

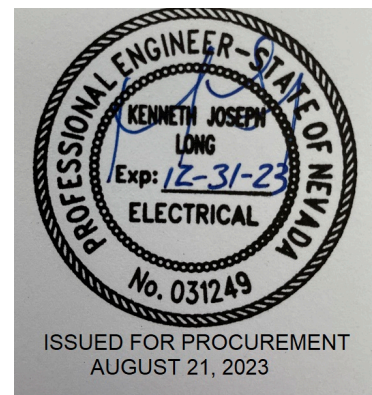
Specification No. 33 75 19

Gas High-Voltage Circuit Breaker

Southern Nevada Water Authority

69-12.47 kV Monthill Substation
Las Vegas, NV

Exhibit A



3010 W Charleston Blvd Suite 100,
Las Vegas, NV 89102-1969

Project No. 3636S (181301299)



Revision Chart

Rev.	Reason for Change	Author	Review	Issue Date
A	Released for Client Review	KJL	CAL	01/13/2023
B	Comment Revisions	KJL	MR	05/03/2023
C	SNWA Backcheck Comment Revisions	KJL	LH	08/04/2023
D	Commitment Number Revisions	KJL	LH	08/18/2023
E	Final Backcheck	KJL	MR	08/21/2023

Abbreviations and Acronyms

A	Amperes, measure of electrical current
AC	alternating current
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
BCT	Bushing Current Transformer
BRKR	Group-Operated High-Voltage Circuit Breaker
Contractor	The Construction Contractor responsible for installation
DAP	Delivered-at-Place, Destination
DC	direct current
DOT	Department of Transportation
DWG	AutoCAD proprietary drawing format
DXF	Data Exchange File
FOB	Free on Board, Destination
GFCI	ground-fault circuit interrupter
Hz	Hertz, measure of electrical frequency
I/O	Input/Output
IEEE	Institute of Electrical and Electronics Engineers
kV	kilovolts (1000's of Volts)
LED	light emitting diode

Abbreviations and Acronyms – continued

MR	Multi-Ratio, refers to CT secondary winding with taps
MSDS	Material Safety Data Sheets
NA	Not Applicable
NEMA	National Electrical Manufacturers Association
NESC	National Electric Safety Code
OE	Owner's Engineer
PD	Partial Discharge
PDF	Portable Document Format
pF	Picofarads, measure of electrical capacitance
ppm	parts per million
PSD	Project Specific Data Sheets (Appendix A)
Purchasing Authority	The originator of the purchase order
QA/QC	Quality Assurance/Quality Control
QSR	Quality Surveillance Representative
RFP	request for proposal
rms	Root mean square, measure of electrical voltage
SF ₆	Sulfur Hexafluoride
SQL	Seismic Qualification Level
SR	Single-Ratio, refers to CT secondary winding without taps
Stantec	Stantec Consulting Services Inc.
TRV	Transient Recovery Voltage
V	Volts, measure of electrical voltage or potential
VA	Volt-Amperes, measure of electrical power

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PART 1 - GENERAL

1.1 SUMMARY

- A. Southern Nevada Water Authority ("Owner") is the owner of this project and will be acting as the Purchasing Authority for the project's substation major material items. Construction responsibilities and additional minor material procurement responsibilities have been contracted to a construction management at-risk (CMAR) Contractor (hereinafter referred to as the "Contractor").
- B. Reference to the Supplier within this specification is intended to mean the equipment manufacturers, their authorized sales representatives, their authorized distributor and/or their subcontractor.
- C. This specification is for 69 kV dead-tank circuit breaker, with three group-operated interrupting contacts contained in separate tanks, internally insulated with SF₆ gas, constituting a pole or phase of the three-phase, three-pole, breaker. Breaker poles are to be mounted on a common frame, with polymer housed bushings, and a common stored energy operating drive mechanism. The BRKR shall be manufactured and tested in accordance with the specific technical parameters stipulated herein and summarized in the PSD. A separate Supplier's Data Sheets document containing much of the same data will accompany the technical specification, which also serves as the bid form document which the Supplier will fill out and return with their proposal. The Supplier shall furnish BRKR(s) for the Project's 69-12.47 kV Monthill Substation in the quantity identified in the PSD.
- D. The proposal will be quoted with Delivery Duty Paid (DDP), if shipped from an international supplier. The BRKR will be shipped under Free on Board (FOB) Destination freight terms to the Project Site (per INCOTERMS® 2020), if shipped from a domestic supplier. High-voltage circuit breakers shall be furnished in the quantity specified and to the Project Site. Delivery will include transference from the transport trailer to the Contractor's laydown yard at the Project Site. Transference by the Contractor shall not occur until after the BRKR(s) have been visually inspected for damage which may have occurred during transit, and any damage noted for repair by the Supplier has been accepted by the Purchasing Authority's Receiving Agent and the OE. The preferred transference method is by a suspended lift between transport and temporary cribbing. Foundation anchorage is to be performed by the Contractor.
- E. The Supplier will separately list in separate line items in the proposal the (i) cost of the goods (ii) cost associated with shipping, transport from factory to the Project Site (iii) field assembly, if required (iv) filling with SF₆ by a factory representative (v) commissioning and field testing by a factory representative, and (vi) relevant duties and taxes included in the proposal.
- F. Unless altered by written directions from the Purchasing Authority, the Supplier will also be responsible for field assembly, dressing, SF₆-filling, and testing the BRKR once it has been secured to the Owner's foundation. The Supplier will list the cost associated with field assembly, dressing, SF₆-filling, and testing as described above as a line items their proposal.

1.2 REFERENCES

- A. The publications listed below shall be used in conjunction with this material specification and form a part of this material specification to the extent specified herein. When a referenced publication is superseded by an approved revision, the current revision at the time of contract award shall apply. Referenced industry publications are listed below.
- B. Applicable industry documents may include, but shall not necessarily be limited to, those listed below. The Supplier will determine if any local jurisdictional requirements apply based upon the Project location identified in the PSD and notify the OE who will be responsible for their inclusion in the technical specifications.

American Institute of Steel Construction	
AISC Manual	Steel Construction Manual (15 th Addition)
	Seismic Design Manual (3 rd Addition)
American National Standards Institute	
ANSI CGA V-1 - 2021	Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections (15 th Edition)
American Society of Mechanical Engineers - International	
BPV-2021	Boiler and Pressure Vessel Code Section VIII, Division 1
American Society for Testing and Materials – International	
ASTM D2029-1997	Test Methods for Water Vapor Content of Electrical Insulating Gases by Measurement of Dew Point
ASTM D2685-2019	Test Method for Air and Carbon Tetrafluoride in Sulfur Hexafluoride by Gas Chromatography
ASTM D2472-2016	Standard Specification for Sulfur Hexafluoride
American Welding Society	
AWS-D1.1/D1.1M-2020 (ANSI)	Structural Welding Code - Steel
Society of Protective Coatings	
SSPC-SP1	Solvent Cleaning
SSPC-SP2	Hand Tool Cleaning
SSPC-SP3	Power Tool Cleaning
SSPC-SP5	White Metal Blast Cleaning
SSPC-SP6	Commercial Blast Cleaning
SSPC-SP7	Brush-Off Blast Cleaning
SSPC-SP10	Near-White Blast Cleaning

Institute of Electrical and Electronics Engineers	
IEEE C2-2023	National Electric Safety Code
IEEE C37.04-2018	Standard for Ratings and Requirements for AC High-Voltage Circuit Breakers with Rated Maximum Voltage Above 1000 V
IEEE C37.06.1-2017	Recommended Practice for Preferred Ratings for High-Voltage (>1000 volts) AC Circuit Breakers Designated Definite Purpose for Fast Transient Recovery Voltage Rise Times
IEEE C37.09-2018	Test Procedure for AC High-Voltage Circuit Breakers Rated on Symmetrical Current Basis
IEEE C37.11-2014	Requirements for Electrical Control for AC High-Voltage (>1000 V) Circuit Breakers
IEEE C37.012-2022	Guide for the Application of Capacitance Current Switching for AC High-Voltage Circuit Breakers Above 1000 V
IEEE C37.100.1-2018	Common Requirements for High Voltage Power Switchgear Rated Above 1000 V
IEEE C57.13-2016	Standard Requirements for Instrument Transformers
IEEE C57.19.00-2004	Standard General Requirements and Test Procedures for Power Apparatus Bushings
IEEE 693-2018	Recommended Practice for Seismic Design of Substations
Insulated Cable Engineers Association	
ICEA S-73-532-2014	ICEA S-73-532
National Electrical Manufacturers Association	
NEMA SG 4-2009	Alternating-Current High Voltage Circuit Breaker
NEMA SG 6-2000	Power Switching Equipment
NEMA WC 57-2014	Control Standard for Control, Thermocouple Extension, and Instrumentation Cables
NEMA WC 70-2021	Non-Shielded Power Cables Rated 2000 V or Less for the Distribution of Electrical Energy (ICEA S-95-658)
National Fire Protection Association	
NFPA 70-2023	National Electric Code
United States Department of Labor - Occupational Safety and Hazard Association	
OSHA 3075-2002	Controlling Electrical Hazards
Underwriters Laboratories	
UL 3173-2021 (SIS/XXHW-2)	Single Conductor with Extruded Insulation
UL 44	Thermoset insulated Wires and Cables (19 th Addition)
UL 1581-2001 (VW-1)	Reference Standard for Electrical Wires, Cables, and Flexible Cords

1.3 CERTIFICATIONS

- A. Materials and equipment shall be suitable for the use intended and labeled and/or listed or certified as acceptable to the approving authority and/or agency having jurisdiction at the Project Site.

1.4 PRACTICES

- A. It is the Supplier's responsibility to be knowledgeable and employ designs and manufacturing practices that incorporate the latest revisions of these standards where and when applicable.
- B. The Supplier of the assembly shall be the manufacturer of the major components within the finished product. The Supplier shall have manufactured similar electrical equipment within their specified manufacturing facility for a minimum of five (5) years prior to submitting their proposal and shall provide a list of projects and references as an attachment to their proposal.

1.5 COMMUNICATIONS

- A. In all cases, communications and correspondence with the Supplier shall be conducted through the Purchasing Authority, with copy to the OE. The Owner, Contractor, and the OE will not accept responsibility for any costs and/or delays resulting from the Supplier's communication through, or correspondence with, persons other than the Purchasing Authority.
- B. The Supplier shall provide a single designated representative for all communication and correspondence with the Purchasing Authority.

1.6 MATERIAL SPECIFICATION COMPLIANCE

- A. No substitutions for, or deviations from, the specific requirements of this specification will be permitted, without first obtaining written approval from the Purchasing Authority. Statements of clarification, exception, or deviation made by the Supplier within the Supplier's proposal will not be considered binding without confirmation and acceptance by the Purchasing Authority. Any such statements within the Supplier's proposal may result in the proposal being deemed as "Nonresponsive." Nonresponsive proposals may not be given further consideration.

1.7 GENERAL TESTING REQUIREMENTS

- A. Factory tests shall include all tests identified as "Production" in IEEE C37.09. Additionally, any special or specific tests identified within this specification shall be performed by the Supplier. The Supplier will submit an Inspection and Test Procedure Outline to the Purchasing Authority for acceptance at least three weeks prior to the commencement of testing.
- B. All test results, measurements, and calculated values shall be recorded on the Supplier's Certified Test Report. All data within the Certified Test Report shall be reviewed and accepted by the Purchasing Authority and OE before the circuit breaker is shipped. All production and special factory tests may be witnessed by the Purchasing Authority or OE.

- C. In addition to these factory tests, the Purchasing Authority or OE may also elect to inspect the interrupter at one or more production "hold" points prior to final testing. The hold points may include the following:
 - 1. Interrupter contacts and arc-extinction nozzles prior to tanking
 - 2. Operating mechanism prior to breaker assembly
- D. The Supplier shall notify the Purchasing Authority at least two weeks prior to each of the scheduled hold point dates
- E. Any test results that are deemed to be "Not Acceptable" or a "Failure" will require a detailed investigation prior to the performance of any remedial actions and/or retest.

