



CIRCUIT BREAKER QUESTIONNAIRE

1. GENERAL

1.1 Scope

1. This specification should provide the outline for the minimum technical requirements for the engineering, design, manufacturing, factory testing, and delivery of:

(Describe Need): _____

The Breaker or Breakers will include bushing current transformers and control cabinet in accordance with the following specifications and the single line diagram provided in Appendix A. The provided equipment shall include all items necessary for the efficient and safe operation of the equipment.

2. CTG shall prepare its proposal in strict conformance with the specification unless the quotation includes a statement and description of the proposed exceptions.
3. CTG shall provide shop drawings, manuals, inspection and test plans, factory testing, and shipping as described.
4. Project Site Location (for use and delivery):
+ _____
Address to be confirmed upon purchase order
5. CTG shall include in its proposal a Warranty for at least (_____) months from date of initial operation.
6. Date Required:
+ _____
7. To be stated in Proposal:
+ CTG will provide a separate price in its proposal for installation supervision, gas filling, and equipment testing on site.
8. Excluded work from the present specification are:
+ Foundations and anchorage;
+ Installation of exterior electrical connections and wiring between cabinets;

1.2 Applicable Standards (please check those that are applicable)

1. All characteristics, definitions, and terminology, except as specifically covered in this specification, shall be in accordance with the latest revision of the following IEEE, and NEMA, IEC, NEC, NFPA70 and ESA compliances.
+ Circuit Breakers (check required) :
____ IEEE C37.06 Standard for AC High-Voltage Circuit Breakers Rated
____ IEEE C37.09 Standard Test Procedure for AC High-Voltage Circuit Breakers
____ IEEE C37.010 Application Guide for AC High-Voltage Circuit Breakers
____ IEEE C37.11 Standard Requirements for Electrical Control for AC High- Voltage Circuit Breakers
____ IEEE C37.017-200 Standard for Bushings for High-Voltage Circuit Breakers
____ IEEE C57.19.00 General Requirements and Test Procedure for Power Apparatus Bushings
____ IEEE C57.13 Standard Requirements for Instrument Transformer
____ ANSI C37.012 Guide for Specifications of High-Voltage Circuit Breakers



- ___ IEC62271-100 High-voltage alternating-current circuit-breakers
- ___ NSI/NETA/ATS Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems
- ___ ISO 9001 Quality management systems — Requirements
- ___ IEC 60376 Specification of technical grade sulfur hexafluoride (SF6) and complementary gases to be used in its mixtures for use in electrical equipment
- + If any of the requirements in this specification are in conflict with the standards, CTG shall request an exception and shall notify the Customer. Proposals lacking in the desired specifications and that does not comply with Customer specifications as noted herein may or may not be rejected.

1.3 Technical Requirements

The Equipment proposed by CTG shall meet the following minimum requirements.

Table 2: SF6 Dead Tank Breaker

CHARACTERISTICS	DATA
Quantity:	
Does the Breaker need to be New or is reconditioned acceptable?	
Location:	
Voltage class (UV):	
Normal continuous operating range:	
Tag(s):	
Min Rated symmetrical Short-Circuit Capability (kA):	
Rated Current (AMP):	
Brake Time (Cycles):	
Operating Elevation (Ft):	
Close and latch current (kA, Peak):	
INSULATION BIL WITHSTAND TEST VOLTAGE	
- Full Wave Impulse (kV):	
- Rated Frequency (Hz):	
- Rated capacitive switching (Class):	
- Low Frequency (kV):	
LINE SIDE CT'S • Protection	
- Ratio:	
- Accuracy Class:	
- Quantity (# of sets):	
LOAD SIDE (MAIN POWER TRANSFORMER SIDE) CT'S:	
- Ratio (Multi?):	
- Accuracy Class (Relaying & Metering):	
- Quantity:	
AC Supply (VAC):	
DC Control Voltage ? VDC, FEED?:	

2. CONSTRUCTION AND DESIGN

2.1 Environmental Consideration

Complete the site design conditions below if the equipment is for outdoor use and if it should be able to sustain the environmental conditions specified in Table 3 below.



