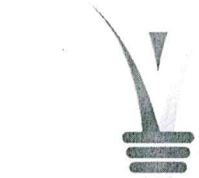
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Kenya Power

33kV VACUUM AUTORECLOSERS (POLE MOUNTED) – SPECIFICATION

A Document of the Kenya Power & Lighting Co. Ltd
September, 2017

Contents

0.1 Circulation List 3
0.2 Amendment Record 4
FOREWORD 5
1 SCOPE 6
2 APPLICABLE STANDARDS 6
3 TERMS AND DEFINITIONS 7
4 REQUIREMENTS 7
4.1 Service Conditions 7
4.2 General Requirements 7
4.3 Operating Mechanism 10
4.4 Ratings 10
4.5 Autorecloser Control Cabinet 11
4.6 Energy and Power Measurements 20
4.7 Operation 21
APPENDICES 23
APPENDIX A: TESTS AND INSPECTION (NORMATIVE) 23
APPENXIX B: FACTORY ACCEPTANCE TESTS 24
APPENDIX C: INSPECTION AT DELIVERY POINT 25
APPENDIX D: WARRANTY 25
APPENDIX E: MARKINGS AND NAME PLATE 25
APPENDIX F: MANUFACTURERS' RECOMMENDED SPARES 26
APPENDIX G: QUALIFICATION OF THE MANUFACTURER(NORMATIVE) 26
APPENDIX H: TRAINING (NORMATIVE) 27
TRAINING AT THE MANUFACTURER'S PREMISES 27
APPENDIX J: LOCAL TRAINING (IN KENYA) (NORMATIVE) 27
APPENDIX K: INSTALLATION OF TWO AUTORECLOSER UNITS (NORMATIVE) 28
APPENDIX L: DOCUMENTATION (NORMATIVE) 28
APPENDIX M: GUARANTEED TECHNICAL PARTICULARS (NORMATIVE) 30

0.1 Circulation List

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

REVISION OF KPLC STANDARDS

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.

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Issued by: Head of Section, Standards Development	Authorized by: Head of Department, Standards
Signed: 	Signed: 
Date: 2017-09-28	Date: 2017-09-28

0.2 Amendment Record

Rev No.1	Date (YYYY-MM-DD)	Description of Change	Prepared by **(Name & Signature)**	Approved by **(Name & Signature)**
Issue 1	2017-09-27	i. Clause 4.6.19. Independent VTs to provided auxiliary supply for Autoreclosers ii. New format of specifications iii. Change of title from "vacuum automatic reclosers" to "vacuum autoreclosers"	S. Nguli	Dr. Eng. Peter Kimemia

FOREWORD

This Specification has been prepared by the Standards Department in collaboration with Technical Services Department both of Kenya Power & Lighting Co. Ltd. (KPLC). It lays down requirements of 33kV Vacuum Autoreclosers (Pole Mounted). It is intended for use by Kenya Power in purchasing the equipment.

This revision of the Specification is intended to capture changes in technology that have occurred since the last review that was done in April 9, 2010. Specifically, it is intended to capture the adoption and use of independent VTs to provide auxiliary supply for Autoreclosers.

The Specification stipulates the minimum requirements for the 33kV Vacuum Autorecloser Units acceptable for use in the company and it shall be the responsibility of the supplier to ensure adequacy of the design, good engineering practice, adherence to the specification, applicable standards and regulations, as well as ensuring good workmanship in the manufacture of the units for KPLC.

It shall be the responsibility of the users of the specification for its correct application and to be knowledgeable of these standards.

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

Name	Division
Paul Mwangi	Network Management
Stephen Nguli	Standards
Bernard Rotich	Standards

1 SCOPE

This Specification is for 33kV Vacuum Autoreclosers (Pole Mounted) together with controls and auxiliary equipment for use on distribution lines to provide switching and protection of the overhead power distribution lines. The equipment shall be used on overhead distribution lines where the nominal voltage is 33kV and the highest rated voltage is 36kV.

The equipment shall be complete with control unit and all components and accessories necessary to realize the intended application.

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

2 APPLICABLE STANDARDS

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

IEC 60529:	Degree of protection offered by enclosures (IP code)
IEC 62271-100	High voltage alternating current circuit breakers
IEC 62271-111:	High-voltage switchgear and control gear. Part 111: Automatic circuit Reclosers and fault interrupters for alternating current systems.
IEC 60815: 2008	Selection and dimensioning of high voltage insulators intended for use in polluted conditions.
IEC 262217: 2012	Polymeric HV Insulators for indoor and outdoor use – general definitions, tests methods and acceptance criteria
IEC 60071: 2014	Insulation co-ordination
IEC 60060-2: 2010	High Voltage Test Technics – Part 2: Measuring systems
BS EN ISO 1461: 2009	Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and Test methods
89/336/EEC	Electromagnetic Compatibility (EMC) directive
IEC 60694	Common specifications for high-voltage switchgear and controlgear standards

3 TERMS AND DEFINITIONS

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

4 REQUIREMENTS

4.1 Service Conditions

4.1.1 The 33kV Vacuum Autoreclosers shall be suitable for continuous operation outdoors in tropical areas exposed to:

a) Altitudes of up to 2200m above sea level,

b) Average ambient temperature of +30°C with a minimum of -1°C and a maximum of +40°C, in direct sunlight,

c) Humidity: upto 95%

d) Pollution: Design pollution level to be taken as "Heavy" (Pollution level III) for inland and "Very Heavy" (Pollution level IV) for coastal applications in accordance with IEC 60815.

e) Isokeraunic levels of up to 180 thunderstorm days per year.

f) Tropical sunshine conditions

4.1.2 Average solar radiation is up to 6Kwh/m^2.

4.1.3 The level of galvanizing and painting for all ferrous parts and materials used for the Autoreclosers tank, control box and all components shall be suitable for these conditions.

4.1.4 The Autorecloser shall be connected to protect 33kV 50Hz, 3-phase overhead line with a maximum system voltage of 36kV and the neutral point is solidly connected to ground at the power transformer, i.e., an effectively earthed system. The Minimum rated short time withstand current for symmetrical fault shall be assumed to be 12.5 KA for 3 seconds.

4.2 General Requirements

4.2.1 The Autorecloser shall be out-door type, designed for three phase operation and suitable for H-pole mounting. Single pole mounting shall also be accepted. The Autorecloser shall be manufactured in accordance with IEC 62271-100

4.2.2 The Autorecloser tank (primary part) shall be made of stainless steel or aluminium alloy, suitably coated to prevent corrosion. The Coating shall be UV resistant.

4.2.3 **Insulation medium and Arc Interruption**: The Autorecloser shall have Air/Solid electrical insulation inside the Autorecloser tank and employ Vacuum interrupters for Arc interruption in accordance with IEC 62271-111

4.2.4 The breaking duty curve for the vacuum interrupter offered shall be provided with the tender bid. Remaining percentage contact wear shall be recorded in the Autorecloser Control Cabinet and accessible on the HMI screen.

4.2.5 In case the Control Cabinet is replaced, it shall be possible to program the remaining contact duty in the new control cabinet. This data shall be accurate and shall indicate when the vacuum interrupter is due for replacement.

4.2.6 The Autorecloser shall be complete with suitable and sufficiently sized brackets fitted on both sides of the Autorecloser tank for fixing of surge diverters. (Drawings and technical details shall be submitted with tender.)

4.2.7 The Autoreclosers shall be supplied complete with mounting frame/brackets for the Autorecloser Tank (primary unit) and Control Cabinet (secondary unit).

4.2.8 The mounting brackets shall be adequate and suitable to independently carry the weight of the Autorecloser tank and the Autorecloser control cabinet.

4.2.9 **Status Indication**: The Autorecloser tank shall have a mechanical status indicator for both the Open (green colour) and the Closed (Red Colour) position.

4.2.10 The status indication shall be provided on the Autorecloser Tank and be visible from the ground. The status indication label shall be either ON and OFF or IEC designated labels; I for close and O for Open. The colour for close and open shall be red and green respectively on white background.

4.2.11 The unit shall be equipped with inbuilt current transformers of appropriate ratio, which will be connected to the control so that faults on the load side or source side can be detected and the Autorecloser opened.

4.2.12 The current transformer shall be appropriately rated taking into consideration minimum continuously rated load current of 630A and minimum rated short circuit current of 12.5 kA.

4.2.13 All current carrying parts shall be made of electrolytic high conductivity copper with the contacts silver-plated.

