

Technical Specifications
Project No. 08232-018
Fire Station Number 8

NO TEXT THIS PAGE

SECTION 16010
ELECTRICAL WORK – GENERAL

PART 1 GENERAL

1.01 SCOPE

- A. The Scope of electrical work shall include all labor, materials, tools, equipment and services or operations necessary for or incidental to proper installation and completion of the work as called for herein and indicated on the Drawings.
- B. Unless otherwise noted, provide all materials necessary for the mounting of all electrical equipment furnished under Division 16 or other Divisions.
- C. Make final connections to all equipment.
- D. The contractor shall furnish labor as necessary for intermediate field inspections by the Engineer.
- E. Acceptance of work will be based upon tests and inspections of work. Contractor shall furnish labor to operate systems, make necessary adjustments and assist with final inspections and tests.
- F. The contractor shall notify the Engineer in writing of any field inspector directives prior to proceeding. Failure to notify the Engineer may result in forfeit of change order.

1.02 DEFINITIONS

- A. “Provide” – Furnish, install and test, complete and ready for intended use.
- B. “Furnish” – Supply and deliver to project site, ready for subsequent requirements.
- C. “Install” – Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, test complete ready for intended use and similar requirements.

1.03 DRAWINGS AND RELATED DOCUMENTS

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

Technical Specifications
Section 16010 – Electrical Work - General
Project No. 08232-018
Fire Station Number 8

- B. Contractor shall submit bid in accordance with Instructions to Bidders or any direction provided by Owner or Architect.
- C. Provisions of this Section apply to work of all Division 16 Sections.
- D. Review all project Drawings to be aware of conditions affecting work.
- E. Drawings and Specifications are intended to be complimentary. Contractor is to perform in accordance with the requirements of both. In the event of conflict, the most stringent document/requirement will apply.
- F. Where manufacturers are listed, listing is alphabetical in nature and does not indicate preference.

1.04 LICENSES/FEES/PERMITS

- A. Contractor shall be licensed in accordance with the rules and regulations of all applicable agencies and authorities. Proof of such licensing shall be furnished upon request.
- B. Contractor shall pay for and obtain all necessary permits, fees, meters and inspections required for his work.
- C. Contractor shall obtain certificate of final inspection at the completion of the work. Deliver inspection certificates as directed.
- D. Contractor shall pay all electric, telephone and cable utility company related charges and include them in his bid. Provide receipt for identified charges upon request.

1.05 REFERENCES

- A. Installation of materials shall comply with the following:
 - 1. Local inspection department of the authority having jurisdiction.
 - 2. The National Electrical Code (NFPA 70), latest edition adopted by the local authority having jurisdiction.
 - 3. Requirements of local telecommunication company supplying telephone/data service to the project.
 - 4. Requirements of local power company supplying electrical service to the project.
 - 5. Building Code referenced in Division 1.

1.06 TEMPORARY POWER

- A. Provide temporary power including material, tools and labor. Coordinate supply point with the local electrical power company. Temporary power shall consist of the following as a minimum:
 - 1. Meet all OSHA requirements for temporary lighting in all enclosed spaces.
 - 2. Provide general purpose 120 volt outlets at intervals as required to accommodate the use of 50' extension cords.
 - 3. Provide temporary construction power for crane(s) as required.
- B. Remove all temporary materials when use is no longer required and prior to final inspection.

1.07 PROJECT COORDINATION

- A. Prior to commencing work, the Contractor shall satisfy himself as to the accuracy of all data indicated on the Drawings and/or provided by the Owner. Should the Contractor discover any inaccuracies, errors or omissions in the data, he shall immediately notify the Engineer. Commencement of work by the Contractor shall be held as an acceptance of the data by him after which time the Contractor has no claim resulting from alleged errors, omissions or inaccuracies of the data.
- B. Verify all field dimensions and locations of equipment to insure close, neat fit with other trades' work. Make use of all Contract Documents and approved shop drawings to verify exact dimensions and locations. Do not scale electrical drawings; rely on dimensions shown of architectural or structural drawings.
- C. Coordinate work in this Division with all other trades in proper sequence to insure that the total work is completed within Contract time schedule and with minimum cutting and patching.
- D. Locate all equipment, materials and apparatus symmetrical with architectural elements. Install to exact height when shown on architectural drawings. When locations are shown only on electrical drawings, be guided by the architectural details and conditions existing at job site and correlate this work with that of other trades.
- E. Install work as required to fit structure, avoid obstructions and retain clearance, headroom, openings and passageways. Cut no structural members without written approval from Structural Engineer or Architect.
- F. Because of the small scale of the Drawings, it is not possible to indicate all offsets and fittings or to locate every accessory. Drawings are essentially diagrammatic. Study carefully the sizes and locations of structural members, wall and partition locations, trusses, and room dimension and take actual

Technical Specifications
Section 16010 – Electrical Work - General
Project No. 08232-018
Fire Station Number 8

measurements on the job. Locate material, equipment and accessories with sufficient space for installing and servicing. Contractor is responsible for accuracy of his measurements and shall not order materials or perform work without verification. No extra compensation will be allowed because field measurements vary from the dimensions on the Drawings. If field measurements show the equipment or material cannot be fitted, the Engineer shall be consulted immediately. Remove and relocate, without additional compensation, any item that is installed and is later found to encroach upon space assigned to another use.

- G. Materials delivered to the site shall be inspected for damage, unloaded and stored with a minimum of handling. All materials shall be stored to provide protection from the weather and damage, blocked off the ground or floor.
- H. Extent of work is indicated in the Drawings, Schedules and Specifications. Singular references shall not be construed as requiring only one device if multiple devices are shown on the Drawings or are required for proper system operation.
- I. Maintain an up-to-date set of as-built drawings on the project site at all times reflecting as-constructed changes. Drawings shall be turned over to the Architect at the time of final acceptance.
- J. Carefully examine any existing conditions, piping and premises. Compare Drawings with existing conditions. Report any observed discrepancies. Written instructions will be issued by the Engineer to resolve discrepancies.

1.08 EXCAVATION FOR ELECTRICAL WORK

- A. The Contractor shall provide all excavating, boring and backfilling operations as necessary to install the electrical work.
- B. The Contractor shall coordinate this work with that of other trades working in the same area including other underground services, landscape development, paving and floor slabs on grade to minimize the amount of excavating, dewatering, flood protection provisions and backfilling.
- C. The Contractor shall schedule work operations with weather conditions where possible and provide temporary facilities as needed for protection of project construction, uninstalled materials, construction personnel, and public safety including but not limited to barricades, temporary access and emergency lighting.

1.09 GUARANTEE AND SERVICE

- A. The Contractor shall guarantee all labor, materials and equipment for a period of one (1) year from the date of Substantial Completion or from Owner's occupancy, whichever is earlier. Contractor shall make good any defects and shall include all necessary adjustments to and replacement of defective items without expense to the Owner.

- B. Multi-year manufacturer warranties as required in selected sections of the specifications shall be transferred to the Owner after the Contractor's year of responsibility expires.
- C. The Contractor is responsible for replacement of all equipment and materials including but not limited to lighting fixture lamps and ballasts damaged or found defective during installation and until final acceptance.
- D. The Owner reserves the right to make emergency repairs as required to keep equipment in operation without voiding Contractor's Guarantee Bond or relieving Contractor of his responsibilities during guarantee period.

1.10 CLOSE-OUT REQUIREMENTS

- A. Assemble two (2) 3-ring binders containing all operating and maintenance manuals for the equipment provided and test reports where required. Provide a list of all major equipment and replacement items. Turn binders over to Owner within thirty (30) days of final acceptance.

PART 2 PRODUCTS/MATERIALS

2.01 EQUIPMENT

- A. The following list does not limit the scope of electrical work but is a list of major equipment and systems:
 - Panelboards
 - Lighting System
 - Fire Alarm System
 - Emergency Generator System
 - Lightning Protection System
- B. The following list does not limit the scope of work performed by other trades, but does list work that design standards designate as work by other trades:
 - Furnish and install electric motors.
 - Furnish motor starters unless otherwise noted.
 - Furnish and install electro-mechanical temperature, pressure, level, flow, tamper, and solenoid control devices.
 - Furnish and install HVAC control wiring unless otherwise noted.
- C. All materials and equipment shall be new, unused, the best of their respective kinds, suitable for the conditions and duties imposed upon them. The description, characteristics and requirements of materials to be used shall be in accordance with qualifying conditions established as follows:

Technical Specifications
Section 16010 – Electrical Work - General
Project No. 08232-018
Fire Station Number 8

1. Equipment and materials furnished under this Division shall be the product of a manufacturer regularly engaged in the manufacture of such items for a period of three (3) years. Where practical, all of the components shall be the products of a single manufacturer in order to provide proper coordination and responsibility.
2. Each item of equipment shall bear a name plate showing the manufacturer's name, model number, serial number if applicable, ratings and other information necessary to fully identify it. This plate shall be permanently mounted in a prominent location and shall not be concealed, insulated or painted.
3. The label of the approving agency, such as UL, ETL, CSA or NEMA, by which a standard has been established for the particular item, shall be in full view. Materials shall be listed by UL, ETL, CSA or other testing organization acceptable to the authority having jurisdiction for the application specified or indicated on the Drawings or Specifications.

2.02 SUBMITTALS/SHOP DRAWINGS

- A. Submittals/shop drawings and/or manufacturer's data sheet requirements are noted in the individual specification section. Quantity of submittals shall be six (6) unless otherwise noted in Division 1 of the specifications.
- B. Submit shop drawings and any other drawings specifically called for in other sections. Shop drawings shall consist of plans sections, elevations, and details to scale (not smaller than 1/4" per foot) with dimensions clearly showing the installation. Direct copies of small scale project drawings issued to the contractor are not acceptable. The contractor will not be furnished electronic files of the Division 16 Drawings. The contractor shall coordinate obtaining architectural backgrounds in electronic form with the Architect.
- C. Submittals/shop drawings shall bear a stamp by the electrical subcontractor and the general contractor indicating they have been reviewed and that the equipment proposed is compatible without exception with the contract documents. Submittals/shop drawings without such stamp shall be returned without review by the Engineer.
- D. The Contractor is specifically advised that one (1) set of re-submittal/shop drawings shall be allowed. Additional re-submittals shall be accompanied by a check payable to the Engineer in the amount of \$300.00 for each re-submittal. Documents will be returned without review if submitted without funds.
- E. Catalog numbers and model numbers indicated in the Drawings and Specifications are used as a guide in the selection of the equipment and are only listed for the Contractor's convenience. The Contractor shall determine the actual model numbers for ordering equipment, accessories and other materials in

accordance with the written description of each item and with the intent of the Drawings and Specifications.