1.8 TESTING PROCEDURE

- A. The order of tests performed will generally be in accordance with IEEE C37.09, and as agreed to in the Inspection and Test Procedure Outline document. The order may be modified as special circumstances present themselves during testing. The tests listed below are not intended to be all inclusive, or in the same order in which they may be performed.
- B. Construction and Dimensional Checking: Measurements are to be made by the Supplier's Quality Control personnel of the construction (paint and weld conditions) and dimensional characteristics, noting any significant deviations from the OE's approved outline drawings.
- C. Control Wiring: Where applicable, control wiring and contacts shall be tested with 60-hertz voltage of 1000 V applied for 60-seconds. Test jigs may be used to apply test voltage to multiple terminals at the same time. "Touch testing" for periods less than 60-seconds is not acceptable.
- D. Timing Checks: Breaker primary interrupting contacts and auxiliary contacts timing.

1.9 SUBMITTAL APPROVAL DOCUMENTS

- A. Provide drawings in both AutoCAD® Data Exchange File (DXF) and Portable Document Format (PDF) softcopy formats. Softcopy drawings are to be provided as a set in the approval drawings submittal package. Electronic copies may be sent via eBuilder to expedite approval as required. Submitted drawings and documents will be returned to the Supplier bearing the Responsible Engineer's Document Review Stamp, with instructions pertaining to the document's disposition in Section 700 - Submittals.
- B. All documents issued "For Approval" and "Final" shall clearly identify the specific purchasing document number, the facility or project name, and Owner's name in or near the title block. Copies of all required documentation shall be distributed as directed by the Purchasing Authority. All drawings and other documents furnished by the Supplier shall have the text written in English.

1.10 SUBMITTALS

- A. The Supplier shall provide the following drawings:

1. Assembled circuit breaker outline plan and elevations drawing, including pole-to-pole dimensions for centerline-to-centerline and metal-to-metal, height to line parts, height to ungrounded parts, height to centerline of pole tank, clearance required to remove the interrupter, and centers of gravity referenced to top of concrete and center of support frame.
2. Circuit breaker outline drawing, including structural details of base support frame, foundation anchorage locations and reactions, anchor bolt detail, conduit access locations, line and grounding terminal details, and foundation loading tables for the pole support frame and common control compartment (if applicable).
3. Nameplate drawing, including separate plates, if applicable, to include electrical ratings related to the breaker's interrupter capability, bushing current transformers, and operating mechanism. The nameplate(s) shall include the Supplier's model type, serial number, bill of material reference, and date of manufacture.
4. Bushing outline drawing, including electrical and mechanical ratings, weight, strike distance, and mounting and line terminal connection details.
5. Control panel assembly drawing, showing scaled locations for components and their accompanying bill of material item numbers.
6. A bill of materials for the control panel assembly drawing(s), including a nameplate schedule. Where applicable, include the original equipment manufacturer's name and part number in addition to the Supplier's designations.
7. Schematic and wiring diagrams showing complete pole and common control compartment wiring (including customer connection points); number, size, and power requirements of motors, compartment heaters, tank heaters; breaker close and trip control schemes; alarm and relay connections; terminal block assignments, and current transformer connections.
8. Bushing current transformer nameplate drawings (or this information may be shown on the main circuit breaker nameplate drawing); CT resistance per winding turn, and resistance of each lead; CT relaying accuracy classes; and CT characteristic curves showing ratio correction and secondary excitation for relaying accuracy CT's.
9. Local Annunciator device connection diagram, including the fiber optic interface.
10. Auxiliary switch(es) and alarm contact schematic and connection diagrams.
11. Instruction manual, covering receiving, handling, installation, operation, and maintenance manual of the BRKR and all accessories. The instruction manual shall also include the following:
 - a. Maximum and normal values of BRKR contact resistance.
 - b. Complete lists of renewal parts for the BRKR and all accessories, including identification of each part by name and part number. The parts lists and drawings shall relate specifically to the equipment covered by this specification; typical lists and drawings will not be acceptable.
 - c. Normal values of BRKR opening and closing times, with associated tolerances, and travel recorder chart.
 - d. Recommended intervals between scheduled maintenance and testing.
12. Manufacturer's Data: Furnish complete manufacturer's data for circuit breaker.

1.11 CERTIFIED TEST REPORTS

- A. Supplier's Certification: Indicate circuit breaker pressure vessels comply with ASME BPV (UG-120) requirements.
- B. Supplier's Certification: Certify that Products meet or exceed specified requirements.
- C. Operation and Maintenance Data: Provide Supplier's instructions covering the receiving, handling, installation, operation, and maintenance of the circuit breaker and all auxiliary equipment. All operation and maintenance manuals shall be written in English.
- D. Safety Data Sheets (SDS) for any chemical compounds that will be delivered in or with the circuit breaker including SF₆.
- E. Manufacturer's Data: Furnish complete manufacturer's data for circuit breaker.

1.12 RENEWAL PARTS

- A. Furnish a complete list of recommended renewal parts for the BRKR and all auxiliary equipment, including identification of each part by name and part number. Parts lists and drawings shall relate specifically to the equipment covered by this specification; typical drawings will not be acceptable.

1.13 FACTORY ACCEPTANCE TEST PLAN AND PROCEDURE

- A. The Supplier will perform routine production and design tests for the equipment specified herein in accordance with applicable industry standards and those identified in the Supplier's proposal.
- B. The Supplier will submit a copy of the Inspection & Test Plan (ITP) document prior to the start of testing associated with any testing performed under the directions of this specification to the Purchasing Authority and OE for approval and acceptance by the Purchasing Authority and OE. A schedule of when the planned activities are to be performed shall be submitted with the Test Plan document to the Purchasing Authority at least two weeks prior to the scheduled testing.
- C. The Supplier will provide specific details of the expected results which they deem to be "passing" or "acceptable" as part of the Inspection and Test Procedure.

1.14 PROPOSAL REQUIREMENTS

- A. The Supplier shall provide the following information with the proposal:
 - 1. A completed Proposal Summary Sheet furnished by the Purchasing Authority as part of the request for proposal (RFP).
 - 2. A reference list for equivalently sized units supplied to the North American Utility market within the past 5-years.
 - 3. Method of shipment.
 - 4. A preliminary outline with overall dimensions including the base mounting details.
 - 5. Approximate shipping weights of the assembled equipment.
 - 6. The Supplier shall identify the factory location where equipment is to be assembled and tested.

7. Major components and accessories Bill of Material, including names of the original equipment manufacturer or sub supplier, and material types and models as appropriate.
- B. The Supplier shall furnish the Quality Assurance/Quality Control Procedures requested in Quality Assurance/Quality Control Procedures QA/QC section of this specification.
- C. The Supplier shall state all the exceptions taken to this specification. If no exceptions are taken, the Supplier shall so state.

1.15 SPECIFICATION COMPLIANCE

- A. No substitutions for, or deviations from, the specific requirements of this specification will be permitted, without first obtaining written approval from the Purchasing Authority. Statements of clarification, exception, or deviation made by the Supplier within the Supplier's proposal is not considered binding without confirmation and acceptance by the Purchasing Authority. Any such statements within the Supplier's proposal may result in the proposal being deemed as "Nonresponsive." Nonresponsive proposals may not be given further consideration.

1.16 BID EVALUATION

- A. The Purchasing Authority's and the OE will evaluate the Supplier's proposed pricing as part of the bid evaluation process, prior to award of a contract. The bid evaluation process will compare the qualified suppliers' total cost including shipment costs, lead time, experience in North American equivalent circuit breakers market, warranty terms, exceptions and clarification to the specification, engineering, and field assembly cost components.

1.17 SHIPPING REQUIREMENTS

- A. The method of preparation for shipment will be such as to protect the equipment, including loose parts removed for shipping and auxiliary devices or accessories against corrosion, dampness, breakage, or vibration damage that might be encountered in transportation and handling. The manner of packaging will be such as to prevent tampering or pilfering and be acceptable to transportation companies.
- B. Shipment is not to be made until factory quality assurance tests have been completed and approved by the Purchasing Authority and OE. Any discrepancies have been resolved with the Purchasing Authority and OE.
- C. The BRKR will be shipped with each three-pole assembly assembled with its bushings whenever possible. If it is not feasible to ship assembled poles, the bushings shall be crated separately, and the poles shall be attached to the base support frame. All accessory items, small parts, and unit components to be separately boxed or bundled to prevent galling due to rubbing of one part against the other.
- D. All accessory items, small parts, and components are to be shipped with the main equipment and labeled for coordinated identification.

- E. A complete itemized bill of lading which clearly identifies and inventories each assembly, subassembly, carton, box, package, envelope, or container will be furnished and enclosed with each item or items shipped at the time of shipment.
- F. The assembled circuit breakers and accessories shall be delivered on a flatbed open trailer to facilitate offloading.

1.18 SULFUR HEXAFLUORIDE (SF₆)

- A. The SF₆ shall be shipped in steel cylinders as a liquefied gas. The net weight of contents shall be clearly identified for each cylinder. Limit the cylinder size to 122 cubic feet. Cylinder color shall be blue or a shade thereof.
- B. Supplier shall pack all cylinders of sulfur hexafluoride provided under this agreement in accordance with commercial standards as to protect them from damage in transit.
- C. Each shipping unit shall be marked plainly with the name of the consignee, shipping destination, purchase order number, markings required by law, and such other marking as requested by the company. A complete packing list shall be securely attached to the outside of each shipping unit.
- D. The Supplier shall obtain insurance on the value of all cylinders and product shipped.
- E. The Supplier's quoted prices shall include charges for the shipment of the cylinders of sulfur hexafluoride to the Purchasing Authority's specified destination.
- F. Title to the product shall not pass to the Purchasing Authority from the Supplier until acknowledgement by the Purchasing Authority and OE to the Supplier that the cylinders of sulfur hexafluoride were delivered to the site without loss or damage.

1.19 DIMENSIONS AND WEIGHT

- A. The Supplier shall be responsible for checking the shipping dimensions and weight of the proposed design for suitability for the method of shipment specified in the procurement documents.

1.20 NOTIFICATION OF SHIPMENT

- A. The Supplier will provide notification to the Purchasing Authority indicating the projected date of shipment, and then notify the Purchasing Authority a minimum of 48-hours prior to delivery of the equipment to ensure provisions for unloading. Contact information for the Purchasing Authority's Receiving Agent will be provided to the Supplier upon notice of shipment.

PART 2 - PRODUCTS

2.1 GENERAL TECHNICAL SPECIFICATION

- A. The BRKR will be an outdoor type, Class S2, with weatherproof operator components. The bushings and pole orientation shall maintain sufficient

separation between energized and de-energized components to maintain its rated BIL for service conditions up to an elevation of 3,300-feet above sea level. IEEE correction factors shall apply for operation above 3300-feet. The maximum ambient air temperature shall be 40°C, and the minimum shall be minus 30°C for "usual" service conditions. Site-specific elevation and ambient temperature range are listed in the Project Information appendix to these specifications. Site-specific conditions outside of the "usual" temperature range shall be dealt with as an "unusual" service condition under the guidelines of IEEE C37.04, Section 4.

