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TECHNICAL SPECIFICATIONS – GROUP SWITCHES

1. SCOPE

This specification covers the technical requirements for the design and manufacturer of three pole, group operated vertical break air disconnect switches rated 230KV, Continuous rating: 3000A, 900A BIL; Duty: GSU high-side / collector yard isolation. The switches shall be supplied complete with mounting channels, post-type insulators, and control mechanisms, including inter-phase operating pipes, vertical operating pipes, gear devices, outboard bearings, and all other parts required to make up the operating mechanisms.

2. PROJECT ENGINEER

For technical questions and clarifications concerning this specification, contact:

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3. STANDARDS

The switches shall be designed, manufactured, assembled, insulated and tested in accordance with the latest edition of applicable codes and standards including, but not limited to ANSI/IEEE, NEMA, OSHA, EPA, IEC, STM and ASTM standards. In the event of any conflict between the Specifications and Codes, the more stringent requirements apply. Specific standards include the following:

ANSI A58.1: Minimum Design Loads for Buildings and Other Structures

ANSI C29.1: Electrical Power Insulators, Test Methods

ANSI C29.9: Wet-Process Porcelain Insulators

ANSI C29.13: Mechanical and Electrical Tests

ANSI C37.34: Test Code for High Voltage Air Switches

ANSI/ASQ A9000-2000: Quality Management Standards.

ANSI/NEMA MG1: Motors and Generators

IEC 61109: Composite insulator requirements

IEC 62271: High-voltage switchgear requirements

IEEE C37.30.1: Switch Guidelines

STM A153: Zinc Coating (Hot Dip) on Iron or Steel Hardware

NEMA SG-6: The switches shall be designed and furnished in accordance with NEMA standards in effect prior to the 1971 revisions. All switches shall be designed for 30^0C temperature rise rather than the 53^0C currently allowed. For switches that have been tested at 53^0C, the Owner will consider those as meeting the 30^0C as long as they are de-rated a minimum of 27%.

4. MANUFACTURER REQUIREMENTS

Each switch shall be manufactured in a facility that has been manufacturing high-quality switches for a minimum of five (5) years and has been approved by JEA.

Manufacturer shall be ISO 9001 certified or equivalent and provide evidence of a quality management system.

Current Approved Manufacturers: **Cleaveland Price** and **Southern States**.

5. RATINGS

All ratings shall be based on ANSI C37.30 and tested in accordance with ANSI C37.34. Minimum ratings are shown below but these ratings shall be exceeded when necessary to accommodate anticipated mechanical or electrical loads.

SWITCH RATINGS			
RATED VOLTAGE (kV)	**FULL LOAD AMPS (A)**	**SHORT CIRCUIT (kA)**	**BIL (kV)**
230	3000	120	900
230	3000	120	1050

6. SERVICE CONDITIONS

The switches shall be suitable for use in an ambient temperature range of -30°C to +50°C.

The switches, structure, material, fittings, and hardware shall be suitable for use in a seacoast marine environment and considered at risk of coastal corrosion and severe weather environments per IEC 62271-1 and IEEE C37.30.1.

7. MATERIALS & WORKMANSHIP

7.1. The materials used for the manufacturing of the switches shall be new and of standard, commercial, first-grade quality as to materials, workmanship, and design. The workmanship and design shall be most suitable for the application. The equipment shall be manufactured to conform to the best engineering practices.

7.2. The switches shall be of outdoor type construction. All external hardware such as nuts, bolts, washers, hinges, handles, etc., shall be galvanized with silicone weather sealant.

7.3. All components internal and external shall be checked for security and tightness.

7.4. The footprint and height range of the switch needs to be included in proposal documents.

7.5. All enclosures shall be sufficiently rigid to prevent warping of doors and latches. Doors shall be hinged and have heavy duty handle type latches. Design of enclosures shall be such that overlapping metal surfaces are sealed to prevent corrosion.