2.03 SUBSTITUTIONS

- A. Where a particular system, product or material is specified by name, consider it as the standard basis for bidding and base proposal on the particular system, product or material specified. Other systems, products, equipment or materials may be accepted only if in the opinion of the Engineer, they are equivalent in quality and workmanship and will perform satisfactorily its intended purpose or design levels established by the Engineer. All such substitutions in materials or equipment shall be approved in writing by the Engineer. Decisions made by the Engineer are final and are not subject to further debate.
- B. In making requests for substitutions, the Contractor shall list the particular system, product, equipment or material he wishes to substitute and at bid time the Contractor shall state the amount he will deduct from his base bid if the substitution is approved by the Engineer.
- C. Requests by Contractor for substitutions will be considered only when reasonable, timely, fully documented and qualifying under one or more of the following circumstances:
1. Required product cannot be supplied in time for compliance with Contract time requirements through no fault of the contractor.
 2. Required product is not acceptable to governing authority, or determined to be non-compatible or cannot be properly coordinated, warranted or insured or has other recognized disability as certified by the Contractor.
 3. Substantial cost advantage is offered Owner after deducting off-setting disadvantages including delays, additional compensation for re-design, investigation, evaluation and other necessary services by the Engineer, other trades or other similar circumstances. Compensation due to re-design by the Engineer necessitated by substitutions shall be at the Engineer's standard hourly billing rates then in effect and payable upon receipt of modified documents. A signed agreement to that effect is required of the Contractor prior to re-design.
 4. All requests for substitution shall contain a "Comparison Schedule" and clearly and specifically indicate any and all differences or omissions between the product specified as the basis of design and the product proposed for substitution. Differences shall include but not be limited to data as follows for both the specified and substitute products:

Principle of operation
Materials of construction or finishes
Dimensions (L, W, H) and thickness of materials

Technical Specifications
Section 16010 – Electrical Work - General
Project No. 08232-018
Fire Station Number 8

Weight of item
Deleted features or items
Added features or items
Changes in work under other divisions caused by the substitution
Performance and rating data
Manufacturer's warranty

If the approved substitution contains differences or omissions not specifically called to the attention of the Engineer, the Engineer reserves the right to require equal or similar features to be added to the substituted products at the Contractor's expense.

2.04 TESTING

- A. Where testing of product or installation by an independent testing agency is required or selected by the contractor, the following requirements shall be met.
1. The testing firm shall be an independent testing organization which shall function as an un-biased testing authority, professionally independent of the manufacturers, suppliers and installers of equipment or systems evaluated by the testing firm.
 2. The testing firm shall be regularly engaged in the testing of electrical equipment, devices, installations and systems.
 3. The testing firm shall utilize technicians who are regularly employed by the firm for testing services.
 4. The testing firm shall submit proof of the above qualifications with the bid documents.

PART 3 EXECUTION

3.01 INSTALLATION

- A. All materials, fixtures and equipment shall be installed and completed in a first-class workmanlike manner and in accordance with the best modern methods and practices.
- B. Special attention shall be given to the appearance of electrical installations exposed to view. Any materials which do not present an orderly and reasonably neat and/or workmanlike appearance, or do not allow adequate space for maintenance, shall be removed and replaced when so directed by the Engineer.
- C. Protect equipment and fixtures at all times during storage and construction. Contractor shall replace all equipment which is damaged as a result of inadequate protection including exposure to condensation.

Technical Specifications
Section 16010 – Electrical Work - General
Project No. 08232-018
Fire Station Number 8

- D. Pay particular attention to Specification sections for excavation, backfill, cutting, patching and painting requirements.
- E. Remove all flammable debris from the building before the end of each workday.
- F. Contractor shall repair all remodel penetrations made by his forces to original condition, paying particular attention to preservation of original fire ratings. Contractor shall submit UL Fire Resistance Directory details for all penetrations through fire rated assemblies (W-L-1001 for walls and C-AJ-1045 for floors or equivalent for new construction).
- G. Provide final connection to all equipment shown on the Drawings. The actual connections shall be made to fully suit the requirements of each location and adequately provide for servicing of the equipment.
- H. Provide local disconnecting means for all equipment except where specifically noted on the Drawings to be furnished by others.
- I. Verify all equipment ratings prior to connection and notify Engineer of any discrepancy prior to proceeding with final connection.
- J. Before any equipment is shut down for disconnecting or tie-ins, arrangements shall be made with the Engineer and the Owner. This work shall be performed at the convenience of the Owner. Outages must be scheduled through the Engineer. Extent, length and timing of outages shall be reviewed by the engineer. Services shall be restored the same day when possible. Provide temporary service as required to maintain Owner's operation for all outages exceeding 12 hours.
- K. Bolt equipment directly to concrete pads or foundation using hot-dipped galvanized anchor bolts, nuts and washers. Set equipment level utilizing galvanized shims where necessary.
- L. Touch-up of factory finishes on all electrical equipment shall be done under Division 16. Obtain factory matched color coatings from the manufacturer and apply as directed by manufacturer. If corrosion is discovered during inspection on the surface of any equipment, clean, prime and paint as required.
- M. Thoroughly clean all exposed parts of apparatus and equipment of cement, plaster, and other materials and remove all oil and grease spots. Re-paint or touch up to look like new. Vacuum interior of all equipment.
- N. Start each piece of equipment in strict accordance with the manufacturer's instructions; or where noted under equipment specifications, start-up shall be done by a qualified representative of the manufacturer. Alignment, lubrication, safety and operating controls shall be included in start-up check.

END OF SECTION 16010

SECTION 16111

CONDUIT

PART 1 GENERAL

1.01 RELATED DOCUMENTS/QUALITY ASSURANCE

- A. Comply with applicable requirements of ANSI, NEMA, NEC, UL and CSA standards pertaining to the items specified herein. Provide products and components which have been UL, CSA listed and labeled.

1.02 SUBMITTALS

- A. None required.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Provide assembly of conduit, tubing and fittings including but not limited to conduit, connectors, couplings, offsets, elbows, straps, bushings, expansion joints, hangers and other components and accessories as required for a complete system. All products shall be of manufacturer's standard materials as indicated by published product information, designed and constructed as recommended by the manufacturer and as indicated on the Drawings.
- B. Metal Conduit, Tubing and Fittings: Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thickness) for each service indicated and meeting the following requirements:
 - 1. Rigid Metal Conduit (RMC – NEC. Art. 344): ANSI C80.1, UL 6. Provide hot-dipped galvanized inside and outside. Fittings shall be threaded type.
 - 2. Intermediate Metal Conduit (IMC – NEC Art. 342): ANSI C80.6, UL 1242. Provide galvanized outside and paint, zinc or enamel inside. Fittings shall be threaded type.
 - 3. Electrical Metallic Tubing (EMT – NEC Art. 358): ANSI C80.3, UL 797. Provide galvanized outside and paint, zinc or enamel inside. Fittings shall be zinc-coated steel, set-screw type.
 - 4. Flexible Metal Conduit (FMC – NEC art. 348): Provide zinc-coated steel, maximum allowable length of 6 feet. Minimum size 1/2". Provide positive locking type cadmium plated steel or malleable iron fittings.

Technical Specifications
Section 16111 – Conduit
Project No. 08232-018
Fire Station Number 8

5. Liquid-Tight Flexible Metal Conduit (LFMC – NEC Art. 350): Provide liquid-tight flexible metal conduit with smooth-wall internal wiring channel. Conduit shall be constructed of single strip, flexible, continuous, interlocked and double-wrapped steel, galvanized inside and outside and coated with a liquid-tight, sunlight-resistant, non-metallic jacket. Maximum allowable length of 6 feet. Minimum size 1/2". Liquid-Tight Flexible Metal Conduit Fittings: Provide cadmium plated steel or malleable iron fittings with compression type steel ferrule and neoprene gasket sealing rings.
- C. Rigid Non-metallic Conduit (RNC – NEC Art 352): Provide non-metallic conduit of types, grades, sizes and weights (wall thickness) for each service indicated and meeting the following requirements:
1. PVC: NEMA TC-2: Schedule 40 and Schedule 80. Minimum Size 3/4". Rigid Non-metallic Conduit Tubing and Fittings: Provide non-metallic fittings of types, grades, sizes and weights (wall thickness) for each service indicated.
 2. HDPE: NEMA TC-7: Schedule 40 and Schedule 80. Minimum size 3/4". Rigid Non-metallic Conduit Tubing and Fittings: Provide non-metallic fittings of types, grades, sizes and weights (wall thickness) for each service indicated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install all conduit and tubing products as indicated in accordance with manufacturer's written instructions, applicable requirements of NEC and complying with recognized industry practices to insure products serve intended function.
- B. Install concealed conduits in new construction work, either in walls, slabs, below slabs or above hung ceilings. Run conduits concealed in existing work where practical. Where conduits cannot be concealed in finished areas, use surface metal raceways.
- C. Provide RMC or IMC in areas where exposed conduit could be subject to physical damage and on exposed portions of service entrance. Conduits emerging from floor up to 10'-0" AFF.
- D. Provide EMT in all interior, exposed and/or concealed areas except where indicated as RMC, IMC, RNC or FMC. Minimum size 1/2".
- E. Provide MC Cable assembly in lieu of conduit at contractor's option where use is permitted by specification section 16123.

Technical Specifications
Section 16111 – Conduit
Project No. 08232-018
Fire Station Number 8

- F. Provide RNC Schedule 40 for direct buried runs below grade, in reinforced floors, concrete walls and roofs. Minimum size 3/4" for all underground conduit unless otherwise noted. Conduits larger than 1" shall be run under slab, not in slab unless otherwise noted. Do not use HDPE under slab.
- G. For direct buried conduit runs less than 50', provide PVC, Schedule 80 elbows. For conduit runs more than 50', provide rigid galvanized steel elbows coated with Bitumastic. Provide long sweep elbows for utility applications.
- H. Provide FMC for connections from outlet boxes to recessed light fixtures. 6' maximum length.
- I. Provide FMC for connections to motors and other equipment subject to movement and/or vibration. 24" maximum length.
- J. Provide LFMC where subjected to one or more of the following conditions:
 - 1. Exterior locations.
 - 2. Moist to humid atmosphere where condensate can be expected to accumulate.
 - 3. Corrosive atmosphere.
 - 4. Subjected to water spray or dripping oil, water or grease.
- K. Provide steel compression type EMT fittings in weatherproof required areas.
- L. Provide 6" minimum separation from un-insulated hot water pipes, steam pipes, heater flues or vents.
- M. Provide 24" minimum cover for runs below finished grade outside of buildings unless otherwise noted.
- N. Provide minimum concrete cover of 1-1/2 times conduit size for conduits in poured concrete but not less than that required to maintain fire ratings.
- O. Route conduit to minimize number of elbows.
- P. Provide protection on inside of conduits against dirt, rubbish during construction by capping all openings with steel, plastic or heavy paper caps or pennies. Do not use duct tape to protect conduits.
- Q. Provide conduit bodies for exposed conduits runs at junctions, bends or offsets where required. Do not use elbows or bends around outside corners of beams, wall or equipment. All conduit body covers shall be accessible.
- R. Make all field cuts square and ream out to full size.