4.2.14 **Local Mechanical Trip Facility**: Facilities shall be provided to allow the Autorecloser to be tripped manually without the need for external power supplies.

4.2.15 This shall normally be provided using a yellow pull ring mounted on the exterior of the Autorecloser tank. The Trip ring shall be designed to be operated from the ground using the normal insulated operating rod.

4.2.16 Once the manual trip has been operated, it shall not be possible to close the Autorecloser either locally or remotely by electrical means without the manual trip lever being manually reset.

4.2.17 A single bushing providing the required creepage shall be mounted on the tank for each phase. Use of an additional boot or cable tails to be connected between the bushing and the overhead line to achieve the required creepage shall not be accepted.

4.2.18 The bushings shall be either HCEP (Hydrophobic Cycloaliphatic Epoxy) or silicon rubber material. The material used must be hydrophobic to achieve satisfactory Autorecloser primary insulation performance. The materials used shall not be affected by ultra-violet radiation.

4.2.19 The minimum creepage distance for bushings shall comply with IEC 61850 standard.

4.2.20 Pollution severity category shall be "d" in accordance with IEC 60815

4.2.21 The Autorecloser shall be complete with suitable primary terminals and connecting clamps for connection of Copper or Aluminium or ACSR conductors of up to 20 mm diameter.

4.2.22 The Autorecloser HV terminals shall be shrouded to protect against interference from birds or small animals. The shrouding accessories shall be included in the tender bid.

4.2.23 **Mounting Frame**: Both the Tank and the mounting frame (bracket) shall have a ground/earth connection point to allow the tank and the mounting bracket to be connected to the pole earthing system. The mounting frame shall be galvanised as per ISO 1461.

4.2.24 A detailed drawing of the complete Autorecloser mounting arrangement shall be provided illustrating the minimum electrical clearances, phase to phase and phase to ground, and clearance to the structure.

4.2.25 **Erection Facilities**: The Autorecloser tank and the Control Cabinet shall have suitably rated lifting eyes to allow the Autorecloser and the tank to be lifted vertically in a safe manner to the mounting position.

4.2.26 The lifting shall be done using standard sling or rope. Other suitable means of safely lifting the Autorecloser and the control box shall be considered.

4.2.27 **Surge Arrester Bracket**: Bracket shall be attached to the tank next to the bushings for mounting of surge arresters both on the source side and on the load side.

4.2.28 The mounting bracket shall be used as the connection point for the surge arrester to ground.

4.2.29 The brackets shall have unpainted corrosion resistant metal connecting zone which has the capability to conduct the surge arrester current.

Note *The Autoreclosers shall be installed on round pre-stressed concrete poles with embedded integral earthing to ensure earthing is permanent and vandal proof.*

4.3 Operating Mechanism

4.3.1 The Autorecloser shall be provided with a multi-shot auto-reclosing mechanism able to undertake up to 4 trip and auto-reclose operations in one cycle.

4.3.2 This mechanism shall be a magnetic actuator for each phase and linked together for three phase operation.

4.3.3 Autorecloser Lockout link shall be provided on the Autorecloser Tank.

4.3.4 Provision of Operation counters in the Autorecloser Control Cabinet as has been specified under the Control cabinet, shall also be supplied.

4.3.5 The Control Cabinet door shall have a provision for padlocking in the closed position with Kenya Power Standard Safety Padlock

4.3.6 The degree of protection of the Control Cabinet enclosure shall be class IP65 as per IEC 60529.

4.3.7 The bidder shall indicate the number of Autorecloser tank operations to the first maintenance and provide the Autorecloser tank breaking duty curve.

4.3.8 The Autorecloser duty cycle shall be stated showing the ability of the unit to carry out four auto-reclose operations before lock out.

4.4 Ratings

Description	Requirement
System Nominal Voltage & Frequency	33kV, 50Hz
System highest operating voltage	36kV
Equipment Rated Voltage	38kV
Rated continuous current, minimum	630A
Minimum Power Frequency Withstand Voltage, rms (50Hz, 60s)	70kV
Minimum Lightening Impulse Withstand Voltage, 1.2/50µs, +ve, dry, KVp	170kVp

Description	Requirement
Minimum rated short time withstand current for symmetrical fault for 3 seconds	12.5 kA
Opening Time	< 35 ms
Closing Time	< 60 ms
Interrupting Time	< 50 ms
Rated recloser Operating Sequence	O – 0.3s – CO – 15s – CO
Minimum creepage distance of insulator (Heavy Pollution at 31kV/mm)	1116mm
Minimum clearance between phase to phase and phase to earth	435mm
Minimum number of Mechanical & Full Load Operations	10,000
Weight of the Autoreclosers	< 120 kg

Note: *The bidder shall apply altitude correction factors on the standard insulation levels indicated above to suit the service conditions given in this specification. The applied derating factor shall be stated and justified by the manufacturer, in the bid.*

4.5 Autoreclosers Control Cabinet

4.5.1 General

4.5.1.1 The Control Cabinet shall be mounted independent of the Autoreclosers.

4.5.1.2 The Control Cabinet shall be adequately sealed and dust protected and shall be internally protected to prevent moisture condensation. The degree of protection shall be suitable for this purpose and in any case not less than IP65.

4.5.1.3 Electronic modules shall perform continuous diagnostic monitoring and shall contain both software and hardware watchdog checking.

4.5.1.4 The supplier shall ensure that the equipment housed in the Control Cabinet can withstand the heating effect of direct solar radiation without causing failure and/or abnormal operation.

4.5.1.5 The Autoreclosers Tank Bushings shall be clearly marked to indicate the normal source side and the load side of the Autoreclosers, with indelible markings that will last the life time of the Autoreclosers.

4.5.1.6 Rating plate shall be provided on the Autorecloser tank and on the controller using a non-ferrous material that shall be weather and corrosion resistance. Stainless steel is preferred, with the following details, engraved, indelibly stamped or etched.

(i) Manufacturer's Name
(ii) Manufacturers type or Identification Number
(iii) Serial Number
(iv) Date of Manufacture
(v) Equipment rated Maximum Voltage
(vi) Rated Continuous current
(vii) Rated Symmetrical Interrupting Current capacity and withstand time
(viii) Rated Power frequency withstand Voltage
(ix) Rated Impulse Withstand Voltage
(x) Property of **Kenya Power & Lighting Co. Ltd.**

4.5.1.7 The name plate shall be mounted clear of live parts in a position that can be read while the Autorecloser is in service, without compromising the safety of personnel.

4.5.1.8 The Control Cabinet shall be designed for the service/climatic conditions specified and shall be adequately ventilated and fitted with substantial door securing devices capable of ensuring entry only by authorized personnel.

4.5.1.9 The Control Cabinet shall be mounted below the Autorecloser tank, on the same structure and shall be connected to the Autorecloser tank by a minimum seven-meter-long multi-core control cable.

4.5.1.10 The multi-core cable shall be stabilized against ultra-violet activity and adequately screened against electrostatic or electromagnetic interference, which may cause mal-operation of the protection or control equipment.

4.5.1.11 This cable shall connect into the Autorecloser tank and the Control Cabinet by means of plug and socket arrangements. Entry of the control cable into the Control Cabinet shall be from the bottom.

4.5.1.12 It shall be possible to disconnect the cable at the tank, while the Autorecloser is in service, without causing damage or maloperation. Also, when the cable is disconnected, the CTs shall be short-circuited. A robust, multi-plug weather proof connector shall be provided.

4.5.1.13 **Provision for cable termination:** The bottom plate of the Control Cabinet shall make provision for entry of at least two additional control cables. The cabinet shall be pre-punched with at least 21 mm and 32 mm holes. The holes shall be suitably blanked off.

4.5.1.14 The cabinet shall be fitted with an earthing stand for connection of the Autorecloser Control Cabinet to the Autorecloser installation grounding system.

4.5.1.15 **Space for Communication equipment**: The Control Cabinet shall have adequate space, inside the cabinet for mounting communication equipment such as mobile phone and modem

4.5.1.16 **Cabinet Heater:** The Control Cabinet shall be supplied complete with a heater controlled by a hygrostat with adjustable humidity and temperature settings, designed to ensure that no condensation occurs inside the cabinet.

4.5.1.17 The equipment including control and communications shall comply with EMC directive 89/336/EEC, IEC60694 and BS EN 62271

4.5.1.18 **Serial Communication Port**: The equipment shall be supplied with a serial communication port to allow connection to a laptop computer for configuration and parameter settings and download and analysis of events and faults records. The serial port shall be accessible once the cabinet door is open.