Table 3: Site Design Conditions	Data
Elevation (Ft.)	
Average Temperature (°F)	
Relative Avg. Humidity (Range)	
Pollution Class IEC Specification (if applicable)	
Wind Velocity	
Snow load	
Seismic Zone	

2.2 HV Circuit Breaker Specs

1. The breaker(s) shall be SF _____ "dead or live tank" type. Specify: _____
2. Control voltage shall be _____ VDC. Each breaker shall be equipped with dual, independent trip coils (TC1 and TC2)? Yes ___ No ___ Heater supply voltage shall be ___/___ VAC?
3. All AC and DC supplies shall be monitored using auxiliary relays with a and b contacts? Yes ___ No ___
4. Each trip coil and its circuit shall be independently monitored in both breaker Closed and Open conditions and alarm contacts wired to terminals? Yes ___ No ___
5. Failure of one trip coil shall not cause failure of the other trip coil. ___ Yes/ ___ No
6. "A" and "B" breaker control circuit wiring shall be identical, independently protected, and physically separated? ___ Yes ___ No.
7. Should Breaker have anti-pumping feature? ___ Yes / ___ No
8. Should each Breaker also be dustproof, weatherproof, tamper-resistant, pad lockable, and include a cam-action door latch? ___ Yes / ___ No
9. Should Breaker open/close operation capability be provided locally and from a remote location using a SCADA HMI system? ___ Yes / ___ No
10. Local/remote selector switch with position contact indication. Is it a requirement that the trip circuit will operate regardless of the local/remote selector switch status? ___ Yes / ___ No
11. Does each breaker need to be equipped with tank heaters, as required, to prevent SF _____? liquefaction and to satisfy fault interrupting criteria at ambient temperatures? ___ Yes / ___ No
12. Each breaker shall be equipped with a minimum of _____# auxiliary "a" or "b" contacts for breaker status indication. ___ Yes / ___ No?
13. Should contacts provide for indication of advanced "a" position as well as charging spring position and failure? ___ Yes / ___ No
14. Accessory trip/alarm/indicating contacts shall be rated for _____ A, _____ VDC minimum?
15. Do the contacts/equipment/terminals connected to/expected to be connected to "a" or "b" circuit be installed separately away from each other, preferably on either side of the control cabinet? ___ Yes / ___ No
16. Are contact multiplication relays prohibited ___ Yes / ___ No?



