

Exhibit B

TECHNICAL SPECIFICATIONS SUBSTATION STRUCTURAL STEEL PACKAGE ERGLE SUBSTATION

1. GENERAL SPECIFICATIONS

This section supplements Exhibit A – General Requirements for Substation Structural Steel Package. The technical requirements for design and fabrication of outdoor electrical substation structures, equipment, materials and necessary incidentals, are outlined herein and indicated on the Contract Drawings.

The Substation Structural Steel Package shall include, but not be limited to, required steel designs and furnishing fabricated hot-dipped galvanized steel structures, both lattice and low profile types, bus conductor, bus connectors, bus support insulators, switches and switch supports, complete, with switch operator's grounding pads, fasteners and assembly material as indicated and specified.

The Ergle Substation design requires the fabrication of galvanized structures and other items of equipment in accordance with the attached Contract Drawings. It is the project intent to provide new structures that conform to the existing substation structures to the greatest extent possible. Where details of the existing structures were available, they are provided as reference drawings. All dimensions and top-of-member elevations shall match the existing structures. Different member sizes will be permitted only where required to meet the loading and deflection requirements. The use of different member types will not be permitted.

More specifically, the Ergle Substation package requires design and fabrication of one (1) low profile 69kV three-phase bus support structure, one (1) low profile 230kV three-phase bus support structure, one (1) low profile 230kV switch support structure, four (4) 230kV single-phase low-bus bus support structures, three (3) 230kV single-phase high-bus bus support structures, one (1) low profile 230kV potential transformer stand, and one (1) 230kV switch support frame to be mounted to an existing tubular steel A-frame structure, all as shown on the Contract Drawings. In addition to the structural steel, the Packager shall also provide all other associated equipment and materials as listed on the

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Contract Drawing Bill of Materials, including but not limited to switches, switch grounding platforms, tubular bus, station post insulators, surge arresters, cables, terminals, connectors, hardware, etc., as required for a complete installation.

The Substation Structural Steel Package does not include field installation of structural steel structures, concrete foundation construction, installation of equipment, installation of conduits and control cables, installation of the substation ground grid, or providing equipment and material as listed as being "Owner Furnished".

2. REFERENCES

The work shall conform to the applicable requirements of all Federal, State and local agencies and applicable provisions of the latest edition or revision of the following standards, except as modified herein.

A. Aluminum Association (AA)

TH56 Aluminum Electrical Conductor Handbook

B. American Concrete Institute (ACI)

318 Building Code Requirements for Structural Concrete

C. Institute of Electrical and Electronics Engineers (IEEE)

C2 National Electrical Safety Code (NESC)

C37.30 Requirements for High-Voltage Switches

C37.35 High-Voltage Air Disconnecting and Load Interrupter Switches,
Guide for Application, Installation, Operation and Maintenance

80 Guide for Safety in AC Substation Grounding

142 Recommended Practice for Grounding of Industrial and
Commercial Power Systems

605 Guide for Bus Design in Air Insulated Substations

837 Qualifying Permanent Connections Used in Substation
Grounding

D. American Society for Testing and Materials (ASTM)

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A36/A36M	Carbon Structural Steel
A123/A123M	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A153/A153M	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A307	Carbon Steel Bolts, Studs, and Threaded Rod
A325M	Structural Bolts, Steel, Heat Treated
A394	Steel Transmission Tower Bolts, Zinc-Coated and Bare
A563	Carbon and Alloy Steel Nuts
A595/A595M	Steel Tubes, Low-Carbon or High-Strength Low-Alloy, Tapered for Structural Use
A992/A992M	Structural Steel Shapes
B8	Concentric-Lay-Stranded Copper Conductors; Hard, Medium-Hard, or Soft
B584	Copper Alloy Sand Castings for General Applications
F1554	Anchor Bolts, Steel
F2329/F2329M	Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners
E. Federal Specifications and Standards (FSS)	
TT-P-645C	Paint, Alkyd Type, Formula Number 84
F. National Fire Protection Association (NFPA)	
--	Handbook of Fire Protection Engineering
70	National Electrical Code (NEC)
G. American Society of Civil Engineers (ASCE)	
MOP 113	Substation Structure Design Guide
SEI 48	Design of Steel Transmission Pole Structures
H. American Institute of Steel Construction (AISC)	

