



The Kenya Power & Lighting  
Co. Ltd.

TITLE:

**SPECIFICATION FOR  
220kV DISCONNECTOR**

Doc. No.

KPLC1/3CB/TSP/11/108

Issue No.

1

Revision No.

0

Date of Issue

2009-10-08

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Authorized by: Head of Department , R & D

Signed:

*[Signature]*

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*[Signature]*

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### 0.1 Circulation List

COPY NO.	COPY HOLDER
1	Research & Development Manager
2	Procurement Manager
3	Stores & Transport Manager
4	Transmission Manager
5	Technical Services Manager
6	Deputy Manager, Technical Audit

### 0.2 Amendment Record

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## FOREWORD

This specification has been prepared by the Research and Development Department in collaboration with the Technical Services and Transmission Departments all of the Kenya Power & Lighting Company Ltd (KPLC) and it lays down requirements for 220kV Disconnecter. The specification is intended for use by KPLC in purchasing the equipment.

The manufacturer shall submit information which demonstrates satisfactory service experience with products which fall within the scope of this specification.

### 1. SCOPE

This specification is for newly manufactured outdoor 220kV, 1600 Amps, 50Hz Disconnecter (Isolator) for use on line disconnection and isolation of substation equipment. The specification covers both the 220 kV isolator with and without earth switch.

The specification also covers inspection and test of the Disconnecter as well as schedule of Guaranteed Technical Particulars to be filled, signed by the manufacturer and submitted for tender evaluation.

The specification stipulates the minimum requirements for 220kV Disconnecter acceptable for use in the company and it shall be the responsibility of the Manufacturer to ensure adequacy of the design, good workmanship and good engineering practice in the manufacture of the Disconnecter for KPLC.

The specification does not purport to include all the necessary provisions of a contract.

### 2. REFERENCES

The following standards contain provisions which, through reference in this text constitute provisions of this specification. Unless otherwise stated, the latest editions (including amendments) apply.

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

IEC 62271-102: High Voltage Switchgear and Controlgear Part 102: Alternating Current Disconnectors and Earthing Switches.

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

### 3. TERMS AND DEFINITIONS

The terms and definitions given in the reference standards shall apply.

### 4. REQUIREMENTS

#### 4.1 Service Conditions

The disconnecter shall be suitable for continuous outdoor operation in tropical areas with the following conditions.

- (a) Altitude: Up to 2200 metres above sea level.
- (b) Temperature: average of +30°C with a minimum of -1°C and max +40 °C
- (c) Humidity: up to 95%,
- (d) Pollution: Design pollution level to be taken as "Very Heavy" (Pollution level IV) according to IEC 815 (31mm/kV)
- (e) Isokeraunic level: 180 thunderstorm days per year
- (f) EMC Class (IEC 61000): Industrial environments
- (g) Seismic coefficient: 0.16.
- (h) Wind pressure on project area of conductors & cylindrical objects: 383-430N/m<sup>2</sup>
- (i) Max wind pressure on steel members on 1.5 times projected area: 820N/m<sup>2</sup>
- (j) Rainfall conditions- Average: 800-1700 mm/year, Maximum: 160mm in 24 hrs.

#### 4.2 General Requirements

4.2.1 The disconnecter shall be designed and manufactured to IEC 62271-102 and the requirements of this specification. The breaking medium shall be air.

4.2.2 The disconnecter shall be horizontal side opening, double side break with rotating centre post insulator type for use on a 220kV, 50 Hz, 3 - phase system.

4.2.3 The isolator shall be complete with supporting steelwork, base, phase coupling details, operating rod, unions and guides and operating mechanism.

