

**SECTION III
SPECIFICATIONS
BID NUMBER 190803**

1. SCOPE

These Specifications define a power circuit breaker to be designed and manufactured for installation and satisfactory operation outdoors under the conditions set forth below. Throughout this Section III, PUD No. 1 of Clallam County is referred to as the "District," and the contractor supplying the circuit breakers described herein is referred to as the "Contractor." The power circuit breaker furnished under these specifications shall be in accordance with all the requirements of applicable ANSI, ASTM, NEMA, and IEEE standards. All materials and devices shall be in accordance with the applicable requirements of the Federal "Occupational Safety and Health Standards".

2. APPLICATION

The circuit breaker will be installed on a 115 – 12.5 kV three phase, 60 Hz, effectively grounded system. The elevation above sea level is 299 feet. The ambient temperature range is 0° F to 100°F. The circuit breaker shall be designed to withstand wind speeds of 90 mph or NESC Medium Loading District, whichever is greater. The circuit breaker will be designed to withstand 0.75 inch of radial ice loading. The circuit breaker will also be designed to withstand adverse atmospheric conditions such as horizontal rain and sea salt air.

3. SEISMIC FORCE

The seismic forces to which the circuit breaker may be subjected are defined by a Seismic Zone D2 earthquake area. The unit shall be capable of withstanding the maximum forces to be encountered in a thirty-five (35) year period in a Seismic Zone D2 area.

4. RATINGS

Refer to the Data Sheets in Proposal.

5. DESCRIPTION

- 5.1 The circuit breaker shall be a three (3) pole, single-throw type suitable for outdoor operation under the conditions specified above.
- 5.2 The circuit breaker shall be free-standing furnished complete with control panel, electrically trip free mechanism, energy storage system, current transformers, position indicator, galvanized steel or aluminum supporting structure, and all other necessary equipment. The installed circuit breaker shall be a complete unit with all equipment mounted on the breaker frame so far as possible.
- 5.3 All wiring for controls, current transformers and auxiliary power circuits shall be terminated in the control compartment. Provisions shall be made for external wiring to enter the control compartment through conduit(s) from below.

6. CONTROL MECHANISM

The control mechanism shall be mechanical stored energy, pneumatic, hydraulic, mechanical spring, magnetic or pneumohydraulic and operate to open and close the three phases of the breaker simultaneously. Note if control mechanism proposed is not properly defined by the following features:

- 6.1 The mechanism shall be electrically trip-free and mechanically, pneumatically, or hydraulically trip-free if applicable.
- 6.2 The mechanism shall be complete with compressor and motor, storage reservoir, and necessary controls for applicable type.
- 6.3 The control circuits shall be arranged and connected to prevent energizing the closing circuit until the breaker is in the fully open position. In addition, the breaker shall be capable of interrupting a fault under the condition of the circuit breaker receiving a trip signal prior to completion of its closing operation without incurring damage.
- 6.4 The control circuit shall be such that closing and tripping operations will be completed when the control contacts have been only momentarily closed, three cycles or less, and shall be non-pumping.
- 6.5 Each control circuit wiring shall be a minimum of #12 AWG stranded copper with 600 volt insulation, Type SIS, terminated with Burndy Type YAE-N lugs or AMP Type PDIG or Purchaser approved ring-type compression terminal lugs.
- 6.6 Terminal blocks for remote connections, except for current transformer leads, shall be Type EB 25 with terminal marking strips labeled in accordance with the wiring diagrams.
 - 6.6.1 At least eight (8) spare terminals shall be provided.
- 6.7 The control circuit components shall be so rated that they will not be damaged if the closing control circuit is energized for five (5) minutes.
- 6.8 Any relays used in the control circuits of the circuit breaker shall be Square D Type X or District approved equals.
- 6.9 The compressor reservoir unit, if proposed shall have a drain valve, pressure relief device, pressure gauge, pressure control switch, and means for manually recharging in case of a loss of power.
- 6.10 The compressor, pump, or rewind motor relay shall have an extra contact that shall be closed when the closing mechanism is charged. In addition, this extra contact shall be wired in series with a 52b auxiliary switch contact for District use. The extra contact shall have the same electrical rating as the auxiliary switch contacts.
- 6.11 There shall be a low pressure alarm and cutout switch, or similar for different types of control mechanisms.

