REVISED 6-15-17

Technical Specifications

Section 16-012

High-Voltage Circuit Breakers – Outdoor 69KV-1200 AMP

Silver Springs Substation

1. GENERAL SPECIFICATIONS

This section supplements the General Requirements for Outdoor High-Voltage Circuit Breakers, Exhibit A – General Requirements. The technical design requirements and associated control systems and operating systems for transmission class substation circuit breakers are outlined herein.

2. RELATED SECTIONS

A. Division 00 of these specifications is a part of this section as if incorporated herein.

B. Other related sections are as listed below.

1. Section 16-010, High-Voltage Circuit Breakers -Outdoor, General Requirements.

3. 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 standards set forth in Exhibit A – General Requirements (References), except as modified herein.

4.. RATINGS

The Circuit Breaker shall meet the ratings as defined in ANSI/IEEE C37.04 and as listed in ANSI/IEEE C37.06 and shall have ratings as follows:

A.	Breaker Class	69 KV, rms
B.	Maximum voltage	72.5 KV, rms
C.	Full Wave Withstand	350 KV, impulse crest

D.	Low Frequency Withstand	160 KV, rms
E.	Rated Continuous Current	1200 amperes, rms
F.	Maximum Symmetrical Interrupting Current	40.0 KA, rms
G.	Closing and latching capability	50 KA, rms
H.	Interrupting Time	3 cycles
I.	Reclosing Time	18 to 22 cycles *
J.	Rated Permissible Tripping Delay (Y)	2 seconds
K.	Nominal Interrupting Capacity Class	4,000 MVA
L.	Poles	3
M.	Nominal Control Circuit Voltage	48 Volt DC
N.	Tanks	1 or 3
O.	Bushing Current Transformer - Multi-Ratio Standard Accuracy	C400
P.	Full Winding Amperes	1200 amperes
Q.	Number per Breaker	12
R.	Mechanism Housing Heater	240 volt, 60 Hz (with Operations at 120 volts)

S. SEL 2515312XX (48 VDC) installed with Low SF6, SF6 Lock-out, A-Finger, B-finger wired to Inputs. Relay to be isolated by Fused Knife Blade Switch.

*Reclosing time shall be adjustable from 18 to 22 cycles, based on a close-open-close operation, and factory set at 20 cycles ± 0.5 cycle. Adjustment resolution in the field shall be 0.5 cycle or better.

Any departures or deviations from the ratings cited above or these specifications shall be specifically cited at the time of bidding as an exception to the specifications.

REVISED 6/15/17 – Section "H" has been removed.

5. PRODUCTS

A. MATERIALS AND EQUIPMENT

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

B. CIRCUIT BREAKER

1. The circuit breaker shall be an outdoor type, 3-pole, single-throw, frame-mounted, complete with, but not limited to, appurtenances, accessories and spare parts, as hereinafter specified.
2. The ampere, voltage, and interrupting ratings of the breaker shall have been established by test on the type breaker proposed. Interrupting medium shall be SF_6 gas.
3. Each circuit breaker shall be mounted on a welded steel supporting framework with a weatherproof sheet steel control cabinet mounted on one end. The breaker shall include an operating mechanism arranged to close and trip the breaker by remote electrical control. The closing mechanism shall be stored energy type. Closing of the circuit breaker shall completely charge all stored energy devices so that the circuit breaker is ready for all subsequent operations that may be required. The circuit breaker shall be complete with a spring-operated mechanism to provide local and remote alarms for failure of the stored energy devices to fully charge subsequent to a close operation of the circuit breaker. Alarm must activate when stored energy devices fail to charge, regardless of whether the breaker contacts are open or closed. The equipment shall be trip free mechanically and electrically. All current carrying parts shall be copper or appropriate copper alloy.
4. All operating devices shall be suitable for 48 VDC as specified.
5. Current transformers and secondary connections shall be designed to withstand injury, from the mechanical shocks incident to handling and operation, and the momentary and three-second current rating of the circuit breakers.
6. Current transformers and control and instrument wiring, where a part of the breaker or its assembly, shall be protected by location or metallic coverings to provide adequate shielding from arcing in or around the circuit breaker and to minimize the possibility of insulation failure introducing line potential on the control wire.
7. Close and trip coil leads, solenoid valve leads, instrument transformer secondary leads and similar wiring shall be securely anchored to the coil.

8. Power supply for air compressor for pneumatic operation, oil pump for hydraulic operation, or winding spring shall be 120 or 240 volts, 60 hertz, single-phase.

9. Control "close" circuits shall use X-Y relay anti-pump arrangement. "open" and "close" circuits shall be subject to approval by City of Ocala. Control power shall be supplied through separate, remotely located breakers for trip and close circuits.

10. The "close" and "trip" circuits shall be connected to the dc supply through knife blade disconnect switches. The "close" circuit shall be fused separately.

11. Insulation for components shall be designed to withstand two (2) times the maximum operating range voltage plus one (1) thousand volts for one (1) minute.

