



ADDENDUM 1
February 12, 2019

ITB TDD 02-19
Turtle Friendly Lighting Retrofits on Conservation Lands

This addendum is to provide technical specifications and answers to questions asked at pre-bid meeting as well as those received via email.

- The opening date for this ITB remains February 20, 2019 at 3:15 PM CST.
- Technical Specifications are attached for reference in bidding this project.

Questions and Answers

1. Verify model number of the BmG fixture (Plans vs Cutsheet); **Model number shall be ZXL30i-CM-AMB-WT, 10W, 40-deg Reflector.**
2. Verify Pole Heights that are required; **Pole heights shall be either 12' or 20' as scheduled and indicated on the photometric sheets.**
3. Verify finish color of Fixture Types BmD and BmE; **Fixtures to have White finish color. Confirm with Owner prior to ordering.**
4. **Technical Specifications are included in this addendum.** (These are attached.)
5. What is the MBE/WBE requirement for this project? **Not a requirement of the grant.**
6. The bid sheet doesn't have a section for the Wayside Park area – is this to be included in the scope of work? **YES**
7. Is there a preferred manufacturer for the Surge Suppression Schedule on Drawing E-2.7? **See Technical Specifications; preferred manufacturer is SSI (Surge Suppression Inc.).**
8. Can you provide any indication of the “nearest unswitched 120 volt circuit” referenced on Drawing E-5.10? **To be field verified by Contractor.**
9. Can you provide any indication of the “nearest unswitched 120 volt circuit” referenced on Drawing E-7.10? **To be field verified by Contractor.**
10. When asking for Unit Pricing on the Bid Sheet, how would you like to define a “unit” for items such as – 1” PVC Conduit; Trenching, Backfill; Paving? **Per LF, LF, LF and CY respectively.**
11. Are equal Lighting Fixtures acceptable for this project? If yes, will the performance period start once submittals are approved? **Yes; other products may be submitted for review during the shop drawing process after award of the project.**
12. Do we need to provide photometrics and submittal package for Equal fixtures at bid day? **No; products may be submitted for review during the shop drawing process after award of the project.**
13. Do they have any light level requirements for parking lot areas or egress areas? **Use 350mA drivers max; Number of LED's in array shall not exceed 55; Maximum light level at any point shall not exceed 2.0 foot-candles; Provide not less than a 0.2 foot-candle minimum; Target average illuminance shall be approximately 0.6 foot-candles; 10:1 or better max/min; 4:1 or better avg/min.**
14. Are we to assume the existing wiring to all fixtures and poles lights are not in need of replacement and/or repair? **Correct.**
15. In the event the projects are awarded to different contractors, will each location be given the same 120 days for performance period? **The contract (regardless of the number of locations awarded) will be given the same 120 day performance period.**

16. The line item for “Island Pier Parking lot indicates “1”PVC conduit; Trenching, backfill; paving”. There was discussion at the pre-bid, the county may be able to take care of the paving. Will the county be responsible for any paving requirements as well as replacement, patching and/or repairs of concrete and/or asphalt? **The selected vendor will be required to complete all aspects of the project.**
17. The lead time for the lighting package typically ranges from 6-12 weeks depending on the item (this usually do not include shipping time). Any long lead times will challenge the 120 day performance period. Please advise how this will be address? **If lead times prove to be excessive. The County will work with the selected vendor to address any delays.**
18. Does Davis-Bacon Act apply to this project? If so, please provide wage determination scale. **No**
19. Are the pole bases required to be engineered and stamped by structural engineer? **Yes.**
20. Will the county provide maintenance of traffic for both high pedestrian and vehicular traffic areas? **The County will provide support to ensure work areas are safe.**
21. Will an electrical permit be required? If so, for each separate location? **An electrical permit will be required; coordinate with County regarding per location requirements.**
22. The insurance requirements in the bid doc’s may not be correct when working over water as on the Pier Structure itself, please verify and issue requirements that may be needed, if additional requirements are needed. It is noted that WC referenced to Longshore Harbor Workers is in the insurance requirements pages. **EPA Insurance in the amount of \$1M will be required since they vendor will be working over conservation lands.**
23. Is a Structural Engineer required to provide stamped and engineered drawing of the foundations of the poles or can a prestress company design be adequacy? **Provide stamped/engineered foundation drawings for review during the shop drawing process after award of contract.**
24. If the lighting package in the bid doc’s are a basis of design and budget, please have the engineer select additional manufactures and equal lighting packages to price as the package in the doc’s could be construed as sole sourcing and public funds cannot be sole sourced unless there is no other manufactures available. **Other products may be submitted for review during the shop drawing process after award of the project. The products listed as the basis of design were selected by a joint effort among the County, FWC and the Engineer, but no intent is made to sole-source; see Drawing E2.0, General Notes 8, 9, 10, and 12.**
25. Please clarify what is exactly in the Bid Sheet(s) unit pricing, one page says “labor and materials” and one page is “unit pricing” because I’m confused as the basis of design lighting does have cost and quantity amounts listed in dollar amounts. **Please disregard the budgetary prices contained in the bid package; prospective bidders shall provide their own pricing. Unit pricing is required for the major items of work listed, such as but not limited to: light poles, luminaires, surge protective devices, conduit, and conductors.**
26. The 120 day completion is of concern and with lead times on certain specialty items may take longer than normal due to our current administration tariff/ trade wars and shutdowns. Would it be possible to delay the NTP till after the approval of the lighting submittal package? **If lead times prove to be excessive. The County will work with the selected vendor to address any delays.**

27. At the pre-bid meeting there was talk of how to cut and patch the existing parking lot surfaces, I suggested patching back with concrete or something other than asphalt, but with further thought, as some of the existing conditions are in need of repair anyway, could the County patch it back after the work is complete? Or what would be acceptable? **The selected vendor will be required to complete all aspects of the project.**
28. In the bidding process, is it safe to assume the line voltage is at the lighting fixtures to be replaced? The reason I ask is that on the pier itself, and other locations, we could easily run into existing wiring issues and to provide and complete and usable finished product may not be possible without extensive trouble shooting. Is trouble shooting required? **Assume line voltage is available at the fixture locations. Any additional work, beyond that required by the plans, will be discussed on a case by case basis.**
29. Is the contractor required to provide slit fencing at any excavation site? **Coordinate/confirm with Owner.**
30. Is the contractor required to do MOT's or can the County help with that on the areas that may need to be closed off to safely do the work? **The County can assist.**
31. There may be special warranty requirements that I can't seem to find in the bid doc's, please provide a written warranty requirement as some contractors do a 1-year warranty and some do 90 days. **Provide a 1-year warranty.**
32. Is the 120 day completion per bid items or is it all 5-of the labor and material bid items? The sheet that says the county reverses the right to award to more than one vendor. **If lead times prove to be excessive. The County will work with the selected vendor to address any delays. The contract (regardless of the number of locations awarded) will be given the same 120 day performance period.**
33. Bid Sheet Supplemental Required Items unit pricing. Is the unit pricing already listed in what appears to be a cut sheet submittal package? And is that to be use a budget for the County or the Contractor to provide an installed price using that unit number? **This is what we used for budgeting purposes. Contractors are welcome to use this as a base line.**
34. Bid Sheet Supplemental Required Items unit pricing. As far as I know, there is not a #8 Aluminum Conductor made at this time and is the County sure they want Aluminum Conductors at all? **Replace all occurrences of #8 AWG Aluminum conductor in the plans/specifications with #6 AWG Aluminum Conductor.**
35. Is the County providing the Lighting Package or does the Contractor? **All work and materials to be provided by the Contractor unless otherwise directed.**

SECTION 01026
SCHEDULE OF VALUES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Submit a Schedule of Values for Major items of Work (see Paragraph 1.01 D below) to the Engineer for approval within ten calendar days after award of Contract.
- B. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
 - 1. Construction schedule.
 - 2. Application for payment forms, including continuation sheets.
 - 3. List of subcontractors.
 - 4. List of products.
 - 5. List of principal suppliers and fabricators.
 - 6. Schedule of submittals
- C. No payment request (including the first) will be approved until the Schedule of Values has been approved by the Engineer.
- D. Major items of work required in Schedule of Values:
 - 1. All proposed (new) luminaires, per Each
 - 2. All proposed (new) light poles, per Each
 - 3. All proposed (new) pole foundations, per Each
 - 4. All proposed (new) lamps/bulbs
 - 5. All proposed (new) surge protection devices (SPD's) to be installed in panel boards or pole bases, per each.
- E. Provide separate costs (cost breakdowns) for each project area as specified:
 - 1. Island Pier
 - a. Island Pier Parking Lot
 - b. Island Pier Buildings/Structures
 - 2. Wayside Park:

- a. Wayside Park Parking Lot
- b. Wayside Park Buildings/Structures
- 3. Beasley Park
 - a. Buildings/Structures Only
- 4. James Lee Park
 - a. James Lee Park Parking Lot
 - b. James Lee Park Buildings/Structures

1.02 **FORMAT AND CONTENT**

- A. Provide at least one line item for each Major item of Work identified in Part 1.01 D above.
 - 1. Include the following Project identification;
 - a. Project name and location.
 - b. Name of Owner.
 - c. Project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 - 2. Arrange the Schedule of Values in tabular form with columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value.
 - h. Percentage of Contract Sum to nearest one-hundredth percent, adjust to total 100 percent.
 - 3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate evaluation

of Applications for Payment. Break subcontract amounts down into several line items if needed. Round amounts to nearest whole dollar; the total shall equal the Contract Sum.

4. Provide a separate line item for each part of the Work where Applications for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed.
5. Provide separate line items for initial cost of materials, for each subsequent stage of completion, and for total installed value.
6. Show line items for indirect costs and margins on costs only when such items are listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete. Include the total cost and proportionate share of general overhead and profit margin for each item.
 - a. Temporary facilities and items that are not direct cost of work-in-place may be shown as separate line items or distributed as general overhead expense.
7. Update and resubmit the Schedule of Values when Change Orders or Construction Change Directives change the Contract Sum.

PART 2 PRODUCTS (NONE THIS SECTION)

PART 3 EXECUTION (NONE THIS SECTION)

END OF SECTION 01026

**SECTION 16010
GENERAL PROVISIONS, ELECTRICAL**

PART 1 GENERAL

1.01 SUMMARY

- A. This section of the specification outlines the provisions of the contract work to be performed under this Division. This section applies to and forms a part of each section of the specifications in Division 16 and all work performed under the electrical contract.
- B. In addition, work in this Division is governed by the provisions of the Bidding Requirements, Contract Forms, General Conditions, and all sections under General Requirements.
- C. These specifications contain statements which are more definitive or more restrictive than those contained in the General Conditions. Where these statements occur, they shall take precedence over the General Conditions. Where the word "provide" or "provision" is used, it shall be definitely interpreted as "furnishing and installing complete in operating condition." Where the words "as indicated" or "as shown" are used, they shall mean as shown on contract drawings. Where items are specified in the singular, this Division shall provide the quantity as shown on the drawings plus any spares or extras mentioned on drawings or in specifications. All specified and supplied equipment shall be new.