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- 4.2.4 The isolator shall be motorised and also fitted with manual operation facility. There shall be a remote selection to allow for operation of the isolator (disconnecter) from the control room. The remote selection shall block any local electrical or manual operation.
- 4.2.5 All the three switches shall be arranged so that the phase units are mounted independently and then finally interconnected with coupling tubes so as to ensure simultaneous operation of all switches by drive rods and operating handle for both manual and motor operation.
- 4.2.6 The operating mechanism shall be fixed at the base frame, in a weather proof, vermin proof and dust proof housing. The degree of protection shall be class IP 54 as per IEC. The operating mechanism shall be provided with a universal joint to allow for a reasonable degree of out-of alignment of the operating rod.
- 4.2.7 The foundation details shall also be provided. These will include drawings made to scale and the bolts required for anchoring the structure to the plinth.
- 4.2.8 The design shall incorporate every reasonable precaution and provision for the safety of all those concerned in the operation and maintenance of the equipment keeping in view the regulatory requirements in Kenya.
- 4.2.9 All material used shall be of the best quality and of the class most suitable for working under the conditions specified and shall withstand the variations of temperatures and atmospheric conditions arising under working conditions without undue distortion or deterioration or the setting up of undue stresses in any part, and also without affecting the strength and suitability of the various parts for the work which they have to perform.

In choosing materials and their finishes, due regard shall be given to the humid tropical conditions under which the equipment will be called upon to work. The supplier shall submit details of his usual practice which have proven satisfactory and which he recommends for application to the parts of the work, which may be affected by tropical conditions. All switchgear and control cubicles shall be rodent and vermin proof.

- 4.2.10 Corresponding parts liable to be replaced shall be interchangeable.
- 4.2.11 All components, including insulators with their mountings, shall be designed so as to avoid pockets in which water can collect.
- 4.2.12 All connections and contacts shall be of ample section and surface for carrying continuously the specified currents without undue heating and fixed connections shall

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be secured by bolts or set screws of ample size, adequately locked. Lock nuts shall be used on stud connections carrying current.

- 4.2.13 Auxiliary dry contacts, five normally open and five normally closed shall be provided for electrical interlocks such that the isolator and associated 220kV circuit breaker(s) can be interlocked with each other. The isolator shall be provided with provisions to interlock with two breakers. The contacts shall be rated to continuously carry at least 10Amps at voltages up to 500V dc/ac.
- 4.2.14 All ferrous parts shall be galvanized by the hot-dip process to ISO 1461 and for all parts other than steel wires shall consist of a thickness of zinc coating equivalent to not less than 610g of zinc per square meter of surface. The zinc coating shall be smooth, clean and of uniform thickness and free from defects. The preparation of galvanizing and the galvanizing itself shall not adversely affect the mechanical properties of the coated material. The quality will be established by tests as per ISO 1461.
- 4.2.15 Each phase shall be mounted on a spiral type solid core porcelain post insulator conforming to IEC 60273, and shall be fitted with clamp connector for ACSR conductor up to 18.2 mm diameter and copper or aluminium busbar tube of up to 76mm diameter.
- 4.2.16 The isolator shall be designed such that in fully open position, it shall provide adequate electrical isolation between the contacts on all the three switches.
- 4.2.17 All current carrying parts shall be made of electrolytic high conductivity hard drawn copper with switch contacts silver plated. Five spare male and five spare female contacts shall be supplied with each disconnecter.
- 4.2.18 The earth switch shall consist of a hinged type earthing switch fixed at the base frame. The earth switch shall have the same rating as the isolator.
- 4.2.19 The isolator shall be provided with both mechanical and electrical interlocking devices between the isolator and earth switch so that during operations, it is only possible to operate the earth switch with the isolator in the open position and the isolator with the earth switches in the open position.
- 4.2.20 Ten normally open and ten normally closed auxiliary contacts shall be provided on the switch for future use.
- 4.2.21 Five normally open and five normally closed auxiliary contacts shall be provided on the earth switch for future use.

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- 4.2.22 The disconnecter and earth switch shall be provided with a padlocking facility such that the mechanism can be locked in OPEN or CLOSED position.
- 4.2.23 Occurrence of corona shall be prevented by using proper shape of parts and anti corona shield rings shall be provided on the disconnectors.
- 4.2.24 The design of the disconnecter and earth switch shall be such that the operating mechanism of the disconnecter and the operating handle of the earth switch shall be located at opposite ends of the mounting structure.
- 4.2.25 Both the disconnecter and the earth switch shall have an earthing point for connection to the earthing Grid and clearly visible closed and open status indicators.
- 4.2.26 The disconnecter is to be installed in limited space and must fit in and allow all the necessary clearances between phases and to the already existing gantry above the isolator/disconnector. A general arrangement drawing will be provided by KPLC as a guide to the space available to fit in the disconnecter.

