SECTION III - TECHNICAL SPECIFICATIONS - ELECTRICAL

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SECTION III - TECHNICAL SPECIFICATIONS – ELECTRICAL

1. SWITCHYARD ELECTRICAL EQUIPMENT

GENERAL

This is a general specification and covers the equipment required for substation construction. Separate Sections of these Specifications provide further information for High Voltage Transmission Systems, Distribution-class Duct Bank Systems, and Metal-Clad Switchgear, where applicable. 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. In case of discrepancy, the Drawings shall be taken in all cases.

1.1. 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.

1.2. 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.

1.3. ELECTRICAL CLEARANCES

1.3.1. All substation bus and equipment shall conform to the below electrical clearance requirements. Any deviation shall be approved of in writing by the JEA Project Representative as well as the responsible Engineer of the project. Any clearance violations shall be brought to the attention of the JEA Project Representative as soon as possible for correction.

System Voltage (kV)	Maximum Phase-to-Phase Voltage (kV)	BIL (kV)	Minimum Metal-to-Metal for Rigid Conductors (inches)	Centerline-to-Centerline Phase Spacing for Rigid Buses (inches)	*Minimum Phase to Grounded Parts for Rigid Conductors (inches)	**Minimum Clearance Above Grade [Between Bare Overhead Conductors and Ground for Personal Safety] (feet)	Minimum Between Bare Overhead Conductors and Roadways Inside Substation Enclosure (feet)	Minimum to Fence Horizontal (feet)
13.2	15.5	110	12″	24″	7″	9′	21′	10′
26.4	38	200	18″	36″	13″	10′	22′	10′
69	72.5	350	31″	60″	25″	11′	23′	12′
138	145	650	63″	96″	50″	13′	25′	14′

230	242	900	89"	132"	71"	15'	27'	16'
*ANSI C37.32, **NESC								

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 Project Representative. 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.

2. SAFETY

2.1. JEA Substation Safety/Access Training shall be required of all Contractor personnel if work is to be performed within any JEA Substation, even if de-energized. Proof of training must be available and presented to JEA before any personnel begin work for the first time and on demand if requested. All personnel are required to wear the proper PPE while in a substation or active construction site. Refer to JEA's Contractor Safe Work Practices Manual for more information.

2.2. Contractor shall comply with all requirements of all applicable OSHA excavation safety standards and regulations. Contractor shall comply with all applicable trench safety standards. Contractor shall adhere to special shoring requirements, if any, of the state or other political subdivisions, which may be applicable to this project scope. For any project that contains a trench excavation deeper than four feet, the Contractor shall submit with his bid the cost of compliance with the applicable trench safety standards.

2.3. The stability of previously constructed structures and facilities shall not be impaired or endangered by excavation work. Previously constructed structures and facilities include both structures and facilities existing when the work under these specifications begins and structures and facilities already provided under these specifications.

2.4. Adequate sheeting and shoring in accordance with OSHA regulations 29 CFR Part 1926 shall be provided to protect and maintain the stability of previously constructed structures and facilities and the sides of excavations and trenches until they are backfilled. Sheeting, bracing, and shoring shall be designed and built to withstand all loads that might be caused by earth movement or pressure and shall maintain the shape of the excavation under all circumstances. Signed and Sealed drawings, prepared by a registered professional engineer licensed in the State of Florida, of all shoring details as required by OSHA shall be furnished to the Project Engineer before any excavation begins. When "sloping" of the sides of the excavation or trench is used in lieu of sheeting or shoring the name of the "Competent Person" in charge for the Contractor shall be submitted in writing to the JEA Project Representative, along with supporting documentation, before any excavation begins.

2.5. The Contractor shall determine the location of underground piping, conduit and cable before proceeding with the work. Should any utilities be encountered that were not expected, work in the area shall be halted and the Engineer notified immediately.

3. AS-BUILT DRAWINGS

3.1. The Contractor shall prepare and maintain accurate, up to date As-Built Drawings for the entire duration of the project. These As-builts shall reflect all field changes, and be updated on a continuous basis.

3.2. Before preliminary inspection, furnish As-built drawings to the JEA Project Representative. At completion of the Contract and before final payment is made, furnish the Project Representative one (1) set of finally approved record drawings. The documents shall be signed and dated. Furnish record drawing data on disk or CD, in format compatible with the Owner's software.

