Public Utility District No. 1 of Benton County

Specification 2021-01

OVERHEAD SWITCHED CAPACITOR BANKS FOR LINE APPLICATIONS

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1.0 GENERAL

1.1 This specification covers the furnishing and delivery of three-phase overhead switched capacitor banks as herein specified for the Public Utility District No. 1 of Benton County (District).

1.2 Only those manufacturers who have demonstrated their capabilities of manufacturing capacitor banks of size and class specified herein will be considered. The manufacturing facility shall be independently certified to meet ISO 9001 standards.

1.3 The capacitor banks shall be constructed and tested in accordance with the latest edition of applicable NEMA, ANSI, IEEE, and ASTM Standards. Particular reference is made to the following:

1.3.a ANSI/IEEE Std. 18

1.3.b ANSI C2 (NESC)

1.3.c ANSI C37.66

1.4 Complete unit shall be constructed to withstand ANSI C2 Grade B, medium loading district requirements.

1.5 The capacitor bank shall include vacuum switches encapsulated in cycloaliphatic-epoxy solid polymer modules. Switches using oil or SF6 as a dielectric are not acceptable.

1.6 All correspondence shall be sent to cp@bentonpud.org unless otherwise noted.

2.0 LANGUAGE AND UNITS

2.1 The English language and the English foot-pound-second (fps) system of units shall be used in all drawings, bulletins, and catalog information submitted with the bid, as well as in all subsequent correspondence and submittals by the successful bidder.

3.0 SERVICE

The capacitor banks procured under this specification shall be used for feeder mid-line volt/VAR control located on the District's distribution system. The electrical system is 12.47Y/7.2 kV, four-wire, grounded neutral, 60 hertz. The capacitor banks will be located outdoors on distribution pole-line. The service area is typically arid with occasional snow, ice, rain, and occasional severe dust storms. Operating temperature range shall be -40° to +60°C. The altitude is below 3300 feet above mean sea level.

4.0 Capacitor Unit

4.1 Rating

The capacitor unit shall be of the all-film dielectric type. The unit's voltage, kVAR rating, and the number of series elements shall be indicated on the proposal sheet. The units BIL shall be a minimum 110 kV. The units shall be capable of being installed either in a grounded or ungrounded Wye configuration.

4.2 Case

4.2.a The capacitor unit shall be designed for outdoor installation. The case and cover shall have a uniform corrosion-resistant finish of a minimum 3.0 mil thickness.

The paint color shall be light gray ANSI Standard No. 70 (Munsell 5BG-7.0/0.4). The underside of all hangers shall be left unpainted for positive grounding.

4.2.b The capacitor case shall include a NEMA standard nameplate manufactured from stainless steel or anodized aluminum permanently imprinted, scribed and/or embossed with information required per IEEE Std. 18, latest revision.

4.2.c A permanent label shall be affixed to each capacitor unit that clearly states the following “Non-PCB fluid having no detectable PCB (less than 1 ppm) at the time of manufacture”.

4.2.d The capacitor case must be able to withstand 6,000 amps of fault current when coordinated with an expulsion or current-limiting fuse.

4.2.e The mounting brackets shall be mounted on both ends of the capacitor case with the mounting holes on 15 5/8” centers.

4.2.f Capacitor case shall incorporate a lifting eye capable of supporting the capacitor unit.

4.3 Bushings

4.3.a All capacitor units shall be equipped with two high-voltage bushings. The bushings shall meet the minimum creepage and strike distances listed in ANSI/IEEE Std. 18, latest revision.

4.3.b Bushing shall be wet-process porcelain, glazed, light-gray (Munsell 5BG-7.0/0.4, ANSI 70) or District approved equal.

4.3.c Bushings shall be welded directly to the capacitor case.

4.3.d Bushing terminal shall be flat pad NEMA B terminals, ½” bolt-holes.

4.4 Capacitor fluid shall be Non-PCB Edisol VI or equivalent. Completed material safety data sheet “Form OSHA-20” for the manufacturer’s capacitor fluid shall be included with the capacitor unit shipment.

4.5 All external fittings, cover bolts, and clamping devices shall be stainless steel, 409 grade or better.

4.6 The capacitor units shall have an internal discharge resistor in accordance with the latest applicable NEMA and ANSI standards.

5.0 Capacitor Rack

5.1 The capacitor rack shall be built for pole mounting. The racks shall be designed to hold three or six capacitor units as indicated on the proposal. The rack shall accommodate a shunt connection for the capacitor units.

5.2 A minimum of two (2) lifting eyes shall be provided on the rack for lifting purposes. The bearing surfaces of the lifting eye shall be free from sharp edges and shall all lie in the same horizontal plane.

5.3 Capacitor rack shall be constructed of welded aluminum structural components and completely factory assembled. Galvanic corrosion protection between the aluminum and any dissimilar metals shall be provided as required.

