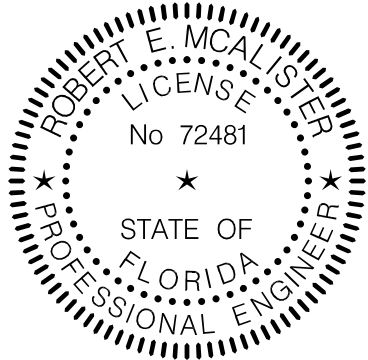




NORTHSIDE BAY ADDITION

TECHNICAL SPECIFICATION – ELECTRICAL

REVISION: 0
Date: August 01, 2017

| PROFESSIONAL ENGINEER | |
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SECTION IX – TECHNICAL SPECIFICATION - ELECTRICAL

TABLE OF CONTENTS

| | | |
|-----------|---|-----------|
| 1. | SWITCHYARD ELECTRICAL EQUIPMENT..... | 1 |
| 1.1. | General | 1 |
| 1.2. | Scope | 1 |
| 1.3. | Standards..... | 1 |
| 1.4. | Materials | 1 |
| 1.5. | Outdoor Switchyard Structures | 1 |
| 1.6. | Circuit Breakers | 2 |
| 1.7. | Insulators, Buswork, & Connectors | 3 |
| 1.8. | Instrument Transformers & Lightning Arresters | 4 |
| 1.9. | Station Service, Automatic Transfer Switch, & Electrical Panels | 4 |
| 1.10. | Switchyard Relay Boxes | 5 |
| 2. | GROUND GRID & BONDING SYSTEM..... | 5 |
| 2.1. | General | 5 |
| 2.2. | Scope | 5 |
| 2.3. | Materials | 5 |
| 2.4. | Ground Grid | 6 |
| 2.5. | Existing Grid Interference | 6 |
| 2.6. | Ground Grid Connections | 7 |
| 2.8. | Equipment Grounding | 7 |
| 2.9. | Structure Grounding..... | 8 |
| 3. | RACEWAY | 8 |
| 3.1. | General | 8 |
| 3.2. | Scope | 8 |
| 3.3. | Materials | 8 |
| 3.4. | Conduit And Wireway | 8 |
| 3.5. | Pullboxes | 9 |
| 4. | CONTROL CABLE & LOW-VOLTAGE ELECTRICAL CABLE | 9 |
| 4.1. | Cable Schedule..... | 9 |
| 4.2. | Splices | 10 |
| 4.3. | Interconnection Drawings | 10 |
| 4.4. | Control Cable Terminals | 10 |
| 4.5. | Grounding Of Shielded Control Cable | 10 |
| 4.6. | Length Of Cables For Control Panels | 10 |
| 5. | CONTROL HOUSE ELECTRICAL..... | 10 |
| 5.1. | Scope | 10 |
| 5.2. | General | 10 |
| 5.3. | Equipment And Materials | 10 |
| 5.4. | Placing Equipment In Service | 11 |

SECTION IX – TECHNICAL SPECIFICATION - ELECTRICAL

6. RECEIVING AND OFF-LOADING OF STRUCTURES AND MATERIALS 11

7. LABELING 11

7.1. Labeling Of Large Transformers And Breakers 11

7.2. Labeling Of Low-Voltage AC/DC Supply Branches 12

7.3. Labeling Of Conduits 12

7.4. Labeling Of Cable 12

SECTION IX – TECHNICAL SPECIFICATION - ELECTRICAL

1. SWITCHYARD ELECTRICAL EQUIPMENT

1.1. GENERAL

This is a general specification and covers the equipment required for substation construction. Any equipment listed which does not apply to this particular project shall be disregarded. The Drawings shall be used to determine the exact quantity and type of equipment intended for use on this project.

1.2. SCOPE

This Section covers labor, equipment, and material requirements for the installation of the switchyard electrical equipment. The Contractor shall erect in place, test, and leave ready for service, the facilities shown on the Drawings and herein specified. The Contractor shall also have responsibilities for receiving, off-loading, and transporting certain structures, equipment, and miscellaneous materials as called for in this Specification. The Contractor shall furnish and install materials and equipment only as specified or approved by the Project Engineer.

1.3. STANDARDS

The installation covered by these Specifications shall conform to the practices set forth in the latest edition of the National Electrical Code (NEC) and the National Electrical Safety Code (NESC), unless otherwise specified in these Plans and Specifications.

1.4. MATERIALS

- 1.4.1. All Contractor furnished materials, unless otherwise indicated, shall be new, of the first quality and of the proper type for use intended. When applicable, all material will be in accordance with the latest published NEMA Standards and/or carry the approval of the Underwriter's Laboratories.
- 1.4.2. The use of a manufacturer's trade name and catalog number is intended to indicate preference. Products of reputable manufacture, equal quality, and functional type may be used only after stamped approval by the Project Engineer.
- 1.4.3. Owner furnished items, with a general description of the items and their storage location, are listed in the Attachments at the end of this Specification. The Contractor shall coordinate the receiving of the items with the JEA Contract Administrator. It is the Contractor's responsibility, unless otherwise specified, to furnish labor and equipment for loading, for transporting, and for off-loading the items at the job site.
- 1.4.4. All material and equipment stored on the substation site or other areas including Owner furnished material and equipment, shall be in the care, custody, and control of the Contractor. The Contractor shall be responsible for any necessary repairs or replacement of materials and equipment damaged, lost, or stolen while in the care and custody of the Contractor.

1.5. OUTDOOR SWITCHYARD STRUCTURES

The Contractor shall install all substation structures as indicated on the Drawings. Assembly of the structures shall be in accordance with the Manufacturer's assembly drawings, unless otherwise specified.