#### 4.3 Ratings

The ratings of the disconnecter, including its operating devices and auxiliary equipments shall be as indicated below.

Nominal Voltage and frequency		220 kV, 50Hz
Highest Voltage		245 kV
Normal current		1600 Amps
Rated short circuit withstand current & time		31.5 kA, 3s
Rated short circuit making current		80 kA
Auxiliary A.C Voltage		415/240 V, 50 Hz
Lightning impulse withstand voltage	With contacts closed	1050 kV peak
	Across open contacts	1200kV peak
One minute power frequency withstand voltage	With contacts closed	460 kV r.m.s.
	Across open contacts	530kV
Creepage distance of insulator (31mm/kV)		7595 mm
Minimum clearance between phases		3100mm
Minimum clearance to earth		1955mm

#### 4.4. QUALITY MANAGEMENT SYSTEM

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4.4.1 The supplier shall submit a quality assurance programme (QAP) that will be used to ensure that the disconnecter design, material, workmanship, tests, service capability, maintenance and documentation, will fulfil the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfil the requirements of ISO 9001:2008.

4.4.2 The Manufacturer's Declaration of Conformity to reference standards and copies of quality management certifications including copy of valid ISO 9001: 2008 certificate shall be submitted with the tender for evaluation.

## 5. TESTS AND INSPECTION

5.1 The Disconnecter shall be inspected and tested in accordance with the requirements of IEC 62271-102 and this specification. It shall be the responsibility of the manufacturer to perform or to have performed all the tests specified. Tenderers shall confirm the manufacturer's capabilities in this regard when submitting tenders. Any limitations shall be clearly specified.

5.2 Copies of previous Type Test Certificates and Type Test Reports issued by the relevant International or National Testing/ Standards Authority or Independent and ISO/IEC 17025 accredited testing laboratory shall be submitted with the offer for evaluation (all in English Language). A copy of the accreditation certificate for the laboratory shall also be submitted. Any translations of certificates and test reports into English language shall be signed and stamped by the Testing Authority.

Copies of type test certificates and type test reports to IEC 62271-102 for the disconnecter offered to be submitted for tender evaluation shall include:

- Dielectric tests (Lightning Impulse and Power Frequency Withstand Tests),
- Short time withstand and peak withstand current tests,
- Temperature rise test,
- Measurement of the resistance of circuits,
- Verification of the protection,
- Tightness tests,
- Electromagnetic compatibility tests,
- Test to prove the short circuit making performance of earthing switches,
- Operation and mechanical endurance tests,
- Operation at the temperature limits.

5.3 The disconnecter shall be subject to acceptance tests at the manufacturer's works before dispatch. Acceptance tests shall be witnessed by two Engineers appointed by The Kenya Power and Lighting Company Limited (KPLC) and shall include the following Routine Tests to IEC 62271-102:

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- Dielectric test on main circuit,
- Dielectric test on auxiliary and control circuits,
- Measurement of the resistance of the main circuit,
- Tightness test,
- Design and visual checks and
- Mechanical operating tests.

**5.4 Testing Facility**

The bidder shall provide current e-mail address, fax and telephone numbers and contact person at the International or National Standards/Testing Facility or testing laboratory of the country where the disconnecter is manufactured and tested.

5.5 Test reports for each disconnecter (including its individual components) shall be submitted to The Kenya Power and Lighting Company for approval before shipment.

5.6 On receipt of the disconnecter, KPLC will inspect it and may perform or have performed any of the relevant tests in order to verify compliance with the specification. The manufacturer shall replace/rectify without charge to KPLC, equipment which upon examination, test or use fail to meet any or all of the requirements in the specification.

**6. MARKING, LABELLING AND PACKING**

6.1 The disconnecter and associated components shall be packed in a manner as to protect it from any damage in transportation and handling.

6.2 Each assembly and package of items associated with the disconnecter shall be suitably marked for ease of identification.

6.3 In addition to markings and labels required elsewhere in the specification, each equipment and component shall be marked in accordance with the relevant IEC standard. Each disconnecter shall be provided with a rating plate of weatherproof material, fitted in a visible position, showing the appropriate details listed in IEC 62271-102. The entries on the plate shall be indelibly marked (either by etching, engraving or stamping).