5.4 A minimum of one ground lug shall be furnished on the aluminum rack for positive electrical grounding. The ground lug shall be capable of connecting to #6 solid through #2 stranded wire.

5.5 The rack shall accommodate the in-line vertical mounting of the specified number of capacitor units.

5.6 The rack shall incorporate a pole mounting plate with two (2) holes 11/16”-3/4” in size to accommodate the mounting of the rack to the pole with the use of two (2) District-supplied 5/8” bolts. Mounting hole spacing shall be 18”.

5.7 The rack shall include sway braces if necessary.

5.8 Capacitor rack shall accommodate the mounting of three single-phase capacitor vacuum switches.

5.8.a For six-unit racks: three switches shall be mounted on the front, or field side, of the rack.

5.8.b For three unit racks: two switches shall be mounted on the side of the rack opposite of the pole. The third switch shall be mounted on the end of the rack.

5.9 The capacitor units shall be assembled vertically-mounted. The primary bushing shall be mounted on the field/front-side of the rack unless otherwise specified. The capacitor units shall be bolted into place and configured for per phase operation.

5.10 Provision for ungrounded bank

The rack shall accommodate a ball stud for attachment of a ground wire for maintenance activities.

6.0 Capacitor Switches

6.1 Ratings

The capacitor switches shall meet the following ratings:

Nominal System Voltage	14.4 kV
BIL	110 kV
Continuous Current Amperes	200 A
Minimum Short Circuit Asymmetrical Amperes	6,000 A
Nominal Frequency	60 Hz

Each capacitor switch shall be capable of safely energizing and de-energizing the capacitive load of the size capacitor bank requested on the quote or bid schedule at rated voltage for a minimum of 30,000 operations without the need for any maintenance.

6.2 Construction

6.2.a Current interruption shall be made by vacuum interrupters.

6.2.b The switches shall include a position indicator, which shows the state of the switch. The position indicator shall be clearly visible from the ground.

6.2.c The switches terminals shall accommodate the connection of #4 through #2 stranded copper wire.

6.2.d The switches shall include a ground lug. The ground lug shall be capable of connection #6 solid through #2 stranded copper wire.

6.2.e The capacitor switch shall consist of a mechanism housing that contains magnetic actuators providing trip and close operation to the encapsulated vacuum interrupter module and shall be powered by a 120VAC source.

6.3 Operation

6.3.a The switches shall be provided with a manual open operating handle. Manual switch operation handle shall be hot-stick operable.

6.3.b The switches shall include a weatherproof five-pin control receptacle for the electrical connection.

7.0 Associated Equipment

7.1 General

The associated equipment specified below includes all necessary equipment to operate the vacuum switches from a capacitor control located at the base of the pole. All associated equipment shall be suitable for outdoor pole mounted applications. The associated equipment shall be designed for operation with the capacitor switches previously specified.

7.2 Sensors - The capacitor bank shall be furnished with the following sensors, sensor cables and sensor accessories; or approved equal:

7.2.a Line post current sensor with the following part number: Lindey 9E653/E1006, Gen2 15kv with extra high leakage, current only, and hotstick keeper.

7.2.b Line post sensor mounting provisions with the following part number: Lindsey 2041, ¾”x7” mounting stud for wood cross-arms.

7.2.c Line post sensor cable with the following part number: Lindsey 9620/20, sensor end bayonet connector and pig tail cable end.

7.2.d Capacitor bank shall be furnished with a neutral current sensor having 35ft cast-in cable with pig-tail leads and the following part number: Lindsey 9525

7.3 Control cable

7.3.a Capacitor control cable between the control enclosure and junction box shall be sixty (60) feet in length, if possible; weatherproof, and flexible. The cable shall have a 7-pin weather-proof receptable on both ends and include conductors of sufficient size to safely operate switches, the control mechanism, and accommodate the signaling and sensing circuits (#16 AWG minimum). The cable shall have control end connector suitable for use with District approved control. District approved control cable is SEL part number C548-45.

7.3.b Capacitor switch control cables shall have a five-pin weather-proof receptable on both ends and include five (5) conductors of sufficient size to safely operate the switches control mechanism and accommodate signaling. The cable shall be of sufficient length to route around the rack frame minimizing free-hanging cable to the junction box.

7.3.c The control power transformer (CPT) cable shall be a two (2) conductor cable, hard-wired to the CPT and connected to the rack-mounted junction box through a weather-proof quick disconnect with the associated mating plug.

7.3.d All control cables shall be provided with strain relief at the control cable junction box.

7.3.e Control cables shall be arranged to drain.

7.4 Junction box

7.4.a The junction box shall be NEMA 4 rated UV-resistant polymer or painted formed steel, unless otherwise specified by the District.

7.4.b The junction box shall be of sufficient size to terminate a total of seven (7) cables as specified above; CPT cable, capacitor control cable, switch control cables (qty 3), line post current sensor cable, and neutral current sensor cable.