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Structural Steel Buildings

3. STRUCTURAL STEEL DESIGN

- A. The Substation shall be designed for nominal voltages of 230 kV with 900 kV BIL and 69 kV with 350 kV BIL insulation level.
- B. Structures and foundations shall be designed to withstand the following loadings:
- i. Structures shall be designed to withstand the forces on conductors from a symmetrical short circuit of 30,000 amperes, minimum. Available symmetrical short circuit amperes and duration are approximately as follows:

	69 kV	230 kV
Three-phase fault	21.4 kA	18.8 kA
Phase-to-phase fault	18.6 kA	16.4 kA
Phase-to-ground fault	23.6 kA	15.8 kA
Maximum duration, cycles	18	

- ii. The structures shall be designed to withstand wind loadings in accordance with the NESC or the ASCE MOP 113, whichever is more restrictive.
- iii. The structures shall be designed to withstand apparatus loads, dead loads, equipment operating dynamic loads, temporary construction loads, specified loads and normal service conditions for the installation location.
- iv. Ice Loading: Allowance for ice loading will not be required in the structure design.
- C. Configuration, unless noted otherwise, shall be as specified herein and indicated on the drawings.
- i. The Packager shall furnish the necessary structures, switches, switch operating handles and inter-phase operating rods, switch operator's grounding pads, adapter plates, and other related devices necessary for complete installations as specified herein and indicated on the drawings.

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- ii. The Contract Drawings indicate the general arrangement of the structures and components, and are furnished to serve as a guide in establishing the basic design to be followed. Details shown for the sizes of members, details of connection, location of holes, etc., are representative only. The Packager is responsible for determining, and verifying, all final detailed designs. The structures provided shall meet the loading design requirements of the applicable standards for the area of service.
 - iii. The design shall provide adequate capacity and space, including space required for operation and maintenance, and shall be satisfactory for the use intended. The design shall provide electrical and mechanical clearances necessary to prevent interference with operating mechanisms or door opening on control cabinets.
- D. Steel structure design and fabrication shall conform to ASCE SEI 48, ASCE MOP 113, and AISC 360. Steel structures shall meet the current design and loading requirements of the NESC.
- i. For purposes of design analysis, the combinations of attachments, wind loading and unbalanced forces that provides the maximum loading on the structures shall be used.
 - ii. Allowable stresses shall be in accordance with the NESC, AISC or local building codes, whichever are the most restrictive.
 - iii. Deflection shall be limited to the following values on Class "A" structures and Class "B" Structures.
 - a. Class "A" structures are those intended for the support of high voltage equipment (i.e. air switches, interrupter switches and circuit interrupting devices).
 - 1) Horizontal deflection of vertical members shall be limited to 1/100 of the vertical height of the structures.
 - 2) Vertical and horizontal deflection of horizontal members shall be limited to 1/200 of the span.

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- b. Class "B" structures are those on which the deflections, within limits, do not affect the performance of the supported equipment (i.e. bus supports and miscellaneous equipment supports).
- 1) Horizontal deflection of vertical members shall be limited to 1/50 of the vertical height of the structure.
 - 2) Vertical deflection of horizontal members shall be limited to 1/200 of the span.
 - 3) Horizontal deflection of horizontal members shall be limited to 1/100 of the span.
- iv. The recommended minimum clearance between conductors and grounded metal parts, conductors of different phases, vertical clearance of unguarded parts and horizontal clearance of unguarded parts shall be as follows:

	Clearance (inches)			
Voltage	Phase to Ground	Phase to Phase	Vertical to Grade	Horizontal to Fence
69 kV	29	60	132	120
230 kV	76	132	180	156

- v. The design shall provide sufficient rigidity so that all equipment, such as air switches, interrupter switches and circuit interrupting devices will operate properly, and so that deflections of members will not exceed the limits specified by the equipment manufacturer. Knee braces and diagonal braces shall be omitted to the maximum extent possible. When knee braces or diagonal braces must be installed, they shall be installed so that the intersection of the bottom of such brace intersects the vertical axis of the associated column no less than 5'-6" above the top of the concrete foundation and shall be installed so that the angle from the vertical does not exceed 45 degrees.
- vi. All connections and attachments shall develop the maximum strength of the member. Bolts shall be used for all connections to be made after fabrication and galvanizing.

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4. STRUCTURAL STEEL FABRICATION

Materials and equipment shall comply with the requirements of Exhibit A – General Requirements, and the following.