Technical Specifications
Section 16111 – Conduit
Project No. 08232-018
Fire Station Number 8

- S. Provide a minimum of (1) 3/4" empty conduit for every (3) single pole or fraction thereof of spare circuit breakers, spaces and not less than (2) 3/4" conduits from every flush mounted panel to an accessible space above or below.
- T. Provide watertight flashing on all conduits penetrating roof. Flashing means shall be "boot" type, sealed with stainless steel adjustable clamps and silicone sealant or pitch pan type. Provide pitch pan where not supplied by others. Coordinate allowable penetration locations and installation procedures with roofing contractor.
- U. Provide polypropylene or nylon pull-line in all empty or spare conduits. Lines are to be pulled full length and tagged at both ends designating opposite terminus.
- V. Install all exposed conduits parallel or perpendicular to structural elements or building lines. Do not install exposed horizontally on walls below 15' AFF or AFG. All vertical runs below 15' AFF or AFG shall be RMC or IMC.
- W. Provide glue-on PVC caps on all empty conduits stubbed-out underground. Mark end of conduit with flush in-ground marker.
- X. Provide expansion/deflection fittings in all raceways where structural expansion joints are crossed including exposed, concealed, in slab and underground locations. Junction boxes connected by FMC or LFMC are not acceptable.
- Y. Provide wire mesh grip style vertical conductor supports in all vertical conduit runs in accordance with NEC requirements.
- Z. Provide fire stopping materials for all rated penetrations as described on the Drawings. Refer to Specification 16010.
- AA. Provide all offsets, couplings, fittings, etc. as necessary to coordinate with structural, architectural, mechanical, etc. items.

END OF SECTION 16111

SECTION 16123

BUILDING WIRE AND CABLE/CONNECTORS

PART 1 GENERAL

1.01 RELATED DOCUMENTS/QUALITY ASSURANCE

- A. Comply with applicable requirements of ANSI, NEMA, NEC, IPCEA, ASTM, UL and CSA standards pertaining to the items specified herein. Provide products and components which have been UL, CSA listed and labeled.

1.02 SUBMITTALS

- A. None required.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Provide wire, cable assembly and connectors of manufacturer's standard materials as indicated by published product information, designed and constructed as recommended by the manufacturer and as indicated on the Drawings.
- B. Wire: Provide factory –fabricated wire of the size, rating, material and type as indicated for each service indicated. Provide materials meeting the following requirements:
 - 1. Copper: Provide copper conductors with conductivity rated not less than 98% at 20 deg C (68 deg F).
 - A. Insulation shall be type THHN/THWN for all power and lighting wiring.
- C. Cable Assembly: Provide Metal-Clad Cable, Type MC meeting the following requirements:
 - 1. Conductors shall be copper, minimum #12 AWG and maximum of #10 AWG.
 - 2. Provide fully rated ground in cable assembly.
- D. Systems: Provide wiring in accordance with system specification, i.e. Fire Alarm – Section 16721. Applies to all special systems.

Technical Specifications
Section 16123 – Building Wire and Cable/Connectors
Project No. 08232-018
Fire Station Number 8

- E. Connectors/Terminals: Provide factory-fabricated, connectors of the size, rating, material, type and class as required for each service meeting the following requirements:
 - 1. Provide split bolt connectors for copper conductor splices, #6 AWG and larger. Tape un-insulated conductors and connector with insulating pads and electrical tape to 150 percent of insulating rating of conductor.
 - 2. Provide insulated spring wire connectors with plastic caps for copper conductor splices and taps, #8 AWG and smaller.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install building wire and cable products as indicated in accordance with manufacturer’s written instructions, applicable requirements of NEC and complying with recognized industry practices to insure products serve intended function.
- B. All conductors shall be copper unless otherwise noted. Minimum aluminum circuit size is 100 amps.
- C. Minimum size conductors are #12 for power and lighting functions and #14 for control functions.
- D. Use solid conductors for feeders and branch circuits #10 AWG and smaller. Use stranded conductors for all others.
- E. Use stranded conductors for control circuits.
- F. Clean conduit system to be free of dirt and moisture prior to installing conductors. Install all conductors into conduit/raceway simultaneously.
- G. Check conduit system to be complete with no loose or damaged connections or conduit sections prior to installing conductors.
- H. Provide insulated conductors in accordance with the following color code:

<u>CONDUCTOR</u>	<u>SYSTEM VOLTAGE</u>
	<u>208Y/120</u>
Phase A	Black
Phase B	Red
Phase C	Blue
Neutral	White
Ground	Green
Isolated Ground	Green/Yellow Stripe

Technical Specifications
Section 16123 – Building Wire and Cable/Connectors
Project No. 08232-018
Fire Station Number 8

For conductors #8 AWG and larger, permanent plastic colored tape may be used to mark conductor end in lieu of colored insulation. Tape shall cover not less than 2" of conductor insulation within enclosure.

- I. Provide an equipment grounding conductor in all raceways except service lateral regardless of indication of Drawings.
- J. Do not exceed manufacturer's recommended values of allowable pulling tensions and sidewall pressures.
- K. Splices in feeders are not permitted.
- L. Provide wire mesh style vertical conductor supports on all vertical conductor runs in accordance with NEC requirements.
- M. Install exposed cable assemblies parallel and perpendicular to structural elements or building lines and follow surface contours where possible. Tie wrap to joists at intervals as required by NEC.
- N. Use manufacturer-approved pulling compound or lubricant where necessary. Compound must not deteriorate conductor or insulation or harden with time preventing the removal of conductors.
- O. Tighten electrical connectors and terminals in accordance with manufacturer's published torque values. If manufacturer's values are not indicated, follow the values published in UL 486A and 486B.
- P. Clean and prepare all conductor surfaces before installing lugs and connectors.
- Q. Neatly train and lace wiring within panelboards, enclosures and boxes.
- R. Run all parallel feeder conductors and ground full length of all wiring troughs. Make all connections in wireway using staggered multiple tap, dual rated connectors.
- S. Check conductors, cable installation for continuity and to be free from shorts using appropriate voltage "Megger" on all feeders prior to energizing circuit. Correct malfunction when detected.
- T. When removing insulation for terminations, do not damage conductors by ringing or removing strands.
- U. Where multiple conductors are terminated with a common/single lug, lug shall be listed as suitable for application.

Technical Specifications
Section 16123 – Building Wire and Cable/Connectors
Project No. 08232-018
Fire Station Number 8

- V. All connections made in in-ground junction boxes or handholes shall be made with waterproof, snap-lock, gel-filled connector kits equal to CMC #DSR2/0 or Raychem #GTAP-2 and King “Dry-Conn” wirenuts for fuse to fixture connection.

END OF SECTION 16123

SECTION 16130

BOXES/FITTINGS

PART 1 GENERAL

1.01 RELATED DOCUMENTS/QUALITY ASSURANCE

- A. Comply with applicable requirements of ANSI, NEMA, NEC, UL and CSA standards pertaining to the items specified herein. Provide products and components which have been UL, CSA listed and labeled.

1.02 SUBMITTALS

- A. None required.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Provide box or fitting assembly of manufacturer's standard materials as indicated by published product information, designed and constructed as recommended by the manufacturer and as indicated on the Drawings.
- B. Outlet boxes, interior locations: Provide galvanized flat rolled sheet steel outlet wiring boxes to suit each respective location and use meeting the following requirements:
 - 1. Provide boxes with pre-punched stamped knockouts in back and sides and with threaded screw holes with corrosion-resistant screws for securing box covers, extension rings and devices.
 - 2. Provide minimum of 4" square boxes unless otherwise noted.
 - 3. Provide device rings suitable for the applicable devices for boxes concealed in walls.
 - 4. Provide raised covers suitable for the applicable devices for exposed boxes.
- C. Outlet boxes, exterior locations: Provide corrosion resistant, cast-metal weatherproof outlet wiring boxes to suit each respective location and use meeting the following requirements:
 - 1. Provide boxes with threaded conduit entrances in back and ends and with adjustable mounting ears.

Technical Specifications
Section 16130 – Boxes/Fittings
Project No. 08232-018
Fire Station Number 8

2. Provide cast-metal faceplates/covers with spring-hinged waterproof caps suitable for the applicable device in each weatherproof location. Provide corrosion-resistant screws and faceplate/cover gaskets.
 3. Provide cast-metal faceplate and deep plastic cover (wet while in use) suitable for the applicable device in each “wet” location. Provide corrosion-resistant screws and faceplate/cover gaskets. Cover is equal to Taymac.
- D. Junction and Pull boxes: Provide galvanized code gauge sheet steel junction and pull boxes with welded seams. For interior locations, provide screw-on covers. For exterior locations, provide weatherproof covers conforming to NEMA 3R requirements.
- E. Conduit Bodies: Provide corrosion resistant, cast-metal weatherproof conduit bodies to suit each respective location and use meeting the following requirements:
1. Provide bodies with threaded conduit entrances and removable covers.
 2. Provide corrosion-resistant screws and cover gaskets.
- F. Bushings, Knockout Closures and Locknuts: Provide corrosion-resistant punched-steel knockout closures, conduit locknuts, conduit bushings and offset connectors of size and type to suit respective locations and uses.
- G. Sealing Fittings: Provide cadmium plated, malleable iron sealing fittings complete with barriers and filler material of size and type to suit respective locations and uses. Provide sealing type washers where required.
- H. In-Ground Splice Boxes: Provide polymer-concrete, open-bottom utility style box in accordance with schedule on Drawings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install boxes/fittings products as indicated in accordance with manufacturer’s written instructions, applicable requirements of NEC and complying with recognized industry practices to insure products serve intended function.
- B. Provide a minimum of 6” horizontal separation of boxes installed in walls. Do not install boxes back-to-back.
- C. Do not install cast aluminum boxes/fittings in concrete.

Technical Specifications
Section 16130 – Boxes/Fittings
Project No. 08232-018
Fire Station Number 8

- D. Arrange junction in rated partitions as required to satisfy the requirements of the UL Fire Resistance Directory.
- E. Provide sealing fittings in all conduit runs entering areas of extreme temperature differential.
- F. Do not use round boxes where conduit must enter through side of box.
- G. Rigidly fasten boxes to surfaces on which they are mounted, or solidly embed boxes in concrete or masonry.
- H. Install hinged-cover boxes, enclosures and cabinets plumb such that covers will remain in either open or closed position. Support boxes at each corner.
- I. Provide pull and junction boxes where required by code whether or not they are shown on the Drawings. All boxes shall be legibly marked to indicate circuits or contents therein.
- J. Inspect factory finished boxes after installation and repair damaged finishes.
- K. Provide bonding pigtails in all metal boxes and assure that all metal boxes are grounded.
- L. Provide horizontal framing members between studs as required to assure that multiple boxes installed in one location are arranged for a maximum of 6" spacing between boxes.
- M. Adjust switch locations at above counter locations to match receptacle locations for appearance and uniformity.
- N. Clean all boxes free of debris prior to closing, covering or installing devices.

END OF SECTION 16130

SECTION 16140
WIRING DEVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS/QUALITY ASSURANCE

- A. Comply with applicable requirements of ANSI, NEMA, NEC, UL and CSA standards pertaining to the items specified herein. Provide products and components which have been UL, CSA listed and labeled.