12. All components including relay coils, pumps, circuit breakers, etc., shall be 250 volt dc or 600 volt ac class.

13. All components shall be temperature and enclosure compensated. Temperature operating ranges shall be -5° C to +85° C. All thermal elements shall be designed and selected for a nominal ambient operating temperature of 55° C.

14. All protective devices on the charging motor, heater, and other circuits shall be cartridge type fuses or approved breakers. Breakers shall be thermal magnetic with front adjustable, non-interchangeable ambient and enclosure applicable compensation.

15. Breakers shall have a mechanical manual trip device located outside the mechanism cabinet. "Close" electrical control at the breaker shall not be provided. The mechanical manual trip device shall have a "close" circuit interlock to prevent remote electrical closing of the breaker and this trip device shall be so arranged that it must be reset before it is possible to close the breaker electrically. Manual reset lever shall be accessible and readily identifiable.

C. BUSHINGS

1. The bushings shall be dry or sealed-condenser type with oil-impregnated paper, wet-process porcelain of manufacturer's standard design for the particular

application. Bushings shall have uniform smooth, hard glaze, light gray in color. The glaze shall be free from imperfections. The bushings shall be impervious to moisture. The bushings shall comply in full with performance and test requirements of the applicable ANSI standards. Bushings shall be equipped with standard threaded studs. Composite bushings, if proposed, must be identified as an exception and shall not be included in base bid.

2. Bushings shall comply with the dimensions, performance and test requirements of ANSI/IEEE
   C57.19.00 and ANSI/IEEE C57.19.01 and shall have ratings as follows:

1.	Voltage Class	69 KV
2.	Continuous Current	1200 A
3.	BIL	350 KV
4.	Low frequency dielectric, one minute dry	175 KV
5.	Low frequency dielectric, 10 second wet	175 KV
6.	Minimum Creep	66 inches

D. ACCESSORIES

The breaker shall be furnished complete with all accessories including, but not limited to, the following:

1. **Bushing Current Transformers:**

   Each circuit breaker shall be equipped with twelve 1200/5 ampere bushing-type, five tap multi-ratio, current transformers as established by the following list. The leads from the current transformers shall be marked to indicate the taps and polarity and shall be brought out to shorting type terminal blocks, Teledyne Penn-Union Series 6000 within the control mechanism housing. Secondary leads shall be installed in weatherproof rigid galvanized steel or aluminum conduit. The 1200/5 bushing current transformers shall have an accuracy classification of not less than C400.

Bushing	CT Designation	Ampere Ratio	Accuracy Class
1	X	1200:5	C400
1	Y	1200:5	C400
3	X	1200:5	C400
3	Y	1200:5	C400
5	X	1200:5	C400
5	Y	1200:5	C400
2	X	1200:5	C400
2	Y	1200:5	C400
4	X	1200:5	C400
4	Y	1200:5	C400
6	X	1200:5	C400
6	Y	1200:5	C400

A. The following data shall be furnished with shop drawing submittals for each item of multi-ratio transformers:

- Typical ratio correction factor curves for each ratio for the ANSI Standard B2 burden (50 VA at 0.5 PF) over a range of 0.25 to 22 times rated primary current.
- Typical ANSI excitation curve for each ratio.
- Resistance of current transformer secondary and connecting leads for each ratio.
- Actual turn ratio for each tap.
- Polarity marks on BCT's shall be toward external bushing terminals.

B. One set of suitable conduit, conduits, and wiring from the current transformer leads to the terminal blocks in the control cabinet.

C. One latch checking switch.

D. 240 VAC space heaters, with personnel protective barriers, in mechanism cabinet with fused switch.

E. Gauges for pertinent systems with window glass (shall not be Plexiglas or plastic) for gauges in housing.

F. Two copper-faced ground pads, diagonally opposite, with two 0.50-13 tapped holes on 1.75-inch centers.

G. SEL 2515312XX (48 VDC) installed with Low SF6, SF6 Lock-out, A-Finger, B-finger wired to Inputs. Relay to be isolated by Fused Knife Blade Switch.

E. CONTROL CABINET

A weatherproof sheet steel control cabinet shall be mounted on the supporting framework, with removable plate in the bottom for conduit entrances, containing the following:

1. Mechanically trip free operating mechanism with 48VDC closing coil and 48 VDC shunt trip coil.
2. One eighteen-pole (minimum) auxiliary switch. The switch shall provide a minimum of five N.O. and five N.C. contacts in addition to those necessary to operate the circuit breaker.
3. One mechanically actuated operation counter, visible with the control cabinet door closed.
4. An adjustable pressure relay where applicable for alarm with two sets of form "C" contacts.
5. One lot of Teledyne/Penn-Union terminal blocks (Cat. No. 6006-SC for current transformer and 6012 for controls), **NO SUBSTITUTIONS** conveniently located for making connections to the external control wiring entering from below.
6. One lot of internal control wiring. Connectors shall be non-insulated ring tongue Burndy Type YAV of appropriate size, **NO SUBSTITUTIONS**. All conductors shall be identified by shrink fit or wrap-on sleeve with legible black characters on a white background to denote the destination terminal point of the conductor from the Home Terminal Point.