17. Do you require a non-resettable operation counter to be provided ___Yes / ___No
18. Lockable disconnecting means be provided inside of breaker operator enclosures, for all electrical circuits, operating at _____V and higher? ___Yes / ___No?
19. The circuit breaker shall have a block trip and a block close on low gas pressure with _____VDC rated alarm contacts?
20. The circuit breaker shall be of self-supporting type to be installed on a concrete foundation, ___Yes / ___No?
21. Support structures shall be supplied with the circuit breaker. The structure shall be high enough to raise the breaker enclosure and mechanism so unguarded live parts height meets the NEC distances? ___Yes / ___No
22. Breakers shall be equipped with charged and discharged stored energy mechanism indicators and contacts? ___Yes / ___No
23. CTG is assuming that monitoring devices shall include but not limited to motor protection operation, SF6 pressure, spring charged, etc. ___Yes / ___No?
24. Should all alarms contacts, breaker position contacts (52a/52b) be wired to terminal blocks in the NEMA 4X control cabinet ___Yes / ___No?
25. The control cabinet shall be equipped with a grounding bar, space heater with thermostat, light with door contact, and one 120VAC GFCI duplex outlet. Is this sufficient? ___Yes / ___No
26. Enclosures shall also be pad lockable, capable of housing safety padlock shackles up to 9/32 inches in diameter. Is this acceptable ___Yes / ___No?
27. Generally, the manufacturer is required to provide a 4-hole NEMA pad for HV overhead connection of the bushings. Is this appropriate? ___Yes / ___No
28. Quality control requirements shall be in accordance with ISO 9001. CTG shall state in the proposal that if this is a new build then these governing standards define quality assurance procedures.
29. For a newly manufactured unit equipment supplied under CTG's proposal shall generally be approved per OESC rule 2-024 with the exception of wire which meets SAE AS22759/16. For control panels (where applicable), they shall meet the requirements of the 4X enclosure type indicated in NEMA 250. Certification costs for equipment shall be included in the base bid price. Is this acceptable? ___Yes / ___No
30. For newly manufactured equipment supplied by CTG the Breakers shall be adequately rated to successfully withstand energization inrush, back-to- back switching, outrush transients, voltage magnification transients, pre-strikes, re-strikes, transient recovery voltages (TRV) and all other power system phenomena associated with switching of equipment and systems in the Facility. Is this acceptable? ___Yes / ___No
31. The Breaker shall be designed and previously Type-tested for "very low" (Class 2) probability of re-strike as defined in IEEE/IEC. Is this adequate? ___Yes / ___No
32. Kirk key system with electrical contacts rated for 125VDC shall be provided for each high voltage breaker for providing mechanical interlock with customer's upstream disconnect switch (provided and installed by others). Operation of the key shall result in immediate opening of the breaker. The key shall only be withdrawable from the lock with the breaker in the "open" position. Upon withdrawal, all control power to the breaker shall be removed immediately and shall not be capable of being restored until the key is placed back into the lock. Is this acceptable? ___Yes / ___No



33. Assuming the inside of the control cabinet must have thermal insulation so as not to affect the operation of the components inside, such outside temperature rating shall provide for varying between - _____°F and + _____°F ?
34. Each breaker shall have the following visual indicators, visible from ground level with all doors closed:
- + Spring charge indicator
 - + Breaker position- ON/OFF (both mechanical and electrical (LED)).
Green = OPEN, Red = CLOSED
 - + Visual mechanical indicator connected to the operating mechanism
 - + Pressure gauge with scale for indication of the SF6 gas absolute pressure
- Are these parameters acceptable? ___Yes / ___No

2.3 Gas

1. Do you require CTG to provide the necessary (SF6) gas cylinders to fill the circuit breakers? ___Yes / ___No? (Note: this is optional but there is an additional cost)
2. What is the required gas quality?_____ or is the IEC 60376 standard acceptable? ___Yes / ___No? Certification and test report shall be supplied with the gas cylinders.
3. CTG can also offer a gas filling kit as a separate optional price item. It shall include all fittings to fill the breakers, fittings to test gas density meters, adaptors for gas cylinder, electronic vacuum/ pressure module (Fluke PV350 or equivalent), hoses, and pressure regulator. Is this required? ___Yes / ___No?
4. Generally, the Breaker or Breakers shall include temperature-compensated SF6 gas pressure monitoring instruments on each pole; each instrument shall at minimum be equipped with alarm contacts for high, low and trip gas pressure indication, a minimum of two (2) contacts for each trip accessory, and a single contact for each alarm. The trip-level pressure alarm setting shall be set at the level corresponding to the minimum pressure required to interrupt rated fault current safely and reliably. Is this required? ___Yes / ___No?

2.4 Structure

1. If factory-painted equipment surfaces that have been damaged during shipping or construction shall be repaired in accordance with the requirements of the manufacturer equipment, including surface preparation requirements necessary to prevent rusting and maintaining the design life of the finish. Manufacturer shall supply touch-up paint for the equipment.
2. All hot-dip galvanized steel elements, where the galvanized layer has been damaged during transport or construction shall be repaired/replaced in accordance with the requirements and recommendations of the manufacturer equipment and the applicable ASTM/CSA standard.

