DOCUMENT NO: KP1/13D/4/1/TSP/11/012-2

Kenya Power

245kV SF_6 REACTOR SWITCHING CIRCUIT BREAKERS WITH SINGLE POLE OPERATING MECHANISM - SPECIFICATION

A Document of the Kenya Power & Lighting Co. Plc.

February 2026.

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0.1 CIRCULATION LIST

COPY NO.	COPY HOLDER
1	Manager, Standards
2	Electronic copy (pdf) on Kenya Power server (http://172.16.1.40/dms/browse.php?fFolderId=23)

REVISION OF KPLC STANDARDS

In order to keep abreast of progress in the industry, KPLC standards shall be regularly reviewed. Suggestions for improvements to approved standards, addressed to the Manager, Standards Department, are welcome.

0.2 AMENDMENT RECORD

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)
Issue 1, Rev 0	2026-02-04	New Issue	Eng. Benson Dianga	Eng. Faith Gicugu

FOREWORD

This Specification has been prepared by the Standards Department and Electrical Plant Department of The Kenya Power and Lighting Company Plc (KPLC) and it lays down requirements for 245kV Reactor Switching SF_6 Circuit Breakers with single pole operating mechanism

The 245kV SF_6 Circuit Breakers with single pole operating mechanism are intended for use in the network for switching Reactors and for reactor fault current interruption.

Specifications in this series are:

(i) KP1/6C/4/1/TSP/11/012-1: 245kV SF_6 Circuit Breakers with single pole operating mechanism -Specification

(ii) KP1/6C/4/1/TSP/11/003: 72.5kV SF_6 Circuit Breakers with ganged three pole operating mechanism -Specification

This Specification stipulates the minimum requirements for 245kV Reactor Switching SF_6 Circuit Breakers with single pole operating mechanism acceptable for use in the company and it shall be the responsibility of the suppliers and manufacturer to ensure that the offered design is of the highest quality and guarantees excellent service to KPLC, good workmanship and good engineering practice in the manufacture of the 245kV SF_6 Circuit Breakers with single pole operating mechanism for KPLC.

Users of this KPLC specification are responsible for its correct interpretation and application.

The following are members of the team that developed this specification:

Name	Department
Eng. Zacheus Omondi Oluoch	Electrical Plant
Eng. Benson Dianga	Standards
Beatrice Gitonga	Electrical Plant

1. SCOPE

This Specification covers the requirements, design, test methods, marking, Switching and packing of 245kV Reactor SF_6 Circuit Breakers with single pole operating mechanism complete with controls, control switching device, support structures and ancillary equipment.

2. NORMATIVE REFERENCES

The following standards contain provisions which, through reference in this text, constitute provisions of this specification. For dated editions, the cited edition will apply; for undated editions, the latest edition of the referenced document shall apply.

IEC 62271-100: High Voltage Switchgear and Control gear - Part 100: High Voltage Alternating Current Circuit Breakers.

IEC 60376: Specification of technical grade sulfur hexafluoride (SF6) for use in electrical equipment.

IEC/ISO 17025: General requirements for the competence of testing and calibration laboratories

ISO 1461: Hot dip galvanized coatings on fabricated iron and steel articles — Specifications and test methods.

IEC 60529: Degrees of protection provided by enclosures (IP Code).

BS1363: 13A plugs socket-outlets adaptors and connections units.

ISO 9001:2015 Quality management systems — Requirements

IEC 60270: High voltage test techniques-partial discharge measurements.

IEC 62271-301: High voltage switchgear and control gear-part 301 Dimensional standardization of HV terminals.

IEC 62271-110: High voltage switchgear and control gear-part 110 inductive load switching

IEC 60273: Characteristics of indoor and outdoor post insulators for systems with nominal voltages greater than 1000V.

3. DEFINITIONS AND ABBREVIATIONS

For the purpose of this specification, the definitions and abbreviations given in the reference standards shall apply together with the following:

3.1 ABBREVIATIONS

KPLC- Kenya Power and Lighting Company Plc.

IEC – International Electro Technical Commission

ISO – International Organization for Standardization.

ISO 9001: 2015 - Quality Management Systems – Requirements

CSD-Controlled switching Device.

4. REQUIREMENTS

4.1 SERVICE CONDITIONS

4.1.1 The 245kV SF_6 Circuit Breakers with single pole operating mechanism shall be suitable for continuous use outdoors in tropical areas with the following conditions:

a. Altitudes of up to 2200m above sea level;
b. Humidity of up to 95%;
c. Average ambient temperature of +30˚C with a minimum of -1˚C and a maximum of +40˚C
d. Pollution: Design pollution level to be taken as "Very Heavy" (Pollution level IV) for coastal applications.
e. Isokeraunic levels of up to 180 thunderstorm days per year.

4.1.2 The circuit breaker shall be installed in an effectively (solidly) earthed system

4.2 DESIGN AND CONSTRUCTION

4.2.1 General Requirements

4.2.1.1 The 245kV SF_6 Circuit Breakers with single pole operating mechanism shall be of single pole mechanism type for each phase, out-door type, SF_6 gas insulated and shall comply with the requirements of IEC 62271-100 and the requirements of this specification.

4.2.1.2 The circuit breakers shall be of live tank type.

4.2.1.3 Each pole shall have separate SF_6 gas system each with a gas pressure monitor.

4.2.1.4 Each of the circuit breaker poles shall be operated by local electrical and remote electrical controls from the local central circuit breaker control cabinet and the remote control panel respectively. The remote control panel shall be equipped with Circuit Breaker Control Switching device.