1.02 CODES, PERMITS AND FEES

- A. Comply with all applicable laws, ordinances, rules, regulations, codes or rulings of governmental units having jurisdiction, as well as standards of the National Fire Protection Association and serving utility requirements.
- B. Obtain and pay for permits, fees, inspections, meters, utility connection and extensions and the like associated with work in each section of this Division.
- C. Installation procedure, methods and conditions shall comply with the latest requirements of the Federal Occupational Safety and Health Act (OSHA).

1.03 EXAMINATION OF PREMISES

- A. Examine the construction drawings and premises prior to bidding. No allowances will be made for not being knowledgeable of existing conditions.

1.04 REFERENCES

- A. American National Standard Institute (ANSI)
- B. National Electrical Manufacturers Association (NEMA)
- C. Institute of Electrical and Electronic Engineers (IEEE)

- D. National Fire Protection Association (NFPA)
- E. National Electrical Contractors Association (NECA)
- F. International Electrical Testing Association (NETA)
- G. Underwriters' Laboratories, Inc. (UL)

1.05 DEFINITIONS

- A. Exposed: Not concealed.
- B. Unfinished Space: A room or space that is ordinarily accessible only to building maintenance personnel, a room noted on the "Finish Schedule" with exposed and unpainted construction for walls, floor or ceilings, or specifically mentioned as "unfinished".
- C. Finished Spaces: Any space ordinarily visible to the visiting public, including exterior areas.
- D. "Wiring": includes, in addition to conductors, all raceways, conduit, fittings, boxes, switches, hangers, and other accessories related to such wiring.
- E. "Regulating Authorities": means all governmental, utility, and fire protection authorities having jurisdiction.
- F. Concealed: Hidden from sight, as in trenches, chases, hollow construction, above furred spaces, suspended ceilings (acoustical or plastic type), or exposed to view only in tunnels, attics shafts, crawl spaces, unfinished spaces, or other areas solely for maintenance and repair.
- G. Furnish: means to supply and deliver to the job.
- H. "Approved Equal": means equipment or materials which, in the opinion of the Engineer, is equal in quality, durability, appearance, strength, design, and performance to equipment or material specified and will function adequately in accordance with the general design.
- I. "Provide": means to supply, erect, install, and connect up complete, the particular work referred to, in readiness for regular operation.

1.06 WORK MATERIALS

- A. Materials provided under the contract for which the UL label is not normally available shall be mounted in separate enclosures and wired to the labeled units in an acceptable manner.
- B. All electrical materials and equipment shall be new and of the type and quality specified, listed by UL and bear their label where standards have been established, in compliance with the applicable standards of NEC (NFPA 70), NFPA, ANSI, IEEE and

NEMA. Replace or repair any nonconforming, damaged or defective items at no extra cost to the Owner.

- C. Deliver materials or equipment to the Project in the manufactures original, unopened, labeled containers, and adequately protect against moisture, tampering or damage from improper handling or storage. Do not deliver materials to the job before they are ready for installation unless adequate security is provided.
- D. Perform all labor in a thorough and workmanlike manner, to the satisfaction of the Engineer. Contractor must staff the project with sufficiently skilled workmen, including a fully qualified superintendent, to complete the work in the time allocated. Superintendent must be qualified to supervise all of the work of this Division.
- E. Materials and equipment shall be standard products of a reputable manufacturer regularly engaged in manufacture of the specified item. Where more than one unit is required of any item, furnish by the same manufacturer, except where specified otherwise. Install material and equipment in accordance with manufactures recommendations. Should variance between plans and Specifications occur with these, contact the Engineer immediately so that variations in installation can be known by all parties concerned.

1.07 SHOP DRAWINGS

- A. Submit all shop drawings and data in accordance with the Special Conditions and one time for all equipment provided under this Division. The complete electrical shop drawings shall be bound in one hard-cover, 3-ring binder indexed to this Division.
- B. Shop drawing submittals processed are not change orders. The purpose of shop drawing submittals by the Contractor is to demonstrate that the Contractor understands the design concept; he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. If deviation, discrepancies or conflicts between shop drawings and specifications are discovered, either prior to or after shop drawings submittals are processed, the design drawings and specifications shall control and shall be followed.
- C. Manufacturer's data and dimension sheets shall be submitted giving all pertinent physical and engineering data including weights, cross-sections and maintenance instruction. Standard items of equipment such as receptacles, switches, plates, etc., which are cataloged items, shall be listed by manufacturer.
- D. Index all submittals and references to these specifications.

1.08 EQUIPMENT PURCHASES

- A. Arrange for purchases and delivery of all materials and equipment within 20 days after approval of submittal. All materials and equipment must be ordered in ample quantities for delivery at the proper time. If items are not on the project in time to expedite completion, the owner may purchase said equipment and materials and deduct the cost from the Contract Sum.

- B. Provide all materials of similar class or service by one manufacturer.

1.09 COOPERATIVE WORK

- A. Correct without charge any work requiring alteration due to lack of supervision or failure to make proper provisions in time. Correct without charge any damage to adjacent work caused by the alteration.
- B. Cooperative work includes: 1) General supervision and responsibility for proper location and size of work related to this Division, but provided under other sections of these specifications. 2) Installation of sleeves, inserts and anchor bolts for work under each section in this Division.

PART 2 PART 2 - PRODUCTS

2.01 WORK AND MATERIALS

- A. All electrical materials and equipment shall be new and of the type and quality specified, listed by UL and bear their label where standards have been established, in compliance with the applicable standards of NEC (NFPA 70), NFPA, ANSI, IEEE and NEMA. Replace or repair any nonconforming, damaged or defective items at no extra cost to the Owner.
- B. Perform all labor in a thorough and workmanlike manner, to the satisfaction of the Engineer. Contractor must staff the project with sufficiently skilled workmen, including a fully qualified superintendent, to complete the work in the time allocated. Superintendent must be qualified to supervise all of the work of this Division.
- C. Materials provided under the contract for which the UL label is not normally available shall be mounted in separate enclosures and wired to the labeled units in an acceptable manner.

2.02 APPROVAL OF MATERIALS AND EQUIPMENT

- A. Refer to Supplementary General Conditions for description of alternate material and equipment.

PART 3 PART 3 - EXECUTION

3.01 VERIFICATION OF DIMENSIONS

- A. Scaled and figured dimensions are approximate only. Before proceeding with work, carefully check and verify dimensions, etc., on Project Plans and drawings, and be responsible for properly fitting equipment and materials together and to the structure in space provided.
- B. Drawings are essentially diagrammatic, and many offsets, bends, pull boxes, special fittings and exact locations are not indicated. Carefully study drawings and premises in order to determine best methods, exact locations, routes building obstructions, etc., and install apparatus and equipment in available locations to avoid obstructions,

preserve headroom, and keep openings and passageways clear.

3.02 CUTTING AND PATCHING

- A. Cut existing work and patch as necessary to properly install new work. As the work progresses, leave necessary openings, holes, chases, etc., in their correct location. If the required openings, holes, chases, etc. are not in their correct location, make the necessary corrections at no cost to the Owner. Avoid excessive cutting and do not cut structural members with the consent of the Engineer.

3.03 CLOSING-IN OF UNINSPECTED WORK

- A. Cover not work until inspected, tested and approved. Where work is covered before inspection and test, uncover it, and when inspected, tested and approved, restore all work to original proper condition.

3.04 CONCRETE

- A. Where used for structures to be provided under the contract such as bases, etc. concrete work and associated reinforcing shall be as specified under that Division.
- B. See other sections for additional requirements for underground vault, cable ducts, etc.

3.05 ACCESSIBILITY

- A. All required access doors or panels in wall and ceilings are to be furnished and installed as part of the work under this Division.
- B. Provide doors which pierce a fire separation with the same fire rating as the separation.
- C. Coordinate work of the various sections to locate specialties requiring accessibility with others to avoid unnecessary duplication of access doors.
- D. Refer to "Finish Schedule" for types of walls and ceilings in each area and Project Plans and drawings for rated wall construction.
- E. Install all control devices or other specialties requiring reading, adjustment, inspection, repairs, removal or replacement conveniently and accessible throughout.

3.06 FLASHING

- A. Flash and counterflash all conduits penetrating roofing membrane.

3.07 CONSTRUCTION FACILITIES

- A. General: under this section of the specifications, execute all work in a manner to provide safe and lawful ingress and egress to the Owner's establishment, and such facilities shall be kept clear of materials or equipment as directed by Engineer.

- B. Furnish and maintain from the beginning to completion all lawful and necessary guards, railings, fences, canopies, lights, warning signs, etc. Take all necessary precautions required by city and state laws and OSHA to avoid injury or damage to any persons and property.
- C. Temporary power and lighting for construction purposes shall be under this Division. Electrical Contractor shall provide minimum OSHA required lighting levels for construction site as applicable. In addition, Electrical Contractor shall provide task lighting or enhanced lighting levels as required for specific construction activities. Coordinate power and lighting needs with General Contractor. The use of existing facility electrical distribution system to supply power to temporary power and lighting shall be approved by the Owner prior to any installations. All temporary installations shall conform to the requirements of NEC Article 305, Temporary Wiring, as applicable.

3.08 GUARANTEE

- A. Guarantee all material, equipment and workmanship for all sections under this Division in writing to be free from defects of material and workmanship for two years from date of final acceptance, as outlined in the General Conditions. Replace without charge any material or equipment proving defective during this period. The guarantee shall include performance of equipment under all conditions of load, installing any additional items of control and/or protective devices as required.

3.09 WIRING OF EQUIPMENT FURNISHED UNDER OTHER SECTIONS

- A. All electrical wiring including power wiring and control wiring, including all raceways, wiring, outlet and junction boxes and labor for installation of the wiring and equipment shall be included in this section of the specifications.
- B. Wiring diagrams complete with all connection details shall be furnished under each respective section.

3.10 EQUIPMENT ROUGH-IN

- A. Rough in all equipment, fixtures, etc. as designated on the drawings and as specified herein. The drawings indicate only the approximate location of rough-ins. The exact rough-in locations must be determined from large scale certified drawings. The Contractor shall obtain all certified rough-in information before progressing with any work for rough-in connections.
- B. Be responsible for providing all outlets and services of proper size at the required location.
- C. Minor changes in the contract drawings shall be anticipated and provided for under this Division to comply with rough-in drawings.