3. PERFORMANCES AND TESTING

3.1 Performances

1. All the equipment's electrical and mechanical components shall be designed and manufactured so that there is no damage during the transport, installation, and operation of the equipment under the site location's climatic conditions.



2. The design shall be such that the installation, replacement, and maintenance will be carried out with a minimum of time and cost.

3.2 Type Tests

The tests shall be carried out in accordance with ANSI/IEEE _____ and/or IEC _____?

3.3 Routine Tests

1. The tests shall be carried out in accordance with ANSI/IEEE _____?
2. Do you require an isolation resistance measurement (Megger) 1000V and an isolation test (Hipot) 2kV for one minute of the final cabling on the control cabinet should be performed before shipping?
____ Yes ____ No
3. The Customer representative reserves the right to inspect the manufacture and assembly of all equipment during the Manufacturer's normal working hours and upon reasonable notice given to Vendor. Such inspection shall not in any way relieve Manufacturer of any responsibility for design, material, or workmanship.
4. Do you wish to reserve the right as the Customer representative to observe the Manufacturer's testing, and/or to formally witness any or all testing; or perform a final inspection of the complete assembly prior to packaging for shipment? ____ Yes ____ No
5. This inspection may be performed to verify the equipment has been built in accordance with the Manufacturer drawings and meets the requirements of the specifications.
6. Check which below are mandatory "HOLD" Witness points during design, manufacturing, testing phase.
____ Kick-off (review of manufacturing, QA/QC, and FAT plan)
____ Factory inspection and testing (FAT)
____ Pre-shipment inspection with insurance representative
7. The breaker manufacturer will, under cover of a separate proposal, also provide Customer optional Site Acceptance Testing of the breaker(s). The following actions/testing shall be implemented on the site:
____ Breaker assembly inspection
____ Gas filling and pressure check
____ Contact resistance
____ Breaker insulation test
____ Main contact closure synchronization
____ Bushing CT testing (ratios, polarity, and saturation levels)

4. OTHER ITEMS, SPARE PARTS, AND SPECIAL TOOLS

Do you require a separate list indicating the costs of spare parts and special tools that could be necessary for the maintenance operations (optional). ____ Yes / ____ No?

5. DELIVERABLES

5.1 Documents and Drawings

1. Breakers type test reports shall contain results of tests required to verify arc proof construction of the breaker.
2. For any alteration to an approved design or details, the drawing requiring the alteration is subject to re-approval.



- 3. The following drawings and documents shall be submitted for review and approval, in accordance with this specification, with resubmittal required to reflect incorporation of required changes.

Check all that apply:

- Drawing list
- Nameplate drawing
- Bill of material
- Schematics & wiring diagrams
- Documents during project execution in DWG files
- Documents during project execution in PDF files
- Documents during project execution in DXF files
- Final documents "AS BUILD from factory" in PDF files
- Final documents "AS BUILD from factory" in DXF files
- Final documents "AS BUILD from factory" in DWG files
- Instruction manual
- The Customer will submit to the manufacturer a comprehensive key interlock operating diagram, including all operating sequences
- Test certificates specially for factory test results

5.2 Delivery to Site

- 1. Does Customer want CTG to deliver equipment to the site Yes / No?
- 2. Will Customer arrange for inspection of equipment before it is removed from the truck Yes / No?
- 3. Does Customer require CTG to manage the shipping and insurance for the equipment? Yes / No?

5.3 Shipping and Storage (Manufacturer Obligations)

- 1. The manufacturer shall be responsible for the correct packing and shipping of all materials provided under the contract.
- 2. The manufacturer shall pack the equipment for outside storage under the weather conditions to be met at the site.
- 3. Materials subject to deterioration from exposure to weather shall be stored in weather-tight containers.
- 4. The manufacturer shall be solely responsible for damage or deterioration resulting from outside storage conditions.
- 5. All packing cases and large items shall be clearly marked.

Add any additional comments or details: _____

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