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0.1 Circulation List

COPY NO.	COPY HOLDER
1	Supplies Manager
2	Stores & Stock Control Manager
3	Technical Services Manager
4	Research & Development Manager
5	Assistant Manager, Technical Audit

0.2 Amendment Record

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)

FOREWORD

This specification has been prepared by the Research and Development and Technical Services Departments of The Kenya Power and Lighting Company Limited (KPLC) and it lays down requirements for 220kV Circuit Breakers. It is intended for use by KPLC in purchasing the equipment.

It shall be the responsibility of the manufacturer to ensure adequacy of the design and good engineering practice in the manufacture of the Circuit Breakers for KPLC. The manufacturer shall submit information which confirms satisfactory service experience with products which fall within the scope of this specification.

1. SCOPE

1.1 This specification is for outdoor 220kV circuit breaker complete with controls and ancillary equipment.

1.2 This specification is for the following circuit breakers:

(i) Triple pole operated circuit breaker

(ii) Single pole operated circuit breaker

2. REFERENCE STANDARDS

The following documents were referred to during the preparation of this specification; in case of conflict, the requirements of this specification shall take precedence.

IEC 62272-100: High Voltage Switchgear and Controlgear - Part 100: High Voltage Alternating Current Circuit Breakers.

IEC 60376: Specification and acceptance of new sulphur hexafluoride.

3. TERMS AND DEFINITIONS

For the purpose of this specification the definitions given in the reference standards shall apply.

4. REQUIREMENTS

4.1 SERVICE CONDITIONS

4.1.1 The Circuit Breakers shall be suitable for continuous operation outdoors in tropical areas at altitudes of up to 2200m above sea level, humidity of up to 90%, average ambient temperature of +30°C with a minimum of -1°C and a maximum of +40°C and heavy saline conditions along the coast.

4.1.2 The circuit breaker shall be connected to an overhead system which is generally earthed i.e with a continuous aerial earth wire.

4.2. DESIGN AND CONSTRUCTION

4.2.1. The circuit breakers shall be single pole or three pole operated, out-door type, SF_6 gas insulated and shall comply with the requirements of IEC 62271-100.

4.2.2. The circuit breaker shall be live tank type.

4.2.3. For three pole operated Circuit Breaker, all the three poles shall be interconnected by a suitable shaft, linked to the operating mechanism so that poles are operated simultaneously with a common gas pressure monitor.

All the three poles of circuit breakers shall be operated simultaneously by local electrical and remote/electrical controls. For Single pole operated Circuit Breakers, means shall be provided at the local marshalling kiosk for Open/Close operation of the individual pole and for Simultaneous close/open Operation of all poles as desired.

4.2.4. The circuit breaker shall have SF_6 gas for electrical interrupting medium.

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.

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

Gas filling equipment suitable for use at site shall be provided.

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. A remote alarm indication to signal this condition shall be provided.

Each pole of the Circuit Breaker shall be fitted with an SF_6 gas Pressure gauge with alarm and Blocking Contacts. The Pressure gauge shall be visible from the ground.

The gauge shall be scaled to indicate the safe working SF_6 pressure for the prevailing ambient temperature.

4.2.5. Insulation creepage distance shall not be less than 25mm per kV of rated voltage between phases.

4.2.6. The Circuit Breaker shall be provided complete with mounting steel structures hot dip galvanized to suit the service conditions.

4.3. OPERATING MECHANISM

4.3.1. The operating mechanism shall be suitable for mounting at the circuit breaker supporting structure, and below the circuit beaker 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.

4.3.2. Operating duty shall be standard and operating mechanism shall be trip free during the entire closing sequence.

4.3.3. Operating mechanism shall be provided with motor wound spring.

Motor operating voltage shall be 110 Volts d.c.

4.3.4. A set of at least ten normally closed and ten 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.

4.3.5. A minimum of twenty (20) spare terminals shall be provided for connection to the current and voltage transformers. The Terminal blocks shall be labelled and all terminals fitted with durable Numbers.

4.3.6. The circuit breaker shall be provided with Local/Off/Remote selector switch. The selection of local operation shall inhibit the operation of the circuit breaker from any remote source.

4.3.7. The circuit breaker shall be provided with a local control switch for Open/Neutral/Close Operation. Alternatively suitably labeled Push buttons for Open/Close operation shall be provided.

4.3.8. Mechanically operated indication to show the status of the circuit breaker operations (open/close and springs charged/discharged) shall be provided.

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

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

4.3.11 Mechanical interlock key (Castel key) arrangement shall be provided on the mechanism such that it will not be possible to withdraw the interlock key with circuit breaker in closed position.

4.3.12 Circuit breaker shall be provided with duplicate trip coils in order to facilitate duplication of protection tripping.