4.2.1.5 The circuit breaker shall have SF_6 gas as medium for electrical interruption and insulation.

4.2.1.6 The SF_6 gas shall comply with the requirement of IEC 60376 and be suitable for use in the circuit breaker when it is operated under the service and system conditions specified. The leakage rate of SF_6 shall not exceed 0.5% per year.

4.2.1.7 Sufficient gas shall be provided for filling the circuit breaker at installation with additional 20% for any losses.

4.2.1.8 Circuit breaker SF_6 gas filling accessories including regulator, male and female connectors and gate valve and any other special accessory required for gas evacuation and filling shall be provided. One set for each complete breaker.

4.2.1.9 When the circuit breaker is in closed position a rapid fall in the SF_6 gas pressure, to a level below that at which safe operation is possible shall not result in tripping the circuit breaker, but lockout of the circuit breaking preventing any electrical open or close operation. A remote alarm indication to signal circuit breaker lockout condition shall be provided.

4.2.1.10 An alarm stage for SF_6 leakage shall also be provided to indicate moderate fall in gas pressure, though in this state the circuit breaker shall be safe to operate.

4.2.1.11 Insulation creepage distance shall not be less than 31mm per kV of rated voltage between phases.

4.2.1.12 Each pole of the circuit breaker shall be equipped with a trip counter operated by the circuit breaker mechanism.

4.2.1.13 A pole discrepancy scheme shall be implemented in the central control cubicle. The pole discrepancy timer shall have adjustable time delay of at least 0 to 5 seconds. The operation of the pole discrepancy will result in three phase trip and lock out of the circuit breaker. A reset will be required to be able to close the circuit breaker. A visual indication will be provided to signal operation of the pole discrepancy scheme, as well as contacts for remote indication.

4.2.1.14 Three galvanized column steel support structures shall be supplied with the circuit breaker, one for each pole. All the bolts, nuts and fasteners for connecting the circuit breaker pole onto the support structure shall be provided. All ferrous parts shall be galvanized as per ISO 1461.

4.2.1.15 The resistance of the circuit breaker primary circuit (contact resistance) shall not exceed the values specified in IEC 62271-100.

4.2.1.16 The circuit breaker shall be capable of 10000 mechanical operations.

4.2.1.17 One trip coil and one closing coil shall be supplied as mandatory spares for each circuit breaker free of cost.

4.2.1.18 The spring winding motor and heaters shall have satisfactory operation at all voltages between 85% and 110% of the rated voltage. They shall be protected by MCB and motor tested as per IEC 60034.

4.2.1.19 The circuit breaker shall be required to switch shunt reactors and rated current shall be taken as per IEC 62271-306.

4.2.1.20 The circuit breaker shall have dielectric strength to handle both nominal and the over voltages across its terminals arising from current chopping phenomenal while switching the small inductive currents of the reactor. Type test documentation to demonstrate that circuit breakers have been type tested for inductive load switching in accordance to IEC 62771-110 shall be provided.

4.2.1.21 Controlled switching device CSD shall be supplied together with the circuit breaker to extend closing or opening commands at optimum time instant on voltage or current waveform to eliminate harmful TRV which may damage interrupters and nearby connected equipment.

4.2.1.22 Circuit Breaker offered would be of Sulphur hexafluoride type and of class C2-M2 as per IEC and of live tank type of proven design.

4.2.1.23 The circuit breaker control schematics shall be finalized in such away, that it may operate with or without CSD by using a suitable selector switch.

4.2.1.24 Circuit breaker shall be able to switch in and out the shunt reactor of 245kV, 15MVAR, Reactance of 3312.77Ω and zero sequence impedance of 3313.35Ω.

4.2.1.25 Laboratory test reports of Circuit Breaker current chopping capability as per IEC 62271-306 shall be submitted with the bid for evaluation.

4.2.2 Operating Mechanism

4.2.2.1 The operating mechanism shall be suitable for mounting at the circuit breaker supporting structure, and below the circuit breaker in a weather-proof, dust-proof, vermin-proof and well ventilated housing. The degree of protection shall be at least IP 54 as per IEC 60529.

4.2.2.2 The operating mechanism shall open and close the circuit breaker within the specified opening and closing time of the circuit breaker and in any case, the opening times will be ≤ 50ms and the closing time will be ≤ 100ms, on average.

4.2.2.3 The operating mechanism shall after charging, carry out an Open-Close-Open (O-0.3s-CO) sequence with no external power supply to the operating mechanism.

4.2.2.4 The circuit breaker shall after a closing operation always be able to trip immediately without intentional time delay.

4.2.2.5 Operating mechanism shall be trip free during the entire closing sequence.

4.2.2.6 Operating mechanism shall be provided with motor wound spring actuated mechanism with provision for hand charge.

4.2.2.7 Spring operated mechanism.

4.2.2.7.1 Spring operated mechanism shall be complete with motor as per manufacturer practice. Opening spring and closing spring with limit switch for automatic charging and other necessary accessories to make the mechanism a complete operating unit shall be provided.

4.2.2.7.2 As long as power is available to the motor, a continuous sequence of closing and opening operations shall be possible. Motor shall have adequate thermal rating for this duty.

4.2.2.7.3 After failure of power supply to the motor one close open operation shall be possible with the energy contained in the operating mechanism.

4.2.2.7.4 Breaker operation shall be independent of the motor which shall be used solely for compressing the closing spring. Facility for manual charging of the closing spring shall also be provided. Motor rating shall be such that it requires not more than 30 seconds for full charging of the closing spring.

4.2.2.7.5 Closing action of circuit breaker shall compress the opening spring ready for tripping.

4.2.2.7.6 When closing springs are discharged after closing the breaker, closing springs shall be automatically charged for the next operation and an indication of this shall be provided in the local and remote control panels.