- 1.5.1. The Owner's Supplier shall furnish the substation structures as a part of the "Structures and Materials" package. It is the Contractor's responsibility, unless otherwise specified in the Appendix, to furnish labor and equipment for receiving, off-loading, and storing these structures at the job site.
- 1.5.2. It shall be the Contractor's responsibility to notify the Owner of any damage to the structures and errors in the structure fabrication before and during the installation, so that the Owner may coordinate with the Manufacturer and make good any such damage to the equipment.
- 1.5.3. Detailed structural assembly drawings may be inspected at the JEA office in Jacksonville, Florida, by contacting the Project Engineer.
- 1.5.4. The steel structures, as shown on the Drawings, will be furnished by the Owner and are fabricated for bolted field assembly. Mounting holes for equipment have been included in the fabrication of the structures.
- 1.5.5. The Contractor shall include in the bid and be responsible for the correction of minor errors and minor modifications in the structures in order to provide for a complete installation as indicated on the Drawings.

SECTION IX – TECHNICAL SPECIFICATION - ELECTRICAL

Corrections shall include but not be limited to the following: reaming misaligned holes, punching new holes, and clipping or punching support angles as required. Approximately 100 punched holes shall be considered minor modifications. All modifications shall be cold galvanized to resist corrosion.

- 1.5.6. Any equipment mounted on the structures by the Contractor (e.g. AC panels, outlet boxes, etc.) shall be mounted utilizing galvanized or stainless steel materials and hardware. Whenever practical, the Contractor shall mount miscellaneous equipment to the structures using non-penetrating methods such as back-to-back unistrut. All holes drilled to mount such equipment shall be cold galvanized to resist corrosion.
- 1.5.7. The Contractor shall provide and install a bit-u-mastic coating for the bases of all aluminum structures which come into direct contact with concrete foundations.
- 1.5.8. The Contractor shall install lighting fixtures mounted on the lightning probe poles and on the takeoff structures complete with conduit, wiring, light fixtures, and switches, in locations as shown on the Drawings. Light fixtures will be furnished by the Owner, as indicated in the Attachments at the end of these Specifications. Conduit, switches, and wiring as specified on the Drawings shall be furnished by the Contractor.
- 1.5.9. Erection of the lightning probe poles shall be in accordance with the Manufacturer's assembly drawings.
- 1.5.10. The Contractor shall install perimeter lighting poles complete with anchor bases, arms, conduit, wiring, light fixtures, and photocells in locations as shown on the Drawings. Lighting poles, anchor bases, arms, light fixtures, and photocells will be furnished by the Owner, as indicated in the Attachments at the end of these Specifications.
- 1.5.11. All substation structures and equipment are stored at the Substation Packager's facility. The Contractor shall plan and make provisions for receiving, unloading, and storing on site all related structures and equipment.
- 1.5.12. The Contractor shall provide dry storage containers, as required, for all items (including but not limited to cardboard boxes, fragile items, etc.) requiring inside storage until assembly and installation by the Contractor. Tarps and/or covers placed on top of the material and stored outdoors do not qualify as dry storage in this Contract.

1.6. CIRCUIT BREAKERS

The Contractor shall be responsible for either transporting the circuit breakers to the substation site from their storage location at an arbitrary location within Duval County, Florida, or receiving all circuit breakers directly from the Manufacturer at the job site at the discretion of JEA.

- 1.6.1. The following tasks must be performed if the breakers are being shipped directly to the job site:
 - A. The Contractor may assume that the Owner's Manufacturer shall have the breakers available for shipping in time to meet the scheduled circuit breaker shipping dates which are shown in the Project Schedule in the Attachments of these Specifications.
 - B. As the project progresses, the Contractor shall notify the Project Engineer in writing (or by electronic mail) at least two (2) weeks in advance of the date of the Contractor's readiness for the breakers. This should be at the time of foundation pouring, to assure sufficient time for curing, and should conform to the breaker delivery dates listed in the Project Schedule in the Attachments of these Specifications.
 - C. The Owner's Manufacturer will then ship the breakers directly to the job site and deliver it on the date specified by the Contractor, +/- five (5) business days.
 - D. The Contractor shall then have employees and equipment on-site during business hours, throughout this five day window, to off-load the breakers within one (1) hour of the shipper's arrival. The Contractor shall then take responsibility of the breakers, and may choose whether to set the breakers directly onto the pad or to set the breakers in an approved storage area. Approved storage areas shall mean any storage location approved by the JEA Contract Administrator for this specific purpose.
 - E. The Contractor shall be responsible to ground the circuit breakers (including each high-voltage bushing) immediately upon arrival at the job site. This may be done by means of a temporary attachment to the ground grid, when approved by the JEA Contract Administrator. The Contractor shall also run temporary AC power to the heater in the control panel of each breaker.