2.2 GENERAL DESIGN REQUIREMENTS

- A. The BRKR shall be a sulfur hexafluoride (SF₆) three-pole, gas-insulated, IEEE Class S2 outdoor type, with single-break puffer or self-blast-puffer interrupters, 60 hertz, classified as a dead tank, with a common supporting frame. The BRKR shall have a common operating mechanism for all three poles. Provide a common SF₆ gas system for all three poles, including a gas density monitoring device, pressure gauge, and fill valve. No other gas shall be mixed with the SF₆. The rated interrupting time shall be three (3) cycles (49.2-mseconds) or less.
- B. Provide a support base frame design that elevates the exposed energized bushing terminals to a height above the breaker's foundation which meets the vertical clearance requirements contained in the NESC. Energized current carrying components associated with each phase (pole) shall be contained within an SF₆ gas-insulated pressurized tank (one pole per tank), with separate SF₆-to-air bushings on each side of the interrupting contacts. Suppliers may quote alternate three-pole breakers, with a common support frame, with independent pole operating mechanisms should an independent pole operated type breaker with enhanced operating features (refer to Table A-1 and A-2 in the PSD) be required. Suppliers are requested to quote composite polymer bushing housings as their base proposal. Suppliers may also propose a vacuum interrupter in a dry-air containment as an alternate to SF₆ insulated interrupters.
- C. Breaker bushings are to be equipped with bushing current transformers protected in a corrosion resistant housing at the base of each bushing flange interface with the breaker's interrupter tank. Refer to the PSD for the BCT ratings and configuration associated with each BRKR.
- D. The BRKR shall be nameplated for continuous operation at the maximum voltage rating specified in the PSD. Supply the BRKR continuous current and interrupting current rating specified in the PSD.
- E. Provide a method for filling, testing, and monitoring the insulating medium. The monitoring system shall be compensated for temperature and include a time delayed alarm to account for fluctuations in gas pressure due to solar radiation heating.
- F. The insulating column's weather shed finish color shall be ANSI #70 light gray, or the Supplier's standard equivalent finish color. The interrupter tank, control cabinet, and any other compartment(s) shall also have a finish color of ANSI #70 light gray, or the Supplier's standard equivalent finish color. Exterior surfaces may be left in their natural finish if galvanized, or constructed of either marine grade aluminum, cast aluminum, or stainless steel. The interrupter tank interior shall have a white finish color.

- G. The BRKR shall be comprised of three (3) separate interrupter chambers (tanks), each qualified to meet the requirements of ASME Boiler & Pressure Vessel Code Section VIII, Division 1. Single-piece tank designs are required. Tanks may be constructed of either cast aluminum or mild steel. When applicable, Suppliers are requested to provide data with their proposal regarding the percentage of cast aluminum tanks which are rejected due to porosity issues. The chamber must have a registered ASME clover leaf stamp Pressure Vessel nameplate, which can be added either at the factory or in the field when specifically required within the PSD appendix of this specification. Aluminum tanks are to be left in their natural finish (unpainted).
- H. Primary terminals shall be a straight flat pad with NEMA standard 4-hole or 6-hole drilling. The width and thickness of the terminal pad shall be appropriate for the continuous current rating of the circuit breaker. Circuit breakers rated 2,000 A through 2,999 A continuous current shall have a 4-inch by 4-inch pad width. Circuit breakers rated 3,000 A continuous current and greater which employ an aluminum pad material shall have a minimum 6-inch by 4-inch pad width, with NEMA 6-hole drilling. Tinned copper terminal pads may be 4-inch pad width, with NEMA 4-hole drilling, may also be used in 3,000 A continuous current applications. Although aluminum primary terminals are preferred, they may be either tin plated bronze, or aluminum; the minimum plating thickness shall be 0.0002-inch applied through a hot tin dipping process. If the bushings are supplied with threaded copper studs, then the studs shall be silver plated, and supplied with plated bronze stud-to-flat straight pad terminal connectors. Provide appropriate corona protection rings for the breaker's BIL at the line connection terminals of the bushings.
- I. Circuit breaker support frame grounding terminals shall either be an integral part of the support frame and be drilled and tapped for a 2-hole NEMA connection, or a drilled 2-hole pad. Provide separate ground terminals on two (2) opposite support legs, no lower than 18 inches above the top of the frame base plate. If the support frame is removed for shipping, provide a ground terminal on both sides of the joining flange to accommodate a visible ground jumper across the frame joints.
- J. The BRKR shall be qualified according to the requirements of IEEE Standard 693. The assembled electrical equipment specified herein shall meet the requirements associated with the acceleration specified in the PSD. Frequency modifying devices shall not be allowed.
- K. Provide lifting gussets with eyes to accommodate handling and installation.
- L. If shunt capacitance is required for ANSI 90 percent short-line faults, the Supplier shall so state in their proposal.

2.3 OPERATING MECHANISM

- A. Operating Mechanism
 - 1. The BRKR shall be furnished with a common operating mechanism for all three poles.
- B. Type of Operating Mechanism
 - 1. The operating mechanism shall be one of the following stored-energy types: spring-spring (equivalent to the General Electric DT1-145, Hitachi/ABB FSA1, or Siemens 3AP) or spring-hydraulic (equivalent to the Hitachi/ABB type HMB-2 operator or Siemens 3AT operator). The

mechanism shall be equipped with control logic and mechanical linkages where necessary to provide the anti-pumping feature. The mechanism shall be capable of driving interrupters to interrupt the level of fault current specified in the PSD.

2. In all cases, the operating drive mechanism will charge a stored energy device upon the completion of a closing operation, which will not require additional application of the drive mechanism to perform an opening operation.
3. Operating mechanisms are to be mechanically charged by an electrical motor rated for operation with either a preferred 120/240 V AC primary source or an alternate DC power input (refer to the PSD for the available DC voltage). Provide separate isolation and overcurrent protection for the operating mechanism's charging (drive) motor power circuit. Additionally, provide a separate undervoltage alarm relay for the preferred AC source (Device Number 27-1), with a Form-B output contact from each providing alarm inputs to the local annunciator (Device Number 30, IN2) to change state when conditions are abnormal.
4. Provide an automatic transfer scheme (Device Number 83M) to transfer to the Alternate DC supply input upon the loss of preferred AC power, and automatically revert upon AC power restoration.
5. The mechanism's charging motor shall be equipped with an excess run-time monitor (Device Number 84M) and thermal overload detection (Device Number 49M) which will alarm an "abnormal" condition. Provide a Form-B contact from each device in series as alarm inputs to the local annunciator (Device 30, IN5 and IN65).
6. The Supplier shall include, in the approval drawings, a listing of the inrush current required to charge the closing spring(s) at 120/240 V AC and the specified DC voltage.

C. Operating Mechanism Enclosure

1. The group-operated BRKR is to be equipped with a common stored energy operating mechanism housed in either the common control compartment, with interior barriers to protect operating personnel from the moving parts of the mechanism, or in a separate compartment. The mechanism shall be accessible for maintenance by either opening latched compartment door(s) or removable panels. If applicable, the Supplier shall furnish all electrical connections between the operating mechanism compartment and the main control compartment. Access to the compartment style operator shall be through hinged and gasketed door(s), with a single rotating handle and multiple-point latching system. Drive mechanism cabinets or housings which are separate from the main control compartment shall be formed from non-corrosive materials.

2.4 BREAKER CONTROL COMPARTMENT

A. Compartment

1. Provide a NEMA 3R control compartment (may be combined with operating drive mechanism compartment where applicable) with door gaskets, screened and filtered vents to inhibit the accumulation of blowing dust and snow within the compartment, and appropriate climate conditioning to house the control and operating components associated with each single-pole circuit breaker assembly. A NEMA 3R compartment may be used so long as the compartment can be made resistant to blowing dust and insects

- with the addition of interior filters over the screened louvers. Provide a means of escape for accumulated interior moisture.
2. The compartment is to house the interface terminal blocks for terminating all electrical wiring. The Contractor will bring all external wiring in conduit or feed-through wireway to the breaker control compartment. The compartment shall be furnished with an interior mounted removable bottom (gland) plate for drilling, punching, or cutting to accommodate conduit/wireway field assembly. Access to the gland plate shall not be blocked by cross-bracing or other support frame features.
 3. The compartment doors shall be vertically hinged, removable, and operated by a single handle through a multiple-point latching system for each door. Each door shall be equipped with wind-stop hardware to secure the door while open. Door hardware shall be stainless steel.
 4. The control components, terminal blocks, and any other devices which may require access by operations and maintenance personnel shall be mounted in the compartment at a height less than 78-inches above foundation level. The bottom of the compartment shall be not less than 2-feet above foundation level. The compartment shall be furnished with two (2) space heaters and two (2) redundant space heaters. Each heater shall be supplied by a separate circuit isolation and overcurrent protection device. One of the heater circuits will operate continuously unless disconnected manually by the isolation and overcurrent protection device. The remaining heater circuits shall be controlled by a thermostat. The thermostats shall be adjustable, and the adjustment provisions shall include clear indication of at least three specific temperatures on the adjustment range. Heating elements shall be rated for an input voltage of 240 V AC; however, they are to be connected for operation at 120 V AC (one-quarter the rated wattage).
 5. The control compartment shall be furnished with one (1) 120 V AC, 20 A, duplex GFCI convenience receptacle, and an LED compartment light located in the top of the compartment adjacent to each door. Each light shall be controlled by a door-activated switch operated by its adjacent door.
 6. Provide a copper ground bus within the control compartment(s) interior, with a visible bonded connection to an external connection point to receive the Owner's grounding pigtails. Provide a removable conduit access plate centered in the floor of the compartment. The plate shall be mounted within the interior of the compartment to facilitate removal during conduit or wireway installation.

B. Auxiliary Power, Alarm, and Control Wiring

1. Auxiliary internal power and control wiring shall consist of stranded copper wire, 600-Volt class, with insulation (or outer covering over the insulation) that is flame-retardant, heat-resistant, oil-resistant, and moisture-resistant. Insulation shall be a thermoset material, and UL classified as either SIS for wiring within a control panel, or XHHW-2 for wiring within a conduit or wireway.
2. Wiring runs outside of weatherproof compartments shall be in continuous corrugated armored cable. All wire terminations associated with inter-pole and Contractor furnished wiring shall be made on suitable molded, one-piece terminal blocks, with washer-less head binding screws. No wires shall be spliced. Both ends of all wires and all terminal block points shall be clearly marked with the designation shown on the Supplier's wiring diagrams. Terminal blocks shall be rated 600 Volts AC, 30 A, equipped with #10–32 binding screws, and suitable for wire sizes #18 through #10 AWG. All wires terminated on these blocks shall have non-insulated ring-type

terminals. Terminal blocks associated with the Contractor's AC and DC station service wiring terminations (refer to Table 4, TB4) at the common control compartment shall be suitable for wire sizes up to and including #6 AWG.

3. Alarm and status circuits between relay outputs and the local annunciator (Device 30) via the TB2 terminal blocks shall be wired using #16 AWG single conductor SIS 600-Volt cable with a dark blue insulation color.
4. Control circuits between the relay output contacts of the local annunciator (Device 30) and the Control Terminal Blocks (TB1) shall be wired using #14 AWG single conductor SIS 600-Volt cable with a white or gray insulation color. Wiring connections between the TB1 terminal blocks and the operating devices shall be wired using #14 AWG single conductor SIS 600-Volt cable with a white or gray insulation color.
5. Should the Supplier have a different insulation color standard than the insulation colors identified above, they are to provide a legend within their diagram of connections drawing(s) which identifies insulation colors by their function.

C. Auxiliary Switch

1. Provide a minimum of two (2) 10-stage auxiliary switches (Device Numbers 52-1 and 52-2) with each operating mechanism to satisfy the operational control requirements associated with a complete BRKR. Each 10-stage switch shall have either convertible contacts which may be configured as either a normally-open (Form-A) contact or a normally-closed (Form-B) contact, or half Form-A and half Form-B. Auxiliary switch operation shall be mechanically linked to the operational position of the breaker's primary interrupting contacts. If the BRKR is closed into a fault and trips open, the Form-B contacts shall remain open for a minimum of 0.025 seconds. Auxiliary switch contacts shall be rated for 600 V and a minimum of 10 Amps continuous current. In addition to those contacts required for operational control, and those identified for the Contractor's use in Table 1, a minimum of 10 percent of the number of utilized contacts shall be wired to terminal blocks as "Spares".