4.2.2.7.7 Separate MCBs shall be provided for each spring charging motor and the rating of MCBs shall be suitably selected to match the starting, running and stalling time.

4.2.2.7.8 Spring charging failure alarm shall be provided with a time delay having setting range from 0-1minutes.

4.2.2.7.9 Motor operating voltage shall be 110 Volts dc. and an overload relay shall be provided for the protection of the motor

4.2.2.8 The operating mechanism shall be at ground potential, and shall house the secondary wiring for interface of the circuit breaker with the networks control and protection system.

4.2.2.9 A set of at least fifteen normally closed and fifteen normally open spare potential free contacts shall be provided for remote electrical indication as well as electrical interlocking and shall be wired to a terminal block in the housing.

4.2.2.10 A minimum of ten (10) spare terminals shall be provided.

4.2.2.11 The circuit breaker shall be provided with Local/Remote selector switch. The selection of local operation shall inhibit the operation of the circuit breaker from any remote source. A spare contact for Local selection and Remote selection shall be provided on the switch for remote indications.

4.2.2.12 The circuit breaker shall be provided with a local switch for Open/Neutral/Close Operation. The position for Open, Neutral and close positions shall be clearly indicated on the switch.

4.2.2.13 Mechanically operated indication to show the status of the circuit breaker position (open/close and springs charged/discharged) shall be provided. "ON" or "I", shall be used for CB closed status and "OFF" or "O" for CB open status.

4.2.2.14 The circuit breaker shall be provided with suitable terminals for connecting clamps for up to 3" outside diameter copper tubes.

4.2.2.15 The circuit breaker shall be provided with means to prevent contact pumping while the closing circuit remains energized, should the circuit breaker either fail to latch or be tripped during closing due to operation of the protective relays.

4.2.2.16 The circuit breaker shall be provided with duplicate trip coils and one closing coil in order to facilitate duplication of protection tripping, where required.

4.2.2.17 The circuit breaker shall have separate operating mechanism for each pole, to allow circuit breaker single pole trip and automatic re-closure by protection and control scheme.

4.2.2.18 Each circuit breaker pole mechanism shall be provided with mechanical open/close operating links for circuit breaker pole maintenance. A clear warning notice should be provided next to the mechanical links, against operating the mechanical links when the SF_6 gas pressure is outside the safe operating levels.

4.2.2.19 The circuit breaker shall have a central control cabinet where the circuit breaker local three phase electrical close and open operations are carried out. This central control cabinet will be separate and independent from the circuit Breaker mechanism boxes. It shall be erected separately from the circuit breaker mechanism. All cabling to the circuit breaker mechanism boxes and to the protection and control cubicles shall be terminated at the central control cubicle. It shall have local/remote switch, open and close push buttons for local operation of the circuit breaker, Close and open CB status indication, spring charge indication, sf6 gas low alarm indication and sf6 gas low lockout indication.

4.2.2.20 An anti-condensation heater of adequate design and with suitable hygrostat and temperature controls shall be provided in the circuit breaker mechanism operating boxes and also in the central control cabinet, to prevent condensation. The anti-condensation heater shall be adequately rated and located in a position that ensure safety of personnel and effectiveness in keeping the whole cubicle dry to prevent condensation. It shall not cause deterioration in the wiring or in operation of the components.

4.2.2.21 A cable plate shall be provided at the bottom of the circuit breaker mechanism box and central control cubicle. The cable plates shall be factory drilled, but blocked with removable stoppers to ensure integrity of IP degree of enclosure for the mechanism box and central control cabinet. The stoppers shall be easily knocked off at site. These shall be shown in the detailed drawings for approval.

4.2.2.22 The central control cubicle shall have a door operated LED lighting.

4.2.2.23 Each mechanism box shall be fitted with suitable lifting lugs for ease of lifting and assembly of the circuit breaker. The central control cubicle shall also be fitted with suitable lifting lugs.

4.2.2.24 Each of the three single phase mechanism boxes for each three phase circuit breaker shall be clearly labelled with letters R, Y and B in indelible marking to identify the phases and the labels shall be readily visible from the ground.

4.2.2.25 The central control cabinet shall be fitted with a 230±10%V AC socket outlet with three square terminals (Live, Neutral and Ground) as per BS 1363 standard. The 230±10%V AC Outlet will be controlled by an embedded ON/OFF switch.

4.2.2.26 All terminal blocks used inside the operating mechanism box and in the central control cabinet, shall as a minimum comply with IP20 degree on enclosure to ensure adequate personnel safety.

4.2.2.27 Wiring of the mechanism box and the central control cubicle shall be done in 2.5 mm^2 stranded and flexible copper conductors. All wiring connections to the terminal block will be lugged and labelled using ferrules. The terminal blocks shall be indelibly marked with numbers.

4.2.2.28 Painting of the mechanism boxes and the central control cubicles shall be such that the paint work shall not wear due to weather conditions and ultra violet radiation during the duration of service. The final colour shade shall be RAL 7035.

4.2.2.29 Closing coil shall operate correctly at all values of voltage between 85% and 110% of the rated voltage. Trip coils shall operate correctly under all operating conditions of circuit breaker up to the rated breaking capacity of the circuit breaker and at all values of supply voltage between 70% and 110% of rated voltage

4.2.2.30 .The trip coils shall be wired such that the contacts for wiring of pre and post close trip. The breaker shall normally be operated by remote electrical control.

4.2.2.31 Electrical tripping shall be performed by shunt trip coils but through local/remote switch. Protection trip wiring for coil 1 and 2 shall be done upto the terminal blocks without going through the local/remote switch.

4.2.3 Ratings

The guaranteed operating characteristics of the 245kV SF_6 Circuit Breakers with single pole operating mechanism shall be complied with during tests, according to Table 1.