SECTION IX – TECHNICAL SPECIFICATION - ELECTRICAL

- 1.6.2. The Contractor shall be responsible for some minor assembly of the breakers at the job site. This assembly, which shall be supervised by JEA personnel, shall include assembly of supports, attachments of control panel doors, etc. The Owner shall supply the Contractor with one (1) copy of the Manufacturer's assembly instructions. The Contractor shall closely follow these instructions.
- 1.6.3. The Owner, the Equipment Manufacturer's Contractor, or representative acting as an agent for the Owner, will furnish and operate the filtering equipment, vacuum drying equipment or SF-6 gas handling equipment, and provide the insulating oil or SF-6 gas. The Owner will be responsible for filling and final adjustment of the circuit breakers.
- 1.6.4. The Contractor shall be responsible for the placement of the circuit breakers on the foundations. The Contractor shall install the circuit breakers such that the lowest point of any energized parts is not less than the appropriate above grade clearance for personnel safety (NESC) above the foundation elevation.
- 1.6.5. Connections to the circuit breakers, by means of bus or conductor, will be the responsibility of the Contractor.
- 1.6.6. The foundation, conduit, control and power cabling, grounding, and associated work will be the responsibility of the Contractor.
- 1.6.7. All associated primary wiring, secondary wiring, and control wiring, and grounding connections shall be installed by the Contractor in accordance with the Manufacturer's assembly instructions, unless directed otherwise on the construction drawings.
- 1.7. INSULATORS, BUSWORK, & CONNECTORS
 - 1.7.1. The station type insulators, bus, conductor, and connectors shall be furnished by the Owner's Supplier as listed in the Bill of Materials as a part of the "Structures and Materials" package and installed by the Contractor in accordance with the Manufacturer's assembly instructions. The Contractor shall receive, off-load, and store this equipment in the same manner as described for the "Structures and Materials" package, unless otherwise directed. That includes providing dry storage for the material, boxes, crates, cartons, etc. not suited for outdoor storage.
 - 1.7.2. The Contractor shall install station type insulators, bus, conductor, and connectors as indicated on the Drawings.
 - 1.7.3. Any chipped or damaged insulators shall be brought to the Owner's attention prior to installation. The Contractor shall repair minor insulator damage after review of the damage and approval of the Contractor's proposed repair process is made by the Project Engineer.
 - 1.7.4. The minimum clearance between bus and overhead conductors of different phases and from conductors to ground shall be as indicated on the Drawings. Where not specifically indicated, the minimum clearances shall be as per ANSI and IEEE requirements.
 - 1.7.5. The Contractor shall install all bus, conductors, and connectors as indicated on the Drawings. All items on the substation structures, including hardware, will be furnished by the Owner's Supplier unless noted otherwise on the Bill of Materials or on the Drawings.
 - 1.7.6. The welding of aluminum bus shall adhere to the following requirements:
 - A. The welding process and all welding operators shall be qualified in accordance with the Aluminum Association Aluminum Construction Manual, "Specifications for Aluminum Structures", Section 7/2/4 (Qualification of Welding Procedure and Welding Operators).
 - B. All joints to be welded shall be free of moisture and hydrocarbons. Degreasing shall be done with a non-toxic solvent. Sufficient time must be allowed for the evaporation of the solvent prior to welding. Wire brushing with a stainless steel wire brush should be employed after solvent cleaning to remove all oxide films, water stains, etc.
 - C. All aluminum welds shall be by the gas metal-arc (MIG) or the gas tungsten-arc (TIG) welding process.
 - D. The working area should be substantially draft-free and protected from atmospheric contamination.

SECTION IX – TECHNICAL SPECIFICATION - ELECTRICAL

- E. All welds shall be made with clean metal and the completed weld shall have a smooth finish and shall indicate good fusion with the parent metal.
- F. All connections shall be checked for the proper edge penetration and alignment before, during, and after the weld is made. The cross sectional area of the weld should not be less than that of the smallest member being joined.
- G. To repair a defective weld, the defective portion must be entirely removed. The area to be repaired should be re-cleaned as described herein and the weld made in a manner similar to the original.
- H. Tackwelding should be used to prevent misalignment of the members being joined during the welding process.
- 1.7.7. Tinned connectors shall be installed when a copper to aluminum connection is made. The tinned connectors shall be furnished by the Owner.
- 1.8. INSTRUMENT TRANSFORMERS & LIGHTNING ARRESTERS
 - 1.8.1. The instrument transformers and lightning arresters will be furnished by the Owner's Supplier as a part of the "Structures and Materials" package. The Contractor shall receive, off-load, and store these materials in the same manner as described for the "Structures and Materials" package, unless otherwise directed.
 - 1.8.2. The Contractor shall install outdoor instrument transformers as indicated on the Drawings. All wiring shall be as listed in the Cable Schedule and Conduit Schedule.
 - 1.8.3. The Owner will furnish, operate, and supervise the filtering equipment and oil for the instrument transformers as required.
 - 1.8.4. The Contractor shall install lightning arresters as indicated on the Drawings.
 - 1.8.5. All associated primary wiring, secondary wiring, instrument and control wiring, and grounding connections shall be installed by the Contractor in accordance with the Manufacturer's instructions, unless stated otherwise in the Drawings.
 - 1.8.6. Tinned connectors shall be installed when a copper to aluminum connection is made. The tinned connectors shall be furnished by the Owner.
- 1.9. STATION SERVICE, AUTOMATIC TRANSFER SWITCH, & ELECTRICAL PANELS
 - 1.9.1. The Contractor shall be responsible for transporting and installing the Owner furnished distribution type transformers in the locations as shown on the Drawings. The transformers are located at the JEA Commonwealth Service Center and will be taken out of stock. JEA will furnish and the Contractor shall install the medium voltage station service transformers.
 - 1.9.2. Less than 600V low voltage class transformers are not normally stocked by JEA. These transformers shall be furnished and installed by the Contractor as shown on the Drawings.
 - 1.9.3. The Contractor shall be responsible for transporting and installing the automatic transfer switch if specified on the Station Service Drawing. The transfer switch shall be ASCO Type 7000 and be furnished by the Owner complete with a NEMA 3R enclosure. The Contractor shall furnish and install galvanized unistrut channels and stainless steel mounting hardware as required to mount the transfer switch to the structure mounting brackets.
 - 1.9.4. The Contractor shall furnish and install all new AC electrical panels on the load side of the automatic transfer switch as shown on the Drawings, unless directed otherwise. The Contractor shall also furnish and install the internal circuit breakers, ground bus, and associated hardware (as required) to complete the wiring shown on the panel drawing. The Contractor shall also furnish and install the galvanized unistrut channel and stainless steel mounting hardware as required to mount the panel to the structure mounting brackets.
 - 1.9.5. The Contractor shall be responsible for furnishing the necessary terminals, connectors, etc., to terminate cables at the ATS and splices (as required).