1.02 SUBMITTALS

- A. Provide manufacturer's data sheets on wiring devices in accordance with Section 16010 requirements.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Provide devices of manufacturer's standard materials as indicated by published product information, designed and constructed as recommended by the manufacturer and as indicated on the Drawings or meeting the following requirements:

1. Wall Switches: White unless otherwise noted.

DESCRIPTION	RATING	LEVITON	HUBBELL	P & S
SPST	20A, 277V	CS120-2W	CS120W	CS20AC1-W
DPST	20A, 277V	CS220-2W	CSB220W	CSB20AC2-W
3 WAY	20A, 277V	CS320-2W	CS320W	CS20AC3-W
4 WAY	20A, 277V	CS420-2W	CSB420W	CSB20AC4-W
SP DIMMER	SEE DRAWINGS	DECORA SLIDE PRE-SET	ARCH SLIDE PRE-SET	DECORATOR SLIDE PRE-SET

2. Wall Receptacles: White unless otherwise noted.

DESCRIPTION	RATING	LEVITON	HUBBELL	P & S
DUP	20A, 120V	BR20-W	CR20WHI	CR20-W
DUP ISO GND ORANGE	20A, 120V	5362-IG	IG5362	IG6300
DUP GFI	20A, 120V	6899-W	GF5352WA	2094-W

Technical Specifications
Section 16140 – Wiring Devices
Project No. 08232-018
Fire Station Number 8

- B. Device Plates: Provide device plates matching and coordinated with installed device meeting the following requirements:
1. Plates shall be standard size, thermoset, non-combustible opaque plastic, white unless otherwise noted.
 2. Where plates are noted on drawings to be engraved, provide standard size, 302 grade stainless steel. Engraving shall be red enamel in-fill paint. If plates are plastic, a clear adhesive label with black 1/4" text shall be submitted for approval to the Architect.
 3. Provide jumbo size plates where required to cover defects in wall construction.
 4. Provide all plates with manufacturer's colored screws matching faceplate material.
 5. Provide 302 grade stainless-steel device plates on all devices located within kitchen or food prep areas.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Coordinate device installation with work of other trades. Provide protection from wall-board compound, paint, dirt, dust and other debris.
- B. Clean all outlet boxes prior to device installation and again prior to installing cover.
- C. Provide and install wiring devices after all wiring installation work is completed.
- D. Install all devices such that removal of device will not affect circuit integrity or operation.
- E. Install all grounded receptacles devices in the following manner:
1. All devices installed below counter height (30") shall be installed with ground pin up unless otherwise noted.
 2. All devices installed at counter height (30") or above shall be installed with ground pin right (horizontal) unless otherwise noted.
 3. All devices locally switched shall be installed 180 degrees from defined method.
- F. Install all device plates so that they are plumb and level.

Technical Specifications
Section 16140 – Wiring Devices
Project No. 08232-018
Fire Station Number 8

- G. Test all devices for proper grounding, wiring polarity, and that switches controlling the intended device and ground/arc fault devices are working properly.

END OF SECTION 16140

SECTION 16145

LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS/QUALITY ASSURANCE

- A. Comply with applicable requirements of ANSI, NEMA, NEC, UL and CSA standards pertaining to the items specified herein. Provide products and components which have been UL, CSA listed and labeled.

1.02 SUBMITTALS

- A. Provide manufacturer's data sheets on lighting control devices in accordance with Section 16010 requirements.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Provide lighting control devices from a same manufacturer.
- B. Provide photoelectric control cells and time clocks of ratings and types which comply with manufacturer's standard design, material, components and construction in accordance with published product information and as indicated on the Drawings.
- C. Provide photoelectric control cells meeting or exceeding the following:
 - 1. Enclosure shall be die-cast zinc, gasketed for weather protection and designed for stem mounting.
 - 2. Cell shall be cadmium sulfide type with built-in time delay to minimize false switching.
 - 3. Control function shall be adjustable from 1-15 fc operation.
 - 4. Cell shall have 5 year warranty, equal to product information as indicated on the Drawings.
- D. Provide time clocks meeting or exceeding the following:
 - 1. Enclosure shall be NEMA 1 for indoor applications unless otherwise noted on the Drawings.

Technical Specifications
Section 16145 – Lighting Control Devices
Project No. 08232-018
Fire Station Number 8

2. Enclosure shall be NEMA 3R for outdoor applications unless otherwise noted on the Drawings.
 3. Time clocks refer to product information as indicated on the Drawings.
- E. Provide photoelectric control cells and time clocks manufactured by one of the following:
1. Intermatic
 2. Paragon
 3. Tork

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install photoelectric control cells and time clocks indicated in accordance with manufacturer's written instructions, applicable requirements of NEC and complying with recognized industry practices to insure products serve intended function.
- B. Provide all necessary mounting hardware as required for rigid mounting of each starter.
- C. Install all devices plumb.
- D. Mount photoelectric cell minimum of 12" above finished roof and aim cell towards northern sky. Adjust for approximately 5fc ON.
- E. Tighten electrical connections and terminals in accordance with manufacturer's published torque tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

END OF SECTION 16145

SECTION 16170

GROUNDING AND BONDING

PART 1 GENERAL

1.01 RELATED DOCUMENTS/QUALITY ASSURANCE

- A. Comply with applicable requirements of ANSI, NEMA, NEC, UL and CSA standards pertaining to the items specified herein. Provide products and components which have been UL, CSA listed and labeled.

1.02 SUBMITTALS

- A. None required.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Provide assembly of ground rods, couplings, clamps, conductors, connectors and fittings as required for a complete ground or bond connection. All materials shall be of manufacturer's standard materials as indicated by published product information, designed and constructed as recommended by the manufacturer and as indicated on the drawings.
- B. Wire: Provide stranded bare soft drawn copper wire for electrode grounding conductors and insulated green colored stranded copper conductors of the same type as current carrying conductors for equipment grounds and bonds. For aluminum feeders, provide copper conductors for grounding and bonding applications.
- C. Clamps: Provide Weaver style clamps, exothermic welds equal to "Cadweld" or "U" type clamps (pipe only) as required by location or as indicated on the drawings.
- D. Rods: Provide copper-clad steel type rods for all driven ground rods unless otherwise noted. Minimum size 3/4" x 10'-0", minimum of (2) rods unless otherwise noted.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install all grounding and bonding products as indicated in accordance with manufacturer's written instructions, applicable requirements of NEC and

Technical Specifications
Section 16170 – Grounding and Bonding
Project No. 08232-018
Fire Station Number 8

complying with recognized industry practices to insure products serve intended function.

- B. The grounding system shall be installed to protect against static charges and to provide personnel protection through the service ground to all electrical equipment. All parts of the electrical system shall be positively grounded in accordance with the requirements of the NEC and all other applicable local and state codes.
- C. Provide connection to the reinforcing steel (20' continuous minimum) in the foundation system and structural steel columns using exothermic methods and materials.
- D. Provide connection from the grounding electrode to the electrical service system neutral at service entrance equipment.
- E. Provide grounding connection to interior metal water piping within 5' of water pipe(s) entrance to the building.
- F. Grounding connections to equipment, grounding bus bars, etc. shall be made using lugs and threaded stud connectors to facilitate removal for testing and maintenance.
- G. Provide grounding connection to gas piping upstream from equipment shut-off. Underground portions of gas piping system shall not be permitted to serve as a grounding electrode.
- H. Exposed grounding and bonding conductors susceptible to mechanical damage shall be protected by an adequate length of Schedule 80 PVC conduit secured with PVC straps and stainless steel screws.
- I. Surfaces where grounding connections are to be made shall be clean and dry. Steel surfaces shall be ground or filed to base metal and cleaned with abrasive cloth to remove oxides before making connections.
- J. Install equipment grounding conductors in all feeders, branch circuits and raceways (except service entrance).
- K. Install grounding bus on telephone board. Use insulated spacer; space 1 inch from board.
- L. Route grounding conductors and connections to ground and protective devices in shortest and straightest paths possible to minimize transient voltage rises.
- M. Tighten electrical connections and terminals in accordance with manufacturer's published torque tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

Technical Specifications
Section 16170 – Grounding and Bonding
Project No. 08232-018
Fire Station Number 8

- N. Provide irreversible compression or exothermic weld connections where required by local codes.
- O. Do not install ground rods directly beneath switchboards. Locate grounds in accessible locations. Do not locate ground rods where they would create a “tripping” hazard. Accurately record service ground rods on as-built drawings.
- P. If telephone service is located greater than 20’ from electrical service, provide additional grounding electrode and conductor as described by NEC 800.
- Q. Connect nearest lightning protection ground terminal to service grounding electrode using lightning protection main sized buried conductor.
- R. Upon completion of installation of electrical grounding and bonding systems and prior to energizing any equipment or gear, test ground resistance with ground resistance tester using “3-point fall-of-potential” method with utility neutral disconnected. Where tests show resistance-to-ground in excess of 25 ohms, take appropriate action to reduce resistance to less than 25 ohms by driving additional ground rods. Re-test to demonstrate compliance. Submit final test report to Engineer upon request.

END OF SECTION 16170

SECTION 16195

ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS/QUALITY ASSURANCE

- A. Comply with applicable requirements of ANSI, NEMA, NEC, OSHA, UL and CSA standards pertaining to the items specified herein. Provide products and components which have been UL, CSA listed and labeled.

1.02 SUBMITTALS

- A. None required.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Provide manufacturer's standard products of categories and types as required for each application unless otherwise noted.
- B. For each electrical conduit system indicated, provide identification of conduits that are exposed or concealed in accessible spaces to distinguish each run as either a power or signal/communication conduit. If power conduit, indicate panel and circuit numbers contained therein. Markings may be permanent marker directly on the conduit, neatly and legibly written.
 - 1. Conduit markings shall be at ends of conduit runs, near switches and/or other control devices, near items of equipment served by the conductors, at points where conduits pass through walls, or floors or enter non-accessible construction and at spacing of not more than 50' along each run of conduit.
 - 2. Switch-leg conduit and short branches for power connections need not be marked where use is obvious and except where conduit is larger than 1".
- C. For all cables and conductors installed in interior locations, provide manufacturer's standard vinyl-cloth self-adhesive markers, plastic-coated pre-numbered wrap-around style or job site printed thermal transfer type. Brady, Panduit or approved equal.
- D. For all cables and conductors installed in exterior locations such as manholes, handholes, etc., provide die-stamped, 1" brass tags.
- E. For all equipment, provide nameplates meeting the following requirements:

Technical Specifications
Section 16195 – Electrical Identification
Project No. 08232-018
Fire Station Number 8

1. Provide engraved, plastic-laminate signs at locations of major units of electrical equipment including panelboards, enclosures, safety switches/disconnects, lighting controls, exhaust fans, emergency generating units, and master units of telephone, clock program, sound, signal, alarm, fire alarm, TV, and similar systems.
2. Signs shall be minimum 1" wide plate with minimum 1/4" lettering as follows:
 - a. Normal Power: Black background with white letters.
 - b. Emergency Power: Red background with white letters.
 - c. Service Plaques: Red background with white letters.
3. Multiple mains at separate and remote locations shall be identified and reader shall be directed to location of all other mains using minimum of 5" x 7" sign. Lettering shall be in accordance with NEC 230.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install all electrical identification products as indicated in accordance with manufacturer's written instructions, applicable requirements of NEC, OSHA and complying with recognized industry practices to insure products serve intended function.
- B. Where identification is to be applied to surfaces that require finishing, install identification after completion of painting.
- C. Provide warning signs where there is a hazardous exposure or danger associated with access to or operation of electrical facilities.
 1. Provide text of sufficient brevity, clarity and lettering size to convey adequate information at each location.
 2. Signs shall be permanently secured by mechanical mounting with self-tapping, stainless-steel screws, stainless-steel rivets or 10/32 stainless-steel machine bolts with nuts and lock washers in an appropriate and effective location.
 3. Do not locate signs behind doors of panels, switchboards or motor controls.
- D. Wherever reasonably required to insure safe and efficient operation and maintenance of electrical systems, including prevention of misuse by

Technical Specifications
Section 16195 – Electrical Identification
Project No. 08232-018
Fire Station Number 8

unauthorized personnel, provide signs on switches, outlets and other controls, devices and covers of electrical enclosures.