Table 1: Ratings for 245 kV SF_6 Circuit Breakers.

Item	Parameters, Units	Value
1.	Rated Voltage, kV	245
2.	Frequency, Hz	50
3.	Normal Current, A	2000
4.	Rated short circuit current, kA	40
5.	Duration of short circuit, sec	3
6.	Rated short circuit making current, kA	100
7.	First pole to clear factor	1.5
8.	Operating sequence	0-0.3 sec – CO – 3 min - CO
9.	Auxiliary D.C Voltage for closing & tripping coils, Vdc	110
10.	Auxiliary A.C Voltage and frequency V, Hz	230AV AC $\pm$10%, 50
11.	Lightning Impulse withstand voltage, kV peak	1050
12.	One minute power frequency withstand voltage, kV r.m.s.	460
13.	Creepage distance of insulator, mm	7595
14.	Minimum clearance between phases, mm	3100
15.	Minimum clearance to earth, mm	2100
16.	Temperature Class of Circuit Breaker	-5°C to +50°C

4.3 CONTROLLED SWITCHING DEVICE.

4.3.1 Time resolution should be 0.1ms or better with ideally a maximum deviation of ±1ms or less to ensure precise point on wave execution.

4.3.2 Shall provide adaptive compensation, automatically adjusting for variations in circuit breaker

Closing/opening times caused by ambient temperature, DC control voltage and operating mechanism condition.

4.3.3 Suitable for 1A current input from CTs and 110V (ph-ph) from VTs/CVTs. Shall have sufficient potential free contacts for monitoring and signaling. It shall withstand transient and dynamic state values of the currents and voltages from secondary of CTs and CVTs.

4.3.4 Shall be designed for independent pole operation (IPO) manage each phase of reactor CB specifically.

4.3.5 Shall include self-diagnostic facilities, alarm signaling and ability to store and download switching data/waveforms (COMTRADE format)

4.3.6 Shall be compatible with modern substation automation system especially IEC 61850 to ensure smooth integration into substation automation system.

4.3.7 The CSD shall be PC compatible its software shall be window based and shall be provided complete with licenses for parameter settings and switching performance analysis.

4.3.8 Facility to bypass CSD via BCU/SCADA or any other means like selector switch shall be provided. This shall ensure smooth operation of the CB with CSD faulty.

4.3.9 The CSD shall ensure optimized control closing to eliminate high inrush currents and voltage transients. Opening strategy targeted for maximum arc extinction at specific voltage points to minimize re-strike.

4.3.10 The CSD shall continuously monitor voltage signals to detect zero crossings to calculate the optimal operating points.

4.3.11 The CSD shall have display facility to display settings and measured values.

4.3.12 The CSD shall have functions for switching ON and OFF the circuit Breakers.

4.3.13 The CSD operating voltage shall be 110V DC.

5 TESTS REQUIREMENTS

The 245kV SF_6 Circuit Breakers with single pole operating mechanism shall be inspected and tested in accordance with the requirements of IEC 62271-100 and this specification.

6 MARKING AND PACKING

6.1 MARKING

The nameplates of the circuit breaker and its operating devices shall be marked in accordance with clause 5.10 of IEC 62271-100 in English language. All markings shall be indelible and legible. Nameplate and their fixings shall be weatherproof and corrosion proof.

6.2 PACKING

6.2.1 245kV SF_6 Circuit Breakers with single pole operating mechanism shall be packaged for outdoor storage in tropical conditions defined in clause 4.1.

6.2.2 A set of five (5) Original Hard Cover Installation, Operation and Maintenance Manuals for the circuit breakers shall be supplied with each complete breaker.

6.2.3 Recommendations for use, care, storage and routine inspection/testing procedures, all in English language shall be submitted.

6.3 MANUFACTURER'S EXPERIENCE AND CAPACITY

6.3.1 The circuit breaker manufacturer shall have a minimum of 25 years' experience in the manufacture of 245kV SF_6 circuit Breakers with single pole operating mechanism.

6.3.2 The circuit breaker on offer shall have been in service and given reliable service for a minimum period of 8 years in at least two (2) power utilities in at least three (3) of the following continents/regions:

i) Europe
ii) North America
iii) Africa
iv) Asia or South America

The manufacturer shall provide references to support requirements of this including export records with copy of contractual letters, circuit breaker details and date of sale/export, letter of satisfaction from power utilities.

6.3.3 Circuit breakers brands that have failed in service or mal-operated while in service on the Kenyan power system shall not be accepted.

6.3.4 The warranty for the offered circuit breaker shall be 5 years from the date of circuit breaker delivery to KPLC store.

APPENDICES

A: TESTS AND INSPECTION (Normative)

A.1 It shall be the responsibility of the supplier to test or to have all the relevant tests performed.

A.2 Copies of Type Test Certificates and Type Test Reports for 245kV SF_6 circuit Breakers with single pole operating mechanism issued by a third party testing laboratory that is accredited to ISO/IEC 17025 and shall be submitted with the tender for the purpose of technical evaluation. A copy of

the accreditation certificate for the testing laboratory shall also be submitted with the tender (all in English Language).

Copies of type test reports to be submitted with the tender for evaluation shall include the Following tests in accordance with IEC 62271-100:

a. Dielectric tests (Power frequency, switching and lightning impulse tests)
b. Radio interference voltage tests
c. Measurement of the resistance of the main circuit
d. Temperature-rise tests
e. Short-time withstand current and peak withstand current tests
f. Tightness tests
g. EMC tests
h. Mechanical operation test at ambient temperature
i. Short-circuit current making and breaking tests
j. Capacitive current switching tests: line-charging current breaking tests
k. Verification of degree of protection
l. Humidity test
m. Small inductive current switching test.
n. Re-ignition performance.