SECTION IX – TECHNICAL SPECIFICATION - ELECTRICAL

- 1.9.6. The Contractor shall be responsible for furnishing and installing the switchyard electrical panels, cabinets, and junction boxes. The exact quantity, locations and sizes of the panels, cabinets, and junction boxes shall be as shown on the Drawings. All switchyard AC panels shall be enclosed in stainless steel enclosures.
- 1.9.7. The AC power panelboards shall be Square D Co. Type NQOD. All panelboards shall be enclosed in a NEMA 3R enclosure and shall also include housings with a lockable cover and/or door.
- 1.9.8. The Contractor shall be responsible for furnishing and installing the main and branch circuit breakers in all yard panels. The main breakers and branch circuit breakers shall be conventional bolt-on type circuit breakers rated in accordance with the Drawings. The wiring and labeling of each panel breaker shall be as shown on the Drawings and in accordance with other applicable Sections of these Specifications.
- 1.9.9. The Contractor shall be responsible for securely mounting switchyard electrical panels to the substation structures. Mounting brackets may have been incorporated into the structure design. The Contractor shall furnish and install galvanized unistrut channels and stainless steel mounting hardware as required to mount the electrical panels, cabinets, and junction boxes to the structure mounting brackets. Should any alteration or modification be necessary for the mounting of electrical panels, the Contractor shall submit details of the proposed alteration to the Project Engineer in writing for approval prior to installation.
- 1.10. SWITCHYARD RELAY BOXES
 - 1.10.1. The Contractor shall be responsible for furnishing and installing the bus differential boxes, potential transformer fuse boxes, terminal blocks, fuse blocks, test switches, and heaters (as specified). The exact quantities, locations, sizes, and types of boxes, blocks, switches, and heaters shall be as shown on the Drawings. The bus differential and PT fuse boxes shall be stainless steel.
 - 1.10.2. The Contractor shall be responsible for securely mounting the switchyard relay boxes to the substation structures. Mounting brackets may have been incorporated into the structure design for most of these boxes. The Contractor shall furnish and install galvanized unistrut channels and stainless steel mounting hardware as required to mount the relay boxes to the structure mounting brackets. Details for mounting and wiring the switchyard relay boxes (if applicable) are included in the Drawings. Should any alteration or modification be necessary for mounting the relay boxes, the Contractor shall submit details of the proposed alteration to the Project Engineer for approval prior to installation.
 - 1.10.3. All above grade conduit to the relay boxes shall be either rigid galvanized steel or UV resistant PVC, Schedule 40. Installation and termination of control and instrument wiring shall be in accordance with the Specifications and Drawings.

2. GROUND GRID & BONDING SYSTEM

2.1. GENERAL

- 2.1.1. This is a general specification and covers the requirements and procedures for the installation of, or addition to, the station ground grid system. Any material or equipment listed which does not apply to this particular project shall be disregarded. The Drawings shall be referenced for specific requirements concerning the quantity, type, and installation of the material to complete the station ground grid system.
- 2.1.2. The Contractor shall be responsible for providing the Owner with an accurate "As Built" drawing of the station ground grid (as specified in Section VII).

2.2. SCOPE

This Section covers the labor, equipment, and material requirements for the installation of, or addition to, the station ground grid system. The Contractor shall install the ground grids as shown on the Drawings and herein specified. The Contractor shall also be responsible for the connection of all switchyard electrical equipment, control building electrical equipment, substation structures, fences and gates to the station ground grid system as shown on the Drawings and herein specified.

2.3. MATERIALS

- 2.3.1. The Contractor shall refer to the Drawings for material requirements to complete the station ground grid system. The Contractor shall furnish materials and equipment only as specified or approved by the Project Engineer.

SECTION IX – TECHNICAL SPECIFICATION - ELECTRICAL

- A. All Contractor furnished materials, unless otherwise specified, shall be new, of first quality and of the proper type for the use intended.
- B. The Owner shall furnish above grade structure and equipment grounding connectors, unless otherwise indicated. The above grade structure and equipment grounding connectors will be furnished by the Owner's Supplier as a part of the "Structures and Materials" package. The Contractor shall receive, off-load, and store these items in the same manner as described for the "Structures and Materials" package. The Contractor shall furnish the below and above grade ground grid conductor; below grade connectors; the equipment, structures, manhole, and fence grounding conductor; and all fence grounding connectors.

2.4. GROUND GRID

- 2.4.1. The Contractor shall furnish the required amount of 19#8 and 7#5 Copperweld conductor and the 500MCM copper conductor for the ground grid, unless otherwise specified. The Contractor shall purchase the grounding material which meets or exceeds JEA material requirements. The 19#8 conductor (JEA #COBCW015) shall be Copperweld, 19-strand #8, 0.643" diameter, 40% conductivity as per ASTM B-227 and B-228, high strength - rated 27,548 lbs. The 7#5 conductor (JEA #COBCW016) shall be Copperweld, 7-strand #5, 0.546" diameter, 40% conductivity as per ASTM B-227 and B-228, high strength - rated 17,949 lbs.
- 2.4.2. The Contractor shall install the ground conductor in the locations indicated on the Drawings and at the depth specified. The Contractor shall install the conductor in an open trench to facilitate proper installation and inspection of the ground grid connections.
- 2.4.3. The Contractor shall notify the Owner of any damaged ground grid conductor before, during, and after installation so the conductor may be replaced.
- 2.4.4. The Contractor shall furnish material (as required) and install all ground rods, ground wells, and grounding connections to complete the ground grid system, as specified.