D. BRKR Control Switch

1. Furnish a rotary type, spring-return to normal, manually-operated breaker control switch (Device Number 52-CS) in the common control compartment, providing local control of three-pole operation, and which is intended to be used for emergency, maintenance, or commissioning purposes only.
2. Trip and close cycles shall be completed for momentary operation of the control switch. Form-A contacts associated with the "Local" position of Device 43L/R will enable Device Number 52-CS to locally open and close the BRKR.

E. Breaker Position Indicating Lights

1. This control switch shall also be furnished with red and green indicating lights. The lights may be mounted directly above the control switch or be integral to the control switch (equivalent to the Electroschwitch Series 24P lighted nameplate control switch). Indicating lights mounted separately shall employ GE type ET-16 Bases. Either method shall employ LED indicating lamps.
2. Provide two (2) red lights, each wired in series with one of the two independent trip coils and a separate Form-A breaker auxiliary contact from

Device Number 52-1. The red indicating lights shall illuminate when the BRKR's main contacts are in the "Closed" position and their associated trip coils are operational.

3. One green light wired in series with a Form-B breaker auxiliary contact from Device Number 52-1. The green indicating light shall illuminate when the BRKR's main contacts are in the "Open" position.
4. Provide a nameplate directly above the indicating lights, with the device number and a brief description of its function or purpose.

F. Local Annunciator

1. Provide a panel-mounted local annunciator within the common control compartment adjacent to the BRKR Control Switch. The local annunciator (Device Number 30) shall be Schweitzer Engineering Laboratories, Inc., Model SEL-2533 Annunciator (P/N 2533012130XA3X0) or an approved equivalent, providing fourteen (14) digital inputs, fifteen (15) digital outputs, and local display of up to ten (10) alarm conditions. Power supply and I/O voltage for Device 30 will be 48 V DC, unless otherwise noted in the PSD. Device 30 is to be equipped with two (2) EIA-232 rear communication ports, and one (1) EIA-232 front panel communication port. Includes IRIG-B SER time-stamping.
2. Control contacts associated with features within the BRKR shall be connected as outputs from the annunciator rear panel connector via intermediate terminal block TB1. Alarm contacts associated with features within the BRKR shall be connected as inputs to the annunciator rear panel connector via intermediate terminal block TB2.
3. Provide a fiber optic transceiver affixed to a rear EIA-232 communication port to convert to multimode fiber through ST connectors. The transceiver shall be equivalent to Schweitzer Engineering Laboratories, Inc., Model SEL-2812, P/N 2812MRX0, or approved equivalent.

G. Auxiliary Power, Alarm, and Control Voltages

1. The breaker primary and secondary trip circuits, close circuit, and the alarm circuits shall be DC powered. The operating mechanism's charging motor and control compartment heaters shall be AC powered. If applicable, pole tank heater circuits shall be rated for and operated at 240 V AC. The BRKR shall be equipped for operation with the AC or DC power supply voltages specified in the PSD. The Contractor will provide AC and DC power sources to the BRKR at the control compartment via Terminal Block TB4.
2. Furnish and install separate molded case circuit breakers, providing isolation and overcurrent protection, for each of the following systems: operating mechanism charging motor primary circuit; operating mechanism charging motor back-up circuit; convenience receptacle and compartment lighting; tank heaters, if applicable; and compartment heater circuits.
3. Additionally, furnish two (2) non-fused, 30 A minimum, 250 V DC, double-pole, single-throw, knife blade-type, gang-operated disconnect switches which are to be used for independently isolating the primary and secondary DC control power circuits from the control power source during maintenance. These switches must provide a means of preventing the electrical operation of the BRKR by any local or remote trip or close control input. Additionally, provide a separate undervoltage alarm relay for each of the primary (Device Number 27-2) and secondary (Device Number 27-3) control circuits, with two (2) independent Form-C output contact sets, one contact providing an alarm input to the local annunciator (Device 30, IN3 and IN4) when conditions are abnormal.

- H. Included Equipment
1. The operating mechanism including mechanical linkages shall be factory installed as completely as possible. The Supplier shall furnish all materials for the assembly of an operational circuit breaker that are to be installed in the field. Components which are removed from a factory operational BRKR for shipment, such as bushings or control compartments, are to be reinstalled at the jobsite by the Supplier, or their subcontracted representatives.
- I. Dual Trip Coils
1. Each operating mechanism shall be furnished with two separate and electrically independent DC trip coils. The two coils shall be arranged so that energization of either coil, or both coils simultaneously, and/or energization of either coil with the other coil shorted, will produce proper tripping. The primary trip coil and the close circuit shall be included in one DC control circuit. The secondary trip coil shall be included in a separate DC control circuit. The BRKR local control switch shall only operate the primary trip coil for manual "Open" operations.
 2. Trip coils shall be rated at 48 V DC and shall operate correctly for a range of 30-55 V DC, unless specified otherwise in PSD.
 3. Provide trip coil monitoring circuits to the local annunciator. (Device Number 30, IN11 and IN12 are set aside for monitoring the primary and secondary trip coils.) Additionally, connect the local red indicating lights, one for each trip coil, in series with each coil. The trip coil monitoring relay will be connected directly to the trip coil without a 52-a contact in-between, being energized so long as the trip coil does not fail to an open circuit. A normally open (52/a) contact from the breaker's auxiliary switch shall be connected as a status input to the local annunciator (Device Number 30, IN13). The station's programmable logic controller (not a part of this contract) will monitor the trip coil circuits and the breaker status contact remotely to determine if there has been a trip coil failure.
- J. Closing Relay
1. The BRKR control circuitry shall include a closing relay (Device 52X) which is to be used to seal in the anti-pump relay (Device 52Y) and initiate the breaker closing operation.
- K. Trip and Close Initiation
1. A protective relaying TRIP contact (from TB1, Positions 31 and 32) will be hard-wired as a common input to the breaker's primary trip coil. A separate protective relaying TRIP contact (from TB1, Positions 33 and 34) will be hard-wired as a common input to the breaker's secondary trip coil. A protective relaying CLOSE contact (from TB1, Positions 35 and 36) will be hard-wired as a common input to the breaker's close coil.
- L. SF₆ Gas Monitoring System
1. Provide a temperature compensated SF₆ gas density monitoring system (Device Number 63GD) having a minimum of three (3) alarm conditions, equivalent to the WIKA Model GDM-100. Provide a common system for all three (3) breaker poles. Mount the monitor in a location which avoids direct sunlight contact as much as possible, particularly when the sun is at a low angle to the horizon.
 2. The Device Number 63DG shall be furnished with normally closed contacts, with each contact connected to a separate auxiliary relay (Device

Numbers 63GDX-1, -2, and -3). Each Device Number 63GDX relay shall be fitted with a minimum of two (2) electrically separate Form-C relay output contacts. The monitoring system shall also provide visual indication of gas pressure in terms of pounds per square inch and in kPa.

3. Provide alarm indication associated with a LOW (abnormal) gas pressure condition. Provide an adjustable (0-30 minutes) time delay within the Device 63GDX-1 pick-up circuit for the LOW alarm condition to compensate for initial solar heating on the monitoring system. Connect a Form-A contact from the 63GDX-1 auxiliary relay as an input to the local annunciator (Device Number 30, IN9). Connect the second alarm relay output as a Form-C contact to Terminal Block TB1, Positions 19, 20, and 21, for the Owner's use. The breaker is to be fully functional and safe to operate when the insulation system pressure has dropped to the LOW gas pressure condition.
4. Provide alarm indication associated with a LOW-LOW (abnormal) gas pressure condition. Connect a Form-A contact from the 63GDX-2 auxiliary relay as an input to the local annunciator (Device Number 30, IN10). The Supplier shall indicate the breaker's functional capability in this alarm condition in their proposal and as a note on the schematic drawing. The Owner may elect to block closing when the breaker is in a LOW-LOW condition. Connect a Form-A contact from the 63GDX-2 auxiliary relay in series with the breaker's CLOSE circuit via Terminal Block TB1, Positions 25 and 26.
5. Provide a third alarm indication associated with a CRITICAL-LOW gas pressure condition. Connect a Form-A contact from the 63GDX-3 auxiliary relay as part of the Primary Trip circuit via Terminal Block TB1, Positions 27 and 28. Connect the second alarm relay output as a Form-C contact to Terminal Block TB1, Positions 22, 23, and 24, for the Owner's use. The intended use for this contact will be an input to the protective relaying scheme, which will in turn send an additional trip signal to the breaker and pick-up a lockout relay indicating a breaker failure condition.
6. Suppliers shall submit recommended maintenance intervals, materials, methods and qualifications necessary for completing service intervals. Provide volume and pressure of SF₆ tanks and anticipated number of operations per tank.
7. Provide an on-line hygrometer/moisture sensor (Device Number 45DP) to monitor the dew point of the SF₆ gas space. The hygrometer shall employ either a chilled mirror or aluminum oxide moisture sensor. The monitor shall indicate both dew point and ambient temperature of the gas mixture referenced in degrees Celsius. Additionally, the monitor shall transmit a 4 – 20 mA analog output as an input to the local annunciator.

M. Local/Remote Switch

1. Provide a 2-position, manually operated, rotary type control switch (Device Number 43L/R) in the common control compartment for locally enabling and disabling tripping and closing circuits. In the "Local" position, the switch will allow closing and tripping of the breaker via the local 52-CS switch while disabling remote close and trip capability. In the "Remote" position, the switch will allow remote closing and tripping of the breaker but will block local closing and tripping via the 52-CS switch. In addition, a normally open contact of the 43L/R switch will be wired into the local annunciator (Device Number 30, IN1) to provide indication that the 43L/R switch is in the "Local" position.

N. Interface Terminal Blocks

1. The Contractor's control and alarm cables shall terminate on independent, 12-position terminal blocks. These terminal blocks shall be furnished by the Supplier in the common control compartment for the exclusive use of the Contractor. The purpose or function of each connection shall be identified. The control, alarm, and auxiliary terminal blocks shall be wired per Tables 1, 2, and 3. Where more than 12-positions are associated with a Terminal Block Number identified in Tables 1, 2, and 3, multiple 12-position terminal blocks are to be provided, with the first block containing positions 1 through 12, and the second block containing positions 13 through 24, and so on. Terminal Block TB4 is intended to terminate larger cables associated with station service AC and DC circuits.
2. Terminal block positions identified as a "Test Point" are intended to aid troubleshooting and are to be inserted into the control schematic at designated points.

O. Fiber Optic Cable Management

1. The Supplier shall furnish and install a fiber optic cable management system within the BRKR control compartment, including a splice and connector housing, and multimode patch cords between the connector housing and each of the auxiliary devices equipped for digital communication. The splice and connector housing shall include provisions for up to twelve (12) multimode fiber connections using ST type connectors, and a splice tray for up to twelve (12) splices. The splice and connector housing shall be Corning Number SPH-01P, with connector panel, Corning Number CCH-CP-G5, or an approved equivalent. Provide and install a patch cord between the connector panel and the Device 30 fiber optic connections. The patch cord shall have ST type connectors and offer OM1 performance.

P. Auxiliary Device Software

1. A record of the installed software, license data, and support information must be documented. The programming of any HMI, logic, control, database settings, etc., must be provided in the original equipment manufacturer's format. Additional licenses must be included to allow the Owner to access and review the data. All manufacturer default accounts and passwords shall be deleted from the HMI prior to acceptance.