NOTE: Any translations of certificates and test reports into English language shall be signed and stamped by the Testing Authority.

A.3 Routine and sample test reports for the 245kV SF_6 circuit breakers with single pole operating mechanism to be supplied shall be submitted to KPLC before delivery. KPLC Engineers will witness tests at the factory before delivery. Tests to be witnessed by KPLC Engineers at the factory before delivery shall be in accordance with IEC 62271-100 and this specification and shall include the following:

a) Dielectric test on main circuit

b) Dielectric test on auxiliary and control circuits

c) Measurement of the resistance of the main circuit

d) Tightness test

e) Design and visual checks

f) Mechanical operating tests

g) Resistance of closing and tripping coils.

h) Motor operating time, peak and average currents.

i) Minimum pick up voltage of the coils.

j) Trip free and anti-pumping operation.

k) Breaker closing and opening times.

l) Point of wave switching test.

m) SF6 Gas leakage test.

n) Dimensional checks and creepage distance check.

A.4 Training on Installation and Maintenance: - The Manufacturer shall conduct Virtual Training on Installation, Testing and Maintenance of the Circuit Breaker to Ten (10) Kenya Power Engineers and Technicians. Maintenance shall cover both the operating mechanism and the interruption chamber. Training on the configuration and testing of the reactor Circuit Breaker Switching Device shall be conducted during the FAT.

A.5 On receipt of the 245kV SF_6 circuit Breakers with single pole operating mechanism, KPLC will inspect them and may perform any of the relevant tests in order to verify compliance with the specification. The supplier shall replace without charge to KPLC, any 245kV SF_6 circuit Breakers with single pole operating mechanism which upon examination, test or use fail to meet any or all of the requirements in the specification.

B: QUALITY MANAGEMENT SYSTEM (Normative)

B.1 The supplier shall submit a quality assurance plan (QAP) that will be used to ensure that the 245kV SF_6 circuit Breakers with single pole operating mechanism physical properties, tests and documentation, will fulfill the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfill the requirements of ISO 9001:2015

B.2 The Manufacturer's Declaration of Conformity to applicable standards and copies of quality management certifications including copy of valid and relevant ISO 9001 certificate shall be submitted with the tender for evaluation.

C: DOCUMENTATION (Normative)

C.1 The bidder shall submit its tender complete with technical documents for tender evaluation. The technical documents to be submitted (all in English language) for tender evaluation shall include the following:

a) Fully filled clause by clause guaranteed technical particulars (GTP) signed and stamped by the manufacturer;

b) Copies of the Manufacturer's catalogues, brochures, drawings giving all relevant dimensions and technical data;

c) References letters to support requirements of clause 6.3.2 including export records with copy of contractual letters, circuit breaker details and date of sale/export, letter of satisfaction from power utilities.

d) Details of manufacturing capacity.

e) Copies of required type test reports by a third party testing laboratory accredited to ISO/IEC 17025.

f) Copy of accreditation certificate to ISO/IEC 17025 for the third party testing laboratory;

g) Contacts and address of third party testing laboratory;

h) Manufacturers letter of authorization, ISO 9001 certificate and other technical documents required in the tender.

C.2 The successful bidder (supplier) shall submit the following documents/details to The Kenya Power & Lighting Company Plc for approval before manufacture:

a) Fully filled clause by clause guaranteed technical particulars (GTP) stamped and signed by the manufacturer (these are not the ones submitted with the tender) ;

b) Detailed Design Drawings with dimensions to be used for manufacture of the 245kV SF_6 circuit Breakers with single pole operating mechanism for KPLC;

c) Quality assurance plan (QAP) that will be used to ensure that the design, material; workmanship, tests, service capability, maintenance and documentation will fulfill the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfill the requirements of ISO 9001;

d) Marking details and method to be used in marking the 245kV SF_6 circuit Breakers with single pole operating mechanism

e) Packaging details including packaging materials.

f) Product samples (where applicable).

C.3 Statement of compliance to specification (indicate deviations if any provide supporting documents)

NOTE: *The drawings to be submitted by the supplier to KPLC for approval before manufacture shall be in standard format clearly indicating the drawing number, parts list with material details and quantities, standard of manufacture, ratings, approval details and identity of the manufacturer (as per manufacturer's authorization submitted during tendering).*

D: GUARANTEED TECHNICAL PARTICULARS (Normative)

To be filled and signed by the Manufacturer and submitted together with relevant copies of the Manufacturer's catalogues, brochures, drawings, technical data, sales records for previous five years, four customer reference letters, details of suppliers' capacity and experience; and copies of complete type test certificates and test reports for tender evaluation, all in English Language)

Tender No. .....
Bidder's name and Address.....

Clause number	KPLC Requirements	Bidder's offer
Manufacturer's Name and address		Specify
Country of Manufacture		Specify
Name and model Number		Specify
1.	Scope	State
2.	Normative References	State
3.	Definitions and Abbreviations	
3.1.	Abbreviations	State
4.	Requirements	
4.1.1	Service conditions	State
4.1.2	CB shall be installed in an effectively (Solidly) earthed system	State
4.2	DESIGN AND CONSTRUCTION	
4.2.1	General	
4.2.1.1	With Single pole Operating mechanism type for each phase, out-door type, SF_6 gas insulated	State
	Comply with IEC 62271-100 and KPLC specification	State
4.2.1.2	Circuit breakers shall be of live tank type	State
4.2.1.3	Each pole shall have separate SF_6 gas system each with a gas pressure monitor	State
4.2.1.4	Each of the circuit breaker poles shall be operated by local electrical and remote electrical controls from the local central circuit breaker control cabinet and the remote control panel respectively.	State
4.2.1.5	circuit breaker shall have SF_6 gas as medium for electrical interruption and insulation	State
4.2.1.6	SF_6 gas shall comply with the requirement of IEC 60376	State
	Leakage rate of SF_6 shall not exceed 0.5% per year	State
4.2.1.7	Sufficient gas shall be provided for filling the circuit breaker at installation with additional 20% for any losses	State
4.2.1.8	SF_6 gas filling accessories including regulator, male and female connectors and gate valve and any other special accessory required	Provide