4.3.13 The circuit breaker shall have separate operating mechanism for each pole.

4.3.14 The Circuit Breaker shall be provided with mechanical open /close operating links. A warning should be provided next to the mechanical links, against operating the mechanical links when the SF_6 gas pressure is outside the safe levels.

4.3.15 An anti-condensation heater with suitable controls shall be provided for the circuit breaker mechanism box and for the marshalling kiosk.

4.3.16 A cable plate shall be provided at the bottom of the circuit breaker mechanism box and also at the bottom of the marshalling kiosk. The cable plates shall be factory drilled, but blocked with removable stoppers to retain the IP54 enclosure protection class. The stoppers shall be easily knocked-off at site.

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

4.3.18 Each mechanism box shall have a door operated lighting bulb at the front and at the rear on the mechanism. Also each mechanism box shall be fitted with lifting lugs for ease of assembly of the circuit breaker.

4.3.19 The three mechanism boxes shall be fitted with the letters R, Y, B visible from the ground to identify the phases.

4.3.20 The marshalling Kiosks shall be fitted with a 240V AC socket outlet with square terminals as per BS standard.

4.1 RATINGS

The Circuit Breakers shall be of the following ratings:

Nominal Voltage	220 kV
Highest Voltage	245 kV
Frequency	50 Hz
Normal current	2000 Amps
Rated short circuit current	40 kA
Duration of short circuit	3 Sec.
Rated short circuit making current	80 kA
First pole to clear factor	1.5
Operating sequence	0-0.3 sec – CO – 3 min - CO
Auxiliary D.C Voltage for closing & tripping coils and spring charging motor	110 V d.c.
Auxiliary A.C Voltage	415/240 V, 50 Hz
Impulse withstand voltage	1050 kV (peak value)
One minute power frequency withstand voltage	460 kV (r.m.s. value)
Minimum Creepage distance of insulator	6125 mm (245kV x 25mm/kV)
Minimum clearance between phases	3100mm
Minimum clearance to earth	1955mm
Temperature class of the circuit breaker	-25°C to +50°C

5. TESTS AND INSPECTION

5.1 Type and Routine Tests shall be done in accordance with the requirements of IEC 62271-100 and this specification. It shall be the responsibility of the manufacturer to perform or to have performed all the tests specified.

5.2 Certified true copies of previous Type Test Reports by the relevant International or National Testing/Standards Authority of the country of manufacture (or ISO/IEC 17025 accredited laboratory) shall be submitted with the offer for technical evaluation of the bid (all in English Language). A copy of accreditation certificate for the laboratory shall also be submitted.

The copies of Type Test Reports to be submitted shall, as a minimum, include the following tests in accordance with IEC 62271-100:

a) Dielectric 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

5.3 Routine test reports for the circuit breakers to be supplied shall be submitted to KPLC for approval before shipment/delivery of the goods. KPLC intends to send two engineers to witness the following routine tests at the factory before shipment:

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

6. MARKING, LABELLING AND INSTRUCTIONS

6.1 The nameplates of the circuit breaker and its operating devices shall be marked in accordance with clause 5.10 of IEC 62271-100.

All markings shall be permanent.

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

6.3 One set of the Original Hard Cover Installation, Operation and Maintenance Manuals including drawings for the mechanism and for the electrical control, indications e.t.c, shall be submitted with the bid for technical evaluation.

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ANNEX A: TECHNICAL PARTICULARS

The Manufacturer shall complete the table below and submit it together with copies of catalogues, brochures, technical data, drawings and test reports for tender evaluation:

Table A1: Technical Particulars

	DESCRIPTION	BIDDER TO ENTER DETAILS
1	Manufacturer's name and address	
2	Type reference number/model of circuit breaker offered	
3	Operating temperature, humidity and altitude	
4	Applicable Standard(s)	
5	Nominal voltage	
6	Highest voltage for equipment	
7	Rated frequency	
8	Rated normal current	
9	Rated short circuit current	
10	Duration of short circuit	
11	Rated short circuit making current	
12	First pole to clear factor	
13	Operating sequence	
14	Auxiliary D.C Voltage for closing & tripping coils and spring charging motor	
15	Auxiliary A.C Voltage	
16	Impulse withstand voltage (peak value)	
17	One minute power frequency withstand voltage rms	
18	Creepage distance of insulator	
19	Minimum clearance between phases	
20	Minimum clearance to earth	
21	Rated filling pressure for operation and interruption	
21	List of copies of type test reports submitted	
22	Name and address of International or National Testing/Standards Authority or ISO/IEC 17025 accredited laboratory where type tests were carried out (including copy of accreditation certificate)	
22	List of routine tests to be witnessed at the factory	
24	Experience in the Manufacture of Circuit Breakers (Yrs)	
25	Experience in Manufacture of the Circuit Breaker	

	Type/Model offered (Yrs)	
26	Attach List of Export sales outside the country of manufacture for the Type/Model offered	

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Manufacturer's Name, Signature, Stamp and Date

Switchgear