4. PERMITS

4.1. The Contractor shall comply with all permit requirements accompanying these specifications and shall obtain additional permits, if required, at no additional cost to JEA. The Contractor shall be held liable for any fines and/or violations for failure to comply with required permits.

5. EROSION AND SEDIMENT CONTROL

5.1. Contractor shall provide erosion and sediment control measures conforming to current Land Development Procedures of the City of Jacksonville, Florida, for all land-disturbing construction activities. The Contractor shall erect silt fences around the entire jobsite in accordance with the applicable FDEP requirements and the Contract Drawings' requirements.

6. 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.

6.1. 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.

6.2. 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.

6.3. Detailed structural assembly drawings may be inspected at the JEA office in Jacksonville, Florida, by contacting the Project Engineer.

6.4. 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.

6.5. 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. 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.

6.6. 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.

6.7. 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.

6.8. 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. Conduit, switches, and wiring as specified on the Drawings shall be furnished by the Contractor.

6.9. Erection of the lightning probe poles shall be in accordance with the Manufacturer's assembly drawings.

6.10. 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 and anchor bases will be furnished by the Owner, as indicated in the Attachments at the end of these Specifications.

6.11. 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.

6.12. 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.

6.13. 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.

6.14. 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 the 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 with ≥ 90% zinc to resist corrosion.

7. POWER TRANSFORMERS

7.1. The Owner will be responsible for delivery and offloading the power transformer(s) onto the foundations unless the Contractor fails to have the transformer foundations ready as per Section VII. The Owner will provide the Contractor the desired delivery date when available. The Contractor shall prepare the site and foundations as directed to facilitate off-loading (see Section VII for additional transformer installation requirements). An approximate delivery date for the transformer is listed in Section VII of these Specifications. Crane and Rigging in Jacksonville, Florida, is the only company approved to lift, transport, and set power transformers for JEA.

7.2. The Owner, the Equipment Manufacturer's Contractor, or representative acting as an agent for the Owner, will be responsible for assembly of the power transformer and will furnish and operate the filtering equipment, vacuum drying equipment, provide the insulating oil, and fill the transformer. The Contractor shall provide adequate working space and access to temporary construction power to allow assembly and vacuum oil filling of the power transformers.

7.3. In no instance is a Contractor's employee or agent to enter a transformer manhole unless accompanied by the Owner's representative and only after suitable oxygen analysis has been conducted on the internal equipment environment.

7.4. The power transformers shall be under the care and custody of the Contractor while on the project site. The Contractor shall be responsible for any minor repairs, as deemed necessary by the Project Engineer, to the finish of the power transformers that may have been damaged while in the care and custody of the Contractor.

7.5. Connections to the power transformers by means of bus or conductor will be the responsibility of the Contractor.

7.6. The conduit, control and power cabling, grounding, and associated work will be the responsibility of the Contractor.

7.7. All associated primary wiring, secondary wiring, control wiring, and grounding connections shall be furnished and installed by the Contractor in accordance with the Manufacturer's assembly instructions and JEA substation equipment interconnection drawings.

8. INSULATORS, BUSWORK, & CONNECTORS

8.1. 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 a secure, dry manner. Storage shall be climate controlled when required by the equipment manufacturer's instructions.

8.2. The Contractor shall install station type insulators, bus, conductor, and connectors as indicated on the Drawings.

8.3. 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.

8.4. 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 indicated on the General Notes Drawing.

8.5. The Contractor shall install all bus, conductors, and connectors as indicated on the Drawings.

8.6. The welding of aluminum bus shall adhere to the following requirements:

8.6.1. 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).

8.6.2. 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.

8.6.3. All aluminum welds shall be by the gas metal-arc (MIG) or the gas tungsten-arc (TIG) welding process.

8.6.4. The working area should be substantially draft-free and protected from atmospheric contamination.

8.6.5. 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.

8.6.6. 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.

8.6.7. To repair a defective weld, the defective portion must be entirely removed. The area to be repaired should be re-cleaned as in Paragraph 7.6.2 above and the weld made in a manner similar to the original.

8.6.8. Tackwelding should be used to prevent misalignment of the members being joined during the welding process.

8.7. Tinned connectors shall be installed when a copper to aluminum connection is made. The tinned connectors shall be furnished by the Owner.

