41.2 & NFPA 70. Provide transient voltage surge suppression per the application type. Use surge protection devices below per the application type for the circuits in items 1 thru 3 below. No surge protection will be placed in any FACP or NAC cabinets. The field wiring terminal cabinet can house surge protection.

C. ESS requires all surge protection be mounted and dated in the FACP terminal cabinet. The surge protection required is listed below by application and type.

- 1. All AC circuits connected to the FACP or sub panels shall be surge protected and dated on install.
- 2. All telephone line circuits shall be surge protected and dated on install.
- 3. All exterior and underground circuits shall be surge protected and dated on install.
- 4. All wires entering into the fire alarm system will be surge protected and dated on install.

| Application Type | Surge Protection Devices (Pre-Approved) |
|-------------------------------|---|
| Signaling Addressable Polling | EDCO FAS 2-033HC |
| Bells, Horns and Strobes | EDCO PHC or SLCP 36 and Base |
| PIV and Tamper | EDCO FAS Series 1 and 2 |
| 120 VAC | EDCO HSP12BT-1RU or FAS-120AC |
| 120/240 Single/Split Phase | EMC-240 B |
| Telephone Lines | EDCO PC2TEL |
| Data 485/232 | EDCO PC624 Series and Base PCB1B |

D. Conduit: All system wiring shall be in EMT type conduit. Conduit fill will not exceed 60%. All conduit junction boxes and couplings will be painted RED and marked "FA" in white. Conduit entering the fire alarm panel will be installed per the manufacturer's instruction. Outside, wet, or underground applications will require PVC conduit, weather tight enclosures piping and fittings. All conduit connections to terminal cabinets and control cabinet shall have grounding bushings installed. Label each end with origin and/or destination in terminal cabinets.

E. Fire Alarm Terminal Cabinet: hinged, lockable cover, with internal fire treated wood backboard and screw type terminals in point-of-entry room to each building and one on the side of the FACP. All terminal connections in terminal cabinets and in equipment shall be made using solder-less block spade connectors. Mount any end-of-line devices required in the building terminal cabinet. All fire alarm terminal boxes, panels and relay enclosures shall be permanently labeled "Fire Alarm". The Fire Alarm Terminal Cabinet mounting and location shall be installed with serviceability in mind. This cabinet must be reachable without using a ladder and within the closest distance possible to the main FACP cabinet.

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1. Size: 24"x24"x6" or other approved by ESS.
- F. Fire Alarm Plan Box: Graphic floor plans in public areas requires a fire alarm safety plan box shall be installed to house the documents of the system. Owner will provide a detailed location to install that will affect the size and type of box. If the box is installed in an electrical /mechanical room, the box can be surface mounted. If it is to be located in a public lobby area, it shall be recess mounted.
1. Product: Mikor 2010L-EK, 2010I-EP; www.mikor.com or equivalent.
- G. Junction Boxes: All fire alarm junction box covers shall be painted RED and a RED round dot shall be installed on the ceiling tile grid below all fire alarm junction boxes and equipment located above the ceiling.
- H. Electrical Boxes: All outside electrical boxes shall be weather proof and shall be secured with security screws that are Torx type only.

PART 3 EXECUTIONS

3.01 INSTALLATION

- A. Install in accordance with applicable codes listed in Reference Standards 1.03, and contract documents.
- B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.
- C. Install in accordance with owner-approved shop drawings and this specification detail.

3.02 INSPECTION AND TESTING FOR COMPLETION

- A. Notify Owner 4 days prior to the following Inspections and Tests. Owner must be scheduled in advance and present onsite for all tests and inspections listed below except #4 & #6.
 1. Pre-construction meeting with electrical and FACP system subcontractors.
 2. Pre-drywall Inspection.
 3. Above ceiling Inspection.
 4. Contractor Quality Assurance Test
 5. ESS System Acceptance Inspection.
 6. Contractor Diagnostic Period (14 day period with system monitored for failures)
 7. Fire Final test with Authority Having Jurisdiction (AHJ). Owner to be issued a copy of the Fire Final AHJ report for record.
- B. Owner will schedule the services of an ESS technician to observe on site all tests and inspections for all items except #4 & #6 above. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- C. If the owner determines that the quality assurance test specified in paragraph 3.02E was not completed and the system is not ready to pass the ESS System Acceptance Test or once the ESS System Acceptance Inspection test begins and it is determined the system will not pass the test in a reasonable and timely manner or if the system has two operational failures, the ESS Technician will leave the test and the Contractor will need to reschedule. The Contractor will be charged for the staff time associated with the retest.
- D. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
- E. Prepare for the ESS system acceptance test by ensuring that all work is complete and correct; perform contractor Quality Assurance Test to verify that system is functioning correctly and ready to ESS system

acceptance. Notify Owner's field representative prior to contractor Quality Assurance Test. Prior to scheduling the ESS system acceptance, contractor is to request central station data to be entered into the system for central station signaling verification.

