October 2020

GOLDEN VALLEY ELECTRIC ASSOCIATION

Pogo Tap Substation (PTS)

Technical Requirements
138kV
1200A Power Circuit Breakers

Specification No. PCB-PTS-01
Revision 1

TECHNICAL REQUIREMENTS
SPECIFICATION NO. PCB-PTS-01
138kV, 1200 AMP POWER CIRCUIT BREAKERS

1. SCOPE

This Specification defines a power circuit breaker to be designed and manufactured for installation and satisfactory operation outdoors under the conditions set forth below. 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(s) will be installed at one or more of GVEA's substations that operate at a nominal 138kV. The elevations of these substations vary from approximately 400 to 2,900 feet above sea level. The ambient temperature range is -58° F (-50°C) to 100°F (38°C). The circuit breaker shall be designed to withstand wind speeds of 105 mph or NESC Heavy Loading District, whichever is greater. The circuit breaker will be designed to withstand 1 inch of radial ice loading.

3. SEISMIC FORCE

The seismic forces to which the circuit breaker may be subjected to are defined by the site's latitude and longitude and the latest U.S. Geologic Survey MCE maps of the United States. The site specific earthquake acceleration is determined by the procedures delineated in ASCE-7 latest edition "Minimum Design Loads for Buildings and Other Structures". The vertical component of the seismic acceleration is to be considered along with the horizontal components and is assumed to act at the approximate center of mass of the equipment or structure. Equipment seismic qualification level rating is to follow the procedures given in IEEE 693 latest edition, using the Seismic Exposure Map Method unless directed otherwise.

Typical Site MCE:

Location Latitude / Longitude: Healy Substation 63.8560 N / -148.9479 W
Pogo Tap Substation 64.310526, -146.129193

MCE (site Class D) Healy
Ss= 0.797 - 1.03
S1= 0.349 - 0.30

4. RATINGS

Refer to the Data Sheets in Appendix A.

5. PHYSICAL CHARACTERISTICS

5.1 General - The circuit breaker shall be a three (3) pole, single-throw type suitable for outdoor operation under the conditions specified above.

5.1.1 The circuit breaker shall be Non-IPT (Independent Pole Tripping) only.

5.2 Interrupting Medium - The interrupting medium shall be specified by the bidder.

5.3 Mounting - The circuit breaker shall be mounted on a painted steel or galvanized frame suitable for substation installation on a concrete foundation.

5.4 Color - The tank, bushings and frame shall be ANSI No. 70, light gray (natural aluminum is also acceptable for the tank).

5.5 Weather –The evaluation criteria includes the cost of auxillary power for heating and controls and estimates of maintenance costs for the heating system per Section 16 of this Specification.

6. CONTROL MECHANISM

The control mechanism shall be mechanical stored energy, pneumatic, hydraulic, mechanical spring or pneumohydraulic with the following features:

6.1 The mechanism shall be electrically and mechanically trip-free.

6.2 The mechanism shall be complete with compressor and motor, storage reservoir, and necessary controls.

6.3 The mechanism shall be capable of performing a minimum of five (5) operations without being recharged. One (1) operation is defined as the breaker changing state from open to close or vice versa.

6.4 The compressor/reservoir unit 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.

6.5 There shall be a low pressure alarm and cutout switch.

6.6 The operating mechanism shall be equipped with an external manual trip device with a reset which overrides all closing circuits.

6.7 There shall be a means for slowly opening and closing the contacts for maintenance and alignment purposes.

6.8 A readily visible mechanical target shall indicate whether the breaker is in the “open” or “closed” position.

6.9 The operating mechanism shall be equipped with an operation counter for the circuit breaker and an elapsed time meter for the compressor motor. If the poles operate independently, each pole shall be equipped with an operation counter.