3.11 OWNER FURNISHED AND OTHER EQUIPMENT

- A. Provide all final connections for the following:

1. Electrical equipment furnished under other sections of the specifications (except as otherwise designated).
2. Owner furnished equipment as shown of the drawings.
3. All equipment furnished under this Division.

3.12 RUSTPROOFING

- A. Rustproofing must be applied to all ferrous metals as follows:
1. Hot-dipped galvanized after forming of angle iron, bolts, anchors, etc.
 2. Hot-dipped galvanized after the fabrication for junction boxes and pull boxes cast in concrete.

3.13 GENERAL WIRING

- A. Drawings, in general, indicate location of motor starting and other equipment. Exact location of motors and other devices are to be determined in field by the Contractor. Provide an electrical feed for all equipment, not smaller than shown or NEC size where size is omitted from drawings, together with a suitable circuit protective device. Verify panel schedules and layout, maintain number of spares of branches indicated.
- B. Conductors for branch circuit lighting, receptacle, power and miscellaneous systems must be a minimum of #12 AWG. Wire indicated specifically to be larger than #12 must be increased the entire length of the circuit.
- C. Conductors sizes for lighting, receptacles, and small motor branch circuits with less than 20 ampere connected load may not be shown. Conductors for such circuits are sized as follows: for branch circuits 75 feet in length from branch circuit panel to center of load, not smaller than #12 AWG, up to 150 feet not smaller than #10 AWG, up to 200 feet not smaller than #8 AWG.
- D. Verify location and mounting height of all receptacles, wall mounted fixtures, switches, and other equipment before roughing in. See drawings for pertinent information. Refer questionable cases to Engineer.
- E. Where located adjacent in walls, outlet boxes shall not be placed back to back, nor shall extension rings be used in place of double boxes, all to limit sound transmissions between rooms.
- F. Complete rough-in requirements of all equipment to be wired under the contract are not indicated. Coordinate with respective trades furnishing equipment or Engineer, as the case may be, for complete and accurate requirements to result in a neat, workmanlike installation.
- G. Provide proper size and type of feeds from proper sources for all such items indicated, checking drawings of all trades to ensure inclusion of all items.

- H. A maximum of 3 branch circuits may be installed in an individual conduit run. In addition, a continuous, full size ground wire (the same size as the phase conductors) shall be installed in all branch, feeder or service conduits. All junction boxes, pull or outlet boxes shall be bonded to the ground wire by an approved (listed) means.
- I. All branch circuit or feeder conduits runs shall be routed from the switchboard or panelboard (or extension cabinet) to the load or outlet device. The use of large junction boxes, pull boxes or wireways as a collection point for conduit runs shall not be permitted. Multiple circuits shall not be installed in the same pull box except for the multiple circuit conduit runs noted above (maximum of 3 circuits).
- J. The Contractor shall not access any fire alarm or emergency power panels without notification of and permission from Owner. It shall be the Contractor's responsibility to coordinate and schedule all such activity with the Owner.
- K. When a circuit is de-energized the disconnect device shall be locked in the open position with a tag securely attached. The lock is to be the property of the electrician who opened the device, not a company or shop stock. The tag shall indicate who opened the device, when it was opened and a telephone number for contact. All work being done at a circuit breaker panelboard shall be tagged at the circuit breaker.
- L. No bus taps, switches, circuit breakers, etc. shall be installed in or on energized equipment without the prior knowledge and approval of a facilities electrical supervisor. All such devices shall be locked and tagged in the open position until the work is completed and approved by the facilities electrical supervisor. The Owner will inspect, test (as required) and accept the Contractor's work prior to being energized. Acceptance of any work by the owner does not relieve the Contractor of any responsibility for completing and installing work in accordance with the contract documents.

3.14 SEPARATE CONDUIT SYSTEMS

- A. Each system shall be contained in a separate conduit system. This includes each power system, each lighting system, each signal system of whatever nature, telephone, emergency system, sound system, control system, fire alarm system, etc.

3.15 FIRE-STOP

- A. Wherever a wall, ceiling, or floor is penetrated with raceways, including but not limited to, conduit, cable tray, and wireway, the hole shall be filled with firestop upon completion of all affected raceways.
- B. The firestop material shall restore the wall to the same fire rating as it had before the penetration was made. Solid firestop material may be used to block up the largest part of the hole. Expanding, sprayed-on foam shall be used to finish filling in around cables and filling all small holes.
- C. This provision shall apply to all walls, interior and exterior. In the event any side of such a wall is in a finished area, the penetration shall be made to match the wall finish with the application of matching materials.

3.16 CLEANUP

- A. In addition to cleanup specified under other sections, thoroughly clean all parts of the equipment. Where exposed part are to be painted, thoroughly clean off any spattered construction materials and remove all oil and grease spots. Wipe the surface carefully and scrape out all cracks and corners.
- B. Use steel brushes on exposed metal work to carefully remove rust, etc., and leave smooth and clean.
- C. During the progress of the work, keep the premises clean and free of debris.

3.17 PAINTING

- A. Paint all unfinished metal with one coat of rust-inhibiting primer. (Galvanized and factory painted equipment shall be considered as having a sub-base finish.)

3.18 CONNECTIONS TO SERVICES

- A. Furnish all connections to electrical services furnished under other Divisions, except as otherwise specifically designated. Provide all necessary connections, etc., required to properly connect all services and equipment.

3.19 PROJECT CLOSEOUT

- A. Prior to completion of project, compile a complete equipment maintenance manual for all equipment supplied under sections of this Divisions, as describe below.

3.20 EQUIPMENT LISTS AND MAINTENANCE MANUALS

- A. Prior to completion of job, Contractor shall compile a complete equipment list and maintenance manual. The equipment list shall include the following items for every piece of material and equipment supplied under this section of the specifications:
 - 1. Name, model and manufacturer with complete parts drawings and list and local supplier for parts and replacement and telephone number.
 - 2. All tags, inspection slips, instruction packages, etc., removed form equipment as shipped from the factory, properly identified as to the piece of equipment it was taken from.
 - 3. Maintenance manuals shall be furnished for each applicable section of the specifications, shall be suitably bound with hard covers, and shall include all available manufactures' operation and maintenance instructions, together with as-builds drawings and lists herein before specified and all other diagrams and instructions necessary to properly operate and maintain the equipment. The equipment list and maintenance manuals shall be submitted in duplicate to the Engineer for approval not less than 10 days prior to the completion of the job. The maintenance manuals shall also include the name, address and phone number of the General Contractor and all subcontractors involved in any of the work specified

herein. The maintenance manuals shall be finally provided in six copies.

3.21 TESTING

- A. Motors shall be operating in proper rotation and control devices functioning properly. Check all motor controllers to determine that properly sized overload devices are installed. Check all electrical equipment for proper operation.
- B. Upon completion of the electrical work, the entire installation shall be tested and demonstrated to be operating satisfactorily. Wiring shall be tested for continuity, short circuits and/or accidental grounds. All systems shall be entirely free from grounds, short circuits, and any and all defects.
- C. Test and adjustments shall be made prior to acceptance of the electrical installation by the Engineer, and a certificate of inspection and acceptance of the electrical installation by local inspection authorities shall be provided.
- D. All equipment or wiring provided, which when tested, prove to be defective or operating improperly, shall be corrected or replaced promptly, at no additional cost to the Owner.
- E. The insulation of all feeder (100 amps or larger), switchboard, motor control starters, panelboards and motors shall be checked and verified by performing a megger test. The megger test voltage and resulting ohm values shall be as specified by National Electrical Testing Association standards. The Contractor shall keep a record of all megger testing to indicate the date, the equipment tested, testing values and test results. These records shall be made available as requested and shall be included with the project record documents.

END OF SECTION 16010

**SECTION 16060
GROUNDING AND BONDING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Grounding and bonding components, including grounding electrodes and conductors, equipment grounding conductors, and bonding to complete grounding system consisting of:
 - 1. Metal underground water pipe.
 - 2. Metal frame of building.
 - 3. Rod electrodes.

1.02 REFERENCES

- A. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association.

1.03 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: 5 ohms.

1.04 SUBMITTALS

- A. In accordance with project Specifications.
- B. Test Reports: Indicate overall resistance to ground.
- C. Project Record Documents: Record actual locations of components and grounding electrodes.
- D. Certificate of Compliance: Indicate approval of installation by authority having jurisdiction.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience with service facilities within 100 miles of Project.

- C. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Cooper Power Systems.
- B. Framatome Connectors International.
- C. Lightning Master Corporation.
- D. Substitution: Engineer-approved equal.

2.02 CONNECTORS AND ACCESSORIES

- A. Exothermic Connections:
 - 1. Product: CADWELD.
 - 2. Substitution: Engineer-approved equal.
- B. Wire: Stranded copper.
- C. Grounding Electrode Conductor: Size as indicated on drawing.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions prior to beginning work.
- B. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.02 INSTALLATION

- A. Install ground electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
- B. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing. Bond steel together.
- C. Provide bonding to meet requirements described in Quality Assurance.
- D. Bond together metal siding not attached to grounded structure; bond to ground.

- E. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

3.03 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA STD ATS except Section 4.

END OF SECTION 16060

**SECTION 16075
ELECTRICAL IDENTIFICATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates and labels.
- B. Wire and cable markers.
- C. Conduit markers.

1.02 REFERENCES

- A. NFPA 70 - National Electrical Code; National Fire Protection Association.

1.03 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Seaton Name Plate Company; Model 2060 Seaton-Ply engraved plastic plaque.
- B. Substitution: Engineer-approved equal.

2.02 NAMEPLATES AND LABELS

- A. Nameplates: Engraved three-layer laminated plastic, black letters on white background.
- B. Locations:
 - 1. Disconnect switch
 - 2. Transformers
 - 3. Each electrical distribution and control equipment enclosure.
 - 4. Circuit breakers.
- C. Letter Size:
 - 1. Use 1/8 inch letters for identifying individual equipment and loads.

2. Use 1/4 inch letters for identifying grouped equipment and loads.

D. Labels: Embossed adhesive tape, with 3/16 inch white letters on black background. Use only for identification of individual wall switches, receptacles, and control device stations.

2.03 WIRE MARKERS

A. Manufacturers:

B. Description: split sleeve type wire markers.

C. Locations: Each conductor at panelboard gutters, pull boxes, outlet boxes, junction boxes, and each load connection

D. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.