- F. Provide all tools, software, and supplies required to accomplish inspection and testing.

Perform ESS system acceptance inspection and testing in accordance with section 1.03 reference standards. See appendix D.

- G. Contractor Diagnostic Period: After successful completion of contractor inspections and ESS system acceptance of the FACP, the contractor shall start the diagnostic period to operate the FACP system in normal mode for at least 14 days (7 days for renovation projects) without any system or equipment malfunctions. If a malfunction(s) occur, this sequence will need to be re-performed. This diagnostic period certifies the system is functioning with no failures and reporting as required. Continued failures of this test past the substantial completion project period will extend the FACP system warranty period until 14 days without failure can occur.

1. Record all system operations and malfunctions connected to central station.
2. Any system failures, this sequence will need to be re-performed.

3.03 OWNER PERSONNEL INSTRUCTION

- A. Administrative: One session covering issues necessary for non-technical administrative staff (building coordinators); classroom.
- a. Training: 1 session pre-closeout.
- B. Basic Operation: One-session for FMD personnel, security officers, and engineering staff; combination of classroom and hands-on:
- a. Training: 1 session pre-closeout.
- C. ESS Maintenance Technicians: Detailed training for technicians, on programming disables, maintaining, repairing, and modifying the system, site walk thru; or required manufacturer or specialty training required to access FACP programming.
- a. Training: One Session, pre-closeout to meet the factory certification requirements.
- D. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

3.04 CLOSEOUT

- A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
- a. Be prepared to conduct any of the required tests.
 - b. Provide one copy of final operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
 - c. Have Fire Alarm Sub-Contractor present during demonstration.
 - d. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
 - e. Repeat demonstration until successful.
- B. Final Owner acceptance of the project will not be achieved until inspection and testing is successful, all items in Appendix D completed and:

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1. Specified diagnostic period without malfunction has been completed.
2. Approved operating and maintenance data has been delivered.
3. All spare parts, tools, software, software keys and materials delivered.
4. All aspects of operation have been demonstrated to Owner.
5. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.

APPENDIX #B – Palm Beach County ESS Pre-Drywall Inspection Checklist

Project Name:

Project Number:

Inspection Date:

ESS Representative:

1. Complete internal review of project specification manual and plans with Planner prior to inspection.

Notes:

2. Walk site with Architectural Field Representative and Contractor to verify device count and location.

Notes:

3. Verify conduit and enclosure installation heights and color coding scheme.

Notes:

4. Inspect fire alarm system main back box and wiring termination cabinet.

Notes:

5. Review duct detector placement with installer.

Notes:

6. Place typical fire installation diagram in the fire alarm cabinet.

Notes:

APPENDIX #C – Palm Beach County ESS above Ceiling Inspection Checklist

Project Name:

Project Number:

Inspection Date:

ESS Representative:

1. Complete internal review of project specification manual and plans with Planner prior to inspection.

Notes:

2. Walk site with Architectural Field Representative and Contractor to verify device count and location.

Notes:

3. Verify conduit and enclosure installation heights and color coding scheme.

Notes:

4. Verify wire installation.

Notes:

5. Inspect fire alarm system main back box and wiring termination cabinet.

Notes:

6. Review duct detector placement with installer.

Notes:

7. Place typical fire installation diagram in the fire alarm cabinet.

Notes:

8. Review punch list from Pre-drywall inspection and verify items have been corrected.

Notes:

APPENDIX #D – Palm Beach County ESS System Acceptance

The items listed below is a listing of all items that ESS will be looking to witness testing, perform testing and verify are either on site, submitted or present at time of ESS System Acceptance. All items in this list are requirements of the ESS Section 283100 Fire Detection and Alarm Guidelines Specification.