Clause number	KPLC Requirements	Bidder's offer
	for gas evacuation and filling shall be provided. One set for each complete breaker	
4.2.1.9	When the circuit breaker is in closed position a rapid fall in the SF_6 gas pressure, to a level below that at which safe operation is possible shall not result in tripping the circuit breaker, but lockout of the circuit breaking preventing any electrical open or close operation	State
	Remote alarm indication to signal circuit Beaker lockout condition shall be provided.	State
4.2.1.10	Alarm stage for SF_6 leakage shall also be provided to indicate moderate fall in gas pressure	State
	In this state the circuit breaker shall be safe to operate	State
4.2.1.11	Insulation creepage distance	State
4.2.1.12	Each pole of the circuit breaker shall be equipped with a trip counter operated by the circuit breaker mechanism	State
4.2.1.13	A pole discrepancy scheme shall be implemented in the central control cubicle	State
	Pole discrepancy timer shall have adjustable time delay of at least 0 to 5 seconds	State
	Operation of the pole discrepancy will result in three phase trip & lock out of the circuit breaker. A reset will be required to be able to close the circuit breaker	State
	A visual indication will be provided to signal operation of the pole discrepancy scheme, as well as contacts for remote indication	Provide
4.2.1.14	Three galvanized column steel support structures shall be supplied with the circuit breaker, one for each pole.	Provide
	All the bolts, nuts and fasteners for connecting the circuit breaker pole onto the support structure shall be provided.	State
	All ferrous parts shall be galvanized as per ISO 1461.	
4.2.1.15	The resistance of the circuit breaker primary circuit (contact resistance) shall not exceed the values specified in IEC 62271-100	State
4.2.1.16	The circuit breaker shall be capable of 2000 mechanical operations.	
4.2.1.17	One trip coil and one closing coil shall be supplied as mandatory spares for each circuit breaker free of cost.	Provide
4.2.1.18	The spring winding motor and heaters shall have satisfactory operation at all voltages between 85% and 110% of the rated voltage	State
	They shall be protected by MCB and motor tested as per IEC 60034.	State

Clause number	KPLC Requirements	Bidder's offer
4.2.1.19	The circuit breaker shall be required to switch shunt reactors and rated current shall be taken as per IEC 62271-306	State
4.2.1.20	The circuit breaker shall have dielectric strength to handle both nominal and the over voltages across its terminals arising from current chopping phenomenal while switching the small inductive currents of the reactor.	State
	Type test documentation to demonstrate that circuit breakers have been type tested for inductive load switching in accordance to IEC 62771-110 shall be provided.	Provide
4.2.1.21	Controlled switching device CSD shall be supplied together with the circuit breaker to extend closing or opening commands at optimum time instant on voltage or current waveform to eliminate harmful TRV which may damage interrupters and nearby connected equipment.	State
4.2.1.22	Circuit Breaker offered would be of Sulphur hexafluoride type and of class C2-M2 as per IEC and of live tank type of proven design.	State
4.2.1.23	The circuit breaker control schematics shall be finalized in such away, that it may operate with or without CSD by using a suitable selector switch.	State
4.2.1.24	Circuit breaker shall be able to switch in and out the shunt reactor of 245kV, 15MVAR, Reactance of 3312.77Ω and zero sequence impedance of 3313.35Ω.	State
4.2.1.25	Laboratory test reports of Circuit Breaker current chopping capability as per IEC 62271-306 shall be submitted with the bid for evaluation.	Provide
4.2.2	Operating Mechanism	
4.2.2.1	Suitable for mounting at the circuit breaker supporting structure, and below the circuit breaker in a weather-proof, dust-proof, vermin-proof and well ventilated housing	State
	Degree of protection shall be at least IP 54 as per IEC 60529	State
4.2.2.2	Shall open and close the circuit breaker within the specified opening and closing time of the circuit breaker. opening times will be ≤ 50ms and the closing time will be ≤ 100ms	State
4.2.2.3	Operating mechanism shall after charging, carry out an Open-Close-Open (O-0.3s-CO) sequence with no external power supply to the operating mechanism	State
4.2.2.4	After a closing operation CB shall always be able to trip immediately without intentional time delay	State

Clause number	KPLC Requirements	Bidder's offer
4.2.2.5	Operating mechanism shall be trip free during the entire closing sequence	State
4.2.2.6	Operating mechanism shall be provided with motor wound spring actuated mechanism with provision for hand charge	Provide
4.2.2.7	Spring operated mechanism	
4.2.2.7.1	Spring operated mechanism shall be complete with motor as per manufacturer practice	State
	Opening spring and closing spring with limit switch for automatic charging and other necessary accessories to make the mechanism a complete operating unit shall be provided.	State
4.2.2.7.2	As long as power is available to the motor, a continuous sequence of closing and opening operations shall be possible	State
	Motor shall have adequate thermal rating for this duty.	State
4.2.2.7.3	After failure of power supply to the motor one close open operation shall be possible with the energy contained in the operating mechanism.	State
4.2.2.7.4	Breaker operation shall be independent of the motor which shall be used solely for compressing the closing spring..	State
	Facility for manual charging of the closing spring shall also be provided	Provide
	Motor rating shall be such that it requires not more than 30 seconds for full charging of the closing spring.	State
4.2.2.7.5	Closing action of circuit breaker shall compress the opening spring ready for tripping.	State
4.2.2.7.6	When closing springs are discharged after closing the breaker, closing springs shall be automatically charged for the next operation and an indication of this shall be provided in the local and remote control panels.	State
4.2.2.7.7	Separate MCBs shall be provided for each spring charging motor	State
	Rating of MCBs shall be suitably selected to match the starting, running and stalling time.	State
4.2.2.7.8	Spring charging failure alarm shall be provided	State
	Time delay having setting range from 0-1minutes.	State
4.2.2.7.9	Motor operating voltage shall be 110 Volts d.c.	State
	Overload relay shall be provided for the protection of the motor	Provide