7.6. All cabinets shall be clean and free of loose parts and debris before leaving the factory.

7.7. All special tools required for installation and maintenance of the switch shall be furnished by the Manufacturer. Metric size wrenches or sockets are not considered as special.

8. SWITCH CONSTRUCTION

8.1. GENERAL: The Switches (SW-1, SW-2, SW-3) required shall function as GSU High-Side Collector Yard Isolation Switches installed on the 230kV high side of generator step-up. They must provide visible isolation of the GSUs and operate only under de-energized conditions.

8.1.1. STRENGTH: The mechanical strength of the switch shall be designed to withstand all stresses to which they will be subjected.

8.1.2. DESIGN LIFE: The switch shall be designed for maintenance-free operation in severe environmental and operating conditions with a design life minimum of 40 years. Note that contact replacements shall not be considered defects if they last a minimum of 15 years.

8.1.3. CONTACTS: All contacts shall be silver to silver and designed to prevent damage or contact welding under normal and fault conditions. Make-break contacts shall be designed so that wiping action is accomplished with minimum wear and without galling of either contact surface.

8.1.4. MOUNTING: Detailed steel structural drawings will be supplied by purchaser with the request for quotation showing the required mounting position, mounting height, and phase spacing of the switches on the request. The Manufacturer shall custom engineer the operating mechanism arrangement for each switch to fit its specific structure.

8.1.5. DISSIMILIAR METALS: There shall be no stainless to aluminum connections in moving joints, pivot points or where long term preventive maintenance will be performed. Stainless steel helical inserts are acceptable where stainless steel screws will be used.

8.2. BLADE: Blades shall be hard drawn bus copper or aluminum tubing with silver current transfer surfaces having a minimum silver thickness of 0.001". Bolted blade contacts shall have a minimum thickness of ½".

8.3. HINGE ASSEMBLY:

8.3.1. COUNTERBALANCE: All vertical break switch blades rated 69KV and above and 2000 amps and above shall be furnished with counterbalances to provide smooth, thoroughly controlled movements of the blades from the fully closed to the fully open position and vice versa. The required operating effort to open and close the switch shall not exceed 35 lbs. Counterbalance springs (and plunger where applicable) shall be insulated maintenance-free coated carbon steel or tectile coated steel (stainless steel is acceptable). The housing shall be galvanized steel, bronze, stainless steel or aluminum housing to protect against dirt and corrosives.

8.4. JAW ASSEMBLY:

8.4.1. CONTACTS: The contacts shall be high pressure contacts backed by stainless steel springs located outside of the current path. The design will be a reverse loop or tulip design to provide superior contact during faults. Current transfer shall be via copper contact fingers having silver current transfer surfaces with a minimum of 10 mils silver. The contact fingers shall be field replaceable and where applicable, interchangeable with the hinge contact fingers. The jaw for double end break switches shall be designed to allow for substantial deflection without diminishing contact pressure of effectiveness of current transfer.

8.5. INTERRUPTING ATTACHMENTS:

8.5.1. ARCING HORNS: Movable and stationary arcing horns suitable for interruption of line charging and transformer magnetizing currents shall be supplied as standard equipment unless the request for quotation specifies that load break interrupters are required. The arcing horn shall be stainless steel or bronze.

8.6. INSULATORS:

8.6.1. TYPE: Insulators shall be wet process station post single porcelain units that have an ANSI/IEEE 70 light gray finish or per best practices for seacoast marine environments, UV resistant polymer/composite with silicone rubber housing.

8.6.2. Approved Manufacturers are **Lapp, Maclean, Newell, NGK-Locke and Victor**. Other manufacturers must be approved prior to usage.

8.6.3. The following table lists required insulator ratings:

Rated Voltage (kV)	BIL (kV)	LEAKAGE DISTANCE	BOLT CIRCLE DIAMETER (BCD)
230	900	165”	5”
230	1050	198”	5”

At 69KV and below the selection of either 3 inch bolt circle insulators or 5 inch bolt circle insulators will be determined by the switch Manufacturer based upon the switch’s requirements for the specific KV and amperage rating required.