8.8. Contractor shall provide hardware required to complete assembly and electrical connections.

8.9. Hardware for bus connections and electrical joints shall be stainless steel hex head bolts and nuts, grade 316. Under both the bolt head and the hex nut, provide one 1-1/4" 316 stainless steel flat washer and one 1-1/8", 2500-3500lb rated 301 stainless steel Belleville compression washer.

9. INSTRUMENT TRANSFORMERS, POTENTIAL TRANSFORMERS, & LIGHTNING ARRESTORS

9.1. The instrument transformers, potential transformers, and lightning arrestors 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.

9.2. The Contractor shall install lightning arrestors as indicated on the Drawings.

9.3. 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.

9.4. Tinned connectors shall be installed when a copper to aluminum connection is made. The tinned connectors shall be furnished by the Owner.

10. STATION SERVICE, AUTOMATIC TRANSFER SWITCH, & ELECTRICAL PANELS

10.1. The Contractor shall be responsible for furnishing the necessary terminals, connectors, etc., to terminate cables at the transformers, panelboards, ATS, and splices (as required).

10.2. 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.

10.3. New 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.

10.4. 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.

10.5. 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.

11. SWITCHYARD RELAY BOXES

11.1. 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.

11.2. The Contractor shall be responsible for securely mounting all 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.

11.3. 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. If required by space constraints, Liquid-tight Flexible Metal Conduit is acceptable when approved by the owner.

12. CONSTRUCTION STATION SERVICE

The Contractor shall be responsible for installing and maintaining a temporary station service facility for new construction and additions to existing stations where adequate facilities are not available.

12.1. The Contractor shall be responsible for following standard permitting and application procedures to obtain the construction service. Where the installation of a power transformer or autotransformer is required, the construction service shall be 3-phase. The Contractor's service is to be metered and shall comply with JEA requirements for meter can, weatherhead, and disconnect.

12.2. The Contractor shall provide the necessary conduit, cable, entrance head, meter, disconnect switch, panels, outlets, etc. to sufficiently supply electric service to the field office, construction outlets, and permanent low-voltage receptacles for station check-out.

12.3. The Owner will provide the distribution lateral, temporary span poles and distribution transformers as required for the construction station service. The Contractor shall be responsible for furnishing and installing secondary conductors and raceway to the transformers as required.

12.4. The Owner will be responsible for the total metered electric charges of the construction service during the term of the Construction Contract.

12.5. The Contractor shall provide a 200A disconnect in a NEMA 3R enclosure to run conduit and cables to the permanent station service facilities for use in equipment check-out by the Owner. The Contractor shall furnish and install conduit to the cable trench, or permanent facilities, and install single conductor 4/0 RHW cable to the ATS or AC panels (as required). This requirement is in addition to the Contractor's service and shall be provided as soon as the low-voltage equipment is in place (see Section VII, Subsection 2, for Sequence of Work).

NOTE: Termination of the permanent station service transformers to the ATS or low-voltage electrical panels shall not be performed until after the temporary service has been disconnected.

12.6. The Contractor will be required to remove any temporary construction service poles and the construction service once the substation is energized and the permanent station service is in operation. Additionally, the Contractor shall apply for removal of the service drop and transformer bank.

12.7. Where there is existing station service available, and JEA service requirements are met, the Contractor shall be allowed to utilize the station service for construction A.C. at no cost.

13. GROUND GRID SYSTEM

13.1. GENERAL

13.1.1. 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.

13.1.2. 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, Subsection 5).

13.2. 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 grid, ground rods, and ground wells as shown on the Drawings and herein specified. The Contractor shall also be responsible for the connection of all switchyard electrical equipment, control house electrical equipment, substation structures, fences and gates to the station ground grid system as shown on the Drawings and herein specified.

13.3. MATERIALS

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.

13.3.1. All Contractor furnished materials, unless otherwise specified, shall be new, of first quality and of the proper type for the use intended.

13.3.2. 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. The Contractor shall also furnish the grounding system as shown on the Drawings for any "sliding-type" main entrance gate.

13.4. GROUND GRID

13.4.1. 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, .0643" diameter, 40% conductivity as per ASTM B-227 and B-228, high strength – 27,548 lbs. The 7#5 conductor (JEA #COBCW016) shall be Copperweld, 7-strand #5, .0546" diameter, 40% conductivity as per ASTM B-227 and B-228, high strength – 17,949 lbs.