Clause number	KPLC Requirements	Bidder's offer
4.2.2.8	Operating mechanism shall be at ground potential, and shall house the secondary wiring for interface of the circuit breaker with the networks control and protection system	State
4.2.2.9	At least fifteen normally closed and fifteen normally open spare potential free contacts provided wired to a terminal block in the housing	Provide
4.2.2.10	Minimum of ten (10) spare terminals shall be provided	Provide
4.2.2.11	circuit breaker shall be provided Local/Remote selector switch	Provide
	Selection of local operation shall inhibit the operation of the circuit breaker from any remote source	State
	Spare contact for Local selection and Remote selection shall be provided on the switch for Remote Indications	Provide
4.2.2.12	Local switch for Open/Neutral/Close Operation	Provide
	Position for Open, Neutral and close positions shall be clearly indicated on the switch.	State
4.2.2.13	Mechanically operated indication to show the status of the circuit breaker position (open/close and springs charged/discharged) shall be provided	Provide
	"ON" or "I", shall be used for CB closed status and "OFF" or "O" for CB open status	State
4.2.2.14	Suitable terminals for connecting clamps for up to 3" outside diameter copper tubes	Provide
4.2.2.15	Means to prevent contact pumping while the closing circuit remains energized, should the circuit breaker either fail to latch or be tripped during closing due to operation of the protective relays	Provide
4.2.2.16	Duplicate trip coils and duplicate closing coils to facilitate duplication of protection tripping, where required	Provide
4.2.2.17	Separate operating mechanism for each pole, to allow circuit breaker single pole trip and automatic re-closure by protection & control scheme	Provide
4.2.2.18	Circuit breaker pole mechanism provided with mechanical open/close operating links for circuit breaker pole maintenance	Provide
	Clear warning notice should be provided next to the mechanical links, against operating the mechanical links when the SF6 gas pressure is outside the safe operating levels	Provide
4.2.2.19	Central control cabinet will be separate and independent from the circuit breaker mechanism boxes	Provide

Clause number	KPLC Requirements	Bidder's offer
	All cabling to the circuit breaker mechanism boxes and to the protection and control cubicles shall be terminated at the Central Control Cubicle.	State
	It shall have local/remote switch, open and close push buttons for local operation of the circuit breaker, Close and open CB status indication, spring charge indication, sf6 gas low alarm indication and sf6 gas low lockout indication.	State
4.2.2.20	Anti-condensation heater of adequate design with suitable hygrostat and temperature controls shall be provided in the circuit breaker mechanism operating boxes and also in the central control cabinet	Provide
	The anti-condensation heater shall be adequately rated and located in a position that ensure safety of personnel and effectiveness in keeping the whole cubicle dry to prevent condensation	State
	It shall not cause deterioration in the wiring or in operation of the components.	State
4.2.2.21	Cable plate shall be provided at the bottom of the circuit breaker mechanism Box and Central Control Cubicle	Provide
	Cable plates shall be factory drilled, but blocked with removable stoppers, easily knocked off at site	State
4.2.2.22	Central control cubicle shall have a door operated LED lighting	Provide
4.2.2.23	Each mechanism box as well as the central control cubicle shall be fitted with suitable lifting lugs	Provide
4.2.2.24	Letters R, Y & B in indelible marking to identify the phases readily visible from the ground	Provide
4.2.2.25	230±10%V AC socket outlet with three square terminals (Live, Neutral & Ground) as per BS 1363 standard inside the central controlled cabinet	Provide
	The 230±10%V AC Outlet will be controlled by an embedded ON/OFF switch.	State
4.2.2.26	IP degree for terminal blocks inside the operating mechanism box and in the Central Control Cabinet.	State
4.2.2.27	Wiring of the Mechanism Box and the central Control Cubicle shall be done in 2.5 mm^2 stranded and flexible copper conductors	State
	All wiring connections to the terminal Block will be lugged and labelled using ferrules	State
	The terminal blocks shall be indelibly marked with numbers.	State
4.2.2.28	Painting of the mechanism boxes and the central control cubicles shall be such that the paint work shall not wear due to weather conditions and ultra violet radiation during the duration of service	State