- E. Provide warning signs where there is a hazardous exposure or danger associated with access to or operation of electrical facilities in or about the project.
- F. Apply cable/conductor identification at origin and termination. Match identification with marking system used in panelboards, shop drawings and contract documents.

END OF SECTION 16195

SECTION 16441

DISCONNECTS AND SAFETY SWITCHES

PART 1 GENERAL

1.01 RELATED DOCUMENTS/QUALITY ASSURANCE

- A. Comply with applicable requirements of ANSI, NEMA, NEC, UL and CSA standards pertaining to the items specified herein. Provide products and components which have been UL, CSA listed and labeled.

1.02 SUBMITTALS

- A. Provide manufacturer's data sheets on disconnects and safety switches in accordance with Section 16010 requirements.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Provide disconnects and enclosed safety switches of manufacturer's standard materials as indicated by published product information, designed and constructed as recommended by the manufacturer and as indicated on the Drawings.
- B. Enclosures shall be surface-mounted, heavy-duty, sheet steel of the type and size indicated on the drawings.
- C. Switches shall be quick-make, quick-break type and constructed so that switch blades are visible in the OFF position with door open.
- D. Switches shall be equipped with operating handles that are lockable in both ON and OFF positions, interlocked with cover and have bypass function.
- E. Switches shall be UL listed for Service Entrance applications where indicated on the Drawings.
- F. Switches shall be equipped with bonding/grounding bar.
- G. Provide NEMA type 1 for indoor applications.
- H. Provide NEMA type 3R for applications exposed to weather.
- I. Provide NEMA type 4 for applications exposed to water spray, wash-down, etc.
- J. Provide fusible switches with rejection clips.

Technical Specifications
Section 16441 – Disconnects and Safety Switches
Project No. 08232-018
Fire Station Number 8

- K. All switches shall be 250 volt rated unless otherwise noted.
- L. Provide all switches with line side and load side lugs as required to accommodate conductors indicated on the drawings.
- M. Provide elevator motor disconnect switches with auxiliary contact kit for controller interlock.
- N. Provide switches manufactured by one of the following:
 - 1. Cutler Hammer
 - 2. General Electric
 - 3. Siemens
 - 4. Square D

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install disconnects and safety switches indicated in accordance with manufacturer's written instructions, applicable requirements of NEC and complying with recognized industry practices to insure products serve intended function.
- B. Switches shall be installed in accessible locations and mounted on or in the visible vicinity of the equipment served.
- C. Provide all necessary mounting hardware as required for rigid mounting of each switch.
- D. Tighten electrical connections and terminals in accordance with manufacturer's published torque tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

END OF SECTION 161441

SECTION 16445

TVSS – TRANSIENT VOLTAGE SURGE SUPPRESSORS

PART 1 GENERAL

1.01 RELATED DOCUMENTS/QUALITY ASSURANCE

- A. Comply with specific requirements of ANSI/IEEE (C62.1 OF C62.11, C62.41 AND C62.45, and applicable requirements of NEMA, NEC, UL and CSA standards pertaining to the items specified herein. Provide products and components which have been UL, CSA listed and labeled.

1.02 SUBMITTALS

- A. Provide manufacturer's data sheets on transient voltage surge suppressors in accordance with Section 16010 requirements.
- B. TVSS submittal data shall consist of the following data to be submitted concurrently as one package. Where indicated by Independent Test (IT), supplier shall submit independent laboratory testing data demonstrating compliance.
 - 1. Electrical and mechanical drawings.
 - 2. Maximum continuous operating voltage.
 - 3. U.L. 1449 surge suppression rating for each mode of protection (include file number and published data for each environment tested).
 - 4. Surge current capacity per phase/coupling mode. (IT)
 - 5. Fusing and short circuit current rating. (IT)
 - 6. Survivability level.
 - 7. Warranty.
 - 8. Oscillographs or equivalent demonstrating surge suppression ratings, applied AC voltage and response time. (IT)

PART 2 PRODUCTS

2.01 MATERIALS

Technical Specifications
Section 16445 – TVSS – Transient Voltage Surge Suppressors
Project No. 08232-018
Fire Station Number 8

- A. Provide TVSS device installed on 208Y/120 volt systems at the service entrance meeting or exceeding the following performance criteria:
 - 1. Testing as outlined in ANSI/IEEE C62.1OR C62.11 FOR .175KV secondary surge arrestors.
 - 2. UL 1449 rating of 400 volt.
 - 3. Survive 1000 sequential category C3 surges without failure following test procedures as outlined in ANSI/IEEE C62.45 with AC voltage applied.
 - 4. Minimum short circuit current rating of 100,000 AIC.
 - 5. Maximum continuous operating voltage of 115% of the nominal RMS voltage applied without degradation.
 - 6. Maximum surge current capacity for 10 sequential surges (1 every 50 secs to 60 secs) shall be 50kA L-N and 100kA L-G.

- B. Provide TVSS devices manufactured by one of the following:
 - 1. L.E.A. Dynatech
 - 2. Advanced Protection Technologies, Inc.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install TVSS devices indicated in accordance with manufacturer's written instructions, applicable requirements of NEC and complying with recognized industry practices to insure products serve intended function.

- B. Provide all necessary mounting hardware as required for rigid mounting of each device.

- C. Provide connecting conductors in accordance with the following instructions:
 - 1. Conductors for parallel connected TVSS devices shall be sized as indicated on the Drawings.

 - 2. Where indicted for parallel connection using individual conductors, the conductors shall be installed as follows:
 - a. Conductors shall be twisted together to the maximum extent possible without degradation to the physical characteristics of the conductors or deformation from a straight grouping.

Technical Specifications
Section 16445 – TVSS – Transient Voltage Surge Suppressors
Project No. 08232-018
Fire Station Number 8

- b. Individual lead lengths shall be kept to a minimum.
- c. Conductors shall be routed so as to avoid sharp bends.
- 3. Where indicated for “Kelvin” connection, conductors shall be as indicated on the Drawings and in accordance with section 16120 of the specifications.
- 4. Conductors shall be terminated under single screw using mechanical lugs suitable for the intended use.
- D. Tighten electrical connections and terminals in accordance with manufacturer’s published torque tightening values. If manufacturer’s torque values are not indicated, use those specified in UL 486A and UL 486B.

3.02 WARRANTY

- A. All TVSS devices shall have a manufacturer’s replacement warranty of not less than five (5) years from the date of installation. Contractor shall provide copy of warranty to owner in accordance with section 16010.
- B. TVSS units shall not require removal and replacement for warranty or other repairs. Any internal component replacements shall be capable of being completed by a licensed electrician without voiding the original warranty.

END OF SECTION 16445

SECTION 16470

PANELBOARDS

PART 1 GENERAL

1.01 RELATED DOCUMENTS/QUALITY ASSURANCE

- A. Comply with applicable requirements of ANSI, NEMA, NEC, UL and CSA standards pertaining to the items specified herein. Provide products and components which have been UL, CSA listed and labeled.

1.02 SUBMITTALS

- A. Provide manufacturer's data on panelboards and enclosures, dimensions of which shall not exceed those as shown on the Drawings or as called out in this section. Indicate voltage, main bus arrangement and rating, circuit breaker and/or fusible switch arrangement and sizes. Include applicable series short circuit ratings information where it is applied.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Provide panelboards of manufacturer's standard materials as indicated by published product information, designed and constructed as recommended by the manufacturer and as indicated on the Drawings.
- B. Power distribution panelboards shall be dead-front, safety type power distribution with protective devices in quantities, ratings, types and with arrangement as shown on the Drawings. Bussing shall be tin-plated aluminum. Circuit Breaker power distribution panelboards shall be equal to Square D "I-Line" or equal.
- C. 120/208 volt Lighting and appliance panelboards shall be dead-front, safety type lighting panelboards with circuit breakers as shown on the Drawings. Circuit breakers shall be bolt-on type. Bussing shall be tin-plated aluminum. Circuit breakers are location specific and shall be arranged as indicated in the panel schedules on the Drawings. Tandem or twin circuit breakers are not allowed. Panelboards shall be Square D "NQOD" or approved equal.
- D. Panel trim shall be surface or flush as indicated on the Drawings.
- E. Provide all panelboards with hinged door with flush lock, keyed alike.
- F. Provide each panelboard with an engraved plastic-laminate nameplate and typewritten directory card in plastic pocket.

Technical Specifications
Section 16470 – Panelboards
Project No. 08232-018
Fire Station Number 8

- G. Provide a ground bus in all panelboards.
- H. Provide all panelboards with provision for connecting feeders at top of panel unless otherwise noted.
- I. Provide NEMA type 1 for indoor applications.
- J. Provide NEMA type 3R for applications exposed to weather.
- K. Provide NEMA type 4 for applications exposed to water spray, wash-down, etc.
- L. All panelboards shall be furnished without factory knockouts. All knockouts shall be field punched for specific purpose.
- M. Where circuit breakers serve HID lighting loads, circuit breakers shall be manufacturer self certified for that purpose.
- N. Where circuit breakers serve HVAC equipment requiring HACR rated circuit breakers, U.L approved HACR rated breakers shall be used.
- O. Multi-section panelboards shall be matched dimensionally.
- P. Load centers are not acceptable.
- Q. Provide panelboards manufactured by one of the following:
 - 1. Square D
 - 2. Cutler Hammer
 - 3. Siemens
 - 4. General Electric

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install panelboards indicated in accordance with manufacturer's written instructions, applicable requirements of NEC and complying with recognized industry practices to insure products serve intended function.
- B. Install panelboards plumb and rigid without distortion as follows:
 - 1. Height: 6' to top of panelboard unless otherwise noted.
 - 2. Install panel taller than 6' with bottom no more than 4 inches above floor.

Technical Specifications
Section 16470 – Panelboards
Project No. 08232-018
Fire Station Number 8

- C. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them including electrical and other types of equipment, raceways, piping and encumbrances to workspace clearance requirements.
- D. Provide all necessary mounting hardware as required for rigid mounting of each panelboard. Fasten enclosures firmly to walls and structural surfaces, ensuring they are permanently and mechanically anchored.
- E. Mount all recessed panelboards with fronts uniformly aligned and flush with wall finish.
- F. Install filler blanks/plates in all unused spaces.
- G. Provide a minimum of (1) 3/4" empty conduit for every (3) single pole or fraction thereof of spare circuit breakers, spaces and not less than (2) 3/4" conduits from every flush mounted panel to an accessible space above or below.
- H. Tighten electrical connections and terminals in accordance with manufacturer's published torque tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- I. Touch up scratched or marred surfaces to match original factory finishes.
- J. Vacuum all panelboards free of debris.