13.4.2. 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.

13.4.3. The Contractor shall notify the Owner of any damaged ground grid conductor before, during, and after installation so the conductor may be replaced.

13.4.4. 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.

13.5. GROUND RODS AND GROUND WELLS

13.5.1. The Contractor shall furnish and install ground rods and ground wells (as specified) in the locations shown on the Drawings. Rods and wells shall be specified by either the depth or resistance required. Details for ground rod connections (if applicable) are included in the Drawings.

13.5.2. Where the installation of ground rods and ground wells is specified by depth or where driving rods in soil of high resistivity, it may be necessary to use casing in the well holes. The Contractor shall make a resistance reading of each ground rod and/or ground well prior to its connection to the station ground grid and report these readings to the Project Engineer for verification of the ground grid design. Connection of the rod to the station ground grid shall be made, only after Owner approval, utilizing the exothermic process. The Contractor shall also include these readings on the "As Built" Drawings.

13.5.3. Where the installation of ground rods and ground wells is specified by resistance, the Contractor shall install the ground rods and ground wells to a minimum, base bid depth of fifty (50') feet, unless otherwise specified. The Contractor shall continue until the specified resistance is achieved. A unit price of $3.75 per foot installed will be used for adjusting the contract price from the base bid depth.

13.5.4. All ground rods and ground wells shall maintain a minimum earth cover as specified on the drawings.

13.5.5. Where the installation of ground rods is not specified by resistance or depth, the Contractor shall install ground rods twenty-four (24') feet deep at all locations as shown on the substation grounding drawing. No ground rods or wells shall be installed under paved roadway areas.

13.6. GROUND GRID CONNECTIONS

13.6.1. Ground grid connections (including connections to ground rods and ground wells) shall be made by approved an 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.

13.6.2. Ground grid connections shall be of the type that avoids cutting and/or splicing of the main grid conductor.

13.6.3. 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 Project Representative shall be present at the demonstration.

13.6.4. The Contractor shall strictly follow the Manufacturer's installation procedures.

13.6.5. 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 Project Representative do not make satisfactory welds shall be removed from the job site.

13.6.6. 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.

13.6.7. All welded connections made by the exothermic process shall be visually inspected by the Project Representative 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.

13.6.8. Buried ground cables shall not be installed adjacent to buried steel pipes or structural steel, except where a connection is required for grounding purposes. If unavoidable, the metal shall be painted with a heavy coating of bitumastic paint, or the ground wire enclosed in nonmetallic conduit. A good connection shall be made by removing paint prior to making the connection to ensure sufficient electrical contact.

13.7. TRANSFORMER GROUNDING

13.7.1. The Contractor shall connect the neutral bushing of the transformer to the existing neutral grounding resistor (NGR). Contractor shall re-terminate the existing insulated grounding cable for this purpose. The cable and insulation shall be inspected to verify it is free of defects, cuts, or nicks. If damage is found, the JEA project representative shall be notified immediately. NO DIRECT CONNECTION BETWEEN THE NEUTRAL BUSHING AND GROUND IS PERMITTED.

13.7.2. The Contractor shall connect the transformer tank to the ground grid in two (2) locations as shown on the Drawings using 7#5 Copperweld conductor and the connection process specified.

13.7.3. The Owner shall furnish the above grade grounding connectors to be used in connecting the power transformers to the ground grid. The Contractor shall furnish the 500MCM copper and the 7#5 Copperweld grounding conductor to be used in connecting the power transformers to the ground grid system.

13.8. EQUIPMENT GROUNDING

13.8.1. 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.

13.8.2. 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.

13.8.3. 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.

13.8.4. 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.

13.8.5. The ground conductor installed on the equipment structures shall be sufficient in meeting the requirements of structure grounding.

13.8.6. 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.

13.9. STRUCTURE GROUNDING

13.9.1. The Contractor shall be responsible for connecting all structures directly to the station ground grid as shown on the Drawings.

13.9.2. 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.

13.9.3. 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.

13.9.4. 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 Section IX and all relevant paragraphs.

13.9.5. Structures must be grounded to the station grid within the same working day the structure is erected.

13.10. CABLE TRENCH AND CONTROL HOUSE GROUNDING

13.10.1. The Contractor shall install the cable trench and control house grounding as specified and shown on the Drawings. The Contractor shall furnish the 7#5 Copperweld conductor necessary to ground the cable trench and control house to the station ground grid and all other required material and labor to complete the installation.