2.5. EXISTING GRID INTERFERENCE

- 2.5.1. The Contractor shall relocate any existing ground grid facilities which are discovered during excavation for this work. It is expected that the Contractor may discover up to five (5) runs of ground grid conductor that must be relocated, to accommodate the foundations and other work that is a part of most station improvement Contracts. Because the existing ground grid components are a part of an existing, energized substation, care must be taken in the relocation of such grounding facilities, which relocation shall be performed as follows:
 - A. The Contractor shall first identify to the JEA Contract Administrator each of the ground grid components that cross any of the excavation areas. This shall be done by means of either a total hand dig or a circumferential hand dig that exposes all facilities that cross through the excavation areas.
 - B. After determining the crossings of the ground grid, the Contractor shall propose a sketch to the JEA Contract Administrator showing how the grid will be rerouted AROUND the periphery of each of the excavation areas. The sketch shall list the existing materials discovered, the materials to be used, and the initial and final configuration of the grid work.
 - C. The JEA Contract Administrator shall transmit the sketch to the Project Engineer for review and approval, and such review shall be provided within five (5) business days. If JEA fails to return approval/comments/corrections on the sketch by the sixth (6th) business day, the sketch shall be approved and the Contractor shall commence work.
- 2.5.2. This electrical power substation will remain energized during this work, and significant ground grid currents may be flowing in any component of the grid at any time. **UNDER NO CIRCUMSTANCE SHALL THE CONTRACTOR CUT ANY EXISTING GROUND GRID FACILITIES** prior to a replacement facility being placed into service. These new facilities must be inspected by the JEA Contract Administrator PRIOR to cutting of and removing the interfering facilities.
- 2.5.3. In the event that more than five (5) ground grid crossings are found in the excavation area, the Contractor shall be entitled to additional compensation, over and above the bid for this Work. This compensation shall be determined by the Contractor (in a formulary way) based solely on labor/material increments for the additional work, and

SECTION IX – TECHNICAL SPECIFICATION - ELECTRICAL

based on the full costs of the most expensive three (3) of such crossings being contained entirely within the original scope of work.

2.6. GROUND GRID CONNECTIONS

- 2.6.1. Ground grid connections (including connections to ground rods and ground wells) shall be made by an approved exothermic process utilizing Cadweld Plus molds and materials manufactured by Cadweld. The Contractor shall use the Cadweld Plus System with the corresponding molds and electronic control unit for weld metal ignition. Molds for each type of connection are to be replaced after a maximum use of fifty (50) welds. Ground grid connections may be made by AMP, or other approved mechanical connectors (only if specified), where the number of connections required is limited.
- 2.6.2. Ground grid connections shall be of the type that avoids cutting and/or splicing of the main grid conductor.
- 2.6.3. A Manufacturer's representative is required to demonstrate the proper installation procedures of the exothermic system being used prior to installation of any ground grid connection. The Contractor shall be responsible for arranging the demonstration. Any Contractor representative that may install the ground grid connections and the JEA Contract Administrator shall be present at the demonstration.
- 2.6.4. The Contractor shall strictly follow the Manufacturer's installation procedures.
- 2.6.5. All surfaces to be joined by the weld shall be thoroughly cleaned and dried prior to final placement of the mold. Worn, damaged, or incorrectly sized molds which in the opinion of the JEA Contract Administrator do not make satisfactory welds shall be removed from the job site.
- 2.6.6. All welded connections made by the exothermic process shall encompass 100% of the end of the material being welded. Welds which do not meet this requirement shall be remade at the Contractor's expense.
- 2.6.7. All welded connections made by the exothermic process shall be visually inspected by the JEA Contract Administrator and may be subjected to testing. Testing shall be in the form of moderate hammer blows, from which a properly formed connection will easily resist any visible damage. Any connection which fails such a test or which, upon visual inspection, indicates a porous or deformed weld shall be remade at the Contractor's expense. Should different molds or materials be required to facilitate the corrected connection of a failed weld, such material shall be furnished at the Contractor's expense. The use of molds and materials other than specified must be approved for use by the Project Engineer.

2.8. EQUIPMENT GROUNDING

- 2.8.1. The Contractor shall be responsible for connecting electrical equipment such as circuit breakers, station service transformers, potential transformers, instrument transformers, lightning arrestors, etc., directly to the station ground grid as shown on the Drawings.
- 2.8.2. Electrical equipment shall be furnished by the Owner, unless otherwise specified. The Contractor shall be responsible for installing the equipment ground conductor on the side of the structure designed to accommodate the ground conductor.
- 2.8.3. The Owner shall furnish all above grade ground connectors necessary to connect the equipment to the station ground grid, unless otherwise specified. The Contractor shall furnish the 7#5 Copperweld grounding conductor and all other material, equipment, and labor necessary to complete the connection of the electrical equipment to the station ground grid.
- 2.8.4. The Contractor shall install the equipment ground conductor such that the continuity of the conductor from the equipment to the station ground grid is maintained as much as practical.
- 2.8.5. The ground conductor installed on the equipment structures shall be sufficient in meeting the requirements of structure grounding.
- 2.8.6. Free standing electrical equipment, such as circuit breakers, shall be connected directly to the station ground grid. The Contractor shall install ground conductors as shown on the Drawings. More than one (1) ground conductor installation may be required in the grounding of free standing electrical equipment.