8.6.4. JACKING BOLTS: For 69KV switches and above, galvanized steel jacking bolts and hardware shall be provided to level all insulator stacks. Shims are not acceptable for leveling.

8.6.5. BEARINGS: The rotating insulator stack bearing shall be a sealed maintenance free double bearing assembly. Acceptable types shall be stainless steel ball type, bronze ball type, Timken tapered roller type or sealed automotive ball type as selected by the Manufacturer for the KV rating and amperage rating of the switch. All bearing seals shall be rubber or felt – plastic (nylon) is not acceptable.

8.7. BASE: The base shall be welded structural steel channel (single or double channel as determined by the Manufacturer based on the KV and amperage rating of the switch) and hot dipped galvanized after fabrication. The channel shall be webbed and rolled. Double channel bases may be bolted together after fabrication. The switch base shall be sufficiently rigid to operate properly under all loading conditions without dependence on the supporting structure.

All switch bases shall have mounting holes custom punched to fit the support structure upon which they will be installed. Excessive holes for additional mounting options are not acceptable as they tend to decrease the strength of the base. Provide mounting brackets and other hardware as required for upright horizontal mounting or vertical mounting on substation switch structures.

8.8. OPERATING MECHANISM: The operating mechanism for the switches shall be defined in the request for quotation and shall be by motor operator (125 VDC) with provisions for local and remote control. The operator shall come complete with all necessary operating rods, attachment hardware, etc. for a complete installation in accordance with the contract drawings. Except for vertically mounted switches, the operating mechanism shall be connected to the B phase with linkages to the A and C phase. The mechanism shall provide smooth, continuous motion with minimal operating effort suitable for motor or manual operator.

8.8.1. INDICATOR AND LOCKING DEVICE: An all metal OPEN and CLOSED position indicating device shall be provided at or near the operating device. Provisions for padlocking the switch in the OPEN and CLOSED positions shall be provided. Holes shall be ½" minimum.

For Grounding switches: Mechanical interlocking will be required to enforce the Switch Locking Device operating sequence of HV breaker – open before disconnect operation and disconnect open before grounding closure. Switch operation is only permitted when associated circuit breaker is OPEN. Circuit breaker cannot CLOSE unless switch is fully CLOSED.

8.8.2. PIPE (INTER-PHASE, DRIVE, and OPERATING): Linkages shall be designed such that they will not deteriorate or become hard to operate with the passage of time. No lubrication, adjustments or maintenance of any kind should be required. The vertical control pipe shall be 2". All other pipes shall be sized as required by the Manufacturer to accommodate the specific installation requirements and to prevent excessive deflection and pipe sag. Where permitted by the structure design the drive pipe shall be connected to the center phase of the switch. All linkage pipes shall be threaded to allow easy adjustments – punched holes are not acceptable. Rod ends and other linkage shall be made from galvanized steel – Cast parts are not acceptable.

Provide auxiliary contacts for the following: Switch OPEN/CLOSED indication, Ground Switch position indication and Remote control interface (SCADA compatibility)

8.8.3. CLEVIS: Clevises shall be galvanized steel or high strength silicone bronze. Pin for clevis, flat washer and cotter key shall be stainless steel (303 or 316).

8.8.4. GROUNDING: A flexible tin-plated copper strap with clamp type connectors shall be furnished for connecting the lower end of the vertical operating shaft (rod) to the structure ground. The conductor's current carrying capability shall not be less than 4/0 AWG copper conductor.

8.8.5. OUTBOARD BEARING: The outboard bearing shall be a sealed maintenance free stainless steel bearing or high molecular weight polyethylene bushing. The housing shall be galvanized, bronze, or aluminum.