7. One mechanical position indicator, visible with the control cabinet door closed, to indicate whether the breaker is in the open or closed position.
8. One control panel, complete with X-Y control scheme and three fused knife switches, for the control circuit, pump motor and the heater circuit. The knife switches shall be located in a safe or guarded position.
9. One 120 VAC duplex receptacle on a dedicated power circuit.
10. Elapsed time meters for pertinent systems.
11. Pressure lockout/alarm switches if pertinent.
12. One lot wiring provisions for tripping and close circuit blocking by transformer and/or bus differential lockout relays.

F. WIRING

1. Switchboard ac and dc control and CT wiring shall be Type SIS, 12 AWG, minimum, stranded copper conductor.
2. The individual control and relay cabinets or the combination control and relay cabinet shall be provided with adequate terminal strips for each conductor entering or leaving the cabinet. Terminal positions shall be provided for each conductor. Manufacture shall not piggyback more than two (2) conductors on any one terminal.
3. A minimum of 25 percent spare terminal positions shall be provided in addition to those terminals required for internal purposes and those required for external conductors to be connected at the time the circuit breaker is installed.

G. NAMEPLATES

Nameplates shall be furnished in accordance with ANSI/IEEE C37.04, mounted at a height for easy reading. All pertinent data on the circuit breaker, operating mechanism, current transformers and accessories shall be marked on the associated equipment nameplate. Appropriate instructions and warning signs shall be located at essential locations. The purchase order number shall be added to the circuit breaker nameplate.

6. SUBMITTALS AND REVIEW

A. SHOP DRAWINGS

Lists of material and/or equipment supplemented by necessary shop drawings, descriptive bulletins, and/or other information necessary to completely describe the material and/or equipment proposed shall be submitted within 30 days from the date of Notice of Award. All test data required must be submitted to the Ocala Electric Utility for review before submission of invoice for each category of material or equipment.

1. All shop drawing submissions required to be delivered to the City of Ocala shall be mailed and one copy furnished on a disc in a format compatible with AutoCAD Release 2010 to: Pete Baker, Project Manager, Ocala Utility Services, 1805 NE 30th Avenue, Bldg 400, Ocala, FL 34470. A minimum of three (3) copies are required. If the Contractor desires return of more than one (1) copy, the appropriate number of additional copies must be submitted.

2. Certified copies of drawings, instruction books, material lists, and operations & maintenance manuals shall be provided for each category of equipment furnished.

3. Manufacturer descriptive bulletins and/or other information shall be complete for all components and shall include a spare parts list applicable to each item of equipment to be furnished under the contract. The spare parts lists shall provide the name and identification number of both the equipment's manufacturer and the original manufacturer of the components. The parts list shall provide the list price for each item of equipment effective as of the date of conditional Notice of Award of Contract and conditional notice to proceed.

B. SHOP DRAWING REVIEW

1. Failure by the City of Ocala for reasons other than actions or omissions on the part of the Equipment Contractor 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 Equipment Contractor shall not constitute grounds for extension of delivery time proposed.

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

7. DELIVERY

All items must be received by City of Ocala Warehouse, 1805 NE 30th Avenue, Bldg. 700, Gate 5, Ocala, FL 34470, no later than **February 1, 2018**, FOB DESTINATION, PREPAID & ALLOWED. The bidder understands proposed delivery time longer than stated above may be grounds for rejection of bid.

The articles to be furnished hereunder shall be delivered All transportation charges paid by the supplier to destination.

Delivery will be F.O.B. designated site, prepaid and allowed, as directed by the City of Ocala and set forth herein.

The electrical equipment will be subject to inspection by the City of Ocala after its arrival at location specified above. If it is found to be defective or otherwise not in conformity with the requirements as set out by the specifications, the City of Ocala will have the right to reject such equipment. Acceptance of delivery from the carrier shall not constitute acceptance of the equipment.

PERMITS AND LICENSES

City, County and Florida Department of Transportation road-use permits, and any other

permits or licenses required for the work shall be obtained by the Contractor at their own expense.

9. TRANSPORTATION

Special arrangements for traffic control, escorts or other special support shall be provided at the expense of the Contractor. The Equipment Contractor shall be responsible for the cost and accomplishment of restoration of all facilities damaged as a result of the Equipment Contractor's transportation operations.

10. PAYMENT

Immediately upon receipt of the Purchase Order the Contractor shall deliver for review a production schedule and a payment schedule indicating the pro rata amount of the lump sum bid that will be invoiced for each item of equipment to be furnished under the proposal. Payment will be made upon completion of delivery as stated herein and submission of invoices in duplicate as set forth herein.

Invoice(s) shall show the price agreed upon for the equipment. Invoice(s) must show Purchase Order number(s).