SECTION IX – TECHNICAL SPECIFICATION - ELECTRICAL

2.9. STRUCTURE GROUNDING

- 2.9.1. The Contractor shall be responsible for connecting all steel structures directly to the station ground grid as shown on the Drawings.
- 2.9.2. The structures are furnished by the Owner and are designed to accept the ground connectors provided. The Contractor shall be responsible for installing the structure ground conductor on the proper side of the structure to facilitate the connection of the structure to the station ground grid.
- 2.9.3. The Owner shall furnish all above grade ground connectors necessary to connect the structures to the station ground grid, unless otherwise specified. The Contractor shall furnish the 7#5 Copperweld grounding conductor and all other material, equipment, and labor necessary to complete the connection of the steel structures to the station ground grid.
- 2.9.4. The Contractor shall install all structure ground conductors such that they conform to the structure and foundation. Ground conductors on structures with grounded equipment shall conform to the requirements of this Specification.
- 2.9.5. Structures must be grounded to the station grid within the same working day the structure is erected.

3. RACEWAY

3.1. GENERAL

- 3.1.1. This is a general specification and covers the requirements and procedures for the installation of conduits, wireways, manholes, cable trenches, and cable trays used to distribute power and control cables to the equipment in the switchyard and control building. Any material or equipment listed which does not apply to this particular project shall be disregarded. The Drawings shall be referenced for specific requirements concerning the quantity, type, and installation of material to complete this work.
- 3.1.2. The Contractor shall be responsible for providing the Owner with accurate "As Built" drawings of the conduit, cable trench, and cable tray systems installed (as specified in Section VII).

3.2. SCOPE

This Section covers the labor, equipment, and material requirements for the installation of conduits, wireways, manholes, cable trenches, and cable trays in the switchyard and control building. The Contractor shall furnish all materials necessary and install the conduits, wireways, manholes, cable trenches, and cable trays as shown on the Drawings and specified herein.

3.3. MATERIALS

The Contractor shall refer to the Drawings for material requirements to complete the installation of the conduits, wireways, manholes, cable trenches, and cable trays as required for the substation raceway system. The Contractor shall furnish materials and equipment only as specified or approved by the Project Engineer.

- 3.3.1. All Contractor furnished materials, unless otherwise specified, shall be new, of first quality, and of the proper type for the use intended.
- 3.3.2. The Contractor shall refer to the "Conduit Schedule" for specific material requirements of individual raceway runs.
- 3.3.3. Unless otherwise specified, UV resistant Schedule 40 PVC shall be permitted for underground conduit runs. All above grade conduit shall be either rigid galvanized steel or UV resistant Schedule 40 PVC, unless otherwise specified or as shown on the Drawings. The inside edge of conduit ends (spigot-end only in the case of belled-end conduit) shall be beveled to eliminate sharp edges and minimize the possibility of cable damage.

3.4. CONDUIT AND WIREWAY

- 3.4.1. The Contractor shall furnish and install the conduits, as listed in the "Conduit Schedule" and as shown on the Drawings.
- 3.4.2. The Contractor is responsible for all hardware necessary to complete the installation of the conduit system.

SECTION IX – TECHNICAL SPECIFICATION - ELECTRICAL

- 3.4.3. Conduits shall be installed at the depth shown on the Drawings, with the area backfilled and compacted to same density as surrounding areas. See section VIII for installation and proofing requirements for the conduit systems, as required.
- 3.4.4. When installing conduit in an existing switchyard, the Contractor shall remove and dispose of the existing rock. The Contractor shall not use this rock to cover the completed work-in-place, but shall place new, clean rock onto the work surfaces. Such rock and its placement shall meet the requirements of Section VIII of these Specifications.
- 3.4.5. When installing conduit in an existing switchyard, the Contractor shall compact the area to the same density, and with similar material, as with the adjacent undisturbed materials. In every such case, the resultant soils will be re-poisoned to eradicate future plant growth, using the herbicide specified in Section VIII of these Specifications. The Contractor shall furnish these herbicides.
- 3.4.6. The Contractor shall form all above grade conduits to conform to the surfaces of the foundations and structures. Rigid galvanized steel conduit shall be formed using a pipe bender. UV resistant Schedule 40 PVC shall be shaped with a Therm-o-Tools Company combo type, Hotbox bender, or approved equal.
- 3.4.7. The Contractor shall furnish and install the wireway as specified in the "Conduit Schedule" and as shown on the Control House Drawings. The wireway shall be NEMA 1 square wireway, smooth, seam free, without knockouts, and shall have removable covers. The wireway and associated fittings shall be finished with baked satin ANSI 61 gray enamel over phosphatized surface. The wireway shall be manufactured from steel not less than 16 gauge and shall conform to NEMA standards. The Contractor shall install the wireway in accordance with the Manufacturer instructions and as indicated on the drawings. All field cuts shall be made with a hacksaw and grounded smooth. Terminations of the wireway run into the cable tray, electrical panels, or electrical equipment shall utilize a panel adapter. Wireway sweeps consisting of two (2) 45 degree bends shall be used in lieu of one (1) 90 degree bend.
- 3.4.8. The Contractor will be responsible for labeling all conduits as listed in the "Conduit Schedule". For details, see Subsection "Labeling" of this Section.
- 3.5. PULLBOXES
 - 3.5.1. Unless otherwise noted, JEA shall furnish and contractor shall install all pre-cast pullboxes in the locations shown on the drawings. The final elevation of the pullbox shall be flush with the final grade or rocked elevation, as necessary.
 - 3.5.2. Requirements for installation, including trenching, backfill, compaction, etc. shall be as shown on the drawings and Section VIII.