Clause number	KPLC Requirements	Bidder's offer
4.2.2.29	Closing coil shall operate correctly at all values of voltage between 85% and 110% of the rated voltage	
	Trip coils shall operate correctly under all operating conditions of circuit breaker up to the rated breaking capacity of the circuit breaker and at all values of supply voltage between 70% and 110% of rated voltage.	
4.2.2.30	The trip coils shall be wired such that the contacts for wiring of pre and post close trip circuit supervision shall be readily available for at the terminal blocks.	
4.2.2.31	The breaker shall normally be operated by remote electrical control. Electrical tripping shall be performed by shunt trip coils but through local/remote switch	
	Protection trip wiring for coil 1 and 2 shall be done upto the terminal blocks without going through the local/remote switch.	
4.2.3	Ratings	
4.2.3.1	Rated Voltage, kV	State
	Frequency, Hz	State
	Normal Current, A	State
	Rated short circuit current, kA	State
	Duration of short circuit	State
	Rated short circuit making current	State
	First pole to clear factor	State
	Operating sequence	State
	Auxiliary D.C Voltage for closing & tripping coils	State
	Auxiliary A.C Voltage	State
	Lightning Impulse withstand voltage	State
	One minute power frequency withstand voltage	State
	Creepage distance of insulator	State
	Minimum clearance between phases	State
	Minimum clearance to earth	State
	Temperature Class of Circuit Breaker	State
4.3	CONTROLLED SWITCHING DEVICE	
4.3.1	Time resolution should be 0.1ms or better with ideally a maximum deviation of ±1ms or less to ensure precise point on wave execution.	State
4.3.2	Shall provide adaptive compensation, automatically adjusting for variations in circuit breaker closing/opening times caused by ambient temperature, DC control voltage and operating mechanism condition	State

Clause number	KPLC Requirements	Bidder's offer
4.3.3	Suitable for 1A current input from CTs and 110V (ph-ph) from VTs/CVTs	State
	Shall have sufficient potential free contacts for monitoring and signaling.	State
	It shall withstand transient and dynamic state values of the currents and voltages from secondary of CTs and CVTs.	State
4.3.4	Shall be designed for independent pole operation (IPO) manage each phase of reactor CB specifically	State
4.3.5	Shall include self-diagnostic facilities, alarm signaling and ability to store and download switching data/waveforms (COMTRADE format)	State
4.3.6	Shall be compatible with modern substation automation system especially IEC 61850 to ensure smooth integration into substation automation system.	State
4.3.7	The CSD shall be PC compatible its software shall be window based and shall be provided complete with licenses for parameter settings and switching performance analysis.	State
4.3.8	Facility to bypass CSD via BCU/SCADA or any other means like selector switch shall be provided. This shall ensure smooth operation of the CB with CSD faulty.	State
4.3.9	The CSD shall ensure optimized control closing to eliminate high inrush currents and voltage transients. Opening strategy targeted for maximum arc extinction at specific voltage points to minimize re-strike.	State
4.3.10	The CSD shall continuously monitor voltage signals to detect zero crossings to calculate the optimal operating points.	State
4.3.11	The CSD shall have display facility to display settings and measured values.	
4.3.12	The CSD shall have functions for switching ON and OFF the circuit Breakers.	
4.3.13	The CSD operating voltage shall be 110V DC.	
5	TEST REQUIREMENTS	
	Test standard	State
6	MARKING AND PACKING	
6.1	Details marked indelibly and legibly on nameplate	specify
	Nameplate and their fixings shall be weatherproof and corrosion proof.	State
6.2	Packing	

Clause number	KPLC Requirements	Bidder's offer
6.2.1	Shall be packaged for outdoor storage in tropical conditions defined in clause 4.1	State
6.2.2	Set of five (5) Original Hard Cover Installation, Operation and Maintenance Manuals for the circuit breakers shall be supplied with each complete breaker.	Provide
6.2.3	Recommendations for use, care, storage and routine inspection/testing procedures, all in English language shall be submitted.	Submit
6.3	MANUFACTURER'S EXPERIENCE AND CAPACITY	
6.3.1	Minimum of 25 years' experience in the manufacture of 245kV SF_6 circuit Breakers with single pole operating mechanism	State
6.3.2	Circuit breaker on offer have been in service and given reliable service for a minimum period of 8 years in at least two (2) power utilities in at least three (3) of the following continents/regions: i) Europe ii) North America iii) Africa iv) Asia or South America	Attach references
6.3.3	Circuit breakers failed in service or mal-operated while in service on the Kenyan power system	State
6.3.4	5 years warranty	State
A	Tests and Inspection	
A.1	Responsibility of the supplier to test or to have all the relevant tests performed	State
A.2	Copies of type test reports submitted for evaluation	list
A.3	Tests to be witnessed by KPLC Engineers at the factory	list
A.4	Manufacturer shall conduct Virtual Training on Installation, Testing and Maintenance of the Circuit Breaker to Ten (10) Kenya Power Engineers & Technicians. Maintenance shall cover both the operating mechanism and the interruption chamber.	State
	Training on the configuration and testing of the reactor Circuit Breaker Switching Device shall be conducted during the FAT.	
A.5	Inspection at the stores and replacement of rejected items	State compliance
B	Quality Management System	
B.1	Quality Assurance Plan	Attach
B.2	Copy of ISO 9001:2015 Certificate	Attach
C	Documentation	
C.1	Documents submitted with tender for evaluation	List

Clause number	KPLC Requirements	Bidder's offer
C.2	Documents submitted for approval before manufacture	List
C.3	Statement of compliance to specification (indicate deviations if any & supporting documents)	State compliance

NOTE:

Bidders shall give full details of the item(s) on offer as per the specification and applicable standards. The details provided shall conform to the test reports and their certificates, as well as labeled drawings complete with dimensions, catalogues and/or brochures for the purpose of tender evaluation.

2) Bidders should note that the above Guaranteed Technical Particulars Schedules must be fully completed and submitted with the bid. Wherever there is conflict between the GTPs and the clauses in the specification, the clauses in the specification take precedence. Failure to complete the schedules shall lead to rejection of the bid.

3) Guaranteed values shall be specified.

** Words like 'agreed', 'confirmed', 'As per KPLC specifications', Yes, etc. shall not be accepted and shall be considered non-responsive.*

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Manufacturer's Name, Signature, Stamp and Date