7.4.c The junction box shall incorporate a captive gasketed cover and include at minimum 24 terminal positions rated at 250VAC. Refer to Attachment 1, SEL drawing LDWC548 for capacitor control cable wiring details.

7.4.d The junction box shall include a minimum of seven (7) knockouts between the bottom and each side.

7.4.e The control cable junction box shall be suitable for mounting to a standard capacitor rack.

7.5 Arrestors

7.5.a Arrestors shall be MOV type rated for 10 kV and 8.4 MCOV, Cooper #URT10050A1A1B1A.

7.5.b Arrestors shall be mounted to the rack frame.

7.5.c Arrestors shall be connected to the line/primary terminal of the capacitor switch.

7.6 Capacitor control

7.6.a AUTOMATIC CAPACITOR BANK CONTROL

The capacitor bank shall be furnished with an SEL-734B automatic capacitor bank control with the following part number:

7.6.a.i SEL 734B Capacitor bank controller 07340U9F1D1626E9GAD3A5X0X, 16 LDP channels, compact non-socket, 7-pin connector, 120 Vac, 10 Vac LEA phase and neutral current, outputs for ganged three-phase control.

7.6.a.ii The capacitor bank controller shall be furnished with necessary pole mounting provisions. District approved pole mounting provision is SEL part number 915900298 for 734B compact.

7.7 Wildlife protection

7.7.a All exposed device bushings (capacitor, arrestor, CPT) shall include a protective cover that will isolate the terminal from contact by animals or birds. The animal-proof material shall be resistant to ultra-violet degradation.

7.7.b All jumper wire shall be either manufactured covered wire or wire covered in shrink-wrap tubing rated for 25kV.

8.0 PROPOSAL INFORMATION

The bidder shall include in their proposal information as follows:

8.1 Dimensional outline drawings shall indicate the following information at a minimum:

8.1.a Proposed rack and all bolt hole locations (including mounting holes for vacuum switches).

8.1.b Proposed bank configuration.

8.1.c Proposed capacitor unit tank design.

8.1.d Proposed vacuum switch design with switch position indicator shall be clearly shown on drawing.

8.1.e Proposed control cable junction box.

8.1.f Proposed capacitor control.

8.2 Weight:

8.2.a Capacitor units only

8.2.b Total weight of fully assembled capacitor rack.

8.3 Provide connection diagram required to open and close the switches electrically including the pin configuration of the control connector.

8.4 Approximate quantity of dielectric fluid in proposed tank for capacitors.

8.5 Anticipated operating life of capacitor switches.

8.6 Descriptive data and cutsheets including manufacturer and catalog numbers of all controls, capacitor units, instrument transformers, bushings, and vacuum switches.

8.7 Recommended maintenance requirements and intervals.

8.8 Conditions of Warranty

9.0 INFORMATION TO BE SUBMITTED AFTER AWARD

9.1 Upon receipt of order the supplier shall electronically submit one (1) copy of drawings as follows:

9.1.a Outline drawings with dimensions and weights

9.1.b Schematic and connection diagrams of control and meter circuits and control panel layout

9.2 Drawing approval is required unless otherwise noted.

9.3 Prior to the shipment of the specified unit(s) the supplier shall submit the following:

9.3.a One PDF set of digital as-built drawings diagrams.

9.3.b One electronic copy of the manufacturer's instruction book(s) which shall contain copies of:

9.3.b.i All drawings and diagrams

9.3.b.ii List of material shipped

9.3.b.iii Certified test reports on each individual unit.

9.3.b.iv Manufacturer's recommended procedure for testing integrity of vacuum bottle.

10.0 TESTS

All routine tests shall be performed in accordance with applicable ANSI, IEEE, and NEMA standards.

11.0 Warranty

Any capacitor and/or capacitor switch that fails due to defective design, material and/or workmanship within twelve months after being energized or eighteen months after delivery, whichever comes first, shall be repaired or replaced without cost to the District. Any defects in design, material, and/or construction discovered within this period shall be corrected on all capacitors and/or capacitor switches furnished on this order at the Manufacturer's expense, either by repair or by replacement.

12.0 SHIPPING CONDITIONS

12.1 The capacitor banks shall be shipped F.O.B. to the District's warehouse at 1500 South Ely Street, Kennewick, Washington 99337.

12.2 Equipment damaged in shipment will be refused on delivery and it will be the Manufacturer's responsibility to arrange for prompt repair or replacement to the standards of new equipment. The Manufacturer shall not be relieved of the responsibility of delivering undamaged equipment, even if the damage is internal, or otherwise undetected, and the nature of the damage is unknown until the equipment is energized and tested. Repaired units shall be shipped, repaired and shipped back to the District within (6) weeks of being notified of a shipping issue.

12.3 A complete list of all material shipped shall be furnished in duplicate to the District.

℘ **END** ℘