4.5.1.19 **Internal Power Socket:** An electrical socket outlet designed for operation at 230V AC shall be provided within the control cabinet. This shall be used to power laptop computer or test equipment. The socket shall be protected by a suitably rated MCB.

4.5.1.20 The Control Cabinet shall have a dust proof drainage filter

4.5.1.21 The Control Cabinet door shall have a stay to hold the door at an angle of at least 110 degrees

4.5.1.22 A drawing showing the dimensions of the Control Cabinet shall be provided with the bid

4.5.2 **Control box features**

The control box shall have the following features on its front face:

4.5.2.1 The Control Cabinet shall be a fully programmable digital (numerical) unit.

4.5.2.2 The Control Cabinet shall have a Large LCD Screen to facilitate manual programming of the protection & control unit and for viewing data such as events, fault records and measurands.

4.5.2.3 The LCD light shall dim after a settable time delay when not in use and shall be activated by pressing the appropriate keys such as panel ON/OFF switch, etc. Provision shall be made for adjustment of the brightness of the LCD screen.

4.5.2.4 **Key Pad**: This shall be used for configuring, setting and viewing the protection and control settings and for viewing the instantaneous and historical measurands, events record and fault records. All data stored in the unit shall be accessible through the keypad.

4.5.2.5 **Control/Functional Keys**: Control keys shall be provided on the front face of the control cabinet, accessible once the door is open to enable and disable various protection and control functions, as follows:

(i) Enable/block earth fault protection
(ii) Enable/block sensitive earth fault protection
(iii) Enable/block cold load (load inrush) protection
(iv) Enable/block auto reclose.
(v) Remote/Local Control selector key.

4.5.2.6 Electrical Close Push-button to manually close the Autorecloser. The status of the Autorecloser shall be shown on the same control key or via a Red LED next to the control key.

4.5.2.7 Electrical Open Push-button to manually open the Autorecloser. The status of the Autorecloser shall be shown on the same control key or via a green LED next to the control key.

4.5.2.8 **Control Cabinet Healthy Status**: This shall be indicated by a Green LED, on the Control Cabinet and by "Control Cabinet healthy status" on the LCD screen.

4.5.2.9 **Autorecloser Control Failure**: This shall be indicated by Red LED on the Control Cabinet and by "Autorecloser Control Faulty status" on the LCD Screen.

Note: If the Control Cabinet fails, then all protection functions shall be blocked from operation.

4.5.2.10 **Autorecloser Control Safety**: The Autorecloser control shall have a door on the front, which is lockable with a padlock to prevent unauthorized access to the control unit. The Standard Kenya Power Padlock will be used for this purpose.

4.5.2.11 **Communication Port**: The Autorecloser Control shall be provided with an RS232, or USB or Ethernet port, for ease of configuration and programming of settings in the unit and down loading of data from the unit via a laptop computer. Twelve (12) serial cables for connecting a laptop to the control unit shall be supplied with the Autoreclosers.

4.5.3 **Software**

4.5.3.1 **Software for Autorecloser control**: The necessary software for installation on Laptop computers to facilitate communication with the Autorecloser Control Unit for

configuration of the unit and programming protection & control settings, and for viewing, downloading and analyzing data and records (Event, Fault and Disturbance) from the Autorecloser Control Cabinet shall be provided.

4.5.3.2 Twelve (12) CDs Loaded with the latest Windows Operating System (Windows 10) and the Autorecloser software shall be supplied with the Autoreclosers. The CDs shall be clearly labelled.

4.5.3.3 The software shall provide for at least two passwords controlled user levels.

4.5.3.4 **Software manuals**: Twelve (12) software manuals describing the software installation, and application for programming the settings and configuration of the control unit as well as downloading and analysis of data shall be provided. The manual shall be detailed and clearly indicate how to carry out these activities. The documents shall be both in Hard copy and soft copy (CDs).

4.5.4 **Laptops**

4.5.4.1 Four (4) New Laptop computers loaded with windows 10 operating system and the Autorecloser software program shall be prepared for use during acceptance testing and shall be delivered together with the Autoreclosers for use by Kenya Power Engineers/Technicians in commissioning and operations and maintenance of the Autorecloser units.

4.5.4.2 **Technical Specifications for Laptop Computer**

Description	Mandatory Minimum Requirements
Processor	Intel Core i7-5500 (2.60GHz 1600MHz 3MB, 2 Cores)
RAM	8GB 1600 MHz DDR3L
Operating System	Windows 10 pro 64 bit
Optical Drive	Super-Multi DVD burner
Hard Disk	750GB 7200 rpm Hard Drive
Display Panel	15.6" FHD LED Glossy (1920x1080) with integrated Webcam 720p camera
Graphics	Intel HD Graphics 5500
Internal Audio	Integrated HD audio internal speaker(standard), ◦1 x Mic / headphone combo
Communications	56K Modem, Integrated Intel Gigabit Network Connection (10/100/1000 NIC),
Wireless	Intel 802.11ac WLAN and Bluetooth(R)

Description	Mandatory Minimum Requirements
Security	Security Lock Slot plus steel cable with a combination lock
Interfaces	Memory Stick (MS), Memory Stick Pro (MS-Pro), Multi-Media Card (MMC) compatible.1 USB 2.0 port, 2 USB 3.0 ports, 1 Ethernet port, 1 HDMI port, Bluetooth, Wi-Fi enabled.
Pointing Devices	Touchpad with scroll zone, two pick buttons or Point stick, two pick buttons
Keyboard	Standard Keyboard
Mouse	External USB Mouse
Warranty	1 Year or More Warranty
Power	4-cell 41WHr Lithium-ion Battery; External AC adapter
Power Supply	240V AC, 50 Hz, British plugs
Carrying Case	Genuine Leather Carrying Case
Manufacturer's Authorization	a) Manufacturers Authorization Certificate/ Letter and for the models quoted, the principal (Manufacturer) MUST have an established regional office in Kenya.

4.5.5 **Control Cabinet**

4.5.5.1 **Default Display on LCD**: This shall be selectable. However preferred default screen shall be instantaneous values of Current, Voltage (phase to phase and phase to ground), Total Power, Active Power, Reactive and Power Factor measurands.

4.5.5.2 **Autorecloser Lockout**: An LED shall be provided to indicate Autorecloser lockout. Also, this status shall be displayed on the LCD Screen of the Autorecloser control.

4.5.5.3 **External Trip Accessory**: This feature shall be included in the control cabinet, to enable the Autorecloser to be tripped via an external signal/command and shall be wired to the Terminal block of the Control Cabinet for external connection. This shall allow the Autorecloser to be tripped by the Transformer mechanical protection functions such as Buchholz trip.

4.5.5.4 The auxiliary DC supply to be used for the external trip input shall be selectable between 30V DC and 110V DC. Alternatively, a dry input contact can be configured to actuate the Autorecloser trip and lockout. Other alternative methods of actualizing the external trip shall also be considered provided satisfactory trip by external command is demonstrated. Receipt of external command shall cause the Autorecloser to trip and lock out

4.5.5.5 **Remote Close Accessory**: This feature shall be included in the Control Cabinet to enable the Autorecloser to be closed from a remote position and shall be wired to the terminal

block of the control Box for external connection. This feature will allow the Autorecloser close /open operations to be done through SCADA.

4.5.5.6 **Autorecloser Auxiliary Contacts**: One set each of NO and NC auxiliary contacts of the Autorecloser shall be wired to the terminal board of the control box for remote/supervisory indication of the Autorecloser open/close status.

4.5.5.7 **SCADA Facility**: This feature is required to allow remote open/close control of the Autorecloser and to monitor the status of the Autorecloser and transmit data such as measurands, fault details, events list, etc., to the control centre. The Autorecloser provided shall be ready for integration into the SCADA using standard protocol, IEC61870-4-103.

4.5.6 **Battery**

4.5.6.1 The Autorecloser control unit shall be powered by a sealed maintenance free rechargeable battery, having a minimum of 5 years' life time. The battery auxiliary AC charging supply will be from an external auxiliary supply source. The charger and the control unit shall be suited to auxiliary power supply rated at 230V AC + 12.5%, -20%, 50Hz. A higher tolerance will be most suited.

4.5.6.2 The battery shall provide control supply to operate (open/close) the Autorecloser primary unit (circuit breaker). Calculations shall be provided showing how many open/close operations a fully charged battery can perform without getting discharged. The battery hold up time shall be at least 12 hrs.