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**Annex A**

**SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR DISCONNECTOR  
OFFERED (pls indicate units of measure)**

No.	REQUIREMENTS	GUARANTEED PARTICULARS	COMMENTS	
1.	Name of the manufacturer and country of origin			
2.	Applicable standards			
3.	Service (indoor/outdoor), altitude, temperature range, humidity, environment (pollution severity level), wind speed etc			
4.	Type	Model/Type Reference Number		
		Breaking medium		
5.	Supporting steelwork & components to be supplied			
6.	Operating mechanism			
7.	Contacts	Materials		
		Thickness of silver coating		
		Contact resistance		
		Current Density	Moving blade	
			Terminal pad	
			Contacts	
			Terminal connector	
Spare contacts (five male & five female)				
8.	Auxilliaries	Auxilliary supplies	DC	
			AC	
		No. of spare auxiliary contacts	Disconnecter	
			Earthing switch	
		Auxilliary contacts current rating		
9.	Earthing switch			
10.	Motor Rating and MCB			
11.	Level of galvanizing			
12.	Rating			
	Nominal Voltage and frequency			
	Highest System Voltage			
	Rated continuous current			
	Rated short circuit withstand current & time			
	Rated short circuit making current			
	Breaking capacity of capacitive current			

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	Rated inductive current switching capacity		
	Max temperature rise under rated voltage and current		
	Breaking capacity at rated voltage		
	Lightning impulse withstand voltage	With contacts closed	
		Across open contacts	
	One minute power frequency withstand voltage	With contacts closed	
		Across open contacts	
	Creepage distance of insulator		
	Minimum clearance between phases		
	Minimum clearance to earth		
13.	Padlocking facility in both open and closed position		
14.	Degree of protection of control box		
15.	Operation	Local (manual)	
		Local (motorized)	
		Remote (motorized)	
		Interlocking with breaker (electrical/mechanical)	
		Interlocking with earth switch (mechanical)	
		Position indication on control box	
16.	Any special assembly tools		
17.	Corona prevention		
18.	Manufacturer's Guarantee and Warranty		
19.	List catalogues, brochures, technical data, drawings submitted to support the offer.		
20.	List customer sales records submitted to support the offer.		
21.	List Type Test Certificates and Type Test Reports submitted with tender (indicate test report numbers, date, Testing Institution and contact addresses) <ul style="list-style-type: none"> <li>• Dielectric tests (Lightning Impulse and Power Frequency Withstand Tests),</li> <li>• Short time withstand and peak withstand current tests,</li> <li>• Temperature rise test,</li> <li>• Measurement of the resistance of circuits,</li> <li>• Verification of the protection,</li> <li>• Tightness tests,</li> <li>• Electromagnetic compatibility tests,</li> <li>• Test to prove the short circuit making performance of earthing switches,</li> </ul>		

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	<ul style="list-style-type: none"> <li>• Operation and mechanical endurance tests,</li> <li>• Operation at the temperature limits.</li> </ul>		
22.	List Acceptance Tests to be witnessed by KPLC Engineers at the factory		
23.	List test reports (for disconnecter and components) to be submitted to KPLC for approval before shipment		
24.	Copy of ISO 9001:2008 Certificate submitted (indicate validity)		
25.	Quality Assurance Programme		
26.	Manufacturer's Declaration of Conformity to Standards (including IEC 62271-102)		
27.	Statement of compliance to tender specifications		
28.	Guaranteed reliability and maintenance indicators: <ul style="list-style-type: none"> <li>a) reliability (MTBF)</li> <li>b) availability (A)</li> <li>c) maintainability (MTTR)</li> <li>d) service life</li> <li>e) warranty period of actuating under normal service conditions without maintenance</li> </ul>		
29.	Deviations from tender specifications and supporting data, test reports, technical documents etc.		
30.	Inspection of the disconnecter and components at KPLC stores/site.		
31.	List and details of auxiliaries, fittings and accessories included in supply.		

.....  
**Manufacturer's Name, Signature, Stamp and Date**

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