Q. Terminal Block Assignments

1. The Supplier shall provide control schematics with references to the following terminal block assignments.

Table 1 – Control Terminal Block TB1 BRKR - Group-Operated			
Terminal Position	Designation	Device 30 Output Number	Explanation and Requirements
1	Primary DC Power Positive		Primary +48 V DC station battery
2	Primary DC Power Negative		Primary –48 V DC station battery
3 and 4	52-1 Form-A Contact		Auxiliary Switch Form-A (52-1/a) contact wired between Terminals 3 and 4 – For Owner's use
5 and 6	52-2 Form-A Contact		Auxiliary Switch Form-A (52-2/a) contact wired between Terminals 5 and 6 – For Owner's use

Table 1 – Control Terminal Block TB1 BRKR - Group-Operated			
Terminal Position	Designation	Device 30 Output Number	Explanation and Requirements
7 and 8	52-1 Form-B Contact		Auxiliary Switch Form-B (52-1/b) contact wired between Terminals 7 and 8 – For Owner's use
9 and 10	52-2 Form-B Contact		Auxiliary Switch Form-B (52-2/b) contact wired between Terminals 9 and 10 – For Owner's use
11 and 12	Remote Open Control		Hard-wired Form-A (52-RS-1/a) from the remote control room's breaker control switch (Device Number 52-RS)
13 and 14	Primary Relay Protection Trip	OUT1	Remote contact closure connected in series with Device 43L/R "Remote" contact to Trip Coil #1
15 and 16	Back-up Relay Protection Trip	OUT2	Remote contact closure connected in series with Device 43L/R "Remote" contact to Trip Coil #2
17 and 18	Remote Close Control	OUT3	Remote contact closure connected in series with Device 43L/R "Remote" contact to Close Coil
19, 20, and 21	Remotely Enable Close	OUT4	Enable both local and remote close (in series with Close Coil)
22, 23, and 24	LOW SF ₆		LOW SF ₆ Pressure Alarm (Device Number 63GDX-1, Form-C contact) – For Owner's use
25 and 26	CRITICAL-LOW SF ₆		CRITICAL-LOW SF ₆ Pressure Alarm (Device Number 63GDX-1, Form-C contact) – For Owner's use
27 and 28	LOW-LOW SF ₆		Block Close when LOW-LOW SF ₆ Pressure Alarms (Device Number 63GSX-2, Form-B contact) – Supply with jumper, Owner removal if desired
29 and 30	CRITICAL-LOW SF ₆		Initiate Trip when CRITICAL-LOW SF ₆ Pressure Alarms (Device Number 63GDX-3, Form-A contact)
31 and 32	Relay Trip		Protective relay trip signal to Primary Breaker Trip circuit (Trip Coil #1)
33 and 34	Relay Trip		Protective relay trip signal to Secondary Breaker Trip circuit (Trip Coil #2)
35 and 36	Relay Close		Protective relay close signal to Breaker Close circuit (Close Coil)

Table 2 – Alarm Terminal Block TB2 BRKR - Group-Operated			
Terminal Position	Designation	Device 30 Input Number	Explanation and Requirements
1	Alarm Positive		Device 30 positive with one side of all alarm contacts wired in common
2	Alarm Negative		Device 30 negative with one side of all alarm inputs wired in common
3 and 4	Annunciator Window 1	IN1	Local/Remote Control Switch (Device 43L/R) in “Local” position
5 and 6	Annunciator Window 2	IN2	Loss of AC Supply to the charging motor circuit (Device Number 27-1)
7 and 8	Annunciator Window 3	IN3	Loss of DC Supply to the primary control circuit (Device Number 27-2)
9 and 10	Annunciator Window 4	IN4	Loss of DC Supply to the secondary control circuit (Device Number 27-3)
11 and 12	Annunciator Window 5	IN5	Excess charging motor run time alarm (Device Number 84 M)
13 and 14	Annunciator Window 6	IN6	Charging motor thermal overload alarm (Device Number 49M)
15 and 16	Annunciator Window 7	IN7	For the Supplier's use.
17 and 18	Annunciator Window 8	IN8	For the Supplier's use.
19 and 20	Annunciator Window 9	IN9	63GD LOW SF ₆ gas alarm
21 and 22	Annunciator Window 10	IN10	63GD LOW-LOW SF ₆ gas alarm
23 and 24	Input Only	IN11	Trip Coil Monitor - Trip Coil #1
25 and 26	Input Only	IN12	Trip Coil Monitor - Trip Coil #2
27 and 28	Input Only	IN13	Auxiliary Switch Form-A (52-1/a) contact for breaker status
29 and 30	Input Only	IN14	Moisture detected
31 and 32	Input Only	IN15	Spare
33 and 34	Input Only	IN16	Spare
35 and 36	Input Only	IN17	Spare

Table 3 – Auxiliary Output Contacts Terminal Block (TB3) BRKR - Group-Operated		
1 and 2	52-1 Form-A	Auxiliary Switch Form-A (52-1/a) contact wired between Terminals 1 and 2
3 and 4	52-2 Form-A	Auxiliary Switch Form-A (52-2/a) contact wired between Terminals 3 and 4
5 and 6	52-1 Form-B	Auxiliary Switch Form-B (52-1/b) contact wired between Terminals 5 and 6
7 and 8	52-2 Form-B	Auxiliary Switch Form-B (52-2/b) contact wired between Terminals 7 and 8
9 and 10	52-1 Form-B	Auxiliary Switch Form-B (52-1/b) contact wired between Terminals 9 and 10
11 and 12	52-2 Form-B	Auxiliary Switch Form-B (52-2/b) contact wired between Terminals 11 and 12

Table 4 – Station Service (TB4) BRKR - Group-Operated Station Service (TB4)		
1	L1	240 V AC (from the Contractor)
2	L2	240 V AC (from the Contractor)
3	N	Neutral to establish 120 V AC (from the Contractor)
4	G	Ground (from the Contractor)
5	Supply Positive	Back-up DC Power for Operating Mechanism Charging Motor (from the Contractor)
6	Supply Negative	Back-up DC Power for Operating Mechanism Charging Motor (from the Contractor)

2.5 BUSHINGS AND CURRENT TRANSFORMERS

A. Bushing Type and Color

1. Bushing housings shall be ANSI 70 light gray polymer. Porcelain bushings may be acceptable as an alternate and should be proposed as an alternate only after proposing polymer bushings.
2. Bushings shall have a minimum strike distance and a minimum leakage (creep) distance as specified in the PSD. The bushing BIL rating shall meet or exceed the breaker's BIL rating.
3. Polymer bushings with a BIL rating above 900 kV shall be supplied with line end voltage grading rings.

B. Bushing Current Transformers

1. BCT's designated for protective relaying functions shall be typically 5-tap, multi-ratio, with full-winding ratios and accuracy as specified in the PSD. Each multi-ratio BCT with a primary current rating of 2000 Amps and higher shall be a Class 1 Instrument Transformer as defined by IEEE C57.13 with an accuracy class of C800, unless noted otherwise in the PSD. Each multi-ratio BCT with a primary current rating of less than 2000 Amps shall be a Class 1 Instrument Transformer as defined by IEEE C57.13 with an accuracy class of C800, unless noted otherwise in the PSD.
2. As noted in the PSD, a three-phase set of single-ratio BCT's may be required for metering functions. In which case the BCT shall have a minimum Accuracy Class as defined by IEEE C57.13 of 0.15%. The metering BCT shall also have a minimum Burden Rating of B0.9 (22.5 VA @ 5 Amps secondary current). Refer to the PSD for the Accuracy Class and Burden Rating required for this project.

3. All BCT secondary leads associated with each pole shall be wired to 6-point short-circuiting type terminal blocks in the common control compartment. A separate terminal block, complete with shorting screws, shall be furnished for each BCT. BCT secondary leads shall be #10 AWG single conductor cables. BCT secondary leads shall not contain splices between the CT core/winding assembly and the shorting terminal blocks.
4. All BCT's shall have a minimum thermal rating factor of 2.0.

2.6 ACCESSORIES

- A. Operation Counter and Mechanical Position Indicator
 1. Each operating mechanism shall have an operations counter arranged to count each opening operation.
 2. Each operating mechanism shall have a visual mechanical position indicator effectively connected to the operating mechanism. Green shall indicate open, and red shall indicate closed.
- B. Bushing Line-End Grading Rings
 1. Provide appropriate grading rings at the line terminal to control coronal discharge. The Supplier shall account for these rings when determining the height of the support frame, to maintain the required vertical clearance to ground level for personnel safety (per the NESC requirements for the breaker's nameplated BIL).
- C. Latch Check Switch
 1. Where applicable, each operating mechanism shall have a latch check switch or hydraulic latch valve. If a latch check switch is not applicable, so state it in the Supplier's proposal.
- D. Travel Recorder
 1. Where applicable, each BRKR pole shall be furnished with provisions for installation of a linear motion travel recorder, with #10-32 threaded connection, or an equivalent transducer such as the Doble 3190. If a travel recorder is not applicable, so state it in the Supplier's proposal.
- E. Maintenance Closing Device and Tools
 1. Where applicable, the BRKR shall be equipped with a manually-operated maintenance closing device, and any special tools required for installation and maintenance. If a manually-operated maintenance closing device is not applicable, so state it in the Supplier's proposal.
- F. SF₆ Gas Installation Tools
 1. SF₆ gas required for field installation shall be furnished by the Supplier in bottles using standard US fittings and shall comply with the requirements as listed below. Gas sampling and filling connections on the BRKR shall be furnished with standard "AN" fittings, male, with 37-degree flare. A SF₆ fill hose and regulator shall be supplied for each shipping destination. The valves fitted to the cylinders shall conform to ANSI B57.1 Part I or IS:3224. Connections shall comply with ANSI CGA V—2021 (Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections, 15th Edition).
- G. Field Installation of Gas

1. The material supplied under this specification shall be a high-purity, low-moisture grade sulfur hexafluoride. Water Content: Moisture content shall not exceed limits established by the BRKR Supplier and approved by the Purchasing Authority and OE, and in no case, be greater than 5 parts per million (ppm) by volume.
 - a. Other Impurity Limits
 - 1) Hydrolysable Fluorides: Hydrolysable fluorides, expressed as HF acidity, shall not exceed 0.3 ppm.
 - 2) Molecular Nitrogen: Air, expressed as N₂ or molecular nitrogen, shall not exceed 250 ppm per volume.
 - 3) Carbon Tetrafluoride: Carbon tetrafluoride shall not exceed 100 ppm by volume.
 - 4) Assay: Total SF₆ assay shall not be less than 99.95% by weight.
 - 5) Toxicity: The Supplier shall certify that the material supplied is at least as non-toxic as those substances in Underwriters Laboratories toxicity classification Group VI. SF₆ gas is not inherently toxic and shall present no dangers other than suffocation or high pressurization.

2.7 PAINT AND FINISH

- A. Control Compartment Exterior Finish and Bushing Color
 1. The control compartment exterior paint finish, and bushing housings shall be Munsell 5.0 BG 7.0/0.4 light gray. Supplier shall furnish one quart of touch-up paint per BRKR. Cast aluminum, aluminum, and stainless steel components shall be left in their natural finish.
- B. Control Compartment Interior Finish
 1. The control compartment interior shall be painted the ANSI 61 Standard.
- C. Surface Preparation
 1. The following referenced surface preparation specifications of the Society of Protective Coatings (SSPC) shall form a part of this specification:
 - a. Solvent cleaning (SSPC-SP1): Removal of oil, grease, soil, salts, and other soluble contaminants by cleaning with solvent, vapor, alkali, emulsion, or steam.
 - b. Hand tool cleaning (SSPC-SP2): Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by hand chipping, scraping, sanding, and wire brushing.
 - c. Power tool cleaning (SSPC-SP3): Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by power tool chipping, descaling, sanding, wire brushing, and grinding.
 - d. White metal blast cleaning (SSPC-SP5): Removal of all visible rust, oil, grease, soil, dust, mill scale, paint, oxides, corrosion products and foreign matter by blast cleaning.
 - e. Commercial blast cleaning (SSPC SP6): Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 33 percent of each square inch of surface area.
 - f. Brush-off blast cleaning (SSPC-SP7): Removal of all visible oil, grease, soil, dust, loose mill scale, loose rust, and loose paint.