4.5.6.3 Battery low voltage alarm shall be displayed on the HMI and be provided for remote indication.

4.5.7 **LV Surge Arrestor**

4.5.7.1 An LV surge Arrester shall be supplied with each Autorecloser control unit and mounted inside the control cabinet.

4.5.7.2 This LV surge arrester will ensure that the Autorecloser control unit power supply and electronics is fully protected from auxiliary power supply surges and sustained LV overvoltage.

4.5.7.3 The technical details of the LV surge arrester and its performance shall be stated.

4.5.7.4 **Compatibility between Autorecloser Tank and Autorecloser Control Cabinet:** Any control box shall work with any Autorecloser Tank, without any limitation and achieve the declared functionality. Cases where a given control box is calibrated and programmed

to only work with a specific Autorecloser Tank to achieve the declared performance shall not be accepted.

4.5.8 Protection and Control Functions

The following Protection Functions shall be provided in the control cabinet.

4.5.8.1 Three Phase Over-Current Protection

The overcurrent function protection shall be equipped with three protection elements as follows:

4.5.8.1.1 Low set element with overcurrent setting range of 20 Amps to 1200 Primary Amps and a time multiplier setting range of at least 0.01 to 2.0.

4.5.8.1.2 A set of inverse time characteristics shall be available for selection, including, but not limited to Standard Inverse, Very Inverse, Extremely Inverse, Longtime Inverse curves as per IEC 60255 and ANSI IEEE standard.

4.5.8.1.3 Two stage high-set elements with current setting range of 20-1200 Amps primary and definite time delay setting of 0 – 120 seconds.

4.5.8.1.4 Directional element shall be freely assigned to any element so that the Autorecloser shall be able to detect and operate for faults in both the forward and the reverse directions. This will also ensure that Autoreclosers can be used to protect a distribution ring Feeder.

4.5.8.1.5 The directional feature to be separately assigned to each overcurrent protection element and shall be either: Forward, Reverse or Non-direction.

4.5.8.2 Earth Fault Protection Function

The Earth Fault protection function shall be equipped with three elements as follows:

4.5.8.2.1 Low set element with setting range of 20 Amps to 1200 Primary Amps and a time multiplier setting range of at least 0.01 to 2.0.

4.5.8.2.2 A set of inverse time characteristics shall be available for selection, including, but not limited to Standard Inverse time, Very Inverse time, Extremely Inverse time and Longtime Inverse curves as per IEC 60255 standard and ASNI IEE standards.

4.5.8.2.3 Two stage high-set elements with current setting range of 20-1200 Amps primary and definite time delay settings of 0 – 120 seconds.

4.5.8.2.4 Directional element shall be freely assigned to any element so that the Autorecloser shall be able to detect and operate for faults in both the forward and the reverse directions.

This will also ensure that Autoreclosers can be used to protection a distribution ring feeder.

4.5.8.2.5 The directional feature to be assigned to each Earth fault protection element shall be, either, Forward, Reverse or Non-direction.

Note: *For both Overcurrent and earth fault functions, provision shall be made for programming of custom made Fault current - time curves to enhance co-ordination of the unit with existing relays, Autoreclosers and fuses.*

4.5.8.3 **Sensitive Earth Fault Function**

4.5.8.3.1 Sensitive Earth Fault function shall be provided with definite time characteristic. The setting range shall cover the range 1 – 40 Amps, primary setting. Definite time delay of 0- 60 seconds shall be provided.

4.5.8.3.2 The SEF protection element shall be assigned a directional feature, of forward, reverse or non-direction.

4.5.8.3.3 The Earth Fault and the Sensitive Earth Fault functions shall be provided with harmonic restraint to prevent operation when harmonics are present in the primary residual earth fault currents.

NB: Higher/wider settings range for Amps, TMS or definite time delay for overcurrent, earth fault and/or sensitive earth fault beyond the ranges given above are acceptable.

4.5.8.4 **Cold Load Pick up Function**

4.5.8.4.1 A cold load pick up feature shall be incorporated to allow successful energization of the protected feeder following long periods of power outage, hence loss of load diversity.

4.5.8.4.2 Appropriate selectable settings range for; Cold Load Multipliers, Cold Load Recognition Time and Cold Load Time, will be provided.

4.5.8.5 **Inrush Feature**

4.5.8.5.1 An Inrush feature shall be provided to prevent feeder trip during energization and during Autorecloser auto-reclose operation due to inrush currents associated with transformers, motor start currents and others.

4.5.8.5.2 A suitable settings range shall be provided for the Inrush Restraint Multiplier and the Inrush Restraint Time.

4.5.8.6 **Auto reclose Function**

4.5.8.6.1 The Sequence of trip and auto-reclose characteristics for Overcurrent, Earth fault and SEF functions, shall be freely programmable to enable the selection of any combination of the available elements for each trip in the trip and reclose functions.

4.5.8.6.2 Only operation of the selected protection functions shall lead to successful auto reclose following each trip.

4.5.8.6.3 Auto reclose of up to four shots shall be provided and shall be initiated by any of the above protection functions which are selected to do so for each auto reclose shot.

4.5.8.6.4 The tripping curves for each stage of the auto reclose sequence shall be programmed separately for over-current and earth fault protection.

4.5.8.6.5 The dead time shall be freely programmable for each reclose sequence. Appropriate time settings range for reclaim time shall be provided.

4.5.8.6.6 Following manual close of the Autorecloser, the auto-reclose sequence shall only be enabled after expiry of the set reclaim time.

4.5.8.6.7 Following successful Autorecloser trip and auto reclose, the full reclose sequence shall be enabled after expiry of the reclaim time.

4.5.8.7 **Control unit functions/features**

4.5.8.7.1 The battery for the control box shall be rechargeable.

4.5.8.7.2 The charger circuit shall accept input from a single-phase distribution transformer rated at 230V AC, 50Hz with a tolerance of +12.5% and -20%.

4.5.8.8 **Software Functions/Features**

4.5.8.8.1 Number of trips to lock out shall be selectable from the menu.

4.5.8.8.2 Operations counters for each Phase and for Earth Fault and Sensitive Earth Fault.

4.5.8.8.3 **Fault Records logging:** with date, time, faulted phase, fault current and fault duration of the fault.

4.6 Energy and Power Measurements

4.6.1 The Autoreclosers offered shall be equipped with Instantaneous Measurands for various parameters as well as energy measurements. The following measurands shall be provided:

(i) **Instantaneous values:** rms phase current, rms phase to phase and phase to ground voltage, three phase KVA, KW, KVAR and power factor

(ii) **Maximum Demand values:** KW, KVA, I, KVAR with Date and Time stamps of occurrence.

(iii) **Energy measurements:** KWh & KVARh, Cumulative.

4.7 Operation

In addition to trip/close push buttons provided on the control unit, the control of the Autorecloser shall be enabled in the software for control through a Laptop computer or through a remote connection such as SCADA.

4.8 Events and Fault Records Lists

4.8.1 The unit shall also generate a sequence of events (time-tagged) for all operations, Auto and Manual and System status (e.g. supply failure etc.).

4.8.2 When tripping of the unit occurs, the protection function responsible for the trip, phase(s) affected, fault current magnitudes, fault duration, date and time (up to hundredth of a millisecond) of the trip, shall be displayed on the LCD screen and shall remain on the screen until reset via a reset button on the control unit.

4.8.3 These details shall also be available in the events list and in the fault records list and accessible by use of a laptop computer.

4.8.4 Events Log

Each event whether generated by manual or automatic operation of the Autorecloser control, shall have the following details:

(i) Serial no.
(ii) Date of occurrence (DD:MM: YY)
(iii) Time of occurrence, up to millisecond level and
(iv) The phase affected and the magnitude of current.

4.8.5 Auxiliary Power Supply

4.8.5.1 The auxiliary supply for the Autorecloser control shall be from a voltage transformer(VT)

4.8.5.2 The Ratio and Power rating of the power VT shall be 33kV/230 VAC, 500VA Limit output and a Minimum burden of 200 VA or other higher rating adequate to meet the auxiliary supply requirement for the Autorecloser control.

4.8.5.3 The manufacturer shall specify the AC Power burden of the Autorecloser control.

4.8.5.4 The VT will be delivered with the mounting frame. The secondary wiring of the VT shall be protected against short circuits with suitably rated fuses mounted on the VT secondary terminal box.