8.8.6. MANUAL OPERATOR: All switches shall come with a manual worm gear operator with a 46:1 gear ratio and permanently lubricated gears. It shall be adjustable from 90 degrees rotation to 180 degrees rotation and pad-lockable in both the open and closed positions. The operator shall require a maximum operating effort to open or close the switch of 35 lbs. of force. There shall be a minimum of 6" from back of housing to the centerline of the vertical pipe for simplicity of mounting brackets. Coupling shall be as necessary for the Manufacturer's designed vertical pipe.

8.8.7. MOTOR OPERATOR:

8.8.7.1. ENCLOSURE: The enclosure shall be weather tight, NEMA 4X aluminum housing (minimum thickness of 1/8") with stainless steel handle hardware. For ease of access to all components, a removable or hinged top and front access door are required. The handle shall have provisions for a padlock. The door shall be removable for easier access to all components. The bottom shall have plate covered openings for three 2" conduits. The enclosure shall have provisions for grounding the cabinet with a #2 copper conductor. Painted motor operator cabinets are not acceptable. Powder coated aluminum is acceptable.

8.8.7.2. LIGHTING: Provide a 120V conventional light socket and bulb in the mechanism housing.

8.8.7.3. MOTOR: The motor shall be a single phase high torque electric motor rated at 125VDC.

8.8.7.4. HEATER CIRCUIT: Provide a 120V single phase heater with thermostat.

8.8.7.5. CONTROLS: The motor operator shall be solid state and shall include local/remote selector switch, open-close-stop pushbuttons, reversing contactor, and an 8 stage auxiliary switch.

8.8.7.6. PROTECTION: Provide thermal overload protection for the motor and fused pullouts to protect the motor/ control circuit and the heater circuit.

8.8.7.7. WIRING: Provide a power terminal block for incoming source supply leads.

8.8.7.8. HAND CRANK: A manual hand crank (insertion of which shall automatically disconnect the motor circuit) shall be provided and stored on the inside of the cabinet door for security purposes. The unit shall include a de-coupler with manual swing handle - the ability to re-couple in the incorrect position shall be positively prevented.

8.8.7.9. ADJUSTMENTS: The motor operating mechanism shall be capable of rotational adjustments from 30 degrees to 330 degrees (but shall be factory set with the proper output rotation for the switch it is to operate).

8.8.7.10. DOCUMENTATION: The unit shall include an instruction book with applicable drawings. A pocket shall be provided on the inside of the front door to store drawings and instruction book.

8.9. INTERRUPTERS: Interrupters to provide full load-break capabilities are required on all switches used in bus-tie applications and per industry practices on switches handling line charging currents. One interrupter shall be provided per phase.

8.10. MISCELLANEOUS:

8.10.1. OPERATOR PLATFORM: All group operated switches shall be supplied with an operator platform as shown on the drawings as "Typical Operator Platform Detail". The platform may be provided by a third party such as the substation packager. The Manufacturer shall provide ground connectors for attaching the platform at one location to the structure and two separate locations to the station ground grid. The platform shall be designed in accordance with recommendations of IEEE-80 pertaining to touch potential.

8.10.2. MECHANICAL STOPS: Adjustable non-breakable stops shall be provided at both the operating mechanism and the rotating insulators.

8.10.3. TERMINAL PADS: All pads shall be finished on the top surface to provide a smooth connection point for terminal connectors to transfer current. The pads shall be tin platted 4-hole NEMA pad suitable for bolted aluminum or copper connectors with standard hole spacing of 1 ¾ inches x 1 ¾ inches.

8.10.4. GREASE: All grease shall be high temperature synthetic grease.

8.10.5. DOUBLE END BREAK SWITCHES: These switches may only be used when the completed assembly will require the same spacing as vertical break switches.

8.11. SPECIAL REQUIREMENTS FOR ALUMINUM SWITCHES:

8.11.1. CONTACTS: Silver contacts shall be applied to a base of copper and then electro-tin plated or hot dip tinned to prevent the wash of copper salts over aluminum parts. Silver applied directly to aluminum is not acceptable.

8.11.2. STAINLESS STEEL SCREWS: In order to prevent aluminum growth from seizing screws, there shall be no direct interconnection of stainless steel screws to aluminum.