- 6.12 The operating mechanism shall be equipped with an external manual trip via push-button controls or a control switch. In addition, a manual tripping device, equipped with automatic lock-out switch which may be operated without opening the doors of the housing, shall be furnished. The lock-out device shall be wired to individual terminals and into the close circuit which overrides all closing.
- 6.13 There shall be a means for slowly closing the contacts for maintenance and alignment purposes.
- 6.14 A readily visible from the ground level mechanical target shall indicate whether the breaker is in the "open" or "closed" position. Target shall be readable at a distance of 20 feet.
- 6.15 The operating mechanism shall be equipped with a 'trip' operation counter for the circuit breaker and an elapsed time meter for the motor.
- 6.16 Gas pressure gauges and operation counters shall be visible from the outside of the control cabinet with the door closed.
- 6.17 The breaker shall be in accordance with the ratio influence voltage requirements of NEMA SG4.
- 6.18 Molded-case circuit breakers shall be provided to protect the compressor motors.
- 6.19 For SF6 gas insulated breakers, connectors shall be provided for vacuum processing, gas filling, and gas sampling. All SF6 gas fittings shall be CGA approved.
- 6.20 The Contractor shall completely assemble, adjust and test each breaker prior to shipment.
- 6.21 The mechanism shall be capable of performing a minimum of four (4) instantaneous operations with 0.5 seconds between the second and third operations, and 5 seconds between the third and fourth without being recharged. One (1) operation is defined as the breaker changing state from open to close or vice versa.
- 6.22 Each breaker shall include an indicator to indicate if the operating mechanism is charged or discharged.

7. CONTROL ENCLOSURE

The control enclosure shall be an insulated, weatherproof, dustproof and not less than No. 12 AWG steel cabinet. Additionally, it shall have:

- 7.1 A gang operated set of knife switches shall be furnished to disconnect all AC and DC control circuits. Each circuit shall be independently protected.
- 7.2 The purchase order number and date of manufacture shall appear on the nameplate.
- 7.3 A door-operated, 120 Vac. service light with a separate on-off switch and a 120 Vac, 15-ampere GFCI convenience duplex receptacle shall be provided in the mechanism cabinet. The receptacle and light circuit shall be wired to separate terminals of the terminal blocks and fuse-protected.
- 7.4 Thermostatically controlled, 120 Vac heaters shall be supplied, but shall be rated for 240 Vac operation and so sized to still provide sufficient heat at 120 Vac. Heaters shall be suitable to accommodate the ambient temperatures specified in Proposal. The thermostat shall have a field adjustable range of 50°F - 70°F. Heaters shall be guarded to protect personnel.
- 7.5 Provisions for locking doors in the open and closed positions to facilitate maintenance, testing and secure closure. Doors are to be vertically hinged.
- 7.6 A bolted, removable 8.00" x 12.00" conduit plate, 16 gage maximum, in bottom of cabinet which can be removed for conduit entry punching in the field. There shall be sufficient clear space above the floor plates to allow all control wiring to be brought into the cabinet.
- 7.7 The breaker factory wiring shall be routed in rigid steel conduit and marked in accordance with the factory wiring diagrams. The wiring shall enter the housing through rain-tight, dust-tight fittings. Wiring insulation shall withstand the ambient temperatures and atmospheric conditions as specified in Proposal without abnormal deterioration.
 - 7.7.1 The required District connections for control power, relaying, etc. shall be clearly identified on the control cabinet terminal diagrams. Ample clear space above the floor plates shall be provided for routing and termination of all District wiring.
 - 7.7.2 All contacts that are available for the District's use shall be identified on the schematic and wiring diagrams.