6.10 A gauge displaying temperature compensated gas pressure shall be visible from the outside of the control cabinet with the door closed. The gauge shall be in a location where it is visible by technicians filling the breaker. If it is necessary that the breaker interrupter tanks be heated to meet operating temperature requirements, the gauge shall have a remote temperature sensor installed in contact with the breaker tank in a temperature neutral location (e.g. not in direct contact with a heater).

6.11 Two (2) separate and electrically independent trip coils shall be provided. The two (2) trip coils shall be arranged such that energization of either coil or both coils simultaneously, or energization of either coil with the other coil shorted, shall produce proper tripping.

7. CONTROL ENCLOSURE

The control enclosure shall be an insulated, weatherproof and dustproof steel cabinet. Additionally, it shall have:

7.1 Manually operated visible break type disconnect switches with overcurrent protection to protect the heater, compressor motor, and control circuits. Each circuit shall be independently protected.

7.2 Current transformer leads connected to shorting-type terminal blocks that are clearly labeled per NEMA standards. Winding taps shall be per NEMA SG4.

7.3 A door-operated, 120 Vac. service light with a separate on-off switch and a 120 Vac GFCI convenience duplex receptacle.

7.4 Thermostatically controlled, 120/240 Vac heater(s) placed so as to avoid heat damage to compressor, solenoids, air receiver and control wiring. Heaters shall be suitable to accommodate the ambient temperatures specified in Appendix A. The thermostat shall have a field adjustable range of 0°F - 90°F.

7.5 All control wiring marked at both ends and all components labeled in accordance with the control diagrams.

7.6 Provisions for locking doors in the open position to facilitate maintenance and testing.

7.7 A bolted, removable conduit plate, 16 gauge maximum, in bottom of cabinet which can be removed for conduit entry punching in the field.

7.8 All circuits for the required auxiliary equipment such as CT's, fans, pumps, etc. factory wired to insulated barrier type terminal blocks located in the control cabinet. Terminal blocks shall have screw-type terminals to accept No. 10 lugs. The manufacturer shall use closed lug terminators for all control wiring. The wiring shall be routed in steel conduit and marked in accordance with the factory wiring diagrams. Wiring insulation shall

withstand the ambient temperatures specified in Appendix A without abnormal deterioration.

7.8.1 The required owner connections for control power, relaying, etc. shall be clearly identified on the control cabinet terminal diagrams. Ample space shall be provided for routing and termination of all owners' wiring.

7.8.2 All contacts that are available for the owners' use shall be identified on the schematic and wiring diagrams.

7.8.3 Conductor labelling will use the "destination" method to label individual conductors or wires. A typewritten, heat shrinkable label shall be installed on each conductor.

8. COMPONENTS

8.1 Standard threaded, tinned bronze or aluminum, stud-type terminals with NEMA four-hole pads shall be furnished on all bushings.

8.2 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.

8.3 Bushing Current Transformers - Each bushing shall be equipped with multi-ratio bushing current transformers of the ratio and class as specified in Appendix A.

9. ACCESSORIES

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

9.1 An auxiliary switch with thirty spare adjustable contacts wired to terminal blocks in the control compartment and available to the purchaser. Factory setting of contacts shall be fifteen (15) "a" and fifteen (15) "b".

9.2 A latch-check switch, or other means of performing an equivalent of the latch-checking function.

9.3 An operation counter arranged to count opening operations and visible from the outside of the cabinet.

9.4 Alarms to indicate low air and/or gas pressure and temperature, and failure of devices critical to breaker operation, including loss of voltage on essential auxiliary power and control circuits. Alarm contact shall open when alarm is to be transmitted.

9.5 A breaker monitoring system that includes the following:

9.5.1. The main breaker monitoring device shall have a DNP3 serial communication link with the following analog values available: control enclosure temperature [°F], temperature compensated gas pressure [psi], and gas density [units to be specified by manufacturer]. The INCON Optimizer 3 is the preferred device for this application.