13.10.2. The Contractor shall install the cable trench and control house ground conductors. The ground conductor shall run the entire length of the cable trench and connect to the station ground grid at all points of intersection. Two (2) ground conductors shall be brought into the control house through the cable trench and attached to the outside of the cable tray. The Contractor shall furnish and install 7#5 Copperweld cable clips on one side of the cable trench to support the ground conductor.

13.10.3. Connection of the ground conductor to the cable tray shall be made utilizing Burndy Type GC2929CT connection or approved equal. The ground conductor shall be secured to the cable tray at each cable tray fitting or at intervals not exceeding four (4') feet throughout the length of the tray. Provide ground wire lugs and hardware (as required). The cable tray shall NOT be used as a ground path.

13.10.4. Control house equipment, including electrical panels shall be connected to the control house ground by means of Anderson Type K3 connector or approved equal.

13.10.5. Where a reinforced concrete floor is installed in the control house, the Contractor shall bond the control house slab reinforcement to the ground grid to provide equipotential surfacing as shown on the drawings. Metal floor decking within modular buildings should be bonded internally by the manufacturer, with connections to the grid on the exterior of the building at the points designated.

14. CONDUITS, CABLE TRENCHES, & CABLE TRAYS

14.1. GENERAL

14.1.1. This is a general specification and covers the requirements and procedures for the installation of conduits, wireways, 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.

14.1.2. 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, Paragraph 5).

14.2. SCOPE

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

14.3. MATERIALS

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

14.3.1. All Contractor furnished materials, unless otherwise specified, shall be new, of first quality, and of the proper type for the use intended.

14.3.2. The Contractor shall refer to the "Conduit Schedule" for specific material requirements of individual raceway runs.

14.3.3. 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.

14.4. CONDUIT AND WIREWAY

14.4.1. The Contractor shall furnish and install the conduits, as listed in the "Conduit Schedule" and as shown on the Drawings.

14.4.2. The Contractor is responsible for all hardware necessary to complete the installation of the conduit system.

14.4.3. 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.

14.4.4. 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.

14.4.5. Conduits shall be installed at the depth shown on the Drawings, with the area backfilled and compacted to same density as surrounding areas.

14.4.6. 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.

14.4.7. The Contractor shall furnish and install all indoor conduits, junction boxes, switches, and receptacles as specified in the "Conduit Schedule" and as shown on the Control House Drawings. All conduits less 2" shall be concealed within block walls.

14.4.8. 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.

14.4.9. 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.

14.4.10. The Contractor will be responsible for labeling all conduits as listed in the "Conduit Schedule". For details, see Subsection "Labeling" of this Section.

14.5. **CABLE TRAY**

The Contractor shall furnish and install any modifications required to the cable tray system located in the switchgear building. The Contractor shall submit a description and/or shop drawings of the proposed cable tray system for approval. The shop drawings submitted shall include certified flexural and loading data with the Manufacturer's recommendation of maximum span for the design load.

14.5.1. Indoor cable trays shall be fabricated from extrusions of aluminum alloy 6063-T5 or 6063-T6. Application shall be in accordance with the ASCE Specifications and AWS Standards. The trays shall be furnished with a six (6") inch depth or four (4") inch depth, as indicated on the Drawings and in nominal twelve (12') foot lengths. Splices shall be of the high pressure bolted type. The design load for the tray installation shall be a minimum 200 lbs. per linear foot for the maximum tray width of thirty-six (36") inches or nine (9") inches, as described on the Drawings, when supported on twelve (12') foot centers.

14.5.2. Indoor cable trays shall be of the aluminum ladder type with cross rungs spaced six (6") inches maximum center to center.

14.5.3. All rungs, dropouts and other metal surfaces in contact with the cable shall have smooth, rounded edges. The rungs shall be joined to the sides by a homogeneous union method, weld on swage.

14.5.4. Cable tray supports shall be provided at intervals not to exceed the Manufacturer's recommendations for maximum span for the design load and type of tray being supported. In no case shall the spans exceed that shown on the Drawings.

14.5.5. All necessary splice plates, bolts, nuts, lock washers, etc., shall be furnished compatible for use with the type of metal tray provided.