8.12. GROUNDING SWITCH DETAILS:

8.12.1. Ground switches are in use at some existing substations. They are installed on the contact end of all transmission voltage class disconnect switches that are used for line terminations at the substation. These ground switches provide a convenient method of grounding the line during planned outages. The ground switches are provided with interlocks to prevent the possibility of both switches being closed at the same time.

8.12.2. If a Ground Switch is required, include the detailed requirements for the Ground Switch with the switch order: Mechanical Interlock requirements and Integrated Ground switch either parallel or perpendicular to the group switch base.

Provide interlocking such that:

1) Circuit breaker is OPEN before disconnect operation.
2) Disconnect is OPEN before ground switch is CLOSED.
3) If Ground switch is CLOSED, Disconnect switch cannot CLOSE.

9. NAMEPLATE

A stainless steel nameplate shall be provided for each switch. The nameplate shall be located on the outside of the switch with the following information stamped on it, as per latest **ANSI/IEEE C37.30 Standard.**

9.1. Manufacturer

9.2. Switch Type and Catalog Number

9.3. Manufacturing Date

9.4. JEA Purchase Order

9.5. Serial Number

9.6. Rated Maximum Operating Voltage

9.7. Rated Continuous Current

9.8. Rated Lightning Impulse Withstand Voltage (BIL)

9.9. Rated Short Circuit Current (kA)

9.10. Rated Power Frequency

10. DRAWINGS

10.1. All drawings and documentation shall be in the English language.

10.2. The Manufacturer shall submit electronic drawings including outline, wiring, and schematic diagrams of the control equipment and interconnection diagrams.

10.3. The drawings shall be submitted to the Project Engineer for approval prior to manufacture of the equipment. Manufacturing shall not be started, under any circumstance, until the Project Engineer has approved the drawings. Approval drawings shall be received within 60 days ARO.

10.4. Each drawing shall include JEA purchase order number and the name of JEA substation.

10.5. All final drawings shall be submitted in hard copies and a flash drive Intergraph CAD system (MicroStation) and PDF format. DXF type conversion file is acceptable. PDF versions of drawings shall also be included on the flash drive. The manufacturer shall also provide a link to a file server where these drawings can be downloaded for a period of 30 days from the date of delivery.

10.6. Deviations or exceptions to this specification may or may not be permitted depending upon the Owner's judgment on whether such a change would be critical to system long term performance. Any approved modifications must be acknowledged by a written letter of acceptance from the Project Engineer.

11. INSTRUCTION BOOKS

11.1. The Manufacturer shall supply one (1) sample instruction book with the bid documents.

11.2. The Manufacturer shall supply three (3) instruction books per substation location.

11.3. The instruction book shall be assembled and bound in a three-ring binder with removable cover and edge sheets.

11.4. The instruction book shall contain information on receiving, storing, assembly, and maintenance of the switch.

11.5. The Manufacturer shall include a complete set of final drawings in a pocket-type page in the back of the instruction books.

11.6. The OEM drawings shall be 11” x 17” drawings and included in the instruction books.

11.7. The instruction books shall include but not be limited to the following:

- 11.7.1. Table of contents and index tabs
- 11.7.2. Specifications,
- 11.7.3. Description of the equipment
- 11.7.4. Operating Instructions (including but not limited to safety precautions and operating limits)
- 11.7.5. Instructions on the methods of receiving, inspection, storage, and handling
- 11.7.6. Complete installation, start-up, initial test, and maintenance instructions
- 11.7.7. Assembly drawings
- 11.7.8. Parts lists including spare parts list
- 11.7.9. Schedule of required lubricants
- 11.7.10. Nameplate information and shop order numbers for each item of equipment and component part
- 11.7.11. Instructions of accessories
- 11.7.12. Separate sheet defining measurements to be performed by customer on installation of the switch
- 11.7.13. Separate sheet providing a summary of all switch and mechanism adjustment values with allowable limits
- 11.7.14. List of maintenance tools furnished with the equipment, if applicable
- 11.7.15. A flash drive containing a PDF format version of the entire instruction book

11.8. The face sheet of each instruction book is to be identified with JEA project name, JEA purchase order number, the product serial number, and product name. The Manufacturer’s job order number **is not** an acceptable substitute for the serial number.