9.5.2. If a combination pressure/temperature sensor is used, it shall be mounted at a temperature neutral point on top of one of the interrupter tanks so that the temperature reading is as close as possible to the temperature of the gas in the tanks. This sensor should be mounted in the same location as the temperature sensor listed in Section 6.10 to ensure both the indication gauge and breaker monitoring system are recording on the same temperature.

9.5.3. In addition to DNP3 communication, the monitoring system shall have analog output measurements with control enclosure temperature [°F], gas pressure [psi], and gas density [units to be specified by manufacturer], configurable in 4-20mA and 0-10V scales.

9.5.4. Gas pressure sensors shall have a valve that can be used to isolate it from the rest of the gas piping.

9.6 At least one (1) extra contact wired out from the “X” and “Y” closing relays for use in external automatic reclosing circuits.

9.7 A control switch located in the control cabinet that allows open and close operation of the circuit breaker.

9.8 A complete set of all special tools as required.

9.9 Two (2) NEMA two-hole copper-faced ground pads on frame on diagonally opposed locations.

9.10 A complete set of spare gaskets.

9.11 The Supplier shall provide the Purchaser with a list of recommended spare parts for the breaker and their costs. The cost of the spare parts shall not be included in the base bid price.

10. TESTING

Before shipping, the Manufacturer shall test the circuit breaker per the applicable standard tests in ANSI 37.09 - *Test Procedure - AC High Voltage Circuit Breakers*. Two (2) copies of the test

reports shall be forwarded to the Owner and the Engineer prior to shipping. The Manufacturer shall obtain release from the Owner prior to shipment. The Manufacturer shall notify the Engineer and Owner a minimum of two (2) weeks prior to testing so that a representative can witness the tests.

11. PAINTING

All surfaces shall be thoroughly cleaned of mill scale and rust by grit blasting or equivalent process. Oil and grease shall be removed chemically. All steel surfaces shall receive a phosphatized or equivalent treatment prior to painting. Internal and external surfaces shall have at least two (2) coats of finish acrylic enamel paint. The exterior color of all steel components shall be ANSI No. 70 Light Gray and the interior cabinet color shall be white.

12. GAS SYSTEM

12.1 The circuit breaker shall utilize gas as an insulating and interrupting medium or vacuum technology.

12.2 The breaker shall be furnished with all standard accessory items that facilitate handling and sampling of the gas.

12.3 The Manufacturer shall supply sufficient gas for complete installation and operation of the breaker.

12.4 The gas shall be a high-purity, low-moisture grade gas and has with a high dielectric strength. The mixed gas shall meet the requirements of IEC 56.

12.4.1 The moisture content shall not exceed that indicated by a max. dew point of 62° C.

12.4.2 The hydrolysable fluorides, expressed as HF acidity, shall not exceed 0.3 ppm.

12.4.3 Mixed Gas (not acceptable for this procurement contract)

12.4.3.1 The carbon tetrafluoromethane, expressed as CF_4, shall not exceed 50% by weight.

12.4.3.2 The total SF_6 assay shall not be less than 50% by weight.

12.4.4 SF_6 Gas (if used)

12.4.4.1 The Molecular nitrogen expressed as N_2, shall not exceed 0.05% by weight.

12.4.4.2 The carbon tetrafluoromethane, expressed as CF_4, shall not exceed 0.05% by weight.

12.4.4.3 The total SF_6 Assay shall not be less than 99.8% by weight

12.5 The supplier shall provide certification of compliance as to mixed gas ratio. The Supplier shall meet the labeling and safety warnings as required by OSHA. The supplier shall also certify that the mixed gas supplied is at least as nontoxic as those substances in Underwriters Laboratories toxicity classification Group VI and supply the appropriate MSDS (Material Safety Data Sheet).

12.6 The supplier shall pack all cylinders of mixed gas in accordance with commercial standards to protect them from 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

13.1 Provide at GVEA's request, a competent Field Service Engineer who has been factory trained and experienced on vacuum or mixed gas/SF_6 circuit breakers and who shall be able to:

13.1.1 Advise on assembly of equipment.
13.1.2 Inspect completed installation to assure that apparatus is correctly installed and in operating condition.