- A. The design, material, structures and workmanship shall meet or exceed current industry standards. Materials shall be new and free of defects.

- B. Structural steel shall conform to ASTM A36/A36M and ASTM A992/A992M. Bolts shall be high strength, galvanized, conforming to ASTM A325M. Anchor rods shall conform to ASTM F1554 and be furnished in sufficient length to achieve the full tensile strength of the bolts.

- C. Galvanizing shall be hot-dipped, conforming to the latest industry standards. All steel, including all bolts, shall be hot-dip galvanized after fabrication.
 - i. Nuts, bolts, washers and threaded bars/studs: ASTM F2329/F2329M
 - ii. All other steel items: ASTM A123/A123M

- D. Fabrication of the structures shall include bolt holes for equipment mounting. Any additional miscellaneous shapes, such as operating rod supports, etc., shall be furnished as required and the structure shall have holes to suit.
 - i. Support structure for potential transformer shall include mounting brackets to attach control wiring junction box where indicated on the drawings.

- E. All laced or trussed members shall be shop assembled and provided with suitable connections for field erection. All pieces shall be clearly marked to facilitate field erection, and Shop Drawings shall indicate markings.

- F. Each member shall be assigned a mark number and shall have this number stamped or imprinted in characters at least 1/2-inch high. All lettering or imprint painted on a member after galvanizing shall be applied with material which will be removed by natural washing action.

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5. OWNER FURNISHED MATERIALS

The Owner has established a list of items by description, which the Owner intends to furnish for the project and which are not part of the Structural Steel Package. Reference numbers are provided for identification on Contract Drawings. The Packager shall coordinate the listed Owner Furnished Materials into all Structural Steel Package designs where indicated. The Packager will be furnished one electronic copy of Manufacturer's Drawings, where available, illustrating terminal arrangements and physical properties of equipment furnished by Owner.

- A. The Owner will also furnish, or cause to be furnished, below-grade materials (grounding conductor and connectors, conduit and fittings, foundation materials) and control cables.

- B. The Owner will also furnish, or cause to be furnished, control house materials such as relay panels with relays, controls and associated devices.

6. PACKAGER FURNISHED PACKAGE MATERIALS

The Owner has established a list of items by description, which the Packager is to furnish for the project. Reference numbers are provided for identification on Contract Drawings. For some items, manufacturer name and catalog number are provided to establish a standard of reference. The list of Packager Furnished Materials is not intended to be comprehensive or complete, and shall be supplemented with accessory and incidental materials as necessary for a complete installation, including anchor bolts. The Package shall verify quantities.

- A. All material shall be new, approved and labeled, where required, by UL. Only products by manufacturers regularly engaged in production of specified units will be acceptable.

- B. Provide materials of suitable composition to perform satisfactorily when exposed to corrosive conditions of project site.

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C. Protection from contact of dissimilar materials:

- i. All metal surfaces to be in contact with mortar, concrete or other masonry materials shall be painted with alkali-resistant coatings such as heavy-bodied bituminous paint.
- ii. Aluminum surfaces placed in contact with steel shall be given one coat of zinc chromate primer complying with FSS TT-P-645C, or equivalent. Aluminum surfaces in contact with stainless, aluminized, hot-dip galvanized or electro-galvanized steel need not be treated.

D. Structure Grounding:

- i. Grounding pads shall be welded, or grounding points shall be incorporated, near the base of each low profile type column leg.
- ii. For lattice steel elements, provide grounding attachment points for vertical runs up, and horizontal runs across, the complete lengths of lattice columns or trusses. Ground cable attachments shall be provided at maximum spacing of 4'-0".

E. Miscellaneous Items:

- i. Switch Operator Platforms: All group operated switches shall be supplied with an operator platform as shown on the Contract Drawings. The platform shall be designed in accordance with the recommendations of IEEE-80 pertaining to touch potentials.
- ii. Terminal Pads: All connector and switch terminal pads shall be finished on the top surface to provide a smooth connection point for terminal connectors to transfer rated current. The pads on switches shall be tin plated, 4-hole NEMA pads suitable for bolted aluminum or copper connectors with standard hole spacing of 1-³/₄ inches x 1-³/₄ inches.
- iii. All necessary connectors shall be provided to terminate or couple bus, cable, equipment, switches, etc.
- iv. All terminal pad connections shall be made using a suitable number of stainless steel hex bolts, hex nuts, 2 stainless steel flat washers and 2 stainless steel compression washers provided per bolt. This hardware shall be provided by the Packager. Bolt lengths shall be sized to provide minimal projection beyond hex nut to prevent excessive noise due to corona, but the entire hex nut shall be engaged.