4.8.6 DC Voltage

4.8.6.1 Upon loss of 230V AC auxiliary supply, a battery shall power the electronics and provide supply for control of the Autorecloser for at least 8 hours.

4.8.6.2 The battery capacity shall be >25AmpHour and this shall be demonstrated during factory acceptance testing in the presence of KPLC Engineers.

4.8.6.3 The normal life of the battery shall be at least 5 years.

4.8.6.4 The supplier shall provide to KPLC a written guarantee for the batteries of at least 5 years.

4.8.6.5 Detailed manuals and drawings of the installation and control unit circuits and components shall accompany the tender (all in English Language)

4.8.7 **Technical Literature and Drawings**

4.8.7.1 Detailed manuals and catalogues with all relevant technical literature and relevant drawings required for understanding the performance and application of the whole Autorecloser unit and all that is required for correct installation of the Autorecloser and the Control Cabinet as well as configuration and protection and control parameter settings on the control cabinet, including test and commissioning of the complete Autorecloser unit, and effective performance of SAT tests, in order to correctly and safely put the Autorecloser unit into service shall be provided.

4.8.7.2 The manuals shall also provide details for operation and maintenance of the whole Autorecloser unit.

4.8.7.3 A separate specific manual for providing step by step procedure for installation, test and commission of the Autorecloser unit shall be provided.

4.8.7.4 Instructions for diagnosis and identification of faults and repair for minor faults as well as replacement procedures for failed components/units shall be well documented in the technical literature provided with the Autorecloser units.

4.8.7.5 One Complete set of the literature and drawings shall be provided with the tender bid, for purposes of tender evaluation.

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APPENDICES

APPENDIX A: TESTS AND INSPECTION (NORMATIVE)

A.1. The Autorecloser shall be tested in accordance with IEC 62271-111, IEC 60529, ANSI C37.60:2012, ISO 1461 and the requirements of this specification. It shall be the responsibility of the manufacturer to perform or to have performed all the relevant tests. Routine tests shall be carried out on every Autorecloser

A.2. **Type Tests**: Certificates of type test reports as per relevant IEC standards shall be submitted with the tender bid for purposes of tender evaluation. This shall include: -

(i) Dielectric Tests
(ii) Rated Symmetrical Interruption Test
(iii) Making currents
(iv) Partial Discharge Test
(v) Temperature rise test
(vi) Mechanical operations test
(vii) Control electronic elements surge withstand capability tests
(viii) Accelerated weathering test in accordance with IEC 62217 (on bushing insulators)
(ix) Radio Interference Voltage Test
(x) Short Time and Peak Withstand Current
(xi) Tightness Test
(xii) Dielectric Test on Auxiliary and Control Circuits

A.3. The test certificates shall be from an accredited reputable independent testing laboratory, acceptable to the purchaser. Proof of accreditation by a national/international authority shall be forwarded with the offer. Test reports shall be complete including all the pages as issued by the testing authority. Submission of only Parts of test reports shall not be acceptable.

A.4. Copies of previous type test reports by the relevant International or National Testing/Standards Authority of the country of manufacture (or ISO/IEC 17025 or ILAC accredited independent laboratory) shall be submitted with the tender for evaluation (all in English Language). A copy of accreditation certificate for the laboratory shall also be submitted.

A.5. **Routine Tests**: Certificates of routine test reports as per relevant IEC standards shall be submitted with the tender bid for purposes of tender evaluation. This shall include: -

(i) Dielectric Test on the Main circuit
(ii) Measurement of the resistance of the main circuit
(iii) Partial Discharge Test

(iv) Temperature rise test
(v) Mechanical operations test
(vi) One minute power frequency withstand test for the Autorecloser control cabinet.

A.6. The test certificates shall be from an accredited testing laboratory, acceptable to the purchaser. Proof of accreditation by a national/international authority shall be forwarded with the offer. Test reports shall be complete including all the pages as issued by the testing authority. Parts of test reports shall not be acceptable.

APPENXIX B: FACTORY ACCEPTANCE TESTS

Kenya Power shall conduct compulsory inspection of all major components and accessories at the manufacturer's factory, and thereafter post-delivery to selected sites, installation, testing, and commissioning. This testing shall include, but not be limited to, verification of controls, logic, drives, releases, failover functions, monitoring and signalling functions, etc.

B.1 Upon completion of manufacturing, the Autoreclosers shall be subject to acceptance tests at the manufacturer's works before dispatch. Acceptance tests shall be witnessed by two or more Engineers appointed by The Kenya Power and Lighting Company Limited (KPLC).

B.2 The manufacturer/supplier shall give one months' notice to Kenya Power on intended dates to conduct the Factory Acceptance Tests (FATs). The Supplier shall further provide letters of invitation to the Kenya Power Engineers nominated to attend the FATs

B.3 During FATs thirty (30%) percentage of all Autoreclosers manufactured shall be subject to the Factory Acceptance Tests in the presence of Kenya Power & Lighting Company Engineers. The Autoreclosers shall be randomly selected via their serial numbers by the KPLC Engineers who will attend the FATs. If failure of any component is witnessed during the FATs, then the number of Autorecloser to be tested during the FATs shall be increased to forty (40%) percent of the total manufactured units.

B.4 The following tests shall be conducted on all the sampled manufactured units and all the other units:

a) Dielectric Test on the Main circuit
b) Measurement of the resistance of the main circuit
c) Partial Discharge Test
d) Temperature rise test
e) Mechanical operations test

f) One minute power frequency withstand test for the Autorecloser control cabinet.

APPENDIX C: INSPECTION AT DELIVERY POINT

C.1. On receipt of the Autorecloser, KPLC will inspect them for acceptance at stores and may perform or have tests performed to verify compliance of the equipment with this specification.

C.2. The supplier shall replace/rectify without charge to KPLC, any equipment which upon examination, test or use, fail to meet any or all of the requirements in this specification.

APPENDIX D: WARRANTY

D.1. The supplier/manufacturer warrants the purchaser that all goods supplied under this contract shall have no defect arising from design, materials or workmanship.

D.2. A warranty of 24 months from the date of delivery of the Autoreclosers to Kenya Power store shall be offered by the manufacturer for the Autorecloser.

D.3 A warranty of 36 months from the date of delivery of the Autoreclosers to Kenya Power store shall be provided for the electronic cards in the Autorecloser control cabinet. Any electronic parts/modules found to have failed at commissioning or while the Autorecloser is in service or store during this warranty period shall be replaced free of charge by the manufacturer/supplier.

APPENDIX E: MARKINGS AND NAME PLATE

E.1. The Autorecloser tank bushings shall be clearly marked to indicate the normal source side and the load side of the Autorecloser, with indelible markings that will last the life time of the Autorecloser.

E.2. Rating plate shall be provided on the Autorecloser tank and on the controller using a non-ferrous material that shall be weather and corrosion resistance. Stainless steel is preferred, with the following details, engraved, indelibly stamped or etched.

(i) Manufacturer's Name
(ii) Manufacturers type or Identification Number
(iii) Serial Number
(iv) Date of Manufacture
(v) Equipment rated Maximum Voltage
(vi) Rated Continuous current
(vii) Rated Symmetrical Interrupting Current capacity and withstand time
(viii) Rated Power frequency withstand Voltage
(ix) Rated Impulse Withstand Voltage
(x) Kenya Power & Lighting Co. Ltd.

E.3. The name plate shall be mounted clear of live parts in a position that can be read while the Autorecloser is in service, without compromising the safety of personnel.

APPENDIX F: MANUFACTURERS' RECOMMENDED SPARES

F.1. The manufacturer shall provide a list of recommended spare parts to ensure that the Autoreclosers provide at least 10 years of continuous service.

F.2. The cost of the recommended spares shall be indicated separately on the bid price as an option. The cost of one unit of recommended spare(s) shall be indicated, as well as the total price. The battery shall be included in the list of recommended spares.

F.3. The purchaser shall decide whether to accept all, part or none of the offered spares.

APPENDIX G: QUALIFICATION OF THE MANUFACTURER (NORMATIVE)

G.1. The manufacturer whom shall be considered for tender award shall among other requirements outlined in the bidding fulfil the following requirements:

G.2. **Quality Assurance**: The manufacturer shall possess a valid ISO 9001: 2008 or later quality assurance certification for the manufacture of the Autoreclosers for the factory where the Autorecloser units are to be manufactured. This shall cover the duration of manufacture and delivery of the Autorecloser units. The bidder shall furnish a copy of the ISO certificate certified as a true copy of the original together with the tender bid.