END OF SECTION 16470

SECTION 16477

FUSES

PART 1 GENERAL

1.01 RELATED DOCUMENTS/QUALITY ASSURANCE

- A. Comply with applicable requirements of ANSI, NEMA, NEC, UL and CSA standards pertaining to the items specified herein. Provide products and components which have been UL, CSA listed and labeled.

1.02 SUBMITTALS

- A. Provide manufacturer's data sheets on fuses including time current curves in accordance with Section 16010 requirements.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Provide fuses of types, sizes, ratings and time current and peak let-thru current characteristics which comply with manufacturer's standard design, material, components and construction in accordance with published product information and as indicated on the Drawings.
- B. Class L Time-Delay Fuses: Provide Class L time delay, current limiting fuses rated 600 volts, 60 hertz, with 200,000 RMS symmetrical interrupting current rating for protection of transformers, motors, circuit breakers and switchboards. Bussmann Low-Peak KRP-C or approved equal.
- C. Class RK1 Dual Element Time-Delay Fuses: Provide Class RK1 dual element, time delay, current limiting fuses rated for the applicable voltage, 60 hertz, with 200,000 RMS symmetrical interrupting current rating for protection of transformers, motors, and circuit breakers. Bussmann Low-Peak LPN-RK/LPS-RK or approved equal.
- D. Non-Time Delay Fuses: Provide non-time delay, single element fuse rated 300 volts, 60 hertz for protection of fluorescent light fixture ballasts. Bussmann GLR with type HLR fuse holder or approved equal.
- E. Miscellaneous Fuses: Provide time delay fuse rated for the applicable voltage, 60 hertz, with 10,000 RMS symmetrical interrupting current rating for protection of exterior, non-fluorescent, ballasted light fixtures. Bussmann FNM/FNQ with HEB fuse holder or approved equal.
- F. Fuse Cabinet: Provide spare fuse cabinet. Bussmann SFC or approved equal.

Technical Specifications
Section 16477 – Fuses
Project No. 08232-018
Fire Station Number 8

- G. Provide fuses manufactured by one of the following:
 - 1. Bussmann
 - 2. Littelfuse
 - 3. Shawmut/Gould

PART 3 EXECUTION

3.01 INSTALLATION

- A. Maintain and store all fuses in dry environment until ready to use.
- B. Clean and tighten all electrical connections prior to installing fuses. Do not install fuses until ready to energize equipment.
- C. Furnish and install interior fluorescent light fixture fuses only when required by local code. Size fuses in accordance with light fixture manufacturer's recommendations.
- D. Furnish and install exterior ballasted light fixture fuses as shown on Drawings.
- E. Furnish 10% spare fuses (3 minimum) of every size and type fuse installed on this project.
- F. Where fuses are current limiting type, contractor shall assure that all corresponding devices are equipped with rejection clips to insure that the fuse cannot be replaced with an incorrect type.

END OF SECTION 16477

SECTION 16485

CONTACTORS

PART 1 GENERAL

1.01 RELATED DOCUMENTS/QUALITY ASSURANCE

- A. Comply with applicable requirements of ANSI, NEMA, NEC, UL and CSA standards pertaining to the items specified herein. Provide products and components which have been UL, CSA listed and labeled.

1.02 SUBMITTALS

- A. Provide manufacturer's data sheets on contactors in accordance with Section 16010 requirements.
- B. Contactor submittal data shall include but not be limited to voltage ratings, phase ampere ratings, number of poles and dimensions.
- C. Submit Lighting Contactor Cabinet layout drawing showing accurately scaled basic components.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Provide contactors of ratings, classes, types and characteristics which comply with manufacturer's standard design, material, components and construction in accordance with published product information and as indicated on the Drawings.
- B. General Description:
 - 1. Configuration: Electrically Held.
 - 2. Configuration: Mechanically Held.
 - 3. Enclosure: Open, NEMA 1 or NEMA 3R as indicated on the Drawings.
 - 4. Finish: Manufacturer's standard gray enamel finish where applicable.
- C. Magnetic Contactor: AC general purpose, lighting rated, magnetically operated, full-voltage contactor with the following characteristics:
 - 1. Coil operating voltage: Select coil voltage based upon controlling function indicated on the Drawings.

Technical Specifications
Section 16485 – Contactors
Project No. 08232-018
Fire Station Number 8

2. Auxiliary Contacts: Provide (1) each NO and NC auxiliary contacts in addition to phase contacts.
 3. Control Transformer: Provide line voltage control transformer where indicated and sized to coil characteristics plus 125% additional capacity minimum. Secondary voltage of transformer based upon controlling function indicated on the drawings. Provide primary and secondary fuses and bond un-fused leg of secondary to enclosure.
 4. Indicating Lights: Provide red indicating light in cover.
 5. Pushbuttons: Provide shrouded reset button in cover.
 6. Selector Switches: Provide rotary style, oil-tight type in cover. Type as indicated on Drawings.
- D. Combination Contactors: Combine contactors with thermal magnetic circuit breakers, on-fusible switches or fusible switches in a common enclosure as indicated on the Drawings.
- E. Provide contactors as manufactured by one of the following:
1. Cutler Hammer
 2. General Electric
 3. Siemens
 4. Square D

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install contactors indicated in accordance with manufacturer's written instructions, applicable requirements of NEC and complying with recognized industry practices to insure products serve intended function.
- B. Provide all necessary mounting hardware as required for each contactor.
- C. Provide typed label on inside of contactor cover indicating load served.
- D. Tighten electrical connections and terminals in accordance with manufacturer's published torque tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

END OF SECTION 16485

SECTION 16510
INTERIOR LIGHTING FIXTURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS/QUALITY ASSURANCE

- A. Comply with applicable requirements of ANSI, NEMA, NEC, UL and CSA standards pertaining to the items specified herein. Provide products and components which have been UL, CSA listed and labeled.

1.02 SUBMITTALS

- A. Provide manufacturer's data sheets on lighting fixtures in accordance with Section 16010 requirements.
- B. Lighting fixtures submittal data shall include but not be limited to housings, reflectors, lenses, ballasts, voltage rating, lamps, lamp holders, mounting accessories and photometric data.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Provide lighting fixtures of types and characteristics which comply with manufacturer's standard design, material, components and construction in accordance with published product information and as indicated on the Drawings. Ship fixtures factory-assembled, with parts required for a complete installation. Design fixtures with concealed hinges and catches, with metal parts grounded as common unit, and so constructed as to dampen ballast generated sounds.
- B. Fluorescent lamp ballasts shall be electronic type capable of operating lamp types indicated, high power factor, rapid-start, and low-noise features; Type 1; Class P; sound-rated A. Provide fluorescent lamp ballasts which comply with Certified Ballast Manufacturers Association standards and carry the CBM label. Provide fusing where required by local code.
- C. High-Intensity-Discharge-Lamp Ballasts: Provide HID lamp ballasts, of ratings, types and makes as recommended by lamp manufacturer, which properly mates and matches lamps to electrical supply by providing appropriate voltages and impedances for which lamps are designed. Provide fusing where required by local codes.
- D. Lamps.

Technical Specifications
Section 16510 – Interior Lighting Fixtures
Project No. 08232-018
Fire Station Number 8

1. Provide incandescent lamps of wattage and styles indicated and as manufactured by Sylvania or Philips.
 2. Provide fluorescent lamps of energy saving types as indicated and as manufactured by Sylvania or Philips.
 3. Provide clear metal halide in wattages indicated and as manufactured by Sylvania, Philips, or Venture.
 4. Provide specialty lamps in types and wattages indicated and as manufactured by Sylvania or Philips.
- E. Provide interior lighting fixtures as manufactured by one of the following and subject to conformance with features of units specified on the Drawings.
1. Cooper Industries
 2. Hubbell
 3. Lithonia
 4. Thomas

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install lighting fixtures at locations and heights as indicated in accordance with manufacturer's written instructions.
- B. Provide fixtures and/or fixture outlet boxes with hangers at diagonal corners to properly support fixture weight. Support from structural elements independent of ceiling system.
- C. Install flush mounted fixtures to eliminate light leakage between fixture frame and finished surface.
- D. Provide plaster frames for recessed fixtures installed in other than suspended grid type acoustical ceiling systems. Brace frames temporarily to prevent distortion during handling.
- E. For air supply type fixtures, retain side slot closures in place for adjustment by Balancing Contractor.
- F. Fasten fixtures securely to indicated structural supports; and ensure that pendant fixtures are plumb and level. Provide individually mounted pendant fixtures longer than 2' with twin stem hangers. Provide stem hanger with ball aligners

Technical Specifications
Section 16510 – Interior Lighting Fixtures
Project No. 08232-018
Fire Station Number 8

and provision for minimum 1" vertical adjustment. Mount continuous rows of fixtures with an additional stem hanger than number of fixtures in the row.

- G. Support surface mounted fixtures greater than 2' in length at a point in addition to the outlet box fixture stud.
- H. Recessed fixtures shall be connected with a maximum 6', 1/2" flexible conduit whip. Flexible conduit shall be of sufficient length to allow relocation of fixtures one tile in any direction without modifications to wiring.
- I. High Bay fixture mounting shall be by factory hooks via 3/8" machine eye bolts installed with double nuts and washers through holes drilled in structural components. Ballasts shall be integrally fused if required by local code.

3.02 ADJUSTING AND CLEANING

- A. Clean lighting fixtures of dirt and debris including fingerprints from reflectors, etc. upon completion of installation.
- B. Protect installed fixtures from damage during remainder of construction period.
- C. Replace burned-out lamps upon completion prior to turning building over to owner.

END OF SECTION 16510

SECTION 16511

EXTERIOR LIGHTING FIXTURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS/QUALITY ASSURANCE

- A. Comply with applicable requirements of ANSI, NEMA, NEC, UL and CSA standards pertaining to the items specified herein. Provide products and components which have been UL, CSA listed and labeled.

1.02 SUBMITTALS

- A. Provide manufacturer's data sheets on lighting fixtures in accordance with Section 16010 requirements.
- B. Lighting fixtures submittal data shall include but not be limited to housings, reflectors, lenses, ballasts, voltage rating, lamps, lamp holders, poles, mounting accessories and photometric data.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Provide lighting fixtures of types and characteristics which comply with manufacturer's standard design, material, components and construction in accordance with published product information and as indicated on the Drawings. Ship fixtures factory-assembled, with parts required for a complete installation. Design fixtures with concealed hinges and catches, with metal parts grounded as common unit, and so constructed as to dampen ballast generated sounds.
- B. Fluorescent lamp ballasts shall be electronic type capable of operating lamp types indicated, high power factor, rapid-start, and low-noise features; Type 1; Class P; sound-rated A. Provide fluorescent lamp ballasts which comply with Certified Ballast Manufacturers Association standards and carry the CBM label. Provide fusing where required by local code.
- C. High-Intensity-Discharge-Lamp Ballasts: Provide HID lamp ballasts, of ratings, types and makes as recommended by lamp manufacturer, which properly mates and matches lamps to electrical supply by providing appropriate voltages and impedances for which lamps are designed. Provide ballasts with ballasts factor which produces Sylvania published lamp lumens. Provide fusing where required by local codes.
- D. Lamps.