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- v. Grease: All grease shall be high temperature synthetic grease.
- vi. All connectors provided for aluminum bus connections shall be of the weldment type unless noted otherwise. All aluminum cable connectors shall be compression type unless otherwise specified.
- vii. Aeolian vibration damping cable shall be provided for all horizontal bus runs of tubing with diameter of 2 inches or larger.
- viii. Provide electrical joint compound for all aluminum-to-aluminum and aluminum-to-copper connections. Furnish AFL "Alnox" Electrical Joint Compound, or approved equal, for aluminum connections.
- ix. All copper bus connectors shall be mechanical.

7. SUBMITTALS AND REVIEW

The Packager shall submit lists of equipment and material supplemented by necessary shop drawings, descriptive bulletins, and/or other information necessary to completely describe the equipment and material proposed. Provide submittals within 30 days from the date of Notice of Award, for review by the Owner. Submittals shall be complete and shall include, but not necessarily be limited to, the following:

A. LATTICE STEEL and LOW PROFILE STRUCTURAL STEEL

- i. Steel structure design calculations, including complete foundation load reactions.
- ii. Plan, elevations and section views necessary to fully illustrate the structure layout and their assembly.
- iii. Complete structural steel details, including member sizes, welding requirements, fabrication and erection instructions. Include all necessary details without limitation of connections to structures.
- iv. Itemized Bills of Material, complete with identifying mark indications and quantities.
- v. Installation and erection instructions, including weights of all preassembled components.
- vi. Foundation bolt (anchor rod) details and templates for structures to be furnished.

B. EQUIPMENT, MATERIALS, and INCIDENTALS

- i. Complete switch manufacturer shop drawings including ratings, dimensions, mounting and terminal details, manual or motor operator details, and maintenance manuals.

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- ii. Complete surge arrester manufacturer shop drawings including ratings, dimensions, mounting and terminal details, and performance characteristics.
- iii. Completely itemized Bill of Material including item Description, Manufacturer, Catalog Number, and Quantity, cross referenced to the Owner's reference numbers.
- iv. Manufacturer's literature and data as necessary to establish "Approved Equal" equivalence for any items substituted.

C. SHOP DRAWINGS

- i. All shop drawing submittals required to be delivered to the City of Ocala shall be mailed (three copies) or sent by e-mail to: Pete Baker, Project Manager, Ocala Utility Services, 1805 NE 30th Avenue, Bldg 400, Ocala, FL 34470, PBaker@Ocalafl.org.
- ii. Certified physical copies of drawings (24" X 36" prints), instruction books, and operations & maintenance manuals shall be provided for each category of equipment furnished. Manufacturer descriptive bulletins and/or other information shall be complete for all components. Electronic files of drawings compatible with AutoCAD Release 2010 shall also be furnished to the Owner for record.
- iii. Submit test data to the Owner for review, for any applicable items.
- iv. Where spare parts are included in the Structural Steel Package award, submittals shall include a list of spare parts items to be furnished under the contract. The spare parts list shall provide the name and identification number of both the Packager and the original manufacturer of the components. The parts list shall provide the list price for each item, effective as of the date of conditional Notice of Award of Contract and conditional notice to proceed.

D. SHOP DRAWING REVIEW

- i. Failure by the Owner for reasons other than actions or omissions on the part of the Packager to return shop drawings within 15 days from date of receipt thereof shall constitute the basis for a day-for-day extension in the proposed delivery schedule. Failure by the Owner to return shop drawings within 15 days due to actions or omissions on the part of the Packager shall not constitute grounds for extension of delivery time proposed.

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- ii. A maximum of two reviews for each submittal to establish conformance with the Specifications will be allowed. In the event an item has been determined by Owner not to be in conformance with the contract requirements after two reviews, the Packager shall pay Owner an amount equal to the cost incurred by CITY OF OCALA to perform additional submittal reviews required to establish conformance with the Specifications. These costs will be deducted from the Packager's retainage prior to final payment.