14.5.6. Provide ground wire lugs and hardware as required. The cable tray shall NOT be used as a ground path. Grounding of the cable tray shall conform to the requirements of Section IX, Subsection 13, Paragraph 12.

15. CONTROL CABLE & LOW-VOLTAGE ELECTRICAL CABLE

15.1. CABLE SCHEDULE

15.1.1. 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.

15.1.2. Cable lengths listed in the Cable Schedule are approximate and based on engineering estimates that may differ due to field routing or other factors. The total quantities required for the project may also affected by factors such as waste, cable reel sizes and optimization (or lack thereof). The Contractor shall be responsible for the actual quantities required and for verification of all cable lengths prior to cutting.

15.1.3. 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 Section VII, Subsection 5.

15.1.4. 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.

15.1.5. The Contractor will be responsible for labeling all cables as listed in the Cable Schedule. For details, see Subsection “Labeling” of this Section IX.

15.2. SHIELDED CONTROL CABLE SPECIFICATIONS

15.2.1.

15.3. SPLICES

15.3.1. All runs of control cable shall be continuous. Splices in control cable shall NOT be permitted.

15.3.2. 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.

15.4. 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.

15.4.1. 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.

15.4.2. The Bid shall be based on the assumption of a termination at both ends of every conductor in each cable of the Cable Schedule and an additional fifty (50) #10 cables with 500 total terminations between panels and/or control house equipment. These jumpers may be Class B multi-conductor cables running between panels, including termination.

15.4.3. 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.

15.5. 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.

15.6. GROUNDING OF SHIELDED CONTROL CABLE

A terminal block 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 Contractor shall provide amp type Termi-foil connectors for jumper connections between the control cable shields to the panel ground terminal block. The jumper wire size shall be a stranded #10 AWG.

15.7. 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.

16. LOW VOLTAGE (UNDER 600V) ELECTRICAL

16.1. SCOPE

This Section covers the equipment, installation, and wiring necessary for the low voltage electrical system, 600V and below.

16.2. 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.

16.3. EQUIPMENT AND MATERIALS

16.3.1. 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.

16.3.2. 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.

16.4. PLACING EQUIPMENT IN SERVICE

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

16.5. CONTROL HOUSE ELECTRICAL PANELS

16.5.1. The Contractor shall be responsible for furnishing and installing the control house electrical panels. The exact quantity, locations, and sizes of the panels shall be as shown on the Drawings.

16.5.2. New AC panels shall be Square-D Company Type "NQOD" or an approved equal. The panelboard shall be enclosed in a NEMA 1 enclosure and include lightning protection. The panels shall include a lockable cover and/or door.

16.5.3. New DC panels shall be Square-D Company I-Line Type "HCN" or an approved equal. The panelboard shall be enclosed in a NEMA 1 enclosure. The panels shall include a lockable cover and/or door.

16.5.4. 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.

17. 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 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:

17.1 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.

17.2 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.

17.3 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).

17.4 When the shipper of each shipment is within 48 hours of the Substation site, the shipper will contact the Project Representative to schedule a delivery appointment. The Contractor, shipper, and Project Representative shall then coordinate a firm appointment.

17.5 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 Project Representative for this specific purpose.

17.6 The JEA Project Representative and the Contractor shall then count, examine, and sign for all Structures and Materials.

18. LABELING

The Contractor shall be responsible for labeling the following newly-installed substation facilities at the job site. This will require that the Contractor perform the following tasks:

18.1. 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.

18.1.1. 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.

18.1.2. The Contractor shall prepare the surface of the transformers and breakers prior to painting, in a manner approved by the Project Representative. The paint shall be Rust-oleum spray on #7776-830, flat black, or equal as approved by the Project Representative.

18.1.3. 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 Project Representative.

18.2. 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:

18.2.1. The Contractor shall label the branch circuits of each AC/DC supply branch to agree with the designations as shown on the "STATION SERVICE AND YARD PANELS" Drawing.

18.2.2. 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.

18.2.3. 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 Project Representative or the Project Engineer at the final checkout / inspection.

18.2.4. 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 Project Representative for approval of a labeling system for this purpose.

18.3. 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:

18.3.1. 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.

18.3.2. 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.

18.3.3. 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.

18.3.4. All conduit identifications shall be those taken from the Conduit Schedule which is attached to these Specifications.