11.9. Instruction books shall comply with ANSI and IEC standards for technical documentation and safety instructions.

12. DELIVERY

12.1. The Manufacturer shall ship the switches F.O.B. JEA site, Jacksonville, Florida. The delivery location shall be furnished upon notification of shipment.

12.2. The Manufacturer shall assume responsibility for safe arrival of the switches and shall handle all claims - if damaged in transit.

12.3. All equipment furnished which requires packaging shall be labeled with the following information: JEA P.O. Number, Substation Name, Item Number per Manufacturer's Bill of Material and Content Description

12.4. For switches rated 138KV and below the individual switch phases shall be shipped fully assembled and adjusted on insulators, thus minimizing field installation time required. For switches rated at 230kV the individual switch phases shall be shipped with the live parts bolted to the switch bases (due to transportation height limitations) and the insulators shipped packaged separately for field installation on the switch phases.

12.5. During transportation, switch contacts must be protected to prevent wearing the silver contacts.

12.6. The switches shall be shipped in wood crates. The inter-phase pipes and operating pipes required for each switch shall be bundled together on a per switch basis. All remaining hardware shall be packaged in waterproof cartons on a per switch basis.

12.7. Any package which contains more than one (1) item shall have a separate packing list attached for the specific contents of that package.

12.8. All packages shall be shipped either on pallets or bundled in an acceptable manner for off-loading.

12.9. Packing shall be such as to adequately protect the contents from any damage that might be reasonably encountered during transportation and handling.

12.10. Any equipment which requires protection from the weather shall utilize packing material and packing crates that shall be sturdy enough to provide weatherproof protection for a period of up to one (1) year of outdoor storage without deterioration of the packaging, crates or damage to the contents.

12.11. Any packages that require indoor storage shall be clearly marked. Sensitive components shall be protected against humidity and temperature extremes during transit and storage.

12.12. Prior to shipment, the Project Engineer shall receive a complete packing list of all the items to be shipped for the customer to verify complete shipment.

12.13. Spare parts shall be packed separately and clearly marked "SPARE PARTS – SWITCHES". In addition, they shall be marked with their respective part numbers, descriptive information and JEA P.O. number.

12.14. Spare parts shall be shipped F.O.B. to:

JEA
Commonwealth Service Center
6674 Commonwealth Avenue
Jacksonville, FL 32254
Attn: Material and Stores Department

13. SPARE PARTS & PM RECOMMENDATIONS

13.1. No spare parts shall be purchased initially as the switches must be essentially maintenance-free devices. Manufacturer's drawings shall have a bill of materials which would allow the identification of any desired spare parts, allowing them to be requested for quotation by specifying exact part numbers and quantities desired.

13.2. A list of recommended spare parts shall include a complete description of the part, including Manufacturer, catalog number or part number and prices for each item.

13.3. The Owner reserves the right to purchase any of the spare parts on the spare parts list. Only those parts required to meet inventory requirements will be purchased.

13.4. A preventive maintenance schedule shall be included in each Manufacturer's proposal. This schedule shall include minor inspections to major overhauls.

13.5. The Manufacturer shall specify any special tools or equipment required for maintenance procedures.

14. WARRANTY

The Manufacturer shall warrant the complete switch to be free from defects in design, material and workmanship for a period of 1 year after commissioning. If any components fail during the warranty period, the Manufacturer shall be responsible for furnishing parts and all transportation, supervision, labor and other cost of dismantling and installing the new or repaired part. In addition, the Manufacturer shall provide an additional 9 years of warranty for parts only. The warranty shall include parts and components of other suppliers which are an integral part of the switch.

15. APPENDICES