13.1.3 Check connections to equipment and adjust control and indicating devices after equipment has been installed and connected.

13.1.4 Fully instruct the plant operators in construction, assembly, operation and maintenance of equipment.

13.2 The Field Service Engineer shall provide the instruments necessary to conduct any tests or adjustments that may be recommended during the equipment installation process.

13.3 The Field Service Engineer shall submit signed and dated documentation addressing the condition of the equipment as found, tests and work performed, and the condition of the equipment as left to GVEA upon completion.

13.4 The Field Service Engineer shall make trips only at the request of GVEA. The Field Service Engineer shall be prepared to remain in Fairbanks until all of his tasks are completed unless approved by GVEA. This shall include making the corrections required to satisfy this contract.

13.5 If any of Field Service Engineer's time spent at project site or if any of his trips to project site are required to make corrections to equipment supplied under this purchase order resulting from defective material or workmanship used in the manufacture of equipment, such time and trips will be at the Bidder's expense.

14. DRAWINGS & INSTRUCTION BOOKS

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

14.1.1 General arrangement 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 A total of three (3) sets of approval documents shall be sent to the Engineer for each unique type or model of breaker. All approval and final drawings or documents shall be marked with the Station Name, Purchase Order Number, and the Owner's name.

14.3 Document Schedule

14.3.1 Approval documents to Engineer 4 weeks ARO.

14.3.2 Approval documents returned by Engineer 2 weeks after receipt from Manufacturer.

14.3.3 Final documents, drawings, installation, operation and maintenance instruction books shall be provided by the Supplier. They shall be shipped as follows:

To Purchaser:
Four (4) Copies of Instruction Manuals
Four (4) Copies of Drawings
1 Copy of Electronic Files, AutoCAD Version 2018

OWNER: Golden Valley Electric Association
758 Illinois Street
PO Box 71249
Fairbanks, AK 99707
Attention: Mike Bartch
(907) 458-5854 or (907)590-9267
E-mail: mbartch@gvea.com

The above documents, drawings and instructions shall be forwarded as soon as they are available, which shall not be later than four (4) weeks subsequent to the award of the contract.

15. DELIVERY

15.1 Delivery shall be made F.O.B. GVEA Warehouse.

15.2 Delivery of all units and components to the GVEA Warehouse shall be no later than April 1st, 2021. Final Bid Proposal shall be submitted to GVEA no later than 5:00 pm AKST, October 23rd, 2020.

15.3 The Owner or Owner's representative will take delivery of the units at the GVEA Warehouse. The Owner will provide the necessary equipment and manpower to unload the units. The Manufacturer shall provide a minimum of seventy-two (72) hours written notice to the Owner prior to shipment release. The trucking company shall provide a minimum of twenty-four (24) hours notice prior to delivery to the GVEA Warehouse. The failure to perform either notice may delay the unloading of the units. Any associated demurrage charges shall be the Manufacturer's responsibility. Delivery shall be Monday through Friday 8:00 A.M. to 2:00 P.M. except holidays recognized by the Owner. The contact point for each notice is listed in Section 14.3.

16. LOSS EVALUATION

16.1 The intent of this adjustment is to encourage the use of more thermal insulation and less electrical heating load to maintain adequate tank and cabinet temperatures for breaker operation in extreme cold ambient temperatures, as well as to encourage the use of mixed gas or lower SF6 pressure.

16.2 The auxiliary load shall be evaluated at $10,000/kW.

16.3 Evaluated load will be calculated by multiplying $10,000/kW values by the guaranteed maximum auxiliary load with all the heaters on.

16.4 If the actual auxiliary load exceeds the guaranteed maximum load values stated in proposal of the Successful Bidder, the Successful Bidder will be charged a penalty value for every kilowatt by which the actual tested auxiliary load values exceed the guaranteed maximum loads upon which the proposal was evaluated. This penalty value will be twenty percent (20%) greater than the Purchaser’s bid evaluation and will be deducted from GVEA’s proposal price when payment for the equipment is remitted.