- g. Near-white blast cleaning (SSPC-SP10): Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 5 percent of each square inch of surface area.
 - h. Marginally prepared surfaces (maintenance): Remove visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter in accordance with manufacturer's instructions.
- 2. All surfaces of the control compartment, covers, panels, etc., shall be thoroughly cleaned by degreasing and abrasive blasting to remove scale, rust, and corrosion (SSPC-SP2, -SP3, -SP5, -SP6, SP7, and -SP10). Oil and grease shall be removed chemically or with steam, and in accordance with the manufacturer's criteria (SSPC-SP1). Steel surface and fabrication defects shall be corrected. Weld splatter and slag shall be removed. Welded seams, undercuts, recesses, porous surfaces, weld flux, and sharp edges are to be finish to smooth and rounded surfaces. All surfaces shall be dry and then be given at least one primer coat within eight hours to prevent the formation of rust. Vinyl, zinc-pigmented, or chlorinated rubber primers are unacceptable.
 - 3. Prepare steel surfaces in accordance with manufacturer's criteria. Cast aluminum and stainless steel components shall be left in their natural finish.
 - 4. After preparing the primed surfaces, all exterior surfaces shall be given two field coats in accordance with the manufacturer's instructions of an approved finish coating having an acceptable total dry-film finish thickness (DFT). The primer, intermediate, and finish coatings are to be compatible with one another and from the same coatings manufacturer. Electrostatically applied polyurethane powder paint is also acceptable if approved by UL for this application.

D. Preparation and Application

- 1. After preparing the primed surfaces, all exterior surfaces shall be given two field coats in accordance with the manufacturer's instructions of an approved finish coating having an acceptable total dry-film finish thickness (DFT). The primer, intermediate, and finish coatings are to be compatible with one another and from the same coatings manufacturer. Electrostatically applied polyurethane powder paint is also acceptable if approved by UL for this application.
- 2. Mix and thin coatings, including multi-component materials, in accordance with manufacturer's instructions. Keep containers closed when not in use to avoid contamination, and do not use mixed coatings beyond pot life limits. Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer's instructions. Uniformly apply coatings at spreading rate required to achieve specified DFT. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems. Ensure that edges, corners, crevices, welds, and similar areas receive film thickness equivalent to adjacent areas.
- 3. Apply coatings in accordance with manufacturer's instructions.
- 4. The Supplier shall furnish documentation to the OE regarding their standard system, and the OE will review and accept as appropriate. The Supplier will furnish one (1) can of matching paint to accommodate field touch-up. Field coating repairs are to be made in accordance with the manufacturer's instructions.

- E. External fasteners and Hardware
 - 1. All external fasteners and hardware (such as bolts, screws, hinges, and handles) associated with the ground-potential portion of the breaker shall be stainless steel.

2.8 CLOSE/OPEN DUTY CYCLES

- A. The BRKR shall be capable of an initial OPEN-CLOSE-OPEN operation cycle without derating.
- B. Following the initial OPEN-CLOSE-OPEN operation cycle, the BRKR shall be capable of performing at least one more CLOSE-OPEN cycle, with a maximum delay of 180-seconds between cycles.
- C. Refer to the PSD for the closing and opening time requirements specific to this project.
- D. The Supplier shall confirm their ability to meet these requirements in their proposal.

2.9 CAPACITANCE CURRENT SWITCHING

- A. The BRKR shall be capable of switching capacitive currents as defined for either a Class C1 or C2 Circuit Breaker (refer to the PSD for specific requirement) as identified by ANSI C57.04. Additionally, the breaker shall be rated to switch overhead line charging current equivalent to ratings listed for either a Class C1 or C2 Circuit Breaker (refer to the PSD for specific requirement) as identified by ANSI C57.04 and corresponding to the Maximum Voltage listed in the PSD. The rated Transient Overvoltage shall correspond to the test duty indicated in the PSD for an effectively grounded system.

2.10 OUT-OF-PHASE SWITCHING

- A. The BRKR shall be suitable for switching under out-of-phase conditions with an opening angle of 180-degrees (full phase opposition) and a closing angle of 90-degrees; out-of-phase switching current rating shall be 25 percent of the rated symmetrical interrupting capability.

PART 3 - EXECUTION

3.1 QUALITY ASSURANCE (QA) / QUALITY CONTROL (QC)

- A. Suppliers shall furnish a copy of the appropriate quality assurance/quality control procedures relating to this product and the specific facilities and design services utilized in the manufacturing process to the Purchasing Authority.
- B. Each Supplier shall have a quality assurance program that meets requirements of ISO 9000. Documentation demonstrating that the Supplier has met these requirements shall be part of the bid documents.
- C. Compliance and suitability of QA/QC procedures for this product shall be evaluated by means of factory inspection trips, self-evaluations, and other methods as deemed appropriate by the Purchasing Authority.

3.2 QUALITY SURVEILLANCE

- A. A Quality Surveillance Representative (QSR) may be employed by the Purchasing Authority to be present at the Supplier's facility during the manufacturing and testing of the equipment as specified herein. If a QSR is employed, the QSR will always comply with the Supplier's safety and procedural requirements while in the Supplier's facility and the following additional guidelines shall apply.
- B. Cooperation with QSR
 - 1. The Supplier shall cooperate with the QSR and arrange a reasonable and mutually agreeable schedule for the required inspections and witnessing of tests, consistent with maintaining scheduled progress of the equipment through the Supplier's facility.
- C. Authority of QSR
 - 1. The QSR will have full authority from the Purchasing Authority to make whatever decisions are necessary to ensure that the completed equipment complies with all requirements of the Purchasing Authority's procurement documents, and to ensure that all required inspection and witness activities are carried out.
- D. Disagreements
 - 1. In the event of significant disagreement between the Supplier and the QSR concerning scheduling of inspection or witness activities or concerning interpretation of the Purchasing Authority's procurement documents, the Supplier and the QSR shall promptly and jointly contact the Purchasing Authority to resolve the matter.

3.3 WARRANTY INSPECTION

- A. If damage is discovered by the Receiving Agent at the time of shipping receipt, the Supplier will be contacted to determine if field repairs can be made. The costs associated with the Supplier's field service representative making the necessary repairs and/or corrections are the responsibility of the Supplier.
- B. Should the nature of the repairs require the unit to be returned to the factory, or authorized service facility for resolution, the associated freight and repair costs are the sole responsibility of the Supplier. The Supplier will contact the Purchasing Authority prior to shipment to discuss the probable schedule impact for having the equipment available for installation and operation. Both parties will mutually agree upon the proposed schedule.
- C. Hidden damages which may be discovered at the time of installation and/or placing the equipment in service including during any field testing activities are to be handled per the warranty terms mutually accepted at the time of purchase order placement.

3.4 DESIGN REVIEW

- A. The Purchasing Authority reserves the right to have a technical representative visit the Suppliers facilities to conduct a formal design review. The Supplier's design personnel are to present the particulars of the circuit breaker's design to the reviewer for comment and acceptance. The reviewer's acceptance will not relieve the Supplier of their design responsibilities.

- B. The approval drawing package should be issued at least 2-weeks prior to design review meeting.

3.5 INSTALLATION

- A. When the BRKR is delivered under DAP freight terms the Supplier shall provide the services of an Installation Service Engineer to oversee the Installation by the Contractor of the BRKR at the jobsite. The Supplier shall include the cost of three (3) separate trips within their proposal.
- B. The first trip shall occur when the breakers are being transferred to the foundation, with a planned duration of two (2) 8-hour days at the jobsite. Travel related expenses are to be included within the proposed cost.
- C. A second trip shall occur when the breakers are ready for field testing and commissioning, with a planned duration of four (4) 8-hour days at the jobsite. Travel related expenses are to be included within the proposed cost.
- D. A final trip shall occur after the breakers have been energized. The purpose of this trip is to provide training to the Owner's operation and maintenance personnel, with a planned duration of two (2) 8-hour days at the jobsite.
- E. The Purchasing Authority will provide a minimum of seventy-two (72) hours' notice to the Supplier for each of the activities described above.
- F. All personnel who are to be admitted to the jobsite will be required to attend a mandatory site orientation and comply with all site safety requirements. Pre-Job Hazard Assessments are required prior to conducting work.
- G. The Contractor will furnish and install the following items which interface with the assembled circuit breaker(s):
 - 1. Station service, control, and alarm circuits which are to be terminated at the interface terminal blocks within the control compartment.
 - 2. Electrical bus connections between the breaker's bushing terminals and the substation switch and bus equipment.
 - 3. Grounding connections between the substation ground grid and the support frame grounding pads and control compartment ground bus.
 - 4. Installation of anchor bolts or welding the breaker's support frame baseplates to the foundation's embedded steel anchorage plates.
- H. Prior to final filling with SF₆ gas, the following tests will be supervised by the Supplier:
 - 1. The insulation resistance of the bushing line terminals to ground shall be measured.
- I. After final filling with SF₆ gas the following tests will be supervised by the Supplier:
 - 1. The insulation resistance of the bushing line terminals to ground shall be measured.
 - 2. Calibration of the gas density monitor and contact closure coordination.
 - 3. Resistance of each pole between assembled terminal pads, including the closed interrupting contacts.
 - 4. Resistance of each pole between assembled terminal pads, including the open interrupting contacts.
 - 5. Other tests as specified by the circuit breaker Supplier.

- J. The Supplier will submit a written test report documenting results of the field testing to the Purchasing Authority. Final acceptance of equipment will not be made until the Purchasing Authority's Technical Representative approves the field tests.
- K. Upon receipt of the OE's acceptance of the written test report results from the Purchasing Authority, the Supplier shall then provide a written certificate to the Purchasing Authority indicating that the installation terms of the warranty have been satisfied, and that the warranty is in full effect as of the date of installation completion.

Appendix A. Project Specific Data Sheets (PSD)

A.1 UNITS REQUIRED FOR THE SPECIFIC PROJECT

The Supplier shall provide the number of three-pole BRKR Group-Operated circuit breaker assemblies either with or without the special features as indicated in Tables A-1 and A-2 below.

Table A-1 - Units Required			
Device Numbers	Supply with Closing Resistors	Continuous Current Rating	Quantity
52-T1 and T2	No	1200 A	Two (2)

Table A-2 - Units Required			
Device Numbers	Synchronous Control of Closing and Opening	Condition Monitoring	External Capacitors for Short-Line fault
52-T1 and T2	No	TBD	No

A.2 SPECIFIC BUSHING CURRENT TRANSFORMER (BCT) CONFIGURATION

Bushing current transformers supplied shall be furnished as indicated in Table A-3 below.

Table A-3 – Bushing Current Transformers				
Device Numbers	Bushing	Position	Ampere Ratio	Accuracy
52-T1 and -T2	1, 3, 5	X and Y	1200:5 MR	C800
	2, 4, 6	X and Y	1200:5 MR	C800

Notes: Position “X” is the bushing current transformer position closest to the bushing’s line terminal, while Position “Y” is directly below Position “X”, and where required Position “Z” is directly below Position “Y” and closest to the interrupting contacts.

A.3 BRKR ELECTRICAL RATINGS

Each BRKR shall be rated for the electrical parameters outlined in Table A-4 below.

TABLE A-4 –BRKR Electrical Ratings	
Power Frequency	60 Hertz
Nominal System Voltage	69 kV rms
Maximum Continuous Voltage	72.5 kV rms
IEEE Application Class	S2
TRV Test Duty	T60
Power Frequency Withstand Voltage (1-minute Dry)	160 kV rms
Full Wave Lightning Impulse Withstand Voltage (BIL)	350 kV Peak
Chopped Wave Withstand Voltage (2-Microseconds)	452 kV Peak
Minimum Continuous Current Rating	1200A
Minimum Interrupting Current Rating	40 kA rms
Minimum Closing and Latching Current	130 kA peak
Rated Interrupting Time	50 milliseconds
Capacitive Current Switching Class	C1
Minimum Overhead Line Switching Current	100 A rms
Minimum Isolated Capacitive Switching Current	800 A rms
Shunt Capacitor Bank Back-to-Back Switching Current	630 A rms
DC Control Voltage	48 V DC
AC Supply Power	120/240 V AC single-phase
Charging Motor Alternate Power Source	48 V DC

A.4 BRKR PHYSICAL RATINGS

The BRKR shall provide the physical clearances and dimensions outlined in Table A-5 below.