TEST & VERIFY: Contractor performs all work & tests - ESS to witness only

1. Test & verify all panel functionalities and notifications of troubles, supervisory alarms, and alarms.
2. Test & verify panel and field wiring for opens, grounds, and T taps. Verify panel notification.
3. Test & verify FACP soft key programming for testing disables, installer/service codes and control function disables.
4. Test & verify all circuit supervisory notifications and field wiring installation. Insure all Duct detectors are programmed to display a "Supervisory Alarm" at the panel and in central station reporting or signaling.
5. Test & verify all initiating FACP devices, functionality and placement and central station reporting.
6. Test & verify all water flow devices for switch alarm timing to be between 30 and 60 seconds.
7. Test & verify all initiating smoke detector sensitivity settings and obscuration and final device condition reports.
8. Test & verify all notification circuit functionality including sound level, light sync, supervision, and wiring method.
9. Test & verify all control functions regarding integration of building systems for life safety purpose. Monitor and control.
10. Test & verify the sequence of operation matrix as designed and documented.
11. Test & verify battery load and operational functions without AC, and panel notification of AC power loss.
12. Test & verify all network connections if installed.

ESS to witness only:

1. Verify all signaling and reporting functions such as labels, descriptors, annunciators, signaling, and central station.

INSTALLATION VERIFICATION: Contractor installs - ESS to witness only

1. Verify all installation requirements, serviceability requirements, methods, heights, and locations listed in specification and standards of section 1.03. Verify proper labeling, readability from floor, spacing and height requirements as installed. Verify corridor spacing of notification devices to meet the 15 feet requirement at end of corridor.
2. Verify device placement, labeling, types, and counts to meet the as built drawing and as listed in the UL certificate issued.
3. Verify a smoke detector was placed above the FACP controller and all remote power supplies.
4. Verify wiring methods listed in specification and standards of section 1.03. Verify field wiring method as specified, cabling type, size, and color per the specification.
5. Verify surge protection applications, types, installed correctly, grounded, and labeled with date installed.
6. Verify all circuits leaving the building or installed on the exterior shall be surge protected and placed in the Terminal Panel. All 120VAC circuits will be surge protected. All telephone and data shall be surge protected.
7. Verify conduit/wire entries into terminal panels, control panels, and power supplies per the manufacturer instructions. No holes drill allowed in the FACP unless specifically instructed by the manufacturer in the installation instructions. Maintain separations of power circuits as listed.
8. Verify terminal panels are installed with wire terminals and permanent alpha labeling of all circuits. Verify all system modules and surge is installed in this terminal Panel for serviceability.
9. Verify the terminal panel was installed at a serviceable height and reachable to the top of panel with a maximum of a 4 foot ladder.
10. Verify the FACP and all remote power supplies are installed on dedicated AC circuit breakers and are labeled and locked out properly.

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11. Verify specification requirements based on type, occupation, or specialty protection or items based on the site and listed in the specification.
12. Verify all labeling and color codes as listed in specification.
13. All outside junction boxes and criminal justice location junction boxes will be installed with Torx type tamper proof screws.
14. Verify all manual pull station installations to meet 42-48 inches to center of the operating handle height from the finished floor.
15. Verify all notification devices installed to meet the 80 to 96 inches from the finished floor with all strobe lenses to be above the 80 inches.
16. Verify protective covers as installed per the specification standard.
17. Verify all system and panel batteries are labeled with the installed and manufacturer date for future replacement scheduling.
18. Verify a plans box was installed per the specifications.
19. Verify battery calculations and batteries sizes installed.

DOCUMENTATION VERIFICATION: Contractor to provide - ESS to receive and verify for correctness

The following documents must be provided no later than CO to issue a UL certificate:

1. Verify two each of accurate NFPA required documents. Testing form and record of completion form. One copy of each in the site book and one for shop to be electronic recorded and filed.
2. Verify hard copy paper accurate and approved shop drawing sets, battery calculation, sequence of operation matrix, and riser diagrams to be left on site.
3. Verify temporary graphic floor plan issued is an accurate floor plan for visual identification of device locations and labeling.
4. Verify a pouch or hanger was mounted for the system book and log.
5. Emergency response and call out telephone numbers to be posted at panel.
6. Provide an electronic copy of the FACP utility and software to left at panel.

After receipt of above, ESS to provide:

1. Verify accurate UL certification requirements and documentation.

CLOSEOUT ITEMS VERIFICATION: Contractor to provide - ESS to receive and verify for correctness

The following is to be issued to ESS no later than 30 days from CO:

1. Verify the FACP hard copy program is the current and installed version.
2. Verify two each of hard copy paper accurate and approved final as built drawing sets, battery calculation, sequence of operation matrix, and riser diagrams all in one or separately if designed as such.
3. Verify one each of an electronic final drawing sets in PDF and CAD_DWG drawings with all references installed and issued on a memory stick to ESS.
4. Verify final graphic floor plan issued is accurate floor plan for visual identification of device locations and labeling and protected and installed per the specification. Issued hard copy and electronic PDF/CAD version on memory stick.
5. Verify the FACP software program and utility software program issued are the currently installed version as tested. To be issued to ESS on a memory stick and verify the copy version left onsite at the panel.
6. Verify ESS was issued any required program keys / devices and or software that is required to open, upload, or download the system program and allow modification and controller replacement.
7. Verify ESS was provided or offered specific technical training to service and maintain the installed system.
8. Verify device cut sheets to installation and issued two sets. One hard copy and one electronic copy.
9. Verify correct installation, user, and programming manuals are issued. Two sets of each.
10. Verify Contractors Diagnostic Period has passed.
11. Verify the ESS warranty appendix E was issued, signed properly filled out, and dated correctly of the start and finish of warranty period.

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12. Verify spare parts have been issued accurately per the specification.

APPENDIX #E – Palm Beach County ESS Fire Alarm Warranty Sign-Off Sheet

Project Name:

Project Number:

Date:

ESS Representative:

System Warranty: All components, parts, assemblies and software shall be guaranteed against defects in materials, workmanship for a period of at least (12) twelve months, beginning on the date of Substantial Completion if ESS has accepted the system and received all closeout items and documents. If not received and accepted, the 12 months will begin when items received and accepted by ESS.

Warranty service shall be provided by a manufacturer's authorized representative who has issued the certificate of completion regardless of status as a sub contractor to the main contractor and provide this service (24) twenty-four hours per day, (7) seven days per week.

The representative shall be based in a fully staffed branch office located within one (1) hour travel time of the installation site and respond within this time. All repairs performed during the warranty period must be non-chargeable for labor, material, and travel time. All repairs performed during the warranty period shall be completed within the time limitations imposed by NFPA rules.

The initial fire alarm call will be handled by ESS who will assess the problem, and notify the vendor who issued the certificate of completion of corrective action required. Failure of the vendor to respond and perform accordingly will result in disqualification of future bids on similar projects for the COUNTY.

ESS Sign Off: _____

Warranty Provider Sign Off: _____

Warranty General Contractor Sign Off: _____

Warranty Start Date: _____

Warranty End Date: _____

Warranty Provider Company Name: _____

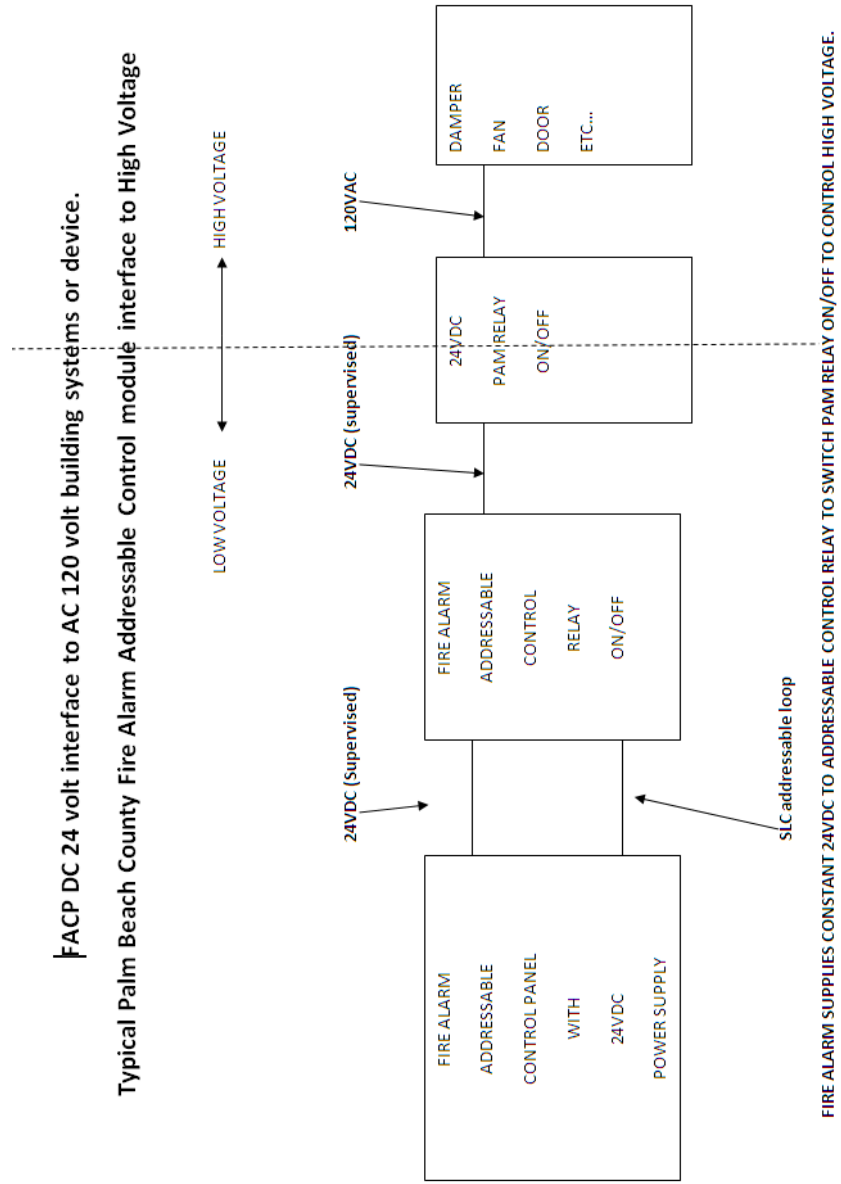
Warranty Provider Company Dispatch #: _____ (24 hours/7 days Tel #)