8. COMPONENTS

- 8.1 Standard threaded, tinned bronze or aluminum, stud-type terminals with NEMA four-hole terminal connectors, 4-inch square shall be furnished on all bushings.
- 8.1.1 Each terminal of the breaker shall be capable of being rotated around the terminal stud to facilitate connecting to the cable with bolts to hold the terminal pads in their final position.
- 8.1.2 Current rating of bushing to be equal to or greater than breaker continuous current rating.
- 8.1.3 Each terminal pad is to be capable of supporting a dead load of 300 pounds.
- 8.2 Galvanizing of steel shapes and plates shall be in accordance with ASTM A123. For shapes and plates, the coating on threaded sections and sharp edges of radii less than 3/32-inch shall be adequate to withstand four immersions of the Preece Test of ASTM A239. All other coats shall be adequate to withstand seven immersions. Steel bolts, nuts, washers, locknuts, and similar hardware shall be galvanized in accordance with ASTM A153.
- 8.3 Bushings - All bushings shall conform to applicable ANSI standards. Bushings shall be high altitude type, if necessary, for the altitude of application of the circuit breaker as specified in Section 2 of this Specification. Porcelain used in the bushings shall be manufactured by the wet process and shall be homogeneous, free from laminations, cavities, or other flaws affecting its mechanical strength or dielectric quality. The glazing of the porcelain shall be free of imperfections, such as blisters or burns.
- 8.4 Bushing Current Transformers - Each bushing shall be equipped with multi-ratio bushing current transformers of the ratio and class as specified in Proposal, for a total of six.
- 8.4.1 All current transformers secondary winding tap leads shall be a minimum of #12 AWG copper, and all taps shall be brought out to shorting terminal blocks, General Electric type EB-27A045 (or District approved alternate), in the breaker control cabinet.
- 8.4.2 Current transformers shall have fully distributed windings for each tap section.
- 8.4.2 Each individual current transformer shall be provided with a serial number.
- 8.4.3 Bushing current transformers shall be so mounted that they can be removed and replaced in the field without damage to them.
- 8.4.4 The terminal blocks shall be readily accessible and clear of all operating mechanism. It shall not be necessary to de-energize the current transformer or any part of the breaker to safely make all tap changes and do other work on the current transformer secondary circuits.

- 8.5 Two (2) NEMA two-hole copper-faced frame grounding terminals on frame legs diagonally opposite each other. The surface of the 2-hole pad shall be copper or copper alloy and capable of carrying the maximum short circuit rating of the circuit breaker.
- 8.6 Contacts shall be of the high-pressure, rotating-arc design. Contacts shall have a sufficient mass of high thermal conductivity metal immediately adjacent to the contact surfaces to preclude the possibility of contact welding or damage at currents within the momentary rating of the breaker.
- 8.7 The breaker and contacts shall be capable of carrying full rated load current at rated voltage and frequency in an ambient temperature of 40°C with a temperature rise that will neither be injurious to the breaker nor interfere with its proper operation.
- 8.8 The vacuum interrupters, if applicable shall be hermetically sealed in a high vacuum, protecting contacts from moisture and dirt. The interrupters shall be maintenance free. The breaker shall have readily accessible provisions for measuring the contact wear on each interrupter.

9. **ACCESSORIES**

Each circuit breaker shall be furnished with standard accessories as required for breaker operation and maintenance as listed by ANSI and NEMA, and the following accessories:

- 9.1 One 12-stage auxiliary switch, adjustable to either "a" or "b" contacts, shall be furnished for the District's use. Auxiliary switch contacts shall have a voltage rating not less than 48 volts DC and a continuous current rating not less than 15 amperes.
- 9.2 A remote white indicating lamp will be electrically connected in series with the trip circuits by the District.
- 9.3 Alarms to indicate low air and/or gas pressure and temperature, pole-discordance and failure of devices critical to breaker operation, including loss of voltage on essential auxiliary power and control circuits. Contact shall close when alarm is to be transmitted.
- 9.4 A Local/Remote switch that allows isolation of the trip and close circuits from remote operation inputs.
- 9.5 A control switch located in the control cabinet that allows open and close operation of the circuit breaker when the Local/Remote switch mentioned above in 9.5 is in the "local" position.
- 9.6 A complete set of all special tools as required (itemize and give a price addition for any special tools not in standard package).
- 9.7 Furnish a list of recommended spare parts and give price addition for these parts.
- 9.8 The Contractor shall supply recommended maintenance and operation information on complete installation and operation of the breaker.