2.04 CONDUIT MARKERS

A. Location: Furnish markers for each conduit longer than 6 feet.

B. Spacing: 20 feet on center.

2.05 UNDERGROUND WARNING TAPE

A. Description: 4 inch wide plastic tape, detectable type colored red with suitable warning legend describing buried electrical lines.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

3.02 INSTALLATION

A. Install nameplates and labels parallel to equipment lines.

B. Secure nameplates to equipment front using screws.

C. Secure nameplates to inside surface of door on panelboard that is recessed in finished locations.

D. Identify underground conduits using underground warning tape. Install one tape per trench at 3 inches below finished grade.

END OF SECTION 16075

**SECTION 16123
WIRE AND CABLE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wire and cable for 600 volts and less.
- B. Wiring connectors and connections.

1.02 REFERENCES

- A. NECA (INST) - NECA Standard of Installation; National Electrical Contractors Association.
- B. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association.
- C. NFPA 70 - National Electrical Code; National Fire Protection Association.

1.03 SUBMITTALS

- A. In accordance with the project Specifications.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.
- C. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 WIRING REQUIREMENTS

- A. Concealed Dry Interior Locations: Use only building wire with Type XHHW insulation in raceway.
- B. Exposed Dry Interior Locations: Use only building wire with Type XHHW insulation in raceway.
- C. Above Accessible Ceilings: Use only building wire with Type XHHW insulation in raceway.
- D. Wet or Damp Interior Locations: Use only building wire with Type XHHW-2 insulation in raceway.

- E. Exterior Locations: Use only building wire with Type XHHW-2 insulation in raceway.
- F. Underground Installations: Use only building wire with Type XHHW-2 insulation in raceway.
- G. Motor Branch Circuits: Use three- or four-conductor Type TC cable or single conductor Type XHHW-2 wire. Where single conductor wire is used, each single phase motor circuit must include 3 conductors and each three phase circuit must include 4 conductors.
- H. Use solid conductor for feeders and branch circuits 10 AWG and smaller.
- I. Use stranded conductors for control circuits.
- J. Use conductor not smaller than 12 AWG for power and lighting circuits.
- K. Use conductor not smaller than 14 AWG for control circuits.
- L. All conductors shall be copper.
- M. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.
- N. All cable insulation shall be rated for 90 degrees C, minimum.

2.02 BUILDING WIRE

- A. Description: Single conductor insulated wire.
- B. Conductor: Copper.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation: NFPA 70, Type XHHW or XHHW-2 as required.

2.03 MOTOR BRANCH AND BRANCH POWER CABLE

- A. Description: Single conductor insulated cable.
- B. Conductor: Copper, stranded.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation: NFPA 70, Type XHHW-2.
- E. Conductors shall be color coded or taped with colored tape within 24 inches of the end of the conductor to indicate a color code. The color code shall be the same as that for multi-conductor cable listed above.

2.04 CONTROL CABLE

- A. Description: Single conductor insulated wire.

- B. Conductor: Copper, stranded.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation: NFPA 70, Type XHHW-2.
- E. Conductors shall be covered by cross-linked polyethylene insulation (minimum thickness 20 mils). Conductors shall be color coded or taped with colored tape within 24 inches of the end of the conductors to indicate a color code.

2.05 INSTRUMENTATION CABLE

- A. Description: Single or multi- twisted pair cables.
- B. Conductor: Copper, stranded.
- C. Insulation Voltage Rating: 300 volts, minimum.
- D. Insulation: PVC. Multi-pair cable shall have PVC jacket.
- E. Conductors shall be in twisted pairs. Each cable shall have an aluminum/polyester tape overlapped to provide 100% coverage, and a 7-strand tinned copper drain wire, same size as the conductors. In multiple pair cable, each pair shall be individually shielded in addition to the overall cable shield, also with an aluminum/polyester tape and drain wire.
- F. Conductor size is given on drawings. If the instrumentation manufacturer recommends a different size from that on the drawings, use the size recommended by the instrumentation manufacturer.

2.06 ETHERNET CABLE

- A. Description: Category 5e Unbonded-Pair Cables
- B. Conductor: Copper, solid.
- C. Insulation: Polyolefin, blue PVC jacket.
- D. Conductors shall be in twisted pairs. Each cable shall have an overall foil shield, and drain wire. Cable shall be RJ-45 compatible.
- E. Cables shall be 4 pair, 24AWG.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that mechanical work likely to damage wire and cable has been completed.
- C. Verify that raceway installation is complete and supported.

3.02 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

3.03 INSTALLATION

- A. Route wire and cable as required to meet project conditions.
 - 1. Wire and cable routing indicated is approximate unless dimensioned.
 - 2. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.
- B. Install wire and cable in accordance with the NECA "Standard of Installation."
- C. Use wiring methods indicated.
- D. Pull all conductors into raceway at same time.
- E. Use suitable wire pulling lubricant for building wire 4 AWG and larger. Lubricants shall be talc, powdered soapstone, or non-hardening compounds approved for pulling by UL and the cable manufacturer.
- F. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- G. Clean conductor surfaces before installing lugs and connectors.
- H. Make taps and terminations to carry full ampacity of conductors with no perceptible temperature rise. Splices shall not be made.
- I. Use split bolt connectors for copper conductor taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- J. Use solderless pressure connectors with insulating covers for copper conductor taps, 8 AWG and smaller.
- K. Use insulated spring wire connectors with plastic caps for copper conductor taps, 10 AWG and smaller.

- L. Identify and color code wire and cable under provisions of Section 16075. Identify each conductor with its circuit number or other designation indicated.
- M. Instrumentation cable (that cable carrying 4-20 mA signals) shall be run in steel conduit only.
- N. Instrument signal cable shields shall be continuous along the entire cable length. Shields shall be grounded only at the panel.

END OF SECTION 16123

SECTION 16131
CONDUIT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Conduit, fittings and conduit bodies.

1.02 REFERENCES

- A. ANSI C80.1 - American National Standard Specification for Rigid Steel Conduit -- Zinc Coated.
- B. ANSI C80.3 - American National Standard Specification for Electrical Metallic Tubing -- Zinc Coated.
- C. NECA (INST) - NECA Standard of Installation; National Electrical Contractors Association.
- D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies; National Electrical Manufacturers Association.
- E. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; National Electrical Manufacturers Association.
- F. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80); National Electrical Manufacturers Association.
- G. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing; National Electrical Manufacturers Association.
- H. NFPA 70 - National Electrical Code; National Fire Protection Association.

1.03 SUBMITTALS

- A. In accordance with project Specifications.
- B. Project Record Documents: Accurately record actual routing of all conduits.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept conduit on site. Inspect for damage.
- B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- C. Protect PVC conduit from sunlight.

PART 2 PRODUCTS

2.01 CONDUIT REQUIREMENTS

- A. Conduit Size: Comply with NFPA 70.
 - 1. Minimum Size: 3/4 inch unless otherwise specified.
- B. Underground Installations:
 - 1. More than Five Feet from Foundation Wall: Use thickwall non-metallic conduit.
 - 2. Within Five Feet from Foundation Wall: Use thickwall nonmetallic conduit.
 - 3. In or Under Slab on Grade: Use thickwall non-metallic conduit.
 - 4. Minimum Size: 1 inch.
- C. Outdoor Locations Above Grade: Use rigid steel conduit. Extend rigid steel conduit from above grade to a point at least one foot below grade.
- D. Dry Locations:
 - 1. Concealed: Use rigid steel conduit.
 - 2. Exposed: Use rigid steel conduit.
- E. Within Concrete Slab: Conduit run within a concrete floor slab shall be rigid steel.
- F. Instrumentation Conduit: Conduit carrying instrumentation cables shall be rigid galvanized steel at any point where the instrumentation conduit is within two (2) feet of a power conduit, whether above- or under-ground

2.02 MANUFACTURERS

- A. Essex Group, Inc.
- B. Hubbell Power Systems.
- C. Tyton Hellermann Corporation.
- D. Substitution: Engineer-approved equal.
 - 1. Allied Tube & Conduit.

2. Beck Manufacturing, Inc.
 3. Wheatland Tube Company.
 4. Substitution: Engineer-approved equal.
- E. Rigid Steel Conduit: ANSI C80.1.
- F. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.
- G. Rigid Aluminum Conduit ANSI C80.5

2.03 PVC COATED METAL CONDUIT

- A. Manufacturers:
1. Allied Tube & Conduit.
 2. OCAL Inc.
 3. Robroy Industries.
 4. Substitution: Engineer-approved equal.
- B. Description: NEMA RN 1; rigid steel or aluminum conduit with external PVC coating, 20 mil thick.
- C. Fittings and Conduit Bodies: NEMA FB 1; steel or aluminum fittings with external PVC coating to match conduit.

2.04 FLEXIBLE METAL CONDUIT

- A. Manufacturers:
1. AFC Cable Systems.
 2. Electri-Flex Company.
 3. International Metal Hose.
 4. Substitution: Engineer-approved equal.
- B. Description: Interlocked steel or aluminum construction.
- C. Fittings: NEMA FB 1.
1. AFC Cable Systems.
 2. Electri-Flex Company.
 3. International Metal Hose.

4. Substitution: Engineer-approved equal.

D. Description: Interlocked steel or aluminum construction with PVC jacket.

E. Fittings: NEMA FB 1.

2.05 NONMETALLIC CONDUIT A.

A. Manufacturers:

1. AFC Cable Systems.

2. Electri-Flex Company.

3. International Metal Hose.

4. Substitution: Engineer-approved equal.

B. Description: NEMA TC 2; Schedule 40 PVC.

C. Fittings and Conduit Bodies: NEMA TC 3.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Verify routing and termination locations of conduit prior to rough-in.

C. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.02 INSTALLATION

A. Install conduit in accordance with NECA Standard of Installation.

B. Install nonmetallic conduit in accordance with manufacturer's instructions.

C. Arrange supports to prevent misalignment during wiring installation.

D. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

E. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.

F. Fasten conduit supports to building structure and surfaces under provisions of Section 16070.

- G. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
- H. Do not attach conduit to ceiling support wires.
- I. Arrange conduit to maintain headroom and present neat appearance. Unsupported spans shall be limited to 10 feet.
- J. Route conduit parallel and perpendicular to walls.
- K. Route conduit installed above accessible ceilings parallel and perpendicular to walls.
- L. Maintain adequate clearance between conduit and piping.
- M. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.
- N. Cut conduit square using saw or pipecutter; de-burr cut ends. P. Bring conduit to shoulder of fittings; fasten securely.
- O. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- P. Install no more than equivalent of four 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one shot bender to fabricate bends in metal conduit larger than 2 inch size.
- Q. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- R. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control, and expansion joints.
- S. Provide suitable pull string in each empty conduit except sleeves and nipples.
- T. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- U. Ground and bond conduit under provisions of Section 16060.
- V. Identify conduit under provisions of Section 16075.