General Contractor Name: _____

General Contractor Tel. #: _____

General Contractor Contact: _____

**APPENDIX #F – Palm Beach County ESS typical DC to AC interface diagram
 END OF SECTION**



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SECTION 16950
TESTING

PART 1 - GENERAL

1.01 WORK INCLUDES

- A. Testing of electrical components and equipment as herein specified.
- B. Prior to beginning work, all electrical equipment and systems shall be operated in the presence of representatives of the Contractor and Representatives of the Owner, in order to establish that all systems are in proper working order at the start of the project. Upon completion of the above test, the Contractor shall submit a detailed listing indicating any items noted which are not in fully operational condition. This listing shall be signed by all parties present at the test. Commencement of work prior to the above shall constitute acceptance of all systems by the Contractor in fully operational condition. The Contractor shall have all electrical systems back in working order at the end of the project.

1.02 SYSTEM DESCRIPTION

- A. Testing includes:
 - 1. Resistance tests.
 - 2. Continuity tests.
 - 3. Phase relationship verification.
 - 4. Voltage tests.
 - 5. Ground fault protection tests.

1.03 QUALITY ASSURANCE

- A. Regulatory Requirement
 - 1. Comply with National Electrical Code, (NEC) 2011.
- B. Reference Publications

1.04 SUBMITTALS

- A. Test Reports: All test reports shall be submitted in triplicate, assembled and bound to Architect/Engineer prior to final acceptance.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Furnish all test equipment to perform specified testing.

PART 3 - EXECUTION

3.01 TESTS

- A. Conduct such tests and adjustment of equipment as necessary to verify performance requirements.
- B. Test Reports: Typewritten, listing testing equipment used, person or persons performing the tests, date tested, circuits tested, motor or equipment nameplate data, and results of tests.
- C. Insulation resistance tests general:
 - 1. Perform insulation resistance tests on equipment and cables listed herein.
 - 2. Test equipment: Furnished by Contractor.
 - 3. Resistance measured: line-to-ground.
 - 4. Disconnect, prior to testing, any device that could be damaged by application of voltage.
 - 5. Insulation resistance tests shall be conducted per following schedule:

| <u>Item Tested</u> | <u>Voltage of Test</u> | <u>Min. Acceptance Resistance in Megohms</u> |
|------------------------------------|------------------------|--|
| No. 2 and larger cables (600 V) | 1000V | 50 |
| Panelboards | 1000V | 25 |

- D. Ground Resistance
 - 1. Measure and record ground resistance from system neutral connection at separately derived system, to convenient ground reference point using suitable ground testing equipment. Minimum acceptable resistance: 10 ohms. When resistance exceeds 10 ohms, modify ground connection and/or increase grounding electrode conductor size and repeat test.
- E. Continuity Test
 - 1. Test branch circuits and control circuits to determine continuity of wiring and connection. Submit written statement that this has been performed.
- F. Voltage test shall be made and recorded at the following listed points. Tests shall be conducted under normal load conditions.
 - 1. Miscellaneous outlets throughout.
 - 2. Motors.

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- G. Phase Relationship: Check connections to equipment for proper A-B-C phase relationships.
 - 1. Disconnect, prior to check, any device which could be damaged by application of voltage of reversed phase sequence.

3.02 CORRECTIONS OF DEFECTS

- A. If tests disclose any unsatisfactory workmanship or equipment furnished under this contract, Contractor shall repair or replace such defects.
- B. If any wiring or equipment is damaged by tests, Contractor shall repair or replace such wiring or equipment.

END OF SECTION