- 9.9 The Contractor will certify to the District that this unit and all dielectric fluids associated therewith during construction comply with all existing environmental regulations; and specifically, that equipment contains less than one PPM polychlorinated biphenyls. Show such certification on the nameplate.

10. TESTING

- 10.1 Production tests shall be in accordance with the requirements of ANSI C37.09a and NEMA SG4 for circuit breakers and ANSI C57.13 for current transformers. Each current transformer shall withstand a low-frequency dielectric test. It shall be documented that the breaker passed rain testing per ANSI C37.20.2, Section 5.2.9.
- 10.2 Design tests shall have been performed on each design and each significant design change of the equipment as proved by certified test reports of previously performed tests or by tests which the Contractor agrees to perform. Tests shall be in accordance with the requirements of ANSI C37.09 and NEMA SG4 for circuit breakers and ANSI C57.13 for current transformers.
- 10.3 At the time quotations are submitted, the Contractor shall furnish the applicable information listed in ANSI C37.12, latest revision.
- 10.4 The Contractor shall furnish copies of time travel charges from tests made on each individual breaker for comparison with field tests to be made later.
- 10.5 At the time of quotation, the Contractor shall furnish the capacitive current switching and transient recovery voltage capability of the circuit breaker being offered.
- 10.6 The Contractor shall notify the District a minimum of two (2) weeks prior to testing so that a representative can witness the tests.

11. FINISH

- 11.1 Whenever possible, metal parts shall be hot double-dipped galvanized in accordance with the ASTM Standard stated above or shall be made of a suitable corrosion-resistant material. Where this is not possible, after thorough cleaning to remove all grease, scale, corrosion, and foreign substances, a minimum of three (3) coats of paint shall be applied to all exterior and interior metal surfaces, including one (1) coat of a rust-inhibiting primer. The total dry film thickness shall not be less than four (4) mils. The two finish coats shall be ANSI No. 70 Sky Gray, low-gloss, Alkyd Resin Enamel. In addition, two (2) cans of matching spray paint shall be furnished if available; otherwise, one (1) pint can of matching paint shall be furnished per breaker for touch-up after installation.
- 11.2 All circuit breaker finishes shall adhere to EEI finish guidelines Draft #6. Contractor shall furnish certified test results demonstrating that the coating system and application methods meet the following minimum test requirements:
- 11.2.1 Salt Fog Resistance
Per ASTM B117, 1500 hours.

- 11.2.2 Crosshatch Adhesion
Per ASTM D3359- tape removal per method B.
- 11.2.3 Humidity
Per ASTM D2247, except at 45°C ± 1°C, there shall be no blisters.
- 11.2.4 Impact
Per ASTM D2794
- 11.2.5 OUV Exposure Accelerated Weather Test
Exposure rate per ASTM G53, loss of gloss shall not exceed 50% as per ASTM D523.
- 11.2.6 Abrasion Test – Taber Abraser
Per ASTM D4060, coating shall survive at least 3,000 abrasion cycles.
- 11.2.7 Oil Resistance
As related to probable mineral oil contact. Immerse two test panels in mineral oil for 72 hours, one at room temperature (20° - 25°C) and one at 100° - 105°C. There shall be no apparent changes, such as color shift, blisters, loss of hardness, or streaking.
- 11.2.8 Moisture Condensation Resistance
Per ASTM D1735. Prior to and upon completion of exposure test, specimen shall be tested for adhesion per ASTM D3359. There shall be 100 percent adhesion to bare metal and between paint layers.
- 11.3 May be provided at Contractor's option:
 - 11.3.1 Flexibility
Per ASTM D1737, 180° bend.
 - 11.3.2 Elcometer Adhesion
Must provide PSI value.
 - 11.3.3 Dry Heat Resistance
Per ASTM D2485.
 - 11.3.4 Direct Impact
Per ASTM G14.