4. CONTROL CABLE & LOW-VOLTAGE ELECTRICAL CABLE

- 4.1. CABLE SCHEDULE
 - 4.1.1. The Contractor shall pull and terminate all cables as listed in the Cable Schedule. All control cable, shielded control cable, and instrument cable will be provided by Owner. All other cables listed shall be provided by the Contractor.
 - 4.1.2. Cable lengths listed in the Cable Schedule are approximate. The Contractor shall be responsible for verification of all cable lengths prior to cutting.
 - 4.1.3. The Contractor is responsible for providing the Owner with accurate "As Built" revisions of the Cable Schedule, Conduit Schedule, and related Drawings, as specified in Specification Section VII.
 - 4.1.4. All low-voltage electrical cable furnished by the Contractor shall be as specified in the Cable Schedule. Where multiple conductor cable is specified, the Contractor shall furnish and install multiple conductor cable. Cable lengths listed in the Cable Schedule are approximate. The Contractor shall supply cable as necessary to complete the work.
 - 4.1.5. The Contractor will be responsible for labeling all cables as listed in the Cable Schedule. For details, see Subsection "Labeling" of this Section.

SECTION IX – TECHNICAL SPECIFICATION - ELECTRICAL

4.2. SPLICES

- 4.2.1. All runs of control cable shall be continuous. Splices in control cable shall NOT be permitted.
- 4.2.2. Splices made in low-voltage electrical cable should be avoided. When necessary, splices in low-voltage electrical cable shall conform to all applicable NEC and NESC standards.

4.3. INTERCONNECTION DRAWINGS

The control cable Interconnection Drawings will be supplied at a later date by the Owner to show all terminations of the cables as listed on the Conduit and Cable Schedules.

- 4.3.1. The Contractor shall be responsible for terminating all cables listed on the Conduit and Cable Schedules. The Contractor shall also be responsible for the termination of any jumpers on terminal blocks in the equipment or on the control panels that may be shown on the Interconnection Drawings.
- 4.3.2. The Bid shall be based on the assumption of a termination at both ends of every conductor in each cable of the Cable Schedule.
- 4.3.3. The Owner shall terminate all cables to existing control panels which are energized. The Contractor shall pull cables to these panels, fan ends, install terminals, and leave ample cable for making terminations.

4.4. CONTROL CABLE TERMINALS

Ring type compression terminals, which shall be furnished by the Contractor, shall be used at both ends of all control cables and wiring. The ring terminals used shall be non-insulated, tin plated, barrel type with brazed seam and sized for the wire being terminated. Terminal manufacturer's recommendation shall be used to select the termination lug to match the size of the terminal screw and the size of the wire. All terminal lugs shall be crimped using a lug-crimping tool recommended by the lug manufacturer. Care shall be taken to avoid under and over crimping. Each crimp shall be inspected for good connection visually and by applying appropriate tension to the joint.

4.5. GROUNDING OF SHIELDED CONTROL CABLE

A copper shield grounding bus has been provided at the top of each relay control panel for terminating the ground conductor of each shielded control cable. Each ground conductor from the shielded cables will land individually on a terminal space, and be identified with its appropriate cable name. The Owner will provide ground cables from the shield bus to the panel ground. The Contractor shall provide amp type Termi-foil connectors for jumper connections between the control cable shields to the panel ground shield bus. The jumper wire size shall be a stranded #10 AWG.

4.6. LENGTH OF CABLES FOR CONTROL PANELS

All cables pulled to the control panels shall be sized to reach the floor of the panel and back to the top of the relay panel or RTU. The insulation jacket shall then be stripped back to the top of the panel and all cables terminated without cutting individual wires.

5. CONTROL HOUSE ELECTRICAL

5.1. SCOPE

This Section covers the equipment, installation, and wiring necessary for the control house.

5.2. GENERAL

The Contractor shall furnish and install the low-voltage equipment in locations as shown on the Drawings. The installation of low-voltage wiring of this equipment shall conform to the practices set forth in the latest edition of the NEC, unless otherwise specified in these Plans and Specifications. It shall be the Contractor's responsibility to furnish the required quantity of conduit and cable necessary to complete the installation.

5.3. EQUIPMENT AND MATERIALS

- 5.3.1. All materials, unless otherwise indicated, shall be new, of the first quality, and of the proper type for the use intended. Where applicable, all material shall be in accordance with the latest published NEMA Standards and/or carry the approval of the Underwriters' Laboratories.

SECTION IX – TECHNICAL SPECIFICATION - ELECTRICAL

- 5.3.2. The use of a manufacturer's trade name and catalog number is not intended to indicate preference, but only the type and quality of the product desired. Products of reputable manufacturers of equal quality and functional type will be acceptable upon approval of the Project Engineer. Substitutes which tend to lower the quality of the work will not be permitted.

5.4. PLACING EQUIPMENT IN SERVICE

Equipment and electrical circuits shall be checked and tested prior to energization. Notification of the JEA Contract Administrator is to be made before energization of the low-voltage electrical equipment so a representative of the JEA Contract Administrator will be present.

6. RECEIVING AND OFF-LOADING OF STRUCTURES AND MATERIALS

The Contractor shall be responsible for taking delivery of all Substation Structures and Materials directly from the Owner or the Manufacturer at the job site. This will require that the Contractor perform the following tasks regarding Substation Structures and Materials delivery as the project progresses:

- 6.1.1. The Contractor may assume that the Owner's Manufacturer shall have the Substation Structures and Materials available for shipping in time to meet the scheduled Structures and Materials shipping date which is shown in the Project Schedule in the Attachments of these Specifications.
- 6.1.2. As the site work progresses, the Contractor shall notify the Project Engineer in writing (or by electronic mail) at least two (2) weeks in advance of the date of the Contractor's readiness for all Structures and Materials. However, this scheduled delivery date must be within two (2) weeks of the scheduled Structures and Materials shipping date which is listed in the Project Schedule in the Attachments of these Specifications.
- 6.1.3. The Owner's Manufacturer will then set an approximate schedule for the shipment of all Substation Structures and Materials directly to the job site and deliver on the date specified by the Contractor, +/- five (5) business days (two week window).
- 6.1.4. When the shipper of each shipment is within 48 hours of the Substation site, the shipper will contact the JEA Contract Administrator to schedule a delivery appointment. The Contractor, shipper, and JEA Contract Administrator shall then coordinate a firm appointment.
- 6.1.5. The Contractor shall then have employees and equipment on-site, throughout normal business hours of that day, to off-load all Substation Structures and Materials within two (2) hours of the shipper's arrival. The Contractor shall then take responsibility of all Substation Structures and Materials, and may store the Structures and Materials on-site in an approved storage area. Approved storage area shall mean any storage location approved by the JEA Contract Administrator for this specific purpose.
- 6.1.6. The JEA Contract Administrator and the Contractor shall then count, examine, and sign for all Structures and Materials.