G.3 **Manufacturing Experience**: The manufacturer of the Autorecloser shall have minimum of 15 years' experience in the manufacture of the Autorecloser and ten years' experience in the manufacture of Autoreclosers with solid primary insulation. The manufacturer must have sold at least 1500 Autorecloser units to overseas customers in the last 5 years. Records of overseas sales with purchaser's name, year and quantity shall be furnished with the bid, as well as the email contact and day telephone number of the purchasers.

The manufacturer shall be required to submit evidence with relevant references of design, supply, installation, testing, training, and commissioning of similar 33kV vacuum Autoreclosers.

G.4. **Letters of Customer Satisfaction:**
Letters of satisfaction from four (4) overseas customers for the particular Autorecloser offered in this tender shall be furnished with the bid. The letters of satisfaction shall bear the rubber stamp of the purchasing utilities and the name and signature of the author of the letter.

G.5. **Previous Performance:**
Autoreclosers with previous poor performance in Kenya Power shall not be considered.

APPENDIX H: TRAINING (NORMATIVE)

TRAINING AT THE MANUFACTURER'S PREMISES

H.1 During the factory acceptance testing (FAT), the manufacturer shall conduct complete training for the complete Autorecloser and the control box for KPLC Engineers/Technicians.

H.2 This shall include theory on how the equipment works followed by practical demonstrations. All the operational, protection and control features of the Tank and the control Box shall be exhaustively explained and demonstrated, including the operation of the interface software

H.3 The manufacturer shall plan adequate time for the training separate from the FATs.
The duration of the training shall however not be less than three (3) eight hour working days. The employer may send a separate team from the team witnessing the FATs to attend the training. The duration and the cost of the training shall be indicated in the bid.

H.4 The Training shall be considered to have been successful once the engineers/Technicians are able to:

(i) Competently carry out all the operations on the Autorecloser Tank and Control cabinet
(ii) Correctly install the equipment, including effective earthing of the tank and the control box
(iii) Establish communication from a laptop to the control box and carry out complete parameter settings and download and analyse data
(iv) Trouble shoot and analyze and rectify any minor breakdowns that may occur. Including safe replacement of parts/modules and recommissioning of the Autorecloser units back to service.

H.5 The manufacturer shall conduct evaluation tests and give a feedback report on the training to the employer for each of the Engineers/Technicians. The Engineers/Technicians shall receive relevant Competency/Authorisation certificates to carry out the said works.

APPENDIX J: LOCAL TRAINING (IN KENYA) (NORMATIVE)

J.1. Following the delivery of the equipment, the manufacturer shall conduct complete training for the complete Autorecloser and the control box for a total of (30) KPLC Engineers/Technicians, in Nairobi Kenya. The training shall be conducted in two sessions of 15 engineers/technicians each. Each session shall last at least one day (eight hours).

J.2. The Training shall include theory on how the equipment works followed by practical demonstrations on operation and protection and control configuration and parameter settings. All the operational, protection and control features of the Tank and the control Box shall be exhaustively explained and demonstrated, including the operation of the interface software.

Note: *Local costs for KPLC participants for travel, training venue, refreshments and meals shall be borne by KPLC.*

APPENDIX K: INSTALLATION OF TWO AUTORECLOSER UNITS (NORMATIVE)

K.1. One Autorecloser shall be installed at Kenya Power International (KPI) in Nairobi to demonstrate correct installation of the Autorecloser by the manufacturer.
One Lecturer at KPI will participate in the exercise alongside KPLC Engineers and Technicians.
The installation work shall be guided and supervised by the Manufacturer's representative who is an expert in field installation and operation of the Autorecloser.

K.2. The Training shall be considered to have been successful once the Engineers/Technicians are able to: -

(i) Competently carry out all the operations on the equipment
(ii) Correctly install the complete equipment, including effective earthing of the tank and the control box
(iii) Establish communication from a laptop to the control box and carry out complete configuration, parameter settings and download and analyze data from the control box.
(iv) Trouble shoot and analyze and rectify any minor breakdowns that may occur
(v) To ensure that the installation and commissioning of the Autoreclosers is carried out correctly, the manufacturers' Technical staff shall supervise the installation of two Autorecloser units on two selected 33kV feeders in Kenya.
(vi) This event shall be arranged to follow immediately after the local training to optimize on the resources.

APPENDIX L: DOCUMENTATION (NORMATIVE)

L.1. The bidder shall submit its tender complete with technical documents required by Appendix M (Guaranteed Technical Particulars) for tender evaluation. The technical documents to be submitted (all in English language) for tender evaluation shall include the following:

a) Guaranteed Technical Particulars signed by the manufacturer;
b) Copies of the Manufacturer's catalogues, brochures, and technical data sheets (including ratings) for 33kV Autoreclosers, the complete assembled unit and layout drawings. Mechanical drawings on the design and construction of the Autorecloser shall also be submitted;
c) Detailed drawing and step by step procedure for safe installation and correct commissioning process of the Autorecloser. This shall include the recommended maximum earthing resistance values for safe operation of the Autorecloser control and the Autorecloser tank.
d) Sales records for the last five years and at least four customer reference letters;
e) Details of manufacturing capacity and the manufacturer's experience;
f) Copies of required type test reports by a third-party testing laboratory accredited to ISO/IEC 17025;

g) Copy of accreditation certificate to ISO/IEC 17025 for the third-party testing laboratory;
h) Manufacturers letter of authorization, ISO 9001:2008 certificate and other technical documents required in the tender.

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

a) Fully filled clause by clause Guaranteed Technical Particulars (GTP) signed by the manufacturer;
b) Design drawings and technical details;
c) Quality assurance plan (QAP) that will be used to ensure that the 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 or later;
d) Detailed test program to be used during factory testing;
e) Marking details;
f) Packaging details (including packaging materials and marking and identification of batches). The Autoreclosers shall be packaged for outdoor storage in tropical conditions. The manufacturer shall state the maximum acceptable storage duration for the complete Autorecloser unit.
g) Manufacturer's undertaking to ensure adequacy of the design, good engineering practice, adherence to the specification and applicable standards and regulations as well as ensuring good workmanship in the manufacture of the Autoreclosers for The Kenya Power & Lighting Company.

L.3. The supplier shall submit recommendations for use, care, storage and routine inspection/testing procedures, all in the English Language, during delivery of the Autoreclosers to KPLC stores.

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APPENDIX M: GUARANTEED TECHNICAL PARTICULARS (NORMATIVE)

To be filled, all clauses, stamped and signed by the Manufacturer and submitted together with relevant copies of the Manufacturer's catalogues, brochures, drawings, technical data, sales records, four customer reference letters, details of manufacturing capacity, the manufacturer's experience and copies of complete type test reports for tender evaluation and for approval before manufacture, all in English Language.

Tender No. .....

CLAUSE	DESCRIPTION	KPLC'S REQUIREMENT	MANUFACTURERS/ BIDDERS' OFFER	Remarks
01	Manufacturers name and address	Bidder to state		
02	Model or Type Reference Number of Autorecloser offered	Bidder to state		
03	Applicable manufacturing standards	Bidder to state		
4.1.1-4.1.4	Operating Service conditions	Bidder to state guaranteed conditions		
4.2	**General requirements**			
4.2.1	Type of Autorecloser and mounting options	Out door and H or single pole mounting		
4.2.2	Autorecloser tank material	Stainless steel or Aluminium alloy, UV protected		
4.2.3	Arc interruption and insulation	Vacuum interruption. Solid or air insulation		
4.2.4	Breaking duty curve for the vacuum interrupter & Remaining percentage contact wear	Provide and be recorded in the Control Cabinet and accessible on the HMI		
4.2.5	Reprogramming a new Control Cabinet to work with existing Autorecloser tank	To detail the programming		
4.2.6	Brackets for fixing surge diverters	Provide		
4.2.7	Mounting brackets for Autorecloser and control cabinet	provide		
4.2.8	Adequate to carry the weight of Autorecloser and control cabinet	State		
4.2.9-	Status Indication	Mechanical indicator		