12. SAFETY AND SHIPPING

- 12.1 The Contractor shall provide certification of compliance as to the breaker operation. The Contractor shall meet the labeling and safety warnings as required by OSHA.
- 12.2 The Contractor shall pack all accessories and parts in accordance with commercial standards to protect them from moisture and damage in transit. Each shipping unit shall be marked clearly with the name of the consignee, shipping destination, purchase order and markings required by law. A complete packing list shall be securely attached to the outside of each shipping unit.

13. FIELD ENGINEERING SERVICES

A Field Service Engineer is optional to supervise the assembly and testing of the unit. Six (6) copies of certified test reports shall be sent to the District within two (2) weeks after completion of field services. The Contractor shall provide a minimum of three (3) days of field engineer time on-site, exclusive of travel time. Quotation shall include all costs including per diem, travel and miscellaneous expenses. Quotation shall also include the cost of additional days of Field Service Engineer.

14. DRAWINGS & INSTRUCTION BOOKS

14.1 Bidding documents and drawings supplied with the bid proposal shall contain sufficient information for a thorough engineering evaluation. Two (2) sets of the following documents shall accompany the Contractor's proposal:

14.1.1 General outline drawings showing the overall dimensions, relative location of all principal parts, and clearance requirements for bushing and interrupter removal.

14.1.2 A general description of the type of materials used for the principal components.

14.1.3 A general description of the construction, including drawings, photographs, or catalog cuts which show the general construction and any accessories included.

14.2 Approval documents and drawings supplied for approval shall be sent to the District for each unique type or model of breaker in accordance with 14.3 Document Schedule. Three (3) sets to the District of the following documents shall be included in the approval documents:

14.2.1 Proposed circuit breaker outline drawing(s) shall also be submitted as time of approval in AutoCAD 2011 format.

14.2.2 Outline drawing(s) shall be of accuracy necessary to design foundation, including anchor locations with anchor bolt sizes and breaker loading parameters.

14.2.3 All approval and final drawings or documents shall be marked with the Station Name, Purchase Order Number, and the District's name. With the District's approval, the approval process of circuit breaker may be completed in electronic email format.

14.3 Document Schedule

- Approval documents to the District 4 weeks ARO or as soon as they are available.
- Approval documents returned by the District 1 week after receipt from the Contractor.
- Final documents, drawings, installation, operation and maintenance instruction books shall be provided by the Contractor. They shall be shipped as follows:

To District:
Three (3) Copies of Instruction Manuals
Three (3) Copies of Drawings

DISTRICT: Clallam County PUD No. 1
PO BOX 1000
Carlsborg, WA 98324

Attention: Doug Adams
(360) 565-3277

15. DELIVERY

- 15.1 Delivery shall be made F.O.B. District warehouse 100 Hooker Road, Sequim, WA. 98382.
- 15.2 Delivery of all units and components to the site shall be no later than August 30, 2019.
- 15.3 The District or the District's representative will take delivery of the units at the District's warehouse. The District will provide the necessary equipment and manpower to unload the units. The Contractor shall provide a minimum of seventy-two (72) hours written notice to the District prior to shipment release. The trucking company shall provide a minimum of twenty-four (24) hours notice prior to delivery to the site. The failure to perform either notice may delay the unloading of the units. Any associated demurrage or detention charges shall be the Contractor's responsibility. Delivery shall be Monday through Friday 8:00 A.M. to 2:00 P.M. except holidays recognized by the District. The contact point for each notice is listed in Section 14.3.

16. WARRANTY

The Contractor shall warrant each unit to be free of defects and to be of good workmanship for a period of one (1) year after energization or eighteen (18) months after delivery, whichever is sooner. The warranty shall be transferable throughout the warranty period.