Table A-5 – BRKR Physical Ratings	
Site elevation above 3300 feet above sea level (Yes/No)	No
Minimum height from base to energized bushing components	126-inches
Minimum height from base to bushing non-grounded flange	102-inches
Minimum phase-to-phase pole spacing at the line terminal centerline	36-inches
Minimum metal-to-metal spacing between pole line terminals	28-inches
Minimum height from base to centerline of pole tank	75-inches
Minimum height from base to bottom of common control compartment	25-inches
Maximum height from base to center of control/relay devices located in the common control compartment	78-inches
Supply with polymer bushings (Yes/No)	Yes
Minimum creepage (leakage) distance of bushing weather sheds	70-inches
Minimum strike distance over bushing weather sheds	22.5-inches
Minimum static horizontal transverse terminal load force	250-pounds-force
ASME "U-Stamp" Required (Yes/No)	Yes
Supply with interphase wiring duct (Yes/No/NA)	NA
Supply with Condition Monitoring	No
Supply with Synchronous Control of Closing and Opening	No

A.5 SEISMIC QUALIFICATION LEVEL

The assembled BRKR will be designed to meet or exceed the requirements associated with IEEE 693 for a SQL as specified in Table A-6 below:

Table A-6 - SQL
Moderate

Appendix B. Site Specific Information

Completion of “blank areas” in the tables of this Appendix will be supplied once the information is available and/or necessary.

B.1 FACILITY SUMMARY

Site Location and Direction

PROJECT NAME	STAGE II RELIABILITY UPGRADES MONTHILL POWER SUBSTATION
State	Nevada
County	Clark
Nearest City or Town	Las Vegas
Latitude (approximate substation location)	36°06'42.62" North
Longitude (approximate substation location)	115°04'58.77" West
Driving Directions from Nearest Interstate Highway	Exit 592 off Highway 93
Project Site Physical Address	4095 E. Flamingo Rd.
Specific Codes/Publications for Project Locality (if known)	

Environmental and Local Conditions

DESCRIPTIONS	DATA		SOURCE
Elevation	1840 FT	Feet above mean sea level	Google Earth Pro
Design – Extreme High Ambient Temperature	47.2	°C	Weatherbase (Las Vegas)
Design – Extreme Low Ambient Temperature	-13.2	°C	Weatherbase (Las Vegas)
Design – Highest Average Ambient Temperature within a 24-hour period	34.6	°C	Weatherbase (Las Vegas)
Average Annual Precipitation	4.2	inches	Weatherbase (Las Vegas)
Ground Acceleration: plus, or minus 0.35g (IEEE 693 Moderate Seismic Performance Level)			

B.2 ORGANIZATION AND MANAGEMENT

Owner Project Personnel

The following staff members have key responsibilities for directing the contracted services for this Project. The project team may include other individuals and support staff as necessary to support the Project.

Owner Name:	Southern Nevada Water Authority
Street Address:	4095 E. Flamingo Rd
Mailing Address (if different)	100 North City Parkway, Suite 700
City State Zip	Las Vegas, NV 89106
COMMERCIAL ISSUES - PURCHASING	Colorado River Commission
Phone	702-856-3611
e-mail	Colorado River Commission
PROJECT MANAGER	Jonathan Tull, PE
Phone	702-691-5228
e-mail	Jonathan Tull <Jonathan.Tull@lvvwd.com>
KEY PROJECT STAFF	
Engineering Manager	Ryan Pearson

Technical Application Questions

Technical questions regarding this material specification or notice of any other technical matters which arise during the proposal process or during equipment design, manufacture, or test, shall be directed to the Owner's Engineer.

Owner's Engineering Firm Name:	Stantec Consulting Services Inc.
Street Address:	601 SW Second Avenue., Suite 1400
Mailing Address (if different):	[same]
City State Zip	Portland, OR 97204-3128
Phone:	503 220-5457
Function/Description	Key Individual/Other Information
KEY PROJECT STAFF	
Owner's Engineer	Kenneth Long, PE, Principal Engineer
e-mail	ken.long@stantec.com

END OF SECTION



CLIENT: SOUTHERN NEVADA WATER AUTHORITY
 PROJECT: 3636S STAGE II RELIABILITY UPGRADES
 TITLE: GAS HIGH-VOLTAGE CIRCUIT BREAKER

SUPPLIER DATA SHEETS
 SPECIFICATION NO. 33 75 19
 EXHIBIT B

ITEM	DESCRIPTION OF SPECIFICATION	UNITS	RFP SPECIFIED PARAMETER (SHADED) SUPPLIER'S PROPOSED PARAMETER (UN-SHADED)
1.	PROJECT		3636S STAGE II RELIABILITY UPGRADES
2.	LOCATION (NEAREST TOWN)		MONTHILL AVE, LAS VEGAS, NEVADA 89121
3.	ALTITUDE (ELEVATION ABOVE SEA LEVEL)		550 METERS (1800-FEET)
4.	DESIGN AMBIENT TEMPERATURE AT LOCATION		EXTREME HIGH: 47.2°C EXTREME LOW: -13.3°C HIGHEST AVERAGE WITHIN A 24-HOUR PERIOD: 34.6°C
5.	BRKR ELECTRICAL PERFORMANCE RATINGS		
	Power Frequency	Hertz	60
	Nominal Transmission System Voltage	kV rms	69
	Maximum Transmission System Voltage (105% of nominal voltage)	kV rms	72.5
	Applicable Industry Standard	Standard	C37.04-2018 (with 2021 Corrections)
	IEEE Application Class	S1/S2	S2
	TRV Test Duty	TXX	T60
	Power Frequency Withstand Voltage (1-minute Dry)	kV rms	160
	Full Wave Lightning Impulse Withstand Voltage (BIL)	kV Peak	350
	Chopped Wave Withstand Voltage (2-Microseconds)	kV Peak	452
	Minimum Continuous Current Rating	A	1,200
	Minimum Interrupting Current Rating	kA rms	40
	Minimum Closing and Latching Current	kA peak	130
	Rated Interrupting Time	milliseconds	50
	Capacitive Current Switching Class	C1/C2	C1
	Minimum Overhead Line Switching Current	A rms	100
	Minimum Isolated Capacitive Switching Current	A rms	800
	Shunt Capacitor Bank Back-to-Back Switching Current	A rms	630
	DC Control Voltage	V DC	48
	AC Supply Power	V AC	120/240 single-phase
	Charging Motor Alternate Power Source	V DC	48
	Supply with Closing Resistors	Yes/No	No
	External Capacitors for Short-Line Fault required?	Yes/No	



CLIENT: SOUTHERN NEVADA WATER AUTHORITY
 PROJECT: 3636S STAGE II RELIABILITY UPGRADES
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SUPPLIER DATA SHEETS
 SPECIFICATION NO. 33 75 19
 EXHIBIT B

ITEM	DESCRIPTION OF SPECIFICATION	UNITS	RFP SPECIFIED PARAMETER (SHADED) SUPPLIER'S PROPOSED PARAMETER (UN-SHADED)
6.	BRKR PHYSICAL PERFORMANCE RATINGS		
	Site elevation above 3300 feet above sea level	Yes/No	No
	Minimum height from base to energized bushing components	inches	126
	Height from base to energized bushing components	inches	
	Minimum height from base to bushing non-grounded flange	Inches	102
	Height from base to bushing non-grounded flange	inches	
	Minimum phase-to-phase pole spacing at the line terminal centerline	inches	36
	Phase-to-phase pole spacing at the line terminal centerline	inches	
	Minimum metal-to-metal spacing between pole line terminals	inches	28
	Metal-to-metal spacing between pole line terminals	inches	
	Minimum height from base to centerline of pole tank	inches	75
	Height from base to centerline of pole tank	inches	
	Minimum height from base to bottom of common control compartment	inches	25
	Height from base to bottom of common control compartment	inches	
	Maximum height from base to center of control/relay devices located in the common control compartment	inches	78
	Height from base to center of control/relay devices located in the common control compartment	inches	
	Bushing Housing material (Porcelain or Polymer)	specify	Polymer
	Minimum creepage (leakage) distance of bushing weather sheds	inches	70
	Creepage (leakage) distance of bushing weather sheds	inches	
	Minimum strike distance over bushing weather sheds	inches	22.5
	Strike distance over bushing weather sheds	inches	
	Minimum static horizontal transverse terminal load force	pounds-force	250
	Static horizontal transverse terminal load force	pounds-force	
	ASME "U-Stamp" Required (Yes/No)	Yes/No	Yes
	Supply with interphase wiring duct (Yes/No/NA)	Yes/No/NA	NA
	Supply with Condition Monitoring	Yes/No	No
	Supply with Synchronous Control of Closing and Opening	Yes/No	No



CLIENT: SOUTHERN NEVADA WATER AUTHORITY
PROJECT: 3636S STAGE II RELIABILITY UPGRADES
TITLE: GAS HIGH-VOLTAGE CIRCUIT BREAKER

SUPPLIER DATA SHEETS
SPECIFICATION NO. 33 75 19
EXHIBIT B

ITEM	DESCRIPTION OF SPECIFICATION	UNITS	RFP SPECIFIED PARAMETER (SHADED) SUPPLIER'S PROPOSED PARAMETER (UN-SHADED)
7.	SEISMIC QUALIFICATION LEVEL		
	MINIMUM QUALIFICATION LEVEL	High/Moderate/Low	Moderate
	QUALIFICATION LEVEL	High/Moderate/Low	
8.	CLARIFICATION		
	A TRAVEL RECORDER WILL BE SUPPLIED WITH EACH LOT OF BREAKERS?	Yes/No/NA	
	BREAKERS ARE FURNISHED WITH A LATCH CHECK SWITCH?	Yes/No/NA	
	BREAKERS ARE FURNISHED WITH A MAINTENANCE CLOSING DEVICE AND TOOLS WITH EACH LOT?	Yes/No/NA	
	WHAT TYPE OF STORED ENERGY MECHANISM WILL BE PROVIDED?	Stipulate	
	SUPPLIER'S STANDARD COLOR FOR PAINTED COMPONENTS?	Stipulate	
9.	BUSHING CURRENT TRANSFORMER ARRANGEMENT		
	BUSHING 1/3/5 X-POSITION	Ratio/Accuracy	1200:5 MR C400
	BUSHING 1/3/5 Y-POSITION	Ratio/Accuracy	1200:5 MR C400
	BUSHING 1/3/5 Z-POSITION	Ratio/Accuracy	1200:5 MR C400
	BUSHING 2/4/6 X-POSITION	Ratio/Accuracy	1200:5 MR C400
	BUSHING 2/4/6 X-POSITION	Ratio/Accuracy	1200:5 MR C400
	BUSHING 2/4/6 X-POSITION	Ratio/Accuracy	1200:5 MR C400



CLIENT: SOUTHERN NEVADA WATER AUTHORITY
PROJECT: 3636S STAGE II RELIABILITY UPGRADES
TITLE: GAS HIGH-VOLTAGE CIRCUIT BREAKER