17. WARRANTY

The Manufacturer shall warrant each unit to be free of defects and workmanship for a period of one (1) year from energization or eighteen (18) months after delivery whichever is sooner. Any defects or repairs shall be performed by the Manufacturer at no charge to the Owner. The warranty shall be transferable throughout the warranty period.

TECHNICAL REQUIREMENTS
APPENDIX A
POWER CIRCUIT BREAKER (PCB-PTS-01)
EQUIPMENT DATA SHEET

	UNIT	REQUIRED VALUE
Quantity		3
Nominal Voltage	kV (rms)	138
Maximum Rated Voltage	kV(rms)	145
Number of Phases		3
Basic Impulse Level	kV	650
Frequency	Hz	60
Rated Continuous Current	A (rms)	1200
Interrupting Capability	kA (rms)	20 (minimum)
Close/Latch Capability	kA (rms)	64
Rated Interrupting Time	cycles	3
Rated Tripping Delay	seconds	1
Rated Reclosing Time	cycles	20
Number of Tanks		3
Type of Operating Mechanism		Trip Free, Anti-Pump
Compressor/Reservoir Recharging Time	seconds	.5-15
Operable Temp. Range of Breaker	°F	-58 – 100
Bushing Current Transformers Relaying:	Qty per Bushing	2
Current ratio		1200:5
Thermal Rating Factor		2.0
ANSI Accuracy Class		C800

TECHNICAL REQUIREMENTS
APPENDIX A
POWER CIRCUIT BREAKER (PCB-PTS-01)
EQUIPMENT DATA SHEET

	UNIT	REQUIRED VALUE
Location (Bushing No. & Position)		1-3-5 X,Y 2-4-6 X,Y
Bushings:		
Creepage (min)	In.	156 or 92.1
Trip Coil		
Nominal Operating Voltage	Vdc	125
No. of Trip Coils		2
Close Coil Voltage	Vdc	125
Compressor Motor Voltage	Vac Vdc	120/240 125
Mechanism and Control Heater Voltage	Vac	120/240
Seismic Design Category		D
Radial Ice Buildup	In.	1
Elevation Above Sea Level	Ft.	1,288
Wind Speed/NESC Loading District	Mph	105/Heavy
Color		ANSI 70 Gray

TECHNICAL REQUIREMENTS
APPENDIX B
POWER CIRCUIT BREAKER (PCB-PTS-01)
BIDDER'S DATA SHEET

	UNIT	PROPOSED VALUE
Manufacturer/Type		
Interrupting Medium		
Nominal Voltage	kV(rms)	
Maximum Rated Voltage	kV(rms)	
Basic Impulse Level	kV	
Frequency	Hz	
Rated Continuous Current	A(rms)	
Maximum Interrupting Capability	kA(rms)	
Close/Latch Capability	kA(rms)	
Rated/Max Interrupting Time	cycles	
Rated Tripping Delay	seconds	
Rated Reclosing Time	cycles	
Rated Capacitance Switching Current	A(rms)	
Number of Tanks		
Number of Series Breaks per Pole		
Type of Operating Mechanism		
Compressor/Reservoir Recharging Time	seconds	
Operable Temp. Range of Breaker	°F	
Bushing Current Transformers Relaying:	Qty per Bushing	
Manufacturer		

TECHNICAL REQUIREMENTS
APPENDIX B
POWER CIRCUIT BREAKER (PCB-PTS-01)
BIDDER'S DATA SHEET

	UNIT	PROPOSED VALUE
Current ratio		
Thermal Rating Factor		
ANSI Accuracy Class		
Location (Bushing No. & Position)		
Bushings:		
Manufacturer		
Model Number		
TR Rating		
Creepage		
NEMA Pad Type and Size		
Trip Coil Voltage	Vdc	
Operating Range	Vdc	
Current at Nominal Voltage	A	
Peak Inrush Current/Duration	A / cycles	
No. of Trip Coils		
Close Coil Voltage	Vdc	
Operating Range	Vdc	
Current at Nominal Voltage	A	
Peak Inrush Current/Duration	A / cycles	
Compressor Motor		