7. LABELING

The Contractor shall be responsible for labeling the following newly-installed substation facilities at the job site. The Contractor shall also re-label equipment designations on existing equipment where the designations are subject to change under the project scope. This will require that the Contractor perform the following tasks:

7.1. LABELING OF LARGE TRANSFORMERS AND BREAKERS

The Contractor shall provide and install all labeling of all newly-installed large transformers and high-voltage circuit breakers in the switchyard as specified below.

- 7.1.1. The Contractor shall label the transformers and breakers using spray paint and a block stencil with six (6") inch high letters. The equipment designations to be used are shown on the "SINGLE LINE DIAGRAM" Drawing.
- 7.1.2. The Contractor shall prepare the surface of the transformers and breakers prior to painting, in a manner approved by the JEA Contract Administrator. The paint shall be Rust-oleum spray on #7776-830, flat black, or equal as approved by the JEA Contract Administrator.

SECTION IX – TECHNICAL SPECIFICATION - ELECTRICAL

- 7.1.3. The labeling shall be applied, at approximately eye level, in two (2) places: on the right hand side of the cabinet door and another location as specified by the JEA Contract Administrator.

7.2. LABELING OF LOW-VOLTAGE AC/DC SUPPLY BRANCHES

The Contractor shall be responsible for labeling of all newly-installed low-voltage AC/DC supply branches at the job site. This will require that the Contractor perform the following tasks:

- 7.2.1. The Contractor shall label the branch circuits of each AC/DC supply branch to agree with the designations as shown on the "LOW VOLTAGE AC & DC DIAGRAMS" Drawing.
- 7.2.2. The Contractor shall label the branch circuits of each AC/DC supply branch in two (2) locations; the panel front surface adjacent to the protection device (breaker) and the branch index sheet provided with the cover of the cabinet.
- 7.2.3. The branch index sheet shall be neatly typed (or clearly printed in ball-point pen) with the branch names shown on the Drawings for these panels. Two (2) copies of this sheet will be produced by the Contractor and provided to either the JEA Contract Administrator or the Project Engineer at the final checkout / inspection.
- 7.2.4. The Contractor shall provide and install labels of each branch on the panel front surface adjacent to the protection device (breaker). The Contractor shall refer to the JEA Contract Administrator for approval of a labeling system for this purpose.

7.3. LABELING OF CONDUITS

The Contractor shall provide and install labels on all newly-installed conduits as a part of this work. This shall require that the Contractor perform each of the following:

- 7.3.1. Where conduits enter an electrical panel (AC/DC service panel, control panel, junction box, etc.), the Contractor shall label the conduit in two (2) places:
- A. The Contractor shall label the conduit circumferentially, about two (2") inches outside of the box, using a permanent fine-tip black marker. The markings shall be positioned and sized so that a person working on the cabinet may readily see the markings.
 - B. The Contractor shall also apply the same labels, using a permanent fine-tip black marker, on the interior of the box, conspicuously near the conduit entry points.
- 7.3.2. Where conduits enter a cable trench, the Contractor shall label the conduit along the axis of the conduit, about two (2") inches below the conduit opening, using a permanent large-tip black marker. The markings shall be positioned and sized so that a person looking downward onto the conduit may readily see the markings.
- 7.3.3. Where a conduit terminates other than as mentioned above, the Contractor shall label the conduit along the axis of the conduit, about two (2") inches below the conduit termination, using a permanent large-tip black marker.
- 7.3.4. All conduit identifications shall be those taken from the Conduit Schedule which is attached to these Specifications.

7.4. LABELING OF CABLE

The Contractor shall provide and install labels on all newly-installed cables as a part of this work. This shall require that the Contractor perform each of the following:

- 7.4.1. All cables are to be labeled:
- A. At both ends.
 - B. Where entering and leaving cable trenches or pullboxes.
 - C. Where exiting station electrical equipment, to include all AC/DC power panels, power circuit breakers, power transformers, junction boxes, fiber optic, video, and station control panels, etc.
- 7.4.2. Cable identification tags will be attached to the cable in a manner approved by the JEA Contract Administrator. The Contractor shall prevent galvanic corrosion and not intermix dissimilar metals (Aluminum-Copper, Stainless

SECTION IX – TECHNICAL SPECIFICATION - ELECTRICAL

Steel-Aluminum) when attaching tags to cables. Plastic cable ties shall not be permitted for exterior applications. Examples of exterior connection methods are lockable beaded chain and metal wire.

- 7.4.3. Outdoor cable identification tags shall be 1/2" wide stainless steel, Dymo M1011 system, unless otherwise approved by the JEA Contract Administrator. Indoor cable identification tags shall be RhinoPRO 1/2" flexible nylon labels - black on white, Manufacturer part# 18488, unless otherwise approved by the JEA Contract Administrator. Indoor labels shall be secured with no less than two plastic cable ties.
- 7.4.4. All cable identification tags will have the appropriate cable number clearly stamped in no less than 1/4" high characters. Cable numbers are specified on the Cable Schedule attached to these Specifications.