SUPPLIER DATA SHEETS
SPECIFICATION NO. 33 75 19
EXHIBIT B

ITEM	DESCRIPTION OF SPECIFICATION	UNITS	RFP SPECIFIED PARAMETER (SHADED) SUPPLIER'S PROPOSED PARAMETER (UN-SHADED)
10.	APPROVAL DOCUMENTATION SCHEDULE (DURATION AFTER SUPPLIER'S RECEIPT OF PURCHASE ORDER)		
	OUTLINE DRAWING (ASSEMBLED BREAKER)	WEEKS	
	OUTLINE DRAWING (FOUNDATION ANCHORAGE)	WEEKS	
	NAMEPLATE DRAWINGS	WEEKS	
	BUSHING OUTLINE DRAWING	WEEKS	
	CONTROL COMPARTMENT DRAWINGS	WEEKS	
	BCT CURVES	WEEKS	
	BILL OF MATERIALS	WEEKS	
	INSTRUCTION MANUALS	WEEKS	
	FACTORY ACCEPTANCE TESTING PLAN AND PROCEDURES	WEEKS	
	DESIGN REVIEW	WEEKS	
	TYPICAL ALLOWANCE FOR REVIEW AND RETURN	WEEKS	
11.	PRODUCTION SCHEDULE (DURATION AFTER SUPPLIER'S RECEIPT OF ACCEPTED APPROVAL DOCUMENTATION)		
	PROPOSED FACTORY LOCATION (CITY/ STATE/ COUNTRY)	SPECIFY	
	PROPOSED METHOD OF TRANSPORT (TRUCK/RAIL/OCEAN GOING VESSEL/ PORT OF ENTRY)	SPECIFY	
	INTERMEDIATE INSPECTION POINTS (IF APPLICABLE)	WEEKS	
	FACTORY ACCEPTANCE TESTING	WEEKS	
	EX-WORKS	WEEKS	
	PORT OF ENTRY (IF APPLICABLE)	WEEKS	
	JOBSITE LAYDOWN AREA	WEEKS	
	READY FOR COMMISSIONING AND START-UP (IF APPLICABLE)	WEEKS	



CLIENT: SOUTHERN NEVADA WATER AUTHORITY
PROJECT: 3636S STAGE II RELIABILITY UPGRADES
TITLE: GAS HIGH-VOLTAGE CIRCUIT BREAKER

SUPPLIER DATA SHEETS
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EXHIBIT B

ITEM	DESCRIPTION OF SPECIFICATION	UNITS	RFP SPECIFIED PARAMETER (SHADED) SUPPLIER'S PROPOSED PARAMETER (UN-SHADED)
12.	WARRANTY PERIOD		
	SPECIFIED PERIOD (MINIMUM)	MONTHS	24 (AFTER INITIAL ENERGIZATION)
	SUPPLIERS PROPOSED PERIOD	MONTHS	
13.	COMMERCIAL		
	PROVIDE A PRELIMINARY OUTLINE DRAWING, INCLUDING OVERALL DIMENSIONS AND WEIGHTS, WITH PROPOSAL	Yes/No	
	PROVIDE A PRELIMINARY NAMEPLATE DRAWING WITH PROPOSAL	Yes/No	
	PROVIDE A QUALITY ASSURANCE PROCEDURES SUMMARY DOCUMENT WITH PROPOSAL	Yes/No	
	PROVIDE A LIST OF EXCEPTIONS, IF ANY, TO THE TECHNICAL REQUIREMENTS OUTLINED IN THE TECHNICAL SPECIFICATION	Yes/No	
	BASE PRICE FOR EACH UNIT	US\$	
	TOTAL TRANSPORTATION COST ASSOCIATED WITH THE LOT FOR DELIVERY TO THE JOBSITE LAYDOWN AREA	US\$	
	NUMBER OF UNITS REQUIRED FOR THIS PROJECT	Quantity	Two (2)
	CIRCUIT BREAKER DEVICE NUMBERS		52-T1 and -T2



CLIENT: SOUTHERN NEVADA WATER AUTHORITY
PROJECT: 3636S STAGE II RELIABILITY UPGRADES
TITLE: GAS HIGH-VOLTAGE CIRCUIT BREAKER

TRANSPORTATION
SPECIFICATION NO. 33 75 19
EXHIBIT C

1 Transportation Specification

Shipment shall be in accordance with the instructions set forth in Exhibit A, Design and Technical Specifications and the requirements of this Exhibit.

1.1 PACKING AND SHIPPING REQUIREMENTS

The Supplier shall be responsible for checking the shipping dimensions and weight of the circuit breaker for suitability for the method of shipment specified. Circuit breaker are to be shipped fully assembled except for the support frame legs, which may either be retracted to a shipping position or shipped separately as a frame assembly. SF₆ gas cylinders are to be banded to a pallet.

1.2 PRICING

Pricing shall include delivery to the jobsite at the substation site in Clark County, Nevada. Off-loading from a flatbed trailer will be provided by the Construction Contractor. All equipment furnished shall be securely crated, braced, wrapped, and covered as required to prevent damage and/or entrance of dirt or moisture during shipment, handling, and jobsite storage.

1.3 SHIPMENT

The Supplier shall notify Owner and Owner's Contractor on the day of shipment from factory and 48 hours prior to the delivery of the breaker(s) to the project site to ensure Contractor can provide clear access for unloading and servicing the breaker(s). No weekend deliveries will be accepted.

- A. All delivery personnel must check in at the onsite construction office. Personnel will be provided an escort for delivery to the substation.
- B. When applicable, Supplier's personnel conducting supervising or conducting work will be required to attend a nominal 2 hour site orientation prior to conducting any work on site.
- C. Supplier's personnel will be required to abide by all site rules for Personal Protective Equipment (PPE), site evacuation, site speed limits, and equipment operation guidelines.
- D. Material Safety Data Sheets are required for all chemicals brought on site. All material containers must be properly labeled, in English. Supplier is responsible for disposal of all chemicals or materials not consumed while installing, assembling, or commissioning the Transformer.
- E. Any injury or near miss must be immediately reported to the on-site Construction Manager.



CLIENT: SOUTHERN NEVADA WATER AUTHORITY
PROJECT: 3636S STAGE II RELIABILITY UPGRADES
TITLE: GAS HIGH-VOLTAGE CIRCUIT BREAKER

TRANSPORTATION
SPECIFICATION NO. 33 75 19
EXHIBIT C

- F. Supplier's personnel will be required to perform daily Pre-Task briefings and documented tailboards. Additional or revised tailboards are required for changes in work activities.

1.4 JOB SITE STORAGE

Job site storage is outside storage.

1.5 ACCESSORY ITEMS, SMALL PARTS, AND UNIT COMPONENTS

All accessory items, small parts and unit components shall be separately boxed or bundled to prevent galling due to rubbing of one part against the other.

1.6 ITEMIZED BILL OF LADING

A complete itemized bill of lading which clearly identifies and inventories each assembly, subassembly, carton, box, package, envelope, or container shall be furnished and enclosed with each item or items shipped at the time of shipment.

1.7 SF₆ AND ACCESSORIES SHIPMENT

The shipment of insulating materials and accessories removed and packages for shipment shall comply with the provisions set forth in Document No. 3636S-TS-03, 69 kV Group-Operated Circuit Breaker design and Technical Specifications as Exhibit A to the high-Voltage Circuit Breaker Purchase Agreement.

END OF DOCUMENT



CLIENT: SOUTHERN NEVADA WATER AUTHORITY
PROJECT: 3636S STAGE II RELIABILITY UPGRADES
TITLE: GAS HIGH-VOLTAGE CIRCUIT BREAKER

SUPPLIER'S QUALITY AND INSPECTION PLANS
SPECIFICATION NO. 33 75 19
EXHIBIT D

1 Quality and Inspection Plans

The selected high-voltage circuit breaker Supplier shall submit formal documents outlining their quality assurance program pertaining to the design, procurement, manufacturing, and testing of the breaker(s) to be supplied under the purchase agreement to which this section is attached as an exhibit.

The exhibit shall also include a typical Test Plan and Procedure document which pertains to the routine factory acceptance test sequence.

END OF DOCUMENT



CLIENT: SOUTHERN NEVADA WATER AUTHORITY
PROJECT: 3636S STAGE II RELIABILITY UPGRADES
TITLE: GAS HIGH-VOLTAGE CIRCUIT BREAKER

SUPPLIER'S MILESTONE SCHEDULE
SPECIFICATION NO. 33 75 19
EXHIBIT E

1 Milestone Schedule

The selected transformer Supplier shall submit formal documents outlining their Milestone Schedule pertaining to the design, procurement, manufacturing, and testing of the circuit breaker(s) to be supplied under the purchase agreement to which this section is attached as an exhibit.

The exhibit shall include as a minimum the milestones outlined in Table E-1 below:

Table E-1 – Milestone Events	
Milestone Event	Event Occurrence (Days after receipt of Contract)
Major material items submittal	
Design Review Meeting	
Revision A Submittal Drawing Package	
Commencement of final assembly	
Commencement of the Factory Acceptance Test Sequence	
Completion of the Factory Acceptance Test Sequence	
Ready for Shipment (Ex-Works)	
DDP at jobsite in Clark County, Nevada	
Completion of Field Assembly (if required)	
Ready for initial energization	
Certification of Warranty validity submittal	



CLIENT: SOUTHERN NEVADA WATER AUTHORITY
PROJECT: 3636S STAGE II RELIABILITY UPGRADES
TITLE: GAS HIGH-VOLTAGE CIRCUIT BREAKER

SUPPLIER'S MILESTONE SCHEDULE
SPECIFICATION NO. 33 75 19
EXHIBIT E

Attachment E-1 – Supplier's Production Schedule

END OF DOCUMENT



CLIENT: SOUTHERN NEVADA WATER AUTHORITY
PROJECT: 3636S STAGE II RELIABILITY UPGRADES
TITLE: GAS HIGH-VOLTAGE CIRCUIT BREAKER

SUPPLIER'S LIST OF DELIVERABLE
SPECIFICATION NO. 33 75 19
EXHIBIT F

1 List of Deliverable Documents

The selected transformer Supplier shall submit formal documents outlining the schedule for submittal of specific documents that will be submitted to the Owner for acceptance under the purchase agreement to which this section is attached as an exhibit.

The exhibit shall include as a minimum the submittal documents outlined in Table F-1 below:

Table F-1 – Submittal Deliverable Events	
Deliverable Event	Event Occurrence (Days after receipt of Contract)
Major material items submittal	
Design Review Meeting	
Revision A Submittal Drawing Package	
Allowance for Owner review	
Revision A Submittal Drawing Package	
Allowance for Owner review	
Revision 0 (Released to manufacturing) Submittal Drawing Package	
Certified As-Built Drawing Package	
Maintenance and Operations Manuals	
Pre-Tanking Test Plan and Procedure document	
Factory Acceptance Test Plan and Procedure document	
Field Assembly Plan and Procedure document	
Commissioning and Initial Energization Plan and Procedure document	
Final test reports, MSDS Sheets, instruction manuals and final drawings	
Certification of Warranty validity document	



CLIENT: SOUTHERN NEVADA WATER AUTHORITY
PROJECT: 3636S STAGE II RELIABILITY UPGRADES
TITLE: GAS HIGH-VOLTAGE CIRCUIT BREAKER

SUPPLIER'S LIST OF DELIVERABLE
SPECIFICATION NO. 33 75 19
EXHIBIT F

Attachment F-1 – Supplier's Document Submittal Schedule

END OF DOCUMENT



CLIENT: SOUTHERN NEVADA WATER AUTHORITY
PROJECT: 3636S STAGE II RELIABILITY UPGRADES
TITLE: GAS HIGH-VOLTAGE CIRCUIT BREAKER

SUPPLIER'S RECOMMENDED SPARE PARTS
SPECIFICATION NO. 33 75 19
EXHIBIT G

1 Recommended Spare Parts

The selected transformer Supplier shall submit a list of recommended spare parts with pricing based upon their inclusion in the initial purchase agreement. The spare parts are to be specific to the circuit breaker(s) to be supplied under the purchase agreement to which this section is attached as an exhibit.

The exhibit shall include as a minimum the spare parts identified in Table G-1 below:

Table G-1 – Suggested Spare Parts List		
Item	Description of Spare Parts	Quantity
1	HV Bushing	1
2	Trip Coil	1
3	Close Coil	1
4	HV Bushing Gasket Set	1



CLIENT: SOUTHERN NEVADA WATER AUTHORITY
PROJECT: 3636S STAGE II RELIABILITY UPGRADES
TITLE: GAS HIGH-VOLTAGE CIRCUIT BREAKER

SUPPLIER'S RECOMMENDED SPARE PARTS
SPECIFICATION NO. 33 75 19
EXHIBIT G

Attachment G-1 – Supplier's Recommended Spare Part List with pricing

END OF DOCUMENT