Technical Specifications
Section 16511 – Exterior Lighting Fixtures
Project No. 08232-018
Fire Station Number 8

1. Provide incandescent lamps of wattage and styles indicated and as manufactured by Sylvania or Philips.
 2. Provide fluorescent lamps of energy saving types as indicated and as manufactured by Sylvania or Philips.
 3. Provide clear metal halide lamp in wattages indicated and as manufactured by Sylvania, Philips, or Venture.
 4. Provide specialty lamps in types and wattages indicated and as manufactured by Sylvania or Philips
- E. Accessories and Finishes:
1. All poles shall be provided with factory standard hand holes, full base cover and pole cap where applicable.
 2. Pre-stressed, reinforced concrete poles shall be constructed of 6,500 PSI concrete.
 3. Provide all poles with hardware necessary to complete the intended installation.
 4. Contractor is required to submit calculations from the pole manufacturer, sealed by a structural engineer licensed in the State of Florida certifying conformance of the entire pole and base assembly (where applicable) in accordance with calculations dictated in the Florida Building Code, 1606-1.6 and ASCE 7-98.
- F. Provide exterior lighting fixtures as listed in the light fixture schedule on the drawings. The listed manufacturers are the only approved manufacturers. Substitutions will not be considered.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install lighting fixtures at locations and heights as indicated in accordance with manufacturer's written instructions.
- B. Fasten wall mounted fixtures securely to structural supports. Provide structural backing material to ensure fixture does not sag or warp wall.
- C. Install anchor bolts as provided by pole manufacturers and in accordance with manufacturer's recommendations.
- D. Provide #4 bare copper equipment ground bond from branch circuit ground and installed ground rod to metal grounding stud.

- E. Install all poles plumb and straight. In the case of tapered poles, use a plumb bob on the center of the pole and plumb in both major axis. Tighten all anchor bolt connections in accordance with manufacturer's published torque tightening values.

3.02 ADJUSTING AND CLEANING

- A. Clean lighting fixtures of dirt and debris including fingerprints from reflectors, etc. upon completion of installation.
- B. Protect installed fixtures from damage during remainder of construction period.
- C. Replace burned-out lamps upon completion prior to turning site or building over to owner.

END OF SECTION 16511

SECTION 16670
LIGHTNING PROTECTION SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS/QUALITY ASSURANCE

- A. Comply with applicable requirements of NFPA, UL and CSA standards pertaining to the items specified herein. Provide products and components which have been UL, CSA listed and labeled.

1.02 SUBMITTALS

- A. Provide manufacturer's data sheets on all lightning protection components in accordance with Section 16010 requirements.
- B. Installing contractor shall provide proof of minimum of (3) years experience in installation and testing of lightning protections systems. LPI Certification is required.
- C. Provide CAD produced to-scale shop drawings depicting the following:
 - 1. Complete layout of all main roof cable showing location of air terminals, cross interconnecting cables, bonding conductors, down leads and ground rods.
 - 2. Provide details complete with catalog numbers on each style and type of connection and piece of equipment used.
 - 3. Provide description of roof adhesive showing compatibility with roof material. Adhesive shall have no reaction to or interaction with roof material.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Provide lightning protection components of manufacturer's standard materials as indicated by published product information, designed and constructed as recommended by the manufacturer and as indicated on the Drawings.
- B. All materials shall be resistant to corrosion or protected against corrosion.
- C. Combinations of materials that form electrolytic couples of such nature that in the presence of moisture corrosion is accelerated shall not be used.

Technical Specifications
Section 16670 – Lightning Protection Systems
Project No. 08232-018
Fire Station Number 8

- D. One or more of the following material shall be used.
1. Copper: Conductors shall be of the grade required for commercial electrical work and shall be of 95-percent conductivity when annealed.
 2. Aluminum: Conductors shall be of electrical grade aluminum. Aluminum shall not be used where contact with the earth is possible or where rapid deterioration is possible.
 3. Copper Alloys: Copper alloy shall be a resistant to corrosion as copper.
- E. Minimum material requirements shall be in accordance with the following:

Class I materials (buildings <75')

DESCRIPTION	PARAMETER	COPPER	ALUMINUM
Air Terminal, Solid	Diameter	3/8"	1/2"
Main Conductor Cable	Size ea. Strand	17 AWG	14 AWG
	Wgt. per length	187lbs/1000'	95lbs/1000'
	Cross sect. area	57,400 CM	98,600 CM
Bonding Conductor Cable	Size ea. Strand	17 AWG	14 AWG
	Cross sect. area	26,240 CM	41,100 CM

Class II materials (buildings >75')

DESCRIPTION	PARAMETER	COPPER	ALUMINUM
Air Terminal, Solid	Diameter	1/2"	5/8"
Main Conductor Cable	Size ea. Strand	15 AWG	13 AWG
	Wgt. per length	375 lbs/1000'	190 lbs/1000'
	Cross sect. area	115,000 CM	192,000 CM
Bonding Conductor Cable	Size ea. Strand	17 AWG	14 AWG
	Cross sect. area	26,240 CM	41,100 CM

- F. Provide lightning protection system materials manufactured by one of the following:
1. Harger Lightning Protection, Inc.
 2. Heary Brothers Lightning Protection
 3. Thompson Lightning Protection

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install lightning protection materials indicated in accordance with manufacturer's written instructions, applicable requirements of NFPA 780 and UL 96A Master Label with recognized industry practices to insure products serve intended function.
- B. Coordinate all work with that of other trades and in particular with roofing and exterior and interior finish installations.
- C. Provide UL Master Label and certificate. Turn over certificate to owner's representative as part of project close-out documents. Mount Master Label in accordance with UL 96A requirements and indicate location on "as-built" drawings. Coordinate location with Architect prior to installation so as to avoid interference with building aesthetics.
- D. Use stainless steel bolts, screws and other miscellaneous hardware fasteners. Cadmium or galvanized plating is not allowed.
- E. Tighten connections and terminals in accordance with manufacturer's published torque tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

END OF SECTION 16670

SECTION 16721

FIRE ALARM SYSTEM

PART 1 GENERAL

1.01 SCOPE

A. The contractor shall furnish all labor, equipment and materials necessary for the installation of a complete system for fire detection and annunciation. The system shall be a multiplexed, intelligent, point-addressable fire alarm system with UL cross-listed initiating, monitoring, and control devices individually addressable and programmable. The system shall be addressed per plans, electrically supervised, connected, tested and left in first-class operating condition. These materials include:

1. Fire Alarm Control Panel.
2. Initiating Devices.
3. Notification Devices.
4. Auxiliary Devices.
5. Conductors.

1.02 REFERENCES (Locally Adopted Editions)

- A. NFPA 70 - National Electrical Code.
- B. NFPA 72 - National Fire Alarm Code.
- C. Americans with Disabilities Act.
- D. Provide products and components which have been UL listed and labeled.
- E. Florida Building Code & Florida Fire Prevention Code.

1.03 SYSTEM DESCRIPTION

A. The system shall use closed loop initiating device circuits with individual address supervision, individual indicating appliance circuit supervision, and incoming and standby power supervision.

1.04 SUBMITTALS

A. Submittals shall consist of the following data to be submitted concurrently as one

Technical Specifications
Section 16721 – Fire Alarm System
Project No. 08232-018
Fire Station Number 8

package. Submittals which do not include shop drawings will be returned without review.

1. Complete point to point wiring diagram indicating all device addresses, signal circuits, and conductor quantities in plan view (not conceptual) and riser style. Conceptual diagrams will be rejected. Deviations from designed address/device designations will not be accepted.
2. The contractor shall submit complete documentation showing the type, size, rating, style, catalog number, manufacturer's names, and catalog data sheets, for all items to ensure compliance with these specifications. Required copies of this information shall be submitted to the engineer and shall be subject to his approval. Any wiring which is indicated on the drawings is for the purpose of defining intent and not intended to relieve the contractor of any responsibility with respect to furnishing a complete operational system in accordance with the plans and specifications.
3. Battery calculations (in alarm) for the FACP and each notification appliance circuit expander panel (refer to 2.05 B). Each notification appliance circuit expander panel shall be furnished with full panel capacity amp-hour batteries.
4. Contractor will not receive Colwill Engineering Consulting Engineers, Inc. electronic design files. Contractor shall obtain architectural backgrounds to create their shop drawings. Contractor is to submit their signed and sealed (by others) shop drawings to the local authority as the local authority requires for permit.
5. Include any and all exceptions, variances or substitutions listed at the time of bid. Any such exceptions, variances or substitutions which were not listed at the time of bid and are identified in the submittal, shall be grounds for return without review.

1.05 PROJECT RECORD DOCUMENTS

- A. Location of the controls, alarm actuating devices and audible alarm signaling devices shall be as shown on the plans. Any necessary deviations shall be approved by the engineer and indicated on as-built documents.

1.06 SYSTEM OPERATION

- A. The system alarm operation subsequent to the alarm activation of any manual pull station, automatic detection device, or sprinkler flow switch shall be as follows:
 1. The appropriate initiating device type, location, and address shall be indicated on the control panel and the remote annunciator until the alarm has been silenced at the control panel or the remote annunciator. A

Technical Specifications
Section 16721 – Fire Alarm System
Project No. 08232-018
Fire Station Number 8

subsequent alarm received shall scroll the alarm devices addresses on the LCD on the control panel. An alarm tone shall occur within the control panel until silenced.