4.2.10		visible from ground		
4.2.11-4.2.12	Inbuilt current transformers and ratings	provide 630A and STC of ≥ 16 kA		
4.2.13	Material of conductive parts	electrolytic high conductivity copper with the contacts silver-plated.		
4.2.14-4.2.16	Local Mechanical trip facility.	Provide on tank with electrical and mechanical interlocks		
4.2.17-4.2.20	HV bushing, material creepage distance,	Vermin bird proof, HCEP or silicon rubber, (UV treated) EMC compatibility creepage:1116mm		
4.2.21	Primary terminal clamps	Bimetallic for ACSR conductor of Φ20mm		
4.2.24-4.2.26	Mounting brackets, lifting lugs	Provide with safety factor of 2.		
4.2.27-4.29	Surge arrestor bracket and earthing points	Provide on tank surface and clear current path		
4.3	**Operating mechanisms**			
4.3.1-4.3.2	Operating mechanisms and number of trips in a cycle	Magnetic actuator (multi-shot auto-reclosing), 4 trips and auto-reclose. (state the cycle)		
4.3.3	Autorecloser Lockout link	Provide on tank surface		
4.3.4	Operation counters	In the Autorecloser Control Cabinet		
4.3.5-4.3.6	Padlocking facility and degree of protection	Provide and IP65 as per IEC 60529.		
4.3.7-4.3.8	Number of Autorecloser tank operations to the first maintenance	Specify and provide breaking curves		
4.4	**Ratings**			
	Highest Equipment Voltage Class	Bidder to state (after altitude correction)		
	Rated Continuous Current carrying capacity	≥630A		
	Short Time Withstand Current & Time	≥12.5kA, for 3Secs		

	Control Box enclosure [IP] class of protection [attach type test certificate]	≥IP65		
	Rated power frequency withstand voltage, 50Hz 60s, wet [attach routine test report]	70kV (bidder to apply altitude correction)		
	Rated lighting impulse withstand voltage, 1.2/50µs +ve, dry [attach type test report]	170kVp (bidder to apply altitude correction)		
	Opening Time	< 35 ms		
	Closing Time	< 60 ms		
	Interrupting Time	< 50 ms		
	Minimum creepage distance of insulator (Heavy Pollution at 31kV/mm)	1116mm		
	Minimum clearance between phase to phase and phase to earth	435mm		
	Minimum number of Mechanical & Full Load Operations	10,000		
	Weight of the Autorecloser	state		
4.5	**Autorecloser Control Cabinet**			
4.5.1	**General**			
4.5.1.1-4.5.1.2	Control Cabinet mounting, sealing, and dust proof	IP 65		
4.5.1.3	Electronic modules	Perform continuous diagnostic monitoring Contain both software and hardware watchdog checking		
4.5.1.4	Withstand	Equipment can withstand the heating effect of direct solar radiation without causing failure and/or abnormal operation		
4.5.1.5	Bushings marking	To indicate normal source and load side of		

		the Autorecloser		
4.5.1.6 – 4.5.1.7	Rating plate	Material		
		Details		
		Mounting		
4.5.1.8	Control cabinet	Designed for the service/climatic conditions specified, ventilated, door securing devices		
4.5.1.9		Mounting		
4.5.1.10	Control cables	7M long multicore UV stabilized, EMC compatibility		
4.5.1.11		Connection and bottom entry		
4.5.1.12	Provision for disconnection between Autorecloser and control cabinet	Disconnection in service		
4.5.1.13	Provision of connection points for the cable on both Autorecloser and control cabinet	Pre-punched and blanked Multi-plug connection point provided on both units, 21mm & 32mm		
4.5.1.14	Earthing stud in the control cabinet.	Provide		
4.5.1.15	Space for communication equipment	Provide and state size		
4.5.1.16	Cabinet heater	Provide with hygrostat control gear		
4.5.1.17	Equipment standard	EMC directive 89/336/EEC, IEC60694 and BS EN 62271		
4.5.1.18	Serial communication port	USB(latest) or RS 232 or Ethernet		
4.5.1.19	Internal socket & MCB	Rated 230V		
4.5.1.20	Dust proof drainage filter	Provide		
4.5.1.21	Door stay	Provide		
4.5.1.22	Drawing	Provide		
4.5.2	**Control box features**			
4.5.2.1	Fully programmable digital (numerical) unit			

4.5.2.2-4.5.26	LCD Screen	Provide for data entry, retrieval and downloads		
4.5.2.3	Dimming	Settable time delay		
4.5.2.4	Key pad	Functions as per spec		
4.5.2.5	Control /Functions Keys	To detail and provide as per specification		
4.5.2.6	Electrical Close Push-button	Functions as per spec		
4.5.2.7	Electrical Open Push-button	Functions as per spec		
4.5.2.8	Control Cabinet Healthy Status	Functions as per spec		
4.5.2.9	Autoreclosers Control Failure	Functions as per spec		
4.5.2.10	Autoreclosers Control Safety	Provide as per spec		
4.5.2.11	Communication Port	Provide as per spec		
4.5.3	**Software**			
4.5.3.1	Autoreclosers control software	Windows 10 based		
4.5.3.2		Provide in 12CDs and operational manuals (all in English)		
4.5.3.3		Two passwords		
4.5.3.4		Manuals		
4.5.4	**Laptop Specification**			
4.5.4.1	Number	4		
4.5.4.2	Technical Specifications			
	Description	**Mandatory Minimum Requirements**		
	Processor	Intel Core i7-5500 (2.60GHz 1600MHz 3MB, 2 Cores)		
	RAM	8GB 1600 MHz DDR3L		
	Operating System	Windows 10 pro 64 bit		
	Optical Drive	Super-Multi DVD burner		
	Hard Disk	750GB 7200 rpm Hard Drive		
	Display Panel	15.6" FHD LED Glossy (1920x1080) with integrated Webcam 720p		

		camera		
	Graphics	Intel HD Graphics 5500		
	Internal Audio	Integrated HD audio internal speaker(standard), ◦1 x Mic / headphone combo		
	Communications	56K Modem, Integrated Intel Gigabit Network Connection (10/100/1000 NIC),		
	Wireless	Intel 802.11ac WLAN and Bluetooth(R)		
	Interfaces	Memory Stick (MS), Memory Stick Pro (MS-Pro), Multi-Media Card (MMC) compatible.1 USB 2.0 port, 2 USB 3.0 ports, 1 Ethernet port, 1 HDMI port, Bluetooth, Wi-Fi enabled.		
	Pointing Devices	Touchpad with scroll zone, two pick buttons or Point stick, two pick buttons		
	Keyboard	Standard Keyboard		
	Mouse	External USB Mouse		
	Warranty	1 Year or More Warranty		
	Power	4-cell 41WHr Lithium-ion Battery; External AC adapter		
	Power Supply	240V AC, 50 Hz, British plugs		
	Carrying Case	Genuine Leather Carrying Case		
	Manufacturer's Authorization	Manufacturers Authorization Certificate/ Letter and for the models quoted, the principal (Manufacturer) MUST have an established regional office in Kenya.		
4.5.5	**Control Cabinet**			

4.5.5.1	Default Display on LCD	To detail and provide as per specifications		
4.5.5.2	Autorecloser Lockout	To detail and provide as per specifications		
4.5.5.3	External Trip Accessory	To detail and provide as per specifications		
4.5.5.4	Auxiliary DC supply	To detail and provide as per specifications		
4.5.5.5	Remote Close Accessory	To detail and provide as per specifications		
4.5.5.6	Autorecloser Auxiliary Contacts	To detail and provide as per specifications		
4.5.5.7	SCADA Facility	To detail and provide as per specifications		
4.5.6	**Battery**			
4.5.6.1	DC Battery System	≥25AmpHour capacity, should be able to sustain a minimum of 8hrs without charging ac supplies. Battery should have a life of at least 5 years		
4.5.6.2	Calculations & hold up time	Provide		
4.5.6.3	Low voltage alarm	Provide		
	LV Surge Arrestor			
4.5.7.1-4.5.7.3	LV Surge Arrestor	Provide together with technical and performance details		
	Auxiliary Power Supply to the Control Box Nominal 240Vac, 50Hz	A VT to provide this as per clause 4.6.19.		
4.5.7.4	Compatibility Between Autorecloser Tank and Autorecloser Control Cabinet	Either Autorecloser or Control Cabinet shall be compatible (Ensure compliance to this requirement)		
4.5.8	**Protection and Control Functions**			
4.5.8.1	**Three Phase Over-Current Protection**			
4.5.8.1.1-	Relays Operating	According to IEC 60255 with at least NI, VI, EI, LTI and DT. Other types of curves like the ANSI		