18.4. **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:

18.4.1. All cables are to be labeled:

A. At both ends.

B. Where entering and leaving the cable trench.

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.

18.4.2. Cable identification tags will be attached to the cable in a manner approved by the Project Representative. The Contractor shall prevent galvanic corrosion and not intermix dissimilar metals (Aluminum-Copper, Stainless 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.

18.4.3. Outdoor cable identification tags shall be 1/2" wide stainless steel, Dymo M1011 system, unless otherwise approved by the Project Representative. Indoor cable identification tags shall be RhinoPRO 1/2" flexible nylon labels - black on white, Manufacturer part# 18488, unless otherwise approved by the Project Representative. Indoor labels shall be secured with no less than two plastic cable ties.

18.4.4. 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.

19. EQUIPMENT REMOVAL

19.1. Contractor shall be responsible for proper disposal of all removed materials, equipment, soils, and construction waste. Consult with JEA Project Representative to determine which removed equipment (if any) JEA will retain possession of.

19.2. All Contractor removed equipment that JEA will retain shall be stored on-site and protected until it can be removed by JEA to stores.

19.3. All removals that contain hazardous waste shall be disposed of in an appropriate manner according to all legal and regulatory requirements. Consult with JEA project representative for appropriate disposal methods/sites.

20. REFERENCES

20.1. Where the codes and standards referenced herein contain recommendations in addition to requirements, consider the recommendations as requirements and follow unless stated otherwise by this Specification.

20.2. In the event of any conflict between codes, or this Specification and codes, the more stringent requirement applies.

20.3. The latest edition and published addenda of the referenced publications herein effect on the date of Contract Award are a part of this Section and, where referred to by title or by basic designation only, are applicable to the extent indicated by the specific reference:

20.4. American Association of State Highway and Transportation Officials (AASHTO)
M 43 - Standard Specification for Sizes of Aggregate for Road and Bridge Construction
M 145 - Standard Specification for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
T 99 – Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop T 180 - Moisture-Density Relations of Soils Using a 10-lb Rammer and 18-inch Drop
T 191 - Standard Method of Test for Density of Soil In-Place by the Sand Cone Method

20.5. American Concrete Institute (ACI)
117 – Specification for Tolerances for Concrete Construction and Materials 229R - Report on Controlled Low-Strength Materials
301 - Specifications for Structural Concrete
304R - Guide for Measuring, Mixing, Transporting and Placing Concrete 305R - Hot Weather Concreting
306R - Cold Weather Concreting
309R - Guide for Consolidation of Concrete
318 - Building Code Requirements for Structural Concrete 347 - Guide to Formwork for Concrete
530/530.1 – Building Code Requirements and Specification for Masonry Structures

20.6. American Institute of Steel Construction (AISC)
303 - Code of Standard Practice for Steel Buildings and Bridges

20.7. American National Standards Institute (ANSI)
A 185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete

20.8. American Society for Testing and Materials (ASTM) International
A 36 - Standard Specification for Carbon Structural Steel
A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
A 123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A 153 - Specification for Zinc Coating (Hot-Dip) on iron and Steel Hardware
A 185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
A 370 - Standard Test Methods and Definitions for Mechanical Testing of Steel Products
A 497 - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
A 563 - Standard Specification for Carbons and Alloy Steel Nuts
A 615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement
A 653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
A 706 - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement A 780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
A 924/A 924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
A 992 - Standard Specification for Structural Steel Shapes
B 695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
C 5 – Standard Specification for Quicklime for Structural Purposes
C 29 - Standard Test Method for Bulk Density (Unit Weight) and Voids in Aggregate
C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field
C 33 - Standard Specification for Concrete Aggregates
C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
C 40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete
C 42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
C 88 - Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
C 90 – Standard Specification for Loadbearing Concrete Masonry Units
C 91 – Standard Specification for Masonry Cement
C 94 / C94M - Standard Specification for Ready Mixed Concrete
C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 in. or 50 mm Cube Specimens)
C 117 - Standard Test Method for Materials Finer Than 75 µm (No. 200) Sieve in Mineral Aggregates by Washing
C 123 - Standard Test Method for Lightweight Particles in Aggregate