TECHNICAL REQUIREMENTS
APPENDIX B
POWER CIRCUIT BREAKER (PCB-PTS-01)
BIDDER'S DATA SHEET

	UNIT	PROPOSED VALUE
Rated Voltage	Vac	
Rated/Inrush Current	A / A	
Mechanism and Control Heater Voltage	Vac	
Unit Dimensions:		
Height (Top of Pad)	Ft.	
Width	Ft.	
Depth	Ft.	
Shipping Height	Ft.	
Maximum Clear Height Necessary for Bushing Removal	Ft.	
Unit Weights (Approximate):		
Breaker	Lb.	
Gas	Lb.	
Total	Lb.	
Shipping	Lb.	
Seismic Zone (IBC)		
Radial Ice Buildup	In.	
Elevation Above Sea Level	Ft.	
Wind Speed/NESC Loading District	Mph	
Color		
Maximum Auxiliary Heater Load	kW	

TECHNICAL REQUIREMENTS
APPENDIX B
POWER CIRCUIT BREAKER (PCB-PTS-01)
BIDDER'S DATA SHEET

	UNIT	PROPOSED VALUE
Recommended Spare Parts:		

TECHNICAL REQUIREMENTS
APPENDIX C
POWER CIRCUIT BREAKER (PCB-PTS-01)
PRICING AND DELIVERY

1. PRICING

1.1	Total firm price for one (1) breaker, as specified, (f.o.b. destination)	$_____
1.2	Total firm price for (3) breakers, as specified, (f.o.b. destination)	$_____
1.3	Gas and Shipping are part of the firm price?	_____Yes_____No
1.4	Does Unit require filling with gas upon dressing out?	
	Filling not required	_____
	Partial filling required	_____
	Shipped without gas	_____
1.5	Is field engineer required to supervise assembly in order to validate warranty?	_____Yes_____No
1.6	Is field engineers' cost for supervising the assembly included? If not, see 1.7 & 1.8.	_____Yes_____No
1.7	Cost of field engineer at the job site for two (2) eight (8) hour days (including all expenses).	$_____
1.8	Cost of field engineer for additional eight (8) hour day (including all expenses) on the same trip.	$_____

2. DELIVERY

2.1	Shipping is scheduled after receipt of order.	_____Weeks
2.2	Shipping is scheduled after drawing approval.	_____Weeks
2.3	Is insulating gas shipped in units or separately?	_____
2.4	If separately, how?	_____
2.5	What action is required to initiate shipping of gas?	_____
2.6	Will shipper fill units?	_____

TECHNICAL REQUIREMENTS
APPENDIX C
POWER CIRCUIT BREAKER (PCB-PTS-01)
PRICING AND DELIVERY

3. DRAWINGS & INSTRUCTION BOOKS

3.1 Schematics, outline and general assembly drawings will be sent _____weeks ARO

3.2 Final Construction drawings will be sent _____weeks ARO

3.3 Installation, spare parts list, operation and maintenance instruction books will be sent _____weeks ARO

4. DEVIATIONS/EXCEPTIONS

4.1 Are there any deviations or exceptions to this Specification? If yes, attach explanation. _____Yes_____No

4.2 Is Manufacturer's Warranty Policy attached? _____Yes_____No

4.3 Is Manufacturer's Field Service Policy attached? _____Yes_____No

5. POINT OF CONTACT

5.1 Contact for technical information (Name, address and phone number) _____

5.2 Contact for commercial information (Name, address and phone number) _____

_____
NAME OF BIDDER

_____
ADDRESS OF BIDDER

BY_____

_____ _____
DATE TITLE OF OFFICER