4.5.8.1.5	Characteristics	curves are acceptable as additional to the IEC curves		
	Protection Functions Available	Must offer, 3OC+EF+SEF +AR as a minimum		
4.5.8.2	**Earth Fault Protection Function**			
4.5.8.2.1 – 4.5.8.2.5	Setting Ranges for Earth Fault Protection (50N/51N)	1…….300A, 2 stage		
	Setting Ranges for Sensitive Earth Fault Protection (50N-2/51N-2)	1…….50A, 1…….1000Seconds		
	All other requirement as per 4.5.8.2.1 – 4.5.8.2.5	Detail compliance to all clauses		
4.5.8.3	Sensitive Earth Fault Functions	Detail compliance to all clauses		
4.5.8.4	Cold load pick up function	Detail compliance to all clauses		
4.5.8.5	Inrush feature	Detail compliance to all clauses		
4.5.8.6	**Auto Reclose Function**			
4.5.8.6.1- 4.5.8.6.7	Sequence of trip and auto-reclose characteristics	Shall be freely programmable to enable the selection(s)		
	Setting Ranges for Auto Reclose Function	1…….4 Shots to Lockout Independently selectable for OC & EF		
	All other requirement	Detail compliance to all clauses		
4.5.8.7	**Control unit functions/features**			
4.5.8.7.1	Battery	Rechargeable		
4.5.8.7.2	Charger input	230V AC, 50Hz. Tolerance +12.5% and -20%.		
4.5.8.8	**Software Functions/Features**	Detail compliance to all clauses		
4.5.8.8.1	Trips to lock-out	Selectable from the menu		
4.5.8.8.2	Operations counters	For each Phase, Earth Fault and Sensitive Earth Fault		

4.5.8.8.3	Fault Records logging	With date, time, faulted phase, fault current and fault duration of the fault		
4.6	**Energy and Power Measurements**			
	Measurands displayable on the LCD screen	Provide		
	Instantaneous values	rms I, V, kW, kVA, kVAR, pf		
	Maximum Demand values	KW, KVA, I, KVAR		
	Energy measurements	kVARh, kWh		
4.7	**Operation**	control of Autorecloser through a Laptop or a remote connection such as SCADA		
4.8	**Events & Fault Records Lists**			
4.8.1-4.8.4	LCD screen and MMI for programming and viewing measurands/settings	Should be able to display all the 3 phase and 1 neutral current simultaneously. Most of the setting parameters should be editable from the MMI. Should indicate Autorecloser status on the MMI Features to Disable /Enable EF, SEF and AR on the MMI Ability to operate unit from MMI		
	Fault Event Records	At Least 50 events with time and date stamps, Affected phases Magnitude of current and fault duration for each phase		
	SCADA Accessory	Provide facility for connection to a SCADA system		
	Provision for Remote operation of Autorecloser	Provide facility		
	Shunt trip accessory	Provide		

4.8.5	**Auxiliary Power Supply**		
4.8.5.1-4.8.5.4	Ratio and Power rating of the power VT	33kV/230 VAC, 500VA (Minimum burden of 200 VA)	
	VT shall be complete with mounting frame	Provide	
	VT shall be protected against short circuits with suitably rated fuses mounted on the VT secondary terminal box	State protection mode offered	
	Charger ratings shall be 30V DC and rechargeable battery set. The charger shall be supplied with 240 V AC 50Hz.	specify	
4.8.6	**DC Voltage**		
4.8.6.1-4.8.6.5	Battery shall last for at least 5 years. Shall power the electronics and provide supply for control of the Autorecloser for at least 8 hours.	specify	
	The battery capacity. This shall be demonstrated during factory acceptance testing in the presence of KPLC Engineers.	>25AmpHour	
	Battery guarantee and warranty of at least 5 years.	provide	
	Spare Auxiliary contacts – minimum requirement	2NO + 2NC	
	Detailed manuals and drawings of the installation and control unit circuits and components	Provide	
4.8.7	**Technical Literature and Drawings**	To provide all	
Spares Items - Optional			
	Spares together with consignment Control Units – 4No. Control Box Battery-5No, Control Cable Sets – 2No. Fuses (if any) – 10No.		
Commissioning Tool			
	Four (4) Laptop Computers to be supplied Specifications: Pentium 4, 2.6Ghz, 40GB, portable Floppy disk drive, 4GB RAM, DVD Drive, WIN XP, RS232, USB Port, Parallel Port		

APPENDICES				
Appendix A: Tests and Inspection				
A1	Applicable Test Standards		State	
A2	Type Test submitted with tender		List	
A3-A4	Accreditation Certificate as per ISO/IEC 17025 of Testing Laboratory Provide name, valid address, email, Telephone contacts of the Testing Laboratory		Provide	
A5	List routine tests to be witnessed during FAT by KPLC engineers		List	
A6	Test certificates to be from an accredited testing laboratory; to be complete		State	
Appendix B. Factory Acceptance Tests				
B1	Acceptance tests shall be witnessed by KPLC Engineers		State compliance	
B2	The manufacturer/supplier shall give one months' notice and letters of invitation to the Kenya Power Engineers nominated to attend the FATs		State compliance	
B3	Sampling and Testing to be as per standard and requirement of this clause		State compliance	
B4	Tests to be conducted		State	
Appendix C. Inspection at Delivery Point				
C1	KPLC shall inspect Autoreclosers at stores to verify compliance of the equipment with this specification.		State compliance	
C2	Supply to replace without to KPLC any Autoreclosers found defective during inspection at stores		State compliance	
Appendix D: Warranty				
D1	The supplier/manufacturer to warrant KPLC that all goods supplied under this contract shall have no defect arising from design, materials or workmanship.		Submit warranty as per tender	
D2-D3	Warranty period	Autoreclosers	State warranty period as per specification	
		Electronic cards		
Appendix E. Markings and Name Plate				
E1	Specify Autorecloser tank bushings markings and method of marking (To be permanent as per specifications)		Specify	
E2	Specify name plate markings and method of marking (To be permanent as per specifications)			
E3	Name plate mounting		Clear of live parts	
Appendix F. Manufacturers' Recommended Spares				
F1-F3	List of recommended spare for at least 10 years of		List	

	continuous service with all the Autoreclosers in service		
Appendix G. Qualification of The Manufacturer			
	The manufacturer/supplier to submit the following documents		
G2	Quality Assurance	ISO 9001: 2008	
G3	Manufacturing Experience	Over 15 years	
G4	Letters of Customer Satisfaction	At least 4 (four) reference letters for overseas customers)	
G5	Previous Performance	Provide evidence	
Appendix H: Training at The Manufacturer's Premises			
HI-H5	Training during FAT, Theory and Practical & Trouble shooting and installation procedures Installation during FAT	State compliance and specify duration of training. Provide provisional training schedule with Topics and durations	
Appendix J. Local Training (In Kenya)			
J1-J2	Local Training: For Engineers and Technicians Theory, Trouble shooting and installation procedures	State compliance and specify duration of training. Provide provisional Training schedule with Topics and durations.	
Appendix K. Installation of Two Autorecloser Units			
K1	Demonstrate correct installation of the Autorecloser by the manufacturer at KPI, guided and supervised the Manufacturer representative	State compliance	
K2	Evaluate and give feedback on the trained teams	State compliance	
Appendix L: Documentation			
L1	Tender submitted with all technical documents	List submitted documents	
L2	Successful bidder to submit documents/details for approval before manufacture	State compliance	
L3	Recommendations for use, care, storage and routine inspection/testing, procedures	Submit	

	Deviations	State (if) any deviations	

NOTE:
Bidders should note that the above Guaranteed Technical Particulars Schedules must be fully completed and submitted with the bid. Failure to complete the schedules shall lead to rejection of the bid.
Guaranteed values shall be specified. Words like "noted and fulfilled '', Yes,' 'comply'' etc. shall be treated as non-compliant and the bid shall be rejected.
Each entry in the schedule in compliance with the specifications shall constitute one (1) mark. The maximum possible score shall be 100% and the lowest possible score shall be 0%.

Criteria for Passing technical evaluation: Any Bidder who fails to score a minimum of 70% in the technical schedule shall not be considered further in the evaluation. In addition to a score of 70% the bidder must fully meet the requirements of the specifications.

Deviation: Any deviation from these specifications if any shall be clearly stated. The bidder shall demonstrate that the technical specifications are still fully met in spite of such minor deviations. Deviations from the Bill of materials or from the ratings of various equipment listed in the specifications shall not be acceptable.

Before Contract signing, any minor deviations shall be discussed and resolved.

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Manufacturer's Name, Signature, Stamp and Date