C 127 - Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
C 128 - Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
C 131 - Standard Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
C 138 - Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
C 142 - Standard Test Method for Clay Lumps and Friable Particles in Aggregates
C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete
C 144 – Standard Specification for Aggregate for Masonry Mortar
C 150 - Standard Specification for Portland Cement
C 172 - Standard Practice for Sampling Freshly Mixed Concrete
C 173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
C 192 - Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
C 207 – Standard Specification for Hydrated Lime for Masonry Purposes
C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
C 260 - Standard Specification for Air Entraining Admixtures for Concrete
C 270 – Standard Specification for Mortar for Unit Masonry
C 289 - Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)
C 309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
C 403 – Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance
C 404 – Standard Specification for Aggregates for Masonry Grout
C 451 - Standard Test Method for Early Stiffening of Hydraulic Cement (Paste Method)
C 470 - Standard Specification for Molds for Forming Concrete Test Cylinders Vertically
C 476 – Standard Specification for Grout for Masonry
C 494/C494M - Standard Specification for Chemical Admixtures for Concrete
C 535 - Standard Test Method for Resistance to Degradation of Large Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
C 566 - Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying
C 617 - Standard Practice for Capping Cylindrical Concrete Specimens
C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
C 920 - Standard Specification for Elastomeric Joint Sealants
D 994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)
C 1064 – Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
C 1077 - Standard Practice for Laboratories Testing Concrete, and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
C 1218 - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete
1602 - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
D 422 - Standard Test Method for Particle-Size Analysis of Soils
D 448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction
D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))
D 854 – Standard Test Methods for Specific Gravity of Soil Solids by Water Pycnometer
D 994 – Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)
D 1140 - Standard Test Methods for Determining the Amount of Material Finer Than 75 ¾m (No. 200 Sieve) in Soils by Washing
D 1556 – Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
D 1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))
D 1751 - Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
D 1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
D 2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)
D 2940 - Standard Specification Graded Aggregate Material for Bases or Subbases for Highways or Airports

D 3282 - Standard Practice for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
D 3740 – Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
D 4355 - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus
D 4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles
D 4595 - Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method
D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
D 4751 – Standard Test Method for Determining Apparent Opening Size of a Geotextile
D 4832 – Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders
D 5199 – Standard Test Method for Measuring the Nominal Thickness of Geosynthetics
D 5261 – Standard Test Method for Measuring Mass per Unit Area of Geotextiles
D 6241 – Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe
D 6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
E 4 - Standard Practices for Force Verification of Testing Machines
F 436 - Standard Specification for Hardened Steel Washers
F 1554 - Standard Specification for Anchor Rods, Steel, 36, 55, and 105-ksi Yield Strength

20.9. American Society of Civil Engineers (ASCE)
5-11/6-11 - Building Code Requirements and Specifications for Masonry Structures.
7-10 – Minimum Design Loads for Building and Other Structures

20.10. American Welding Society (AWS)
D1.1 - Structural Welding Code - Steel

20.11. Concrete Reinforcing Steel Institute (CRSI)
MSP-2-01 - Manual of Standard Practice

20.12. National Ready Mixed Concrete Association:
Certification of Ready-Mixed Concrete Production Facilities

20.13. The Society for Protective Coatings (SSPC)
PA-1 - Shop, Field, and Maintenance Painting of Steel SP-6 - Commercial Blast Cleaning

20.14. U.S. Army Corps of Engineers
CRD-C572 - Specifications for Polyvinyl Chloride Waterstops

20.15. U.S. Department of Labor, Occupational Safety and Health Administration Standards (OSHA)
29 CFR, Part 1926, Safety and Health Regulations for Construction, Standard Number: 1926.652, Requirements for Protective Systems, Subpart P – Excavations
29 CFR, Part 1926, Safety and Health Regulations for Construction, Standard Number: 1926.652, Requirements for Protective Systems, Subpart T – Demolition

20.16. 2010 Florida Building Code

20.16.1. City of Jacksonville, Florida (COJ)
Land Development Procedures Manual
City Standard Specifications, Department of Public Works

20.16.2. Florida Department of Environmental Protection
Florida Stormwater Erosion and Sedimentation Control Inspector's Manual
State of Florida, Erosion and Sediment Control, Designer and Reviewer Manual

20.16.3. Florida Administrative Code
62-621 – Generic Permits
62-701 – Solid Waste Management Facilities
62-710 – Used Oil Management
62-711 – Waste Tire Rule
62-730 – Hazardous Waste