2. All visual alarm lamps shall flash at a rate of 1-2 Hz until extinguished by the alarm silence switch. Where multiple visual alarm lamp outputs may be viewed from a single location, they shall be synchronized. Provide synchronization strobes and modules as necessary to accommodate.
 3. A supervised signal to notify the local fire department or an approved central station shall be activated.
 4. All doors normally held open by door control devices shall close, where required for smoke control.
 5. Activate signals to security system controlled emergency exit electric door locks to unlock these doors.
- B. The alarm indicating appliances may be silenced by authorized personnel upon entering the locked control cabinet and operating the alarm acknowledge key or by use of the key operated switch at the remote annunciator. Such operation will cause the flashing "Alarm" LED to glow steadily. A subsequent initiating device circuit alarm shall reactivate the signals.
- D. The system shall include a sprinkler supervisory sequence which shall operate as follows:
1. The activation of any standpipe, detector check valve, or sprinkler tamper switch shall activate a distinctive system supervisory audible signal, illuminate a "Supervisory" LED at the system controls and the remote annunciator, and sequence up to three messages on the alphanumeric display. There shall be no confusion between valve tamper activation and opens and/or grounds on fire alarm initiation circuit wiring.
 2. Activating the supervisory acknowledge key will silence the supervisory audible signal while maintaining the "Supervisory" LED indicating the tamper contact is still activated.
 3. Restoring the valve to the normal position shall cause the audible signal and LED to pulse at a march time rate.
 4. Activating the trouble acknowledge key will silence the supervisory audible signal, cause "Trouble" LED to glow, and restore the system to normal.
 5. Each such switch shall have a separate supervisory address.
- E. The activation of any duct smoke detector shall, in addition to the operations

Technical Specifications
Section 16721 – Fire Alarm System
Project No. 08232-018
Fire Station Number 8

listed above, signal to the smoke control panel via an addressable auxiliary relay module. Smoke control panel sequence of operation is under a different Division of these specifications.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. All panels and peripheral devices shall be the standard product of specified manufacturers and shall display the manufacturer's name on each component. The catalog numbers specified under this section are those of Silent Knight and Wheelock and constitute the type, quality of design, material, and operating features desired. Provide system manufactured by one of the following:
 - 1. Silent Knight
 - 2. Edwards Systems Technology
 - 3. Notifier
 - 4. Siemens
- B. All equipment in the system shall be Factory Mutual Research Approved. The manufacturer's product brochures for the fire alarm system shall be submitted to engineer for review. If a Factory Mutual Research Approved central station is provided, the alarm company shall provide Standard Service per FM Global Standard No. 3011.
- C. All Factory Mutual Research Approved materials are required to have the approval mark on the packaging or material itself. Materials without proper labeling are not Factory Mutual Research Approved and shall not be accepted.
- D. The digital communicator will be acceptable provided it is compatible with the receiving equipment at the Factory Mutual Research Approved central station.

2.02 FIRE ALARM CONTROL PANEL (FACP)

- A. Silent Knight 5700, complete with all ancillary components required to satisfy the requirements of the Florida Building Code for group A Assembly Occupancy.
 - 1. The control panel shall receive 120 VAC power (as noted on the plans) via a dedicated circuit breaker with handle lock-on device marked with red and labeled "FIRE ALARM SYSTEM".
 - 2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal supervisory mode of a period of twenty-four (24) hours with five (5) minutes, but not less than that required by the local authority, of alarm

Technical Specifications
Section 16721 – Fire Alarm System
Project No. 08232-018
Fire Station Number 8

indication at the end of this period. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic. Batteries, once discharged, shall recharge at a rate to provide a minimum of 70% capacity in 12 hours. All notification appliance circuit expander panel batteries shall be sized for 100% signal device load on each circuit.

3. All circuits requiring system operating power shall be 24 VDC and shall be individually fused at the control panel.
4. There shall be a sufficient quantity of independently supervised and independently fused indicating appliance circuits for alarm horns and flashing alarm strobes with ratings as noted on drawings (75 candela minimum). Each circuit shall be capable of supplying a minimum of 2.0 amps at 24 VDC in alarm.
5. The FACP shall contain (2) dry-contact relays capable of indicating alarm and trouble conditions.
6. All auxiliary manual controls shall be supervised so that all switches must be returned to the normal automatic position to clear system trouble.
7. The FACP shall contain the following LED indicators; fire alarm, trouble/security alarm, display trouble, AC power, signals silenced.
8. Each independently supervised circuit shall activate the discrete "Trouble" LED to indicate disarrangement conditions per circuit.
9. The incoming power to the system shall be supervised so that any power failure shall be audibly and visually indicated at the control panel. A "Power" LED shall be displayed continuously while incoming power is present.
10. The system batteries shall be supervised so that disconnection of a battery shall be audibly and visually indicated at the control panel.
11. The system expansion modules connected by ribbon cables shall be supervised for module placement. Should a module become disconnected, the system trouble indicator shall illuminate and audible trouble signal shall sound.
12. There shall be one supervisory initiation address for connection of each sprinkler valve tamper switch and one alarm initiation address for each water flow switch to perform the operation listed for 1.06 D. Wiring methods which affect any fire alarm initiation circuits to perform this function shall be deemed unacceptable; i.e.: sprinkler and standpipe tamper switches (N/C contacts) shall NOT be connected to circuits with fire alarm initiation devices (N/O contacts). These independent initiation

Technical Specifications
Section 16721 – Fire Alarm System
Project No. 08232-018
Fire Station Number 8

addresses shall be labeled "Sprinkler Supervisory Tamper" and "Sprinkler Supervisory Flow" and shall differentiate between tamper switch activation, flow switch activation, and wiring faults.

13. Digital alarm communicator transmitter with two line dialer integral to FACP.

2.03 INITIATING DEVICES

- A. Manual Pull stations - Semi flush, double-action, PS-DA.
- B. Smoke detectors - Photoelectric type with environmental compensation, ceiling mounted, 2251-COPTIR.
- C. Smoke detectors - Photoelectric type, duct mounted, DNR with housing with relay base and sampling tube(s). Division 16 Contractor is to provide control wiring to location required for Division 15 to terminate control circuit of air handling unit via relay base or addressable control relay to shut down fans. Detectors are to be furnished by the Division 16 contractor installed by the Division 15 contractor, and circuited by the Division 16 subcontractor. Provide with remote test station. Locate RTS at 46" AFF on wall nearest unit served.
- D. Water flow and tamper switches - Furnished and installed by sprinkler contractor. Provide monitor modules to satisfy 1.06 D above.

2.04 NOTIFICATION DEVICES

- A. Strobe Units - Wall mounted (80" AFF to bottom of lens), Wheelock RSS-24MCW-FR. 15/75 cd strobes will not be accepted. Must comply with ADA for spacing shown on plans. Furnish with synchronization modules as necessary.
- B. Horn/Strobe Units - Multi-candela, wall mounted (80" AFF to bottom of lens), Wheelock NS-24MCW-FR. 15/75 cd strobes will not be accepted. Must comply with ADA for spacing shown on plans. Furnish with synchronization modules as necessary.

2.05 AUXILIARY DEVICES

- A. Notification Appliance Circuit (NAC) Expander - Wheelock FCPS-24S8 shall be supplied to provide sufficient signal capacity for the total signal demand in alarm. Each of the panels provide an 8.0 amp, 24 volt DC power supply dedicated to four 2.0 amp, supervised channels. Provide at least 20% expansion capacity on each signal circuit. Provide batteries sized to handle full expander capacity. The expander panel shall receive 120 VAC power (as noted on the plans) via a dedicated circuit breaker with handle lock-on device marked with red and labeled "FIRE ALARM SYSTEM".
- B. Control Relays - For fan shut-down, alarm signal monitoring by security and

smoke control systems.

- C. Surge Suppressor – UL 1449 listed, hardwired to FACP and each notification appliance circuit expander panel, EDCO model FAS-120AC.
- D. Remote Alarm Annunciator Panel (RAAP) – 80 character LCD.

2.06 CONDUCTORS

- A. Conductors shall be a minimum gauge as required by circuit requirements and UL listed for FPL fire rated service, in accordance with NEC Article 760 and 725 for Class 2 and 3 power limited, 105 degrees Centigrade, 300 volt, fire protective signaling circuits. The cables shall be color coded with an integral polarizing stripe molded into the insulation. All wiring will be color coded the same throughout the entire installation.

PART 3 EXECUTION

3.01 INSTALLATION

- A. The contractor shall notify the Engineer in writing of any field inspector directives prior to proceeding. Failure to notify the Engineer may result in forfeit of change order compensation.
- B. All device addresses shall be programmed to indicate device type and location.
- C. Install products in accordance with manufacturer's instructions.
- D. Install manual station with operating handle 46 inches above finished floor. Install audible and visual signal devices 80 inches above finished floor to bottom of device lens. No visual signal devices are to be ceiling mounted.
- E. All wire will be installed in 3/4" EMT.
 - 1. For alarm initiating circuits - #16 AWG (minimum) twisted, shielded pair, stranded per NEC Article 760.
 - 2. For bell circuits, 24 VDC power, door holder wiring - #16 AWG (minimum) twisted pair, stranded per NEC Article 760.
- F. Mount end-of-line device in box with last device or separate box adjacent to last device in circuit as required by manufacturer.
- G. Mount outlet box for magnetic door holders to withstand 80 pounds pulling force.
- H. Make conduit and wiring connections to door release devices, sprinkle flow switches, sprinkler valve tamper switches, fire suppression system control panels, duct smoke detectors and other fire alarm system devices installed by

Technical Specifications
Section 16721 – Fire Alarm System
Project No. 08232-018
Fire Station Number 8

others.

- I. Automatic Detector Installation: Conform to NFPA 72 and manufacturer's instructions.
- J. Junction boxes shall be spray painted red.
- K. Contractor shall provide a framed typewritten address schedule which clearly indicates devices connected to each alarm initiating device circuit and signal circuit and hang adjacent to the FACP.
- L. All conduits shall contain #16 AWG equipment ground unless manufacturer provides documentation to the engineer which negates the need for this conductor.

3.02 FIELD QUALITY CONTROL

- A. Test in accordance with NFPA 72 and local fire department requirements.
- B. All work shall be performed by a State of Florida Certified Electrical Contractor (EC) or Alarm Contractor I (EF).

3.03 SUPERVISION AND TESTING

- A. The installation shall be supervised by an authorized manufacturer's representative.
- B. Upon completion, the system shall be tested in accordance with NFPA 72 in the presence of the owner and tenant's representative, the Fire Marshal, and an authorized manufacturer's representative.
- C. Manufacturer's and contractor's certification of completed, operable, and successfully tested system shall be furnished to the owner.
- D. Indicate satisfactory completion of required tests and inspections.

END OF SECTION 16721

SECTION 16741

TELEPHONE AND DATA SYSTEM

PART 1 GENERAL

1.01 RELATED DOCUMENTS/QUALITY ASSURANCE

- A. Comply with applicable requirements of ANSI, NEMA, NEC, UL and CSA standards pertaining to the items specified herein. Provide products and components which have been UL, CSA listed and labeled.

1.02 SUBMITTALS

- A. None required.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Outlet Boxes: Outlet boxes shall consists of 4" square box with depth as required per field conditions with single gang tile ring.
- B. Conduits: Telephone instrument conduits shall consist of ¾" minimum EMT interior and 1" minimum PVC exterior (and underground).
- C. Backboards: Backboard shall consist of (1) 4' x 8' x ¾" Grade AC plywood sheet.
- D. Ground Bus: Ground bus shall consist of (1) ¼" x 4" x 20" drilled copper bus bar. Equal to Newton Instrument Company system 3055.

PART 3 EXECUTION

3.01 INSTALLATION

- A. In insulated walls and fire-rated walls, install (1) ¾" conduit from telephone outlet box to the accessible ceiling space and terminate with insulated bushing.
- B. In non-insulated walls and non-fire-rated walls, eliminate the outlet box and install a single gang tile ring and pull string up through the top plate and tied off.
- C. Paint telephone backboard with (2) coats of white, fire retardant paint.
- D. Install ground bus assembly adjacent to electrical outlet on backboard.
- E. Clean all conduits after installation install pull string and secure at each terminus.

Technical Specifications
Section 16741 – Telephone and Data System
Project No. 08232-018
Fire Station Number 8

- F. Route all conduits to minimize quantity of ells.
- G. Install long-sweep, 90-degree rigid galvanized steel ells on all PVC telephone service conduits.

END OF SECTION 16741