END OF SECTION 16131

**SECTION 16138
BOXES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall and ceiling outlet boxes.
- B. Pull and junction boxes.

1.02 REFERENCES

- A. NECA (INST) - NECA Standard of Installation; National Electrical Contractors Association; 1993.
- B. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies; National Electrical Manufacturers Association; 1993.
- C. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association; 1996.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 1997.
- E. NFPA 70 - National Electrical Code; National Fire Protection Association; 2011.
- F. ANSI/SCTE-77 Tier 22 – Specification for Underground Enclosure Integrity
- G. ASTM C857 A-16 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures

1.03 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Provide products listed and classified by Underwriters Laboratories, Inc., as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
 - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.
- B. Wall Plates for Finished Areas: As specified in Section 16140.

2.02 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- B. Cast Metal Boxes: NEMA 250, Type 4, flat-flanged, surface-mounted junction box
 - 1. Material: Stainless steel
 - 2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws
- C. Pull boxes: Quazite PG series or equal.
- D. Handholes in non-traffic areas: ANSI/SCTE-77 Tier 22, ASTM C857 A-16
 - 1. Body
 - a. Material: DuoMold Composite
 - b. Size (nominal): 36" W x 60" L; 24" and 36" depths
 - c. Weight: 24" Depth: 190 lbs; 36" Depth: 222 lbs
 - d. Wall Type: Straight
 - e. Bodies are stackable to depths of 48", 60", or 72", and are assembled with fasteners to form a single unit at the factory.
 - 2. Cover
 - a. Style: Flush Solid
 - b. Material: DuoMold Composite
 - c. Size (nominal): 36" x 60"
 - d. Weight: 358 lbs
 - e. Fasteners: 1/2-13 Stainless Steel Hex Head Bolt, Self-Locating Insert
 - f. Options: ELECTRIC Logo
 - g. Surface: Slip Resistant
 - h. Coefficient of Friction: >0.6 ASTM 1028
- E. Handholes in traffic areas: H-20 rated in addition to above specifications.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify locations of outlets in offices and work areas prior to rough-in.

3.02 INSTALLATION

- A. Install boxes in accordance with NECA "Standard of Installation."
- B. Install in locations as shown on Drawings, and as required for taps, wire pulling, equipment connections, and as required by NFPA 70.
- C. Coordinate installation of outlet boxes for equipment connected under Section 16155.
- D. Set wall mounted boxes at elevations to accommodate mounting heights indicated.
- E. Orient boxes to accommodate wiring devices oriented as specified in Section 16140.
- F. Maintain headroom and present neat mechanical appearance.
- G. Install boxes to preserve fire resistance rating of partitions and other elements.
- H. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- I. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
- J. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- K. Use flush mounting outlet box in finished areas.
- L. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- M. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- N. Use adjustable steel channel fasteners for hung ceiling outlet box.
- O. Do not fasten boxes to ceiling support wires.
- P. Support boxes independently of conduit.
- Q. Use gang box where more than one device is mounted together. Do not use sectional box.
- R. Use cast outlet box in exterior locations exposed to the weather and wet locations.
- S. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.
- T. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

3.03 ADJUSTING

- A. Adjust flush-mounting outlets to make front flush with finished wall material.
- B. Install knockout closures in unused box openings.

3.04 CLEANING

- A. Clean interior of boxes to remove dust, debris, and other material.
- B. Clean exposed surfaces and restore finish.

END OF SECTION 16138

SECTION 16300
SURGE PROTECTIVE DEVICES (SPD) FOR INSTRUMENTATION AND CONTROL
EQUIPMENT, LED Pole Lighting AND DATA LINE PROTECTION

PART 1 – GENERAL

1.01 SUMMARY

A. Description: The surge protective devices (SPD) shall be designed to protect all dedicated circuits within control panels; all data transmission circuits and connected equipment; and all point-of-use loads such as LED lighting. The devices will protect the following:

1. Dedicated 120 volt and 240 volt LED AC circuits, series connected.
2. Dedicated 120 volt control signals.
3. Analog instrumentation signal, field mounted.
4. Data line, control panel mounted.

1.02 QUALITY ASSURANCE

A. Referenced Codes and Standards:

1. ANSI/IEEE Std C62.41.1™-2002, IEEE Guide on the Surge Environment in Low- Voltage (1000 V and Less) AC Power Circuits
2. ANSI/IEEE Std C62.41.2™-2002, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits
3. ANSI/IEEE Std C62.45™ -2002, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits
4. ANSI C84.1, American National Standard for Electric Power Systems and Equipment – Voltage Ratings (60 Hertz)
5. ANSI/IEEE Standard 1100-2005, IEEE Recommended Practice for Power and Grounding Electronic Equipment (Emerald Book) - Clause 8.6.1
6. National Fire Protection Association (NFPA) 70 (N.E.C.) – 2002 - Article 285
7. ANSI/UL Standards 1449 Listed (UL 1449 Current Edition), UL 1283 Listed, CUL Listed & CE compliant “low-voltage directive.”
8. IEEE Standard C62.72™ - 2007 – IEEE Guide for the Application of Surge-Protective Devices for Low-Voltage (1000 V or less) AC Power Circuits
9. UL 1283, Standard for Safety Electromagnetic Interference Filters
10. UL 497B - Protectors for Data Communications and Fire Alarm

Circuits, June 14, 2004

B. Qualifications:

1. Operates a Quality System Certified manufacturing facility as ISO 9001:2000 Compliant.
2. Provide devices from a manufacturer who has been regularly engaged in the development, design, testing, and manufacturing of SPDs of the type and ratings required for a period of 10 years or more and whose products have been in satisfactory use in similar service.
3. All SPDs shall be from the same manufacturer.

1.03 DEFINITIONS

- A. Let-Through Voltage (LTV) – The voltage that is measured at the end of the output leads of the surge protective device (SPD) measured from the zero voltage reference to the peak of the surge when the applied surge is induced at a specified phase angle; i.e., 90 or 270 degree phase angle.
- B. Clamping Voltage – The voltage level where the SPD begins to conduct and handle the excess energy of the surge thus providing a low-resistance direct path for the surge.
- C. Maximum Continuous Operating Voltage (MCOV) – The maximum steady state voltage at which the SPD can operate and meet its specification. This is the maximum designated root-means square (RMS) value of the power frequency voltage that may be continuously applied to each mode of protection of the SPD.
- D. Protection Modes: This parameter identifies the modes for which the SPD has directly connected protection elements; i.e. line-to-neutral (L-N), line- to-ground (L-G), and neutral-to-ground (N-G).
- E. Peak Surge Current (PSC): The maximum 8 x 20 microsecond surge current pulse the SPD device is capable of surviving on a single-impulse basis without suffering either performance degradation or more than 10 percent deviation of clamping voltage at a specified current.
- F. System Peak Voltage: The electrical equipment supply voltage sine wave peak (i.e., for a 120 volt system the L-N peak voltage is 170 volts).
- G. EMI/RFI Filtering (Electromagnetic/Radio Frequency Interference): This filter is designed to attenuate unwanted electromagnetic and radio frequency signals (such as noise and interference) generated from electromagnetic sources.
- H. Frequency Responsive Circuitry/Sine Wave Tracking (SWT): A term used to describe the circuitry of a low-pass filter designed to attenuate “switching” or “ring wave” transients/surges.

1.04 SUBMITTALS

Surge suppression submittals shall include, but shall not be limited to the following items:

- A. Complete schematic data for all suppressors indicating part numbers, conductor sizes, etc.
- B. Dimensioned drawing of each suppressor type indicating mounting arrangement. C. Manufacturer's ANSI/UL 1449-2006 Third Edition listing classification page and listing number(s).
- C. Manufacturer's UL 1283 listing classification page and listing number(s).
- D. Certified test data documenting ANSI/IEEE C62.41-2002 performance and the ability of the device to meet or exceed all requirements of this specification. Include complete let-through voltage/measured limiting voltage test data (not Voltage Protection Rating), test graphs, and scope traces for each mode for each product submitted for Category's C, B, A (including Cat A, 2 kV, 67 A, 100 kHz ring wave at both 90 & 270 degree electrical phase angles).
- E. Letter from manufacturer stating products are in strict compliance with the recommendations of IEEE Standard 1100-2005, Clause 8.6.1 and incorporate individual dedicated discrete modes of protection for each mode including direct line-to-line components. (Reduced-mode variations will not be accepted).
- F. Certificate of declaration that product is CE low voltage directive compliant
- G. Statement of manufacturer's warranty duration and replacement policy.

1.05 WARRANTY

- A. All SPD devices shall be warranted to be free from defects in materials and workmanship under normal use in accordance with the instructions provided for a period of twenty-five (25) years from date of substantial completion.
- B. Any SPD device that shows evidence of failure or incorrect operation, including damage as the result of lightning strikes, during the warranty period shall be replaced as a complete unit (not just modules, subassemblies, or components) by the manufacturer at no charge to the owner. Warranty will provide for multiple exchanges of any inoperable devices at any time during the warranty period that starts at the date of substantial completion of the system to which the surge suppressor is installed.
- C. SPD manufacturers whose warranty does not meet the requirements listed above standard shall submit a letter extending the warranty to meet these standards with the product submittal

PART 2 – PRODUCTS

2.01 MANUFACTURER QUALIFICATIONS

- A. All surge suppression devices shall be manufactured by an ISO 9001-2000 certified company normally engaged in the design, development, and manufacture of such equipment, with at least 10 years of engineering experience in the design and manufacture of permanently connected SPD devices.
- B. The surge suppressor manufacturer shall provide unlimited free replacement of the entire SPD for all inoperable SPD units during the warranty period.
- C. The use of any mechanical or electro-mechanical thermal/over-current protection (i.e. moving parts and/or springs and shutters), in combination with or for the protection of the suppression elements are expressly prohibited and will be rejected
- D. The listing of a manufacturer as “acceptable” does not imply automatic approval. It is the sole responsibility of the Contractor to ensure that any submittals made are for products that meet or exceed the specifications included herein. Subject to compliance with requirements, provide products by the following manufacturers and specific models listed below only:

Surge Suppression Incorporated / 888-212-2728)

or Pre-approved manufacturers.

- 1. Pre-Approval submittals for products by manufacturers not listed above must be submitted not less than ten (10) business days prior to bid date to allow ample engineering time for review of submitted products. Products not submitted within this timeframe will not be reviewed.
- 2. Submit proper documentation showing detailed (line-by-line) compliance with this specification. Prior approvals not received by the deadline date defined above will not be considered.
- 3. Along with the line-by-line comparison from manufacturers not listed herein, pre-approval surge suppression submittals shall include all of the items listed in Part 2.2, below.
- 4. Incomplete submittal packages will not be approved.

2.02 REQUIREMENTS

A. 120 Volt and 240 Volt AC LED Power Circuit Protection (Surge Suppression Incorporated Model SPT2-1P1-LP-21(120 Volts) or SPT2-1P24-LP-21 (240 Volts) :

- 1. Maximum Continuous Operating Voltage: 150 volts (120 Volts) or 320 volts (240 Volts)
- 2. Maximum Continuous Operating Current: 20 Amps
- 3. Peak Surge Current: 20 kA per mode; 60 kA total

4. SPD circuitry shall include only solid-state clamping components consisting of a multi-stage hybrid design. Device shall be bi-directional, enclosed in a UL listed/recognized encapsulated thermal stress reducing compound.
5. Discrete and dedicated protection components must be provided for each mode of protection (L-N, Normal Mode) (L-G, N-G Common Mode).
6. Frequency Responsive Circuitry (sine-wave tracking) must be provided the Line-Neutral mode of protection. Products utilizing basic EMI/RFI filter performance (dB insertion loss rating) will not be considered.
7. Let-Through Voltages of product tested with the IEEE C62.41.1 & C62.41.2-2002; 100 KHz Ring Wave. 2 kV/67 A and Combination Wave, 6 kV/3 kA must be equal to or better than the following:

Cat A, 30 Ohm 100 kHz Ring Wave, 2 kV/67 A @ 270 degree Phase Angle

Voltage	120Volts	240 Volts
L-N	32	35
L-G	370	706
N-G	380	722

Cat B, 2 Ohm 100 kHz Ring Wave, 6 kV/3 kA @ 90 degree Phase Angle

Voltage	120Volts	240 Volts
L-N	421	1000
L-G	359	932
N-G	509	936

8. Enclosure: ABS Plastic, UL 94-5VA Flame Rating (UL's highest rating) and must be electrically non-conductive.
9. Connection Method: 3 position screw terminal strip on the line and on the load side of the enclosure.
10. Status Light: SPD must have a remotely mountable NEMA 4X LED (Green LED, normally on) for operational status indication.
11. Warranty: 25 Years Unlimited Free Replacement.

B. 120 Volt AC Control Power Circuit Protection (Surge Suppression

Incorporated Model SPT1P1-21):

1. Maximum Continuous Operating Voltage: 150 volts
2. Maximum Continuous Operating Current: 30 Amps
3. Peak Surge Current: 20 kA per mode; 60 kA total
4. SPD circuitry shall include only solid-state clamping components consisting of a multi-stage hybrid design. Device shall be bi-directional, enclosed in a UL listed/recognized encapsulated thermal stress reducing compound.
5. Discrete and dedicated protection components must be provided for each mode of protection (L-N, Normal Mode) (L-G, N-G Common Mode).
6. Frequency Responsive Circuitry (sine-wave tracking) must be provided for each mode of protection. Products utilizing basic EMI/RFI filter performance (dB insertion loss rating) will not be considered.
7. Let-Through Voltages of product tested with the IEEE C62.41.1 & C62.41.2-2002; 100 KHz Ring Wave and Combination Wave must be equal to or better than the following:
Cat A, 30 Ohm 100 kHz Ring Wave, 2 kV @ 270 degree Phase Angle

L-N ≤ 50 volts
L-G ≤ 50 volts
N-G ≤ 50 volts
8. Enclosure: ABS Plastic, UL 94-5VA Flame Rating (UL's highest rating) and must be electrically non-conductive.
9. Warranty: 25 Years Unlimited Free Replacement

C. Analog Signal/Current Loop (4-20 mA) Circuit Protection (Surge Suppression Incorporated Model CLP24A6DINS-B-21 can accommodate up to three 2- wire loops)

1. Products shall be listed to UL 497B, Protectors for Data Communications Circuits and Fire Alarm Circuits, June 14, 2004.
2. Maximum Continuous Operating Voltage: 36 volts DC
3. Maximum Continuous Operating Current: 500mA
4. Series Resistance: 5 Ohms per wire (10 Ohms loop)
5. Maximum Data Rate: 2 Mbps
6. Peak Surge Current: 10 kA per mode; 20 kA total per loop.
7. SPD circuitry shall include only solid-state clamping components consisting of a multi-stage hybrid design. Model shall be bi-directional and encapsulated in a high dielectric compound.
8. Discrete and dedicated protection components must be provided for each mode of protection. (L-L, Normal Mode) (L-G, Common Mode)
9. Let-Through Voltages of product tested with the IEEE C62.41.1 & C62.41.2-2002; Cat B, 2 Ohm Impulse (Combination) Wave, 6kV/3k Amp @ 90 degree Phase Angle must be equal to or better than the following:
L-L < 40 volts
L-G < 40 volts

10. Enclosure: Devices shall be enclosed in an enclosure constructed of a superior temperature/fire-rated material (UL94 5VA high-range temperature material) and must be electrically non-conductive. DIN rail mounted.
11. Warranty: 25 Years Unlimited Free Replacement

D. Network Cable – Ethernet High Speed Data Circuit Protection (Surge Suppression Incorporated Model D2RJ45##C8DIN-B-21)

1. Products shall be listed to UL 497B, Protectors for Data Communications Circuits and Fire Alarm Circuits, June 14, 2004.
2. SPD devices shall be rated for the class of service necessary for the application.
3. Signal/Operating Voltage: 14 to 200 Volts.
4. Data Rates: Up to 100 Mbps
5. SPD circuitry shall include only solid-state clamping components consisting of a multi-stage hybrid design. Device shall be bi-directional, enclosed in a UL listed/recognized encapsulated thermal stress reducing compound.
6. Protection Modes: Data transmission pairs shall be protected Line-to- Line and Line-to-Ground. Shield or signal ground protections shall be provided to ground only.
7. Each data carrying conductor shall have no internal series resistance per wire and no internal series resistance on the shield or signal ground conductor.
8. Each pair of data conductors must have a peak surge current rating of 1,500 Wpk per mode.
9. The device must be designed to be series connected and mounted internally to control panels for protection of equipment connected to data lines.
10. Enclosure: Devices shall be enclosed in a plastic enclosure constructed of a superior temperature/fire-rated material (UL94 5VA high-range temperature material) and must be electrically non- conductive. DIN rail mounted.
11. Warranty: 25 Years Unlimited Free Replacement

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Connect the Ground of the SPD to the grounding bar of the control cabinet using a minimum of No. 10 AWG wire. Further, the grounding bar of the cabinet shall be connected to the basic grounding system using a minimum of No. 6 AWG wire.
- B. All labor, materials, equipment, and services necessary for, and incidental to the installation of the SPDs as specified, shall be provided by the electrical contractor (installer).

END OF SECTION

**SECTION 16310
SURGE PROTECTIVE DEVICES**

PART 1 GENERAL

1.01 SUMMARY

- A. This section describes the quality, performance, and installation of Parallel Connected, AC Power, Panel Type, Surge Protective Devices (SPDs).

1.02 QUALITY ASSURANCE

- A. All Surge Protective Devices (SPDs) shall be tested and listed to ANSI/UL 1449-
- B. Current Edition by an independent testing agency, with the experience and capability to conduct the testing indicated, that is a Nationally Recognized Testing Laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction. This agency must comply with ANSI/IEEE C62.45 test procedures for all categories established in C62.41 (1991). “Manufactured in accordance with UL 1449” is not equivalent to being listed to ANSI/UL 1449 and does not meet the intention of this specification. In addition to being UL 1449 listed, Type 2 SPDs shall be Complimentary Listed to UL 1283.

1.03 CODES AND STANDARDS

- A. ANSI/IEEE Std C62.41.1™-2002, IEEE Guide on the Surge Environment in Low- Voltage (1000 V and Less) AC Power Circuits
- B. ANSI/IEEE Std C62.41.2™-2002, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits
- C. ANSI/IEEE Std C62.45™ -2002, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits
- D. ANSI C84.1, American National Standard for Electric Power Systems and Equipment – Voltage Ratings (60 Hertz)
- E. ANSI/IEEE Standard 1100-2005, IEEE Recommended Practice for Power and Grounding Electronic Equipment (Emerald Book) – Clause 8.6.1
- F. National Fire Protection Association (NFPA) 70 (N.E.C.) – 2002 - Article 285
- G. ANSI/UL Standards 1449, UL 1283 Listed, CUL Listed & CE compliant “low- voltage directive.”
- H. C62.62-2010 - IEEE Standard Test Specifications for Surge-Protective Devices (SPDs) for Use on the Load Side of the Service Equipment in Low Voltage (1000 Volts and less) AC Power Circuits

IEEE Standard C62.72™ - 2007 – IEEE Guide for the Application of Surge- Protective Devices for Low-Voltage (1000 V or less) AC Power Circuits

1.04 MANUFACTURER QUALIFICATIONS

- A. All surge suppression devices shall be manufactured by an ISO 9001-2008 certified company normally engaged in the design, development, and manufacture of such equipment, with at least 10 years of engineering experience in the design and manufacture of permanently connected SPD devices.
- B. The surge suppressor manufacturer shall provide unlimited free replacement of the entire SPD for all inoperable SPD units during the warranty period.
- C. All SPDs shall be manufactured by the same manufacturer.
- D. The listing of a manufacturer as “acceptable” does not imply automatic approval. It is the sole responsibility of the Contractor to ensure that any submittals made are for products that meet or exceed the specifications included herein. Subject to compliance with requirements, provide products by the following manufacturers and models listed below only:
 - E. Surge Suppression Incorporated (SpecPro Series) (888-212-2728) Emerson (Liebert) Corporation (560xx16 & 570xx17 Series) / 614-888-0246 Current Technology (SL3-150Series) / 800-238-5000 or Pre-approved manufacturers.
 - 1. Pre-Approval submittals for products by manufacturers not listed above must be submitted not less than ten (10) business days prior to bid date to allow ample engineering time for review of submitted products. Products not submitted within this timeframe will not be reviewed.
 - 2. Submit proper documentation showing detailed (line-by-line) compliance with this specification. Prior approvals not received by the deadline date defined above will not be considered.
 - 3. Along with the line-by-line compliance from manufacturers not listed herein, pre-approval surge suppression submittals shall include all of the items listed in Section V, below.
 - 4. Incomplete submittal packages will not be approved.

1.05 SUBMITTALS

- A. Surge suppression submittals shall include, but shall not be limited to the following items:
 - 1. Complete schematic data for all suppressors indicating part numbers, conductor sizes, etc.

2. Dimensioned drawing of each suppressor type indicating mounting arrangement. Manufacturer's ANSI/UL 1449 listing classification page and listing number(s).
3. Manufacturer's UL 1283 listing classification page and listing number(s).
4. Certified test data documenting ANSI/IEEE C62.41-2002 performance and the ability of the device to meet or exceed all requirements of this specification. Include complete let-through voltage/measured limiting voltage test data (not Voltage Protection Rating), test graphs, and scope traces for each mode for each product submitted for Category's C, B, A (including Category A 2kV, 30 Ohm Ring Wave at both 90 & 270 degree electrical phase angles).
5. Letter from manufacturer stating products are in strict compliance with the
6. Recommendations of IEEE Standard 1100-2005, Clause 8.6.1 and incorporate 10 individual dedicated discrete modes of protection for three-phase Wye systems, including direct line-to-line components. (Reduced-mode variations will not be accepted).
7. Certificate of declaration that product is CE low voltage directive compliant.
8. Statement of manufacturer's warranty duration and replacement policy.

1.06 REQUIREMENTS

- A. The Surge Protective Devices (SPDs) shall be of a parallel-connected design using fast-acting transient energy protection components that will divert and dissipate the surge energy.
- B. All SPDs shall be tested and listed to ANSI/UL 1449 by a Nationally Recognized Testing Laboratory (NRTL) (i.e. CSA, UL, etc.). Type 2 SPDs shall be Complimentary Listed to UL1283.
- C. All SPDs shall be Type 2 SPDs unless otherwise directed by the specifying engineer; Type 4 SPDs are not permitted. (Definitions: Type 1 SPD – Permanently connected SPDs intended for installation between the secondary of the service transformer and the line side of the service equipment overcurrent device, as well as the load side, including watt-hour meter socket enclosures and intended to be installed without an external overcurrent protective device. Type 2 SPD – Permanently connected SPDs intended for installation on the load side of the service equipment overcurrent device; including SPDs located at the branch panel. Type 4 SPD – Recognized Component SPDs, including discrete components as well as component assemblies, which bear specific conditions of acceptability.)
- D. The SPD shall be tested and listed by an NRTL as a complete assembly to a symmetrical fault current rating greater than or equal to the available fault current at the location of installation at the connected panel without the need for upstream over current

protection, in accordance with NEC Article 285 and shall be marked with the Short Circuit Current Rating (SCCR). If the available fault current is unknown, then the SCCR of the SPD shall be 200 kAIC. Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6. Permanently connected devices mounted parallel to service, distribution, and sub panels are required. SPD device drawings shall be made available upon request.

- E. All SPDs shall have a Nominal Discharge Current (I_n) of 10 kA. The service entrance SPD shall have a Nominal Discharge Current (I_n) of 20 kA only if a UL96A compliant lightning protection system is to be installed.

1.07 Fusing:

- A. The SPD shall provide as a minimum, over-current, over temperature protection in the form of component-level thermal fusing to ensure safe failure and prevent thermal runaway. This component-level fusing shall be an integral part of the MOV itself and not silver wire (or other) independently laid across each MOV. SPDs without thermal fuses or disconnects, or SPDs with shared thermal devices that disconnect more than one MOV are not acceptable
- B. Surge protective devices shall contain integral short circuit current safety fusing within each device for over-current requirements of the NEC. This fusing will be independent of the “component-level” fusing and be specifically for over-current protection and shall be constructed utilizing surge rated, cartridge fuses and not rated ‘silver-fuse-wire’ (or other).
- C. Any SPD that is connected directly to the bus on a panel, panelboard, or MCC must have a properly sized breaker in the circuit between the SPD and the bus to permit the SPD to be serviced without the requirement to remove the power from the gear.
- D. The fusing mechanisms employed must effectively coordinate their performance in conjunction with the high current abnormal over-voltage testing under ANSI/UL1449.
- E. The use of any mechanical or electro-mechanical thermal/over- current protection (i.e. moving parts and/or springs and shutters) in combination with or for the protection of the suppression elements is expressly prohibited and will be rejected. Large-Block 34mm (50kA) square Thermal Protected MOVs are expressly prohibited and will not be accepted

1.08 MCOV

- A. The SPD shall have a maximum continuous operating voltage (MCOV) capable of sustaining 115% of nominal RMS voltage continuously without degrading.

1.09 Component Limitations

- A. The SPD shall only use solid-state clamping components to limit the surge voltage and divert the surge current. SPD components that “crowbar” short-circuit the AC power system (e.g. spark gaps, gas tubes, selenium cells, or SCR’s) shall not be acceptable. Device circuitry shall be bi-directional, enclosed in a UL listed encapsulated thermal stress reducing compound, and be of a parallel design.

1.10 Per Phase Ratings

- A. ‘Per-Phase’ ratings for a three-phase Wye-connected SPD are determined by multiplying the kA per mode times the number of discrete modes of protection (directly connected suppression components), minus the value for the Neutral to Ground mode, divided by the number of phases.

$$\text{Per-Phase} = (((\text{kA per mode}) \times (\# \text{ of modes})) - (\text{N-G mode kA})) / (\# \text{ of phases})$$

- B. The SPD shall provide Line-Neutral (Normal mode), and Neutral-Ground (common Mode) Protection for Wye configured SPDs. The SPD shall provide Line-Neutral (Normal mode), and Line-Ground (common Mode) Protection for Delta configured SPDs .

1.11 Frequency Responsive Circuitry

- A. (FRC) (a.k.a. Sinewave Tracking Capability): The power panels and MCCs serving sensitive electronic equipment shall utilize voltage independent, dedicated Frequency Responsive Circuitry (FRC) intended to mitigate the effects of switching or ringing surges that is specifically designed so that it can survive the surge environment. EMI/RFI filtering specifically will not be considered as equal to FRC! The performance of FRC is defined by the level to which it mitigates Ring Wave transients and can be demonstrated in the test results of IEEE C62.41.2-2002, Category A 2kV, 30 Ohm Ring Wave.

To demonstrate the FRC capability of the submitted devices, manufacturers shall submit 3rd party, independent tests results for units claiming FRC capability. Such tests shall include testing under the standards of ANSI/IEEE C62.41 and C62.45 category A (2kV, 67A, 100kHz ring wave) applied at the 270 degree phase angle, positive polarity. On a 3-phase Wye device, on each of the following modes: line-to-neutral, line-to-ground, and line-to-line (dynamic tests with normal voltage applied to the unit under test), and neutral-to-ground (static test with no normal voltage applied to unit under test) shall be tested. The “let-through voltage” derived from each of these tests shall have a maximum amplitude of less than 50V peak deviation from the insertion point of the surge on the sine wave to the peak of the transient. Measurement of the let-through voltage shall be made with six-inches of lead length external to the SPD housing in accordance with ANSI/UL 1449. Performance requirements are as stated in the table in Section VIII below (ANSI/IEEE C62.41 Let-Through Voltage) at Test Category A Ring Wave (2kV).

1.12 Status Indicators:

- A. SPD units shall have panel front status monitors as a minimum to indicate a continuous

positive status of each protected phase. A remote audible alarm option must be supplied where the specifying engineer deems it necessary and cost effective under the circumstances. Refer to the appropriate drawings and schedules for these details.

1.13 Equipment Certification:

- A. Items shall be listed to ANSI/UL 1449-Current Edition, shall bear the seal of the NRTL, shall bear the Marking "Listed to UL 1449", shall have been tested under ANSI/UL 1449-Current Edition, and shall be marked in accordance with the referenced standard. SPD units shall be UL 1283 Listed as an Electromagnetic Interference Filter and marked accordingly. All surge suppression devices shall be manufactured by an ISO 9001-2008 certified company normally engaged in the design, development, and manufacture of such equipment.

1.14 Circuit Configuration:

- A. The circuit configuration of the suppression units shall be bi- directional, thermal stress reducing, encapsulated, custom parallel connected, and solid state. (Series units or units equipped with "load carrying" components are expressly prohibited due to the possibility of single point series failures causing power interruption to protected loads.)

1.15 Enclosures:

- A. Unless otherwise noted, provide NEMA 1 or better enclosures for indoor mounting and NEMA 4 enclosures or better for all outdoor locations. All units will contain Form C, N/O or N/C, dry relay contacts, if so specified, and weatherproof fittings to maintain the required NEMA integrity.

1.16 Maintenance Restrictions:

- A. No suppression unit shall be supplied which requires scheduled preventive maintenance or replacement parts. Units requiring functional testing, special test equipment, or special training to monitor surge protection device (SPD) status are not acceptable. SPD shall require NO routine maintenance. SPD devices are considered non-repairable items and shall be fully replaced upon failure.

1.17 Commonality:

- A. All SPDs at the service entrance, distribution panels, and sub- panels shall be from the same manufacturer.

1.18 Performance Criteria:

- A. All SPDs shall meet or exceed the performance Criteria shown in the Peak Surge Current & Performance Table below:

Location	Voltage	SPD Model	Peak Surge Current Per Phase	Frequency Responsive Circuitry
SPD-A	1 \emptyset , 120/240	CRMA101S1X3E30-21	100	Yes
SPD-B	3 \emptyset , 120/240	CRMA103D1X3E30-21	100	Yes
SPD-C	3 \emptyset , 120/208	CRMA103Y1X3E30-21	100	Yes
SPD-D	1 \emptyset , 120/240	CRMA101S1E30-21	100	Yes
SPD-E	3 \emptyset , 120/240	CRMA103D1E30-21	100	Yes
SPD-F	3 \emptyset , 120/208	CRMA103Y1E30-21	100	Yes
SPD-G	1 \emptyset , 120	SPT2-120-LP-21	60	Yes
SPD-H	1 \emptyset , 240	SPT2-240-LP-21	60	Yes

1.19 VII. ANSI/IEEE C62.41 LET-THROUGH VOLTAGE

- A. The SPD shall meet the Let-Through Voltage requirements shown in the tables below for voltage and locations specified. All voltages shall be peak ($\pm 10\%$), Positive Polarity, Time base = $10\mu\text{s}$, Sampling Rate = 500 Megasamples per second to ensure maximum transient capture. (These settings assure Let-through Voltage test results are accurate). Surge voltages shall be measured from the insertion of the surge on the sine wave to the peak of the surge. All tests are Static (unpowered), except for the 120V circuits that are Dynamic (powered). Let-through voltages on static tests calculated by subtracting sine wave peak from let-through measured from zero. All tests shall be performed in accordance with UL 1449 -2006 with measurements performed at a point on the leads 15.24 cm (6 inches) outside of the device enclosure. No data measured at a module, lugs, component, or undefined location will be accepted. These settings assure Let-through Voltage test results are accurate. SPDs shall meet the following criteria:

1.20 Service Entrance

- A. ANSI/IEEE Cat. C Impulse Wave The let-through voltage based on ANSI/IEEE C62.41 and C62.45 recommended procedures for the ANSI/IEEE Cat. C (High) (10,000 amps), shall be less than (values are total let-through voltage (LTV) measured from the insertion point of the transient on the sine wave to the peak of the transient):

Mode / Voltage	120/208Y	277/480Y	480V, 3 \emptyset Δ
L-N	1075V	1340V	N/A
L-L	1390V	1990V	1990V

L-G	1056V	1310V	2150V
N-G	1441V	1730V	N/A

1.21 Distribution and Branch Panels/Panelboards (Non-Electronics)

- A. ANSI/IEEE Cat. A Combination Wave Impulse Let-Through Voltage: The let-through voltage based on ANSI/IEEE C62.41 and C62.45 recommended procedures for the ANSI/IEEE Cat. A Combination Wave Impulse (6kV, 200 amps) at the 90 degree phase angle, shall be less than; (values are total let-through voltage (LTV) measured from the insertion point of the transient on the sine wave to the peak of the transient):

Mode / Voltage	120/208Y	277/480Y	480V, 3Ø Δ
L-N	315V	437V	N/A
L-L	467V	535V	515V
L-G	340V	424V	515V
N-G	597V	960V	N/A

1.22 Branch Panels/Panelboards (Electronics (LED Lighting))

- A. ANSI/IEEE Cat. A Ring Wave Let-through- Voltage: The let-through voltage based on ANSI/IEEE C62.41 and C62.45 recommended procedures for the ANSI/IEEE Category A 2kV, 30 Ohm Ring Wave at the 270 degree phase angle, shall be less than (values are total let-through voltage (LTV) measured from the insertion point of the transient on the sinewave to the peak of the transient):

Mode / Voltage	120/240 1Ø	120/208Y	120/240V, 3Ø Δ
L-N	30V	30V	30V
HiLeg-N	N/A	N/A	60V
N-G	50V	50V	50V

1.23 ANSI/UL 1449-2006 VOLTAGE PROTECTIVE RATING

- A. Voltage Protection Rating (VPR) is a rating selected from a list of preferred values as detailed in ANSI/UL 1449-2006 and assigned to each mode of protection. The value of a VPR is determined as the nearest highest value taken from a list of preferred values (as detailed in ANSI/UL 1449-2006) compared to the measured limiting voltage determined during the transient voltage surge suppression test using the combination wave generator at a setting of 6 kV, 3 kA.
- B. The SPD shall have Voltage Protection Ratings (VPRs) no greater than those shown below:

Nominal System Voltage	Mode	VPR
Single-Phase 120/240	L-N	600 V
	L-G	1000 V
	N-G	600 V
	L-L	1000 V

Three-Phase 120/240 Delta	L-N	600 V
	HL-N	1200 V
	L-G	600 V
	HL-G	1800 V
	N-G	600 V
	L-L	1200 V
120/208 Wye	HL-L	1800 V
	L-N	600 V
	L-G	1200 V
	N-G	600 V
	L-L	1200 V

1.24 WARRANTY

- A. All SPD devices shall be warranted to be free from defects in materials and workmanship under normal use in accordance with the instructions provided for a period of ten (10) years from date of substantial completion.
- B. Any SPD device that shows evidence of failure or incorrect operation, including damage as the result of lightning strikes, during the warranty period shall be replaced as a complete unit (not just modules, subassemblies, or components) by the manufacturer at no charge to the owner. Warranty will provide for multiple exchanges of any inoperable devices at any time during the warranty period that starts at the date of substantial completion of the system to which the surge suppressor is installed.
- C. SPD manufacturers whose warranty does not meet the requirements listed above standard shall submit a letter extending the warranty to meet these standards with the product submittal

1.25 INSTALLATION

- A. GENERAL: There are a few basic principles for the installation of SPDs in electrical panels. They are:
- B. For proper performance, the SPD must be installed with the wires as short and straight as possible. Any sharp bend in the wire is unacceptable! This applies to phase, neutral, and ground leads. The objective is to reduce the lengths of wire provided on each unit, not add to it. The priority is to the phase leads, then the neutral, and then the ground lead.
- C. Install the breaker for the SPD close to the neutral bus on the neutral bus side of the panel. If no neutral circuit is present in the electrical panel, install the breaker close to the ground bus if possible.
- D. Install the SPD on a dedicated breaker. If the unit is piggybacked on a breaker that feeds other equipment, when that breaker is turned off to service the other equipment, you

have lost the surge suppression for that panel.

- E. Mount the SPD directly across from the breaker. While holding the SPD on the wall or side of the panel, determine the shortest distance between the hub on the SPD and the hub to be installed on the panel. If using the flexible conduit supplied with the SPD, cut the flexible conduit to the shortest length possible to fit securely over both hubs. Twist the trimmed flexible conduit onto the extra hub. Slide the conduit and hub over the wires of the SPD and twist the conduit onto to the hub of the SPD. Connect the extra hub to the panel and mount the SPD to the wall or the panel.
- F. The breaker, the neutral bus, and the SPD should be close together to keep the wires as short and straight as humanly possible. Twist the phase and neutral wires together for 2 or 3 twists between the SPD and the breaker. Then these wires should be cut short as possible and connected to the breaker or the neutral bus, as appropriate, with no sharp bends in the wire.
- G. The ground wire should be connected to the panel ground bus if it is close to the SPD. If this is not possible, connect the ground wire to a ground lug installed near the SPD in the can or frame as they are grounded. If necessary, once this is done, the ground wire can be extended from the lug to the ground bus if the AHJ requires this connection.
- H. These same principles apply to installation on switchboards and MCCs. On MCCs, try to locate the SPD as close to the main bus as possible so that the lead lengths are short. If possible, when installing an SPD in an MCC, install it in a bucket with a feeder breaker and use a remote light mounted on the door. The Remote Light Kit (option –LP) must be ordered with the SPD. It cannot be ordered to add to the SPD as an in-the-field modification.

1.26 SPECIFIC:

- A. Provide surge suppressor at each building service entrance and at other distribution and panelboard locations as indicated on the drawings. The SPD shall be located immediately adjacent to the switchboard or panelboard being protected (close-nipple to panelboards). The SPD may not be located integral (switchgear manufacturer installed) within the switchboard or panelboard(s) unless the switchgear manufacturer providing such SPD products expressly meets or exceeds ALL parameters of this specification for the SPD. These SPDs shall be individually tested and Listed to ANSI/UL 1449 according to their type (Type 1 or Type 2) and not be listed solely as part of the larger assembly. SPD devices not meeting or exceeding the performance of this specification will be deemed unacceptable.
- B. Do not energize or connect service entrance equipment and panelboards to their sources until SPD devices are properly installed and connected.
- C. Do not perform insulation resistance tests of the distribution wiring equipment with the SPD installed. Disconnect before conducting insulation resistance tests, and reconnect immediately after the testing is over.

- D. Install the SPD with #10 AWG conductors to dedicated 30-amp breaker(s) in panel per manufacturer's installation instructions and close to the Neutral Bus. The dedicated breaker shall serve as a means of service disconnect for the SPD so that the electrical panel remains energized during SPD servicing. The installer may rearrange breaker locations to ensure the shortest and straightest leads to the SPD. If a dedicated breaker is not provided, an SPD with internal 30-amp fuse or a UL Listed disconnect switch shall be installed as a minimum. The conductors (neutral and phase wires) serving the SPD shall be twisted together (2 or 3 twists per 12" of wire) to reduce the SPD system input impedance and shall be kept at the minimum length. The SPD shall be installed in strict accordance with the manufacturer's recommended practices and in compliance with N.E.C. requirements, State, and Local Codes.
- E. If any lead lengths exceed 18", the Contractor responsible for installation must contact the specifying electrical engineer and the surge suppression manufacturer or distributor (888-212-2728) for installation assistance.
- F. The electrical contractor shall verify the proper application of the SPD (i.e., voltage, phases, etc.). The electrical contractor shall ensure that all Neutral conductors are bonded to the system ground at the service entrance the serving isolation transformer prior to installation of the associated SPD. The electrical contractor will ensure that neutral-to-ground bonds do not exist at locations that are not service entrances or newly derived power sources.
- G. The electrical contractor shall furnish all labor, materials, equipment, and services necessary for and incidental to the installation of the SPD system components as specified herein.
- H. The electrical contractor shall coordinate with other electrical work as necessary to interface installation of the transient voltage surge suppression systems with other work on the site.
- I. The SPD installation shall be certified by a licensed electrician that the installation is in accordance with the manufacturer's recommendations, applicable electrical code requirements and the requirements of the specification above. Any deficiencies noted shall be corrected by the Contractor. Provide written documentation of this inspection as part of the closeout documentation.

END OF SECTION

SECTION 16520
EXTERIOR LUMINAIRES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior luminaires and accessories.

1.02 REFERENCES

- A. ANSI C78.379 - American National Standard for Electric Lamps -- Reflector Lamps -- Classification of Beam Patterns.
- B. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low Pressure Sodium Lamps (Multiple-Supply Type).
- C. ANSI 8750 - Standard for Light Emitting Diode Equipment for Use in Lighting Products.
- D. NFPA 70 - National Electrical Code; National Fire Protection Association.
- E. Florida Fish and Wildlife Conservation Commission Turtle Friendly Lighting Recommendations/Practices
- F. Destin Lighting Ordinance (as applicable)

1.03 SUBMITTALS

- A. In accordance with project Specifications.
- B. Shop Drawings: Indicate dimensions and components for each luminaire which is not a standard product of the manufacturer.
- C. Product Data: Provide dimensions, ratings, and performance data.
- D. Test Reports: Indicate measured illumination levels.
- E. Maintenance Data: For each luminaire.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Electrical Components: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. As listed on the lighting fixture schedule.
- B. Substitutions: Engineer/FWC approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install luminaries at height as indicated on Drawings. Install per mounting details on drawing.
- B. Install LED lamps in each luminaire not equipped with LEDs.
- C. Bond luminaires, metal accessories, and metal poles to branch circuit equipment grounding conductor. Provide ground rod at each pole.

3.02 FIELD QUALITY CONTROL

- A. Perform field inspection, testing, and adjusting for optimum performance.
- B. Operate each luminaire after installation and connection. Inspect for improper connections and operation.

3.03 ADJUSTING

- A. Aim and adjust luminaires to provide illumination levels and distribution indicated on Drawings.

3.04 CLEANING

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosure.
- C. Clean photometric control surfaces as recommended by manufacturer.
- D. Clean finishes and touch up damage.

3.05 PROTECTION OF FINISHED WORK

- A. Relamp luminaires which have failed lamps at Substantial